

Student Achievement Committee Meeting

Wednesday, November 20, 2024 6:30 PM

BOE Auditorium and via Zoom Meeting Platform, 129 Church Street, Bristol, CT 06010

1. Call to Order/ Pledge of Allegiance

2. Decision: Approval of Minutes

3. Public Comment

4. Information

4.1. 23-24 Multilingual Learner Achievement and Growth **Presenter:** Carly Fortin and Azra Redzic

4.2. 23-24 Freshman On-Track Data **Presenter:** Carly Fortin

4.3. 23-24 Smarter Balanced Assessment Data **Presenter:** OTL

5. Decision

5.1. History of American Pop Music ECE **Presenter:** Kenneth Bagley

5.2. Music Theory I and II ECE **Presenter:** Kenneth Bagley

5.3. Grade 3-5 Science **Presenter:** Jillian Romann

5.4. Marketing II **Presenter:** Laura Lanza

5.5. PLTW: Cybersecurity **Presenter:** Laura Lanza

5.6. Three-Dimensional Modeling **Presenter:** Laura Lanza

6. Adjournment



Student Achievement & Outcomes Committee
September 18, 2024
MINUTES - DRAFT

The minutes presented within this document are a summary of the discussion that took place at the Student Achievement Committee meeting. To view the meeting in its entirety and hear full reports please go to: [September 18, 2024 SAC Meeting Recording](#)

PRESENT Committee members: Jill Fitzsimons-Bula, Maria Simmons (Zoom)

ALSO PRESENT: Kenneth Bagley (Zoom), Kimberly Culkin, Carly Fortin, Sara Hale (Zoom), Lea McCabe, Scott Redman (zoom), Azra Redzic (Zoom), Jillian Romann (Zoom), Ericka Treannie, Kristy Trelli, Melanie Vetrano, Leszek Ward, Iris White

Call to Order

Commissioner Fitzsimons-Bula called the meeting to order at 6:30 p.m.

Decision: Approval of Minutes from August 21, 2024 meeting:

On a motion made by Commissioner Fitzsimons-Bula and seconded by Commissioner Simmons, followed by a Roll Call Vote, it was unanimously;

VOTED: to approve the August 21, 2024 meeting minutes.

Information: BAIMS Lottery Process Update

Mrs. Lea McCabe, Principal at Bristol Arts and Innovation Magnet School, discussed the timeline for the BAIMS lottery pull process, what the process entails, and possible ways to make the process more efficient to improve the transition experiences of students and families going forward.

Questions and comments followed.

Decision: Freshman Academy Curriculum

Ms. Kristy Trelli, Supervisor of Climate, Culture, and Student Supports, presented the curriculum for Freshman Academy. Freshman Academy is an introductory course for ninth-grade students that is designed to support students with the transition from middle school to high school. In this course, students will learn strategies and skills to help them be successful in high school. There are 3 units of instruction: 1. Foundations for Success: Building Academic, Executive & Social-Emotional Skills, 2. Understanding Self and Others: Skills for Success, and 3. Pathways to Success: Career and Education Exploration.

Questions and discussion followed.

On a motion made by Commissioner Fitzsimons-Bula and seconded by Commissioner Simmons,

Followed by a Roll Call Vote, it was unanimously;

VOTED: to move the Freshman Academy curriculum to the full Board of Education for approval.

Information: 24-25 Anticipated Curriculum Revisions

Mrs. Carly Fortin, Chief Academic Officer, presented the curriculum revision process and courses that are slated to be revised or developed this school year. Secondary STEM courses will be added to the curriculum docket once the position has been filled.

Information: 24-25 Scheduled Data Presentations

Mrs. Fortin presented a proposed timeline for when specific data presentations will be brought to the Student Achievement and Outcomes meeting throughout this school year.

Information: 23-24 Attendance and Discipline Reports

Mrs. Erika Treannie, Director of Climate, Culture, and Engagement, presented the data around chronic absenteeism. Some highlights include: Bristol Public Schools continue to decrease our chronic absenteeism rate, Bristol Schools chronic absenteeism rates in the 4 major subgroups are lower than the state average, and Bristol is now a LEAP district and has hired 2 additional staff to support attendance and engagement. Ms. Trelli presented data reports on Bristol Public Schools Discipline. Overall, we have seen a reduction in discipline incidents from the prior year. She also shared the district's next steps in making sure the discipline incidents continue to decline.

Questions and comments followed.

Information: 2024 SAT Report

Mrs. Fortin presented the PSAT and SAT performance data across different populations throughout the last few years. She shared highlights and areas of growth as well as targeted actions toward improvement for the 24-25 school year.

Information: 2024 AP Report

Mrs. Fortin presented data on Advanced Placement enrollment and achievement last school year. AP enrolment increased from the year before and the number of students who scored a 3 or higher also increased. Mrs. Fortin presented the areas of focus for the 24-25 school year.

Information: 2024 Summer School Report

Mrs. Fortin reported on the number of students enrolled in summer school this past summer. There has been a 20% increase in attendees from the Summer of 2023. She also shared some highlights from the Summer CNA Training Program.

There being no further discussion, Commissioner Fitzsimons-Bula adjourned the meeting at 9:03p.m.

Respectfully submitted,

Katlyne Laprise

Katlyne Laprise



PROCEDURES FOR REMOTE PUBLIC COMMENT

Members of the public are invited to comment to the Board on any topic related to school business.

Items requiring consideration by the Board must be approved as an agenda item by a 2/3ds vote of the Board members present. Such items may be referred for further study and not necessarily acted upon at this meeting.

Anyone wishing to address the Board should adhere to the following procedures:

PUBLIC COMMENT

Before a Remote Meeting

1. Send your comments to: KatlyneLaprise@bristolk12.org
2. Be sure to put **PUBLIC COMMENT-SAC** in the subject line.
3. Include your name and address.
4. Direct your comments to the Board Chair.
5. Your comments will be read at the meeting by the Board Chair.
6. All comments should be written in an appropriate manner, particularly if concerning a personnel matter.
7. Any comments not adhering to the guidelines will not be read at the meeting.

During a Remote Meeting

1. Everyone is requested to address the Chair for recognition.
2. Each speaker must state his/her name and address.
3. All speakers must observe rules of common etiquette. Personalities are not to be injected. Anyone violating this rule will be denied the floor. Unless waived by the Chairperson or a majority of the Board,
4. Each speaker shall limit his/her remarks to three (3) minutes.
5. A speaker will not be recognized for a second time on the same topic.
6. Each speaker must concern himself/herself with the topic under discussion. Anyone digressing from the topic will be ruled out of order.
7. Written statements and materials may be made available, in advance of comments, for distribution to Board members.
8. Speakers shall state their positions on the subject being discussed.
9. Board members will not respond directly to comments during the Board meeting. The Superintendent will direct the question to the appropriate staff member for follow-up.

Course Title:	Content Area:	Grade Level:	Credit (if applicable)
History of American Pop Music - ECE	Music	9-12	0.5

Course Description:

An introduction to popular music and diversity in America: jazz, blues, Top-40 pop, rock, hip-hop, and other genres. Musicians and their music studied in the context of twentieth-century and contemporary American society, emphasizing issues of race, gender, class, and resistance.

Aligned Core Resources:

American Popular Music - From Minstrelsy to MP3 6th Ed.
Larry Starr & Christopher Waterman with Brad Osborn

Oxford University Press

Connection to the [BPS Vision of the Graduate](#)

- Demonstrate Academic Knowledge and Skills**
CONTENT MASTERY
- Develop and draw from a baseline understanding of knowledge in academic disciplines from our Bristol curriculum
- CRITICAL THINKING AND PROBLEM SOLVING**
- Collect, assess and analyze relevant information
 - Transfer knowledge to other situations
- Successfully employ skills for self-sufficiency**
GOAL DIRECTED
- Set goals with tangible and intangible success criteria
 - Persist to accomplish difficult tasks and to overcome academic and personal barriers to meet goals
- Meaningfully Contribute to a Global Society**
GLOBAL AWARENESS
- Understand other nations and cultures including the use of Non-English language

Additional Course Information:
Knowledge/Skill Dependent courses/prerequisites

Link to Completed [Equity Audit](#)

None

[History of American Popular Music - Equity Curri...](#)

Standard Matrix

District Learning Expectations and Standards	Early 20th Century Root Music (Late 19th Century-1945)	1920s-30s, TinPan Alley, Broadway	1940s-1960s	1960s - 1980s Chapter 10-13	1980s - today Chapter 13-15
Creating					
MU:Cr1.1 Generate and				x	

conceptualize artistic ideas and work.					
MU:Cr2.1 Organize and develop artistic ideas and work.					
MU:Cr3.1 Refine and complete artistic work.					
Performing					
MU:Pr4.1 Select, analyze and interpret artistic work for presentation.					
MU:Pr5.1 Develop and refine artistic techniques and work for presentation.					
MU:Pr6.1 Convey meaning through the presentation of artistic work.					
Responding					
MU:Re7.1 Perceive and analyze artistic work.	x	x	x	x	x
MU:Re8.1 Interpret intent and meaning in artistic work.	x	x	x	x	x
MU:Re9.1 Apply criteria to evaluate artistic work.				x	x
Connecting					
MU:Cn10.0 Synthesize and relate knowledge and personal					

experiences to make art.					
MU:Cn11.1 Relate artistic ideas and works with societal, cultural and historical context to deepen understanding.			x	x	x

Unit Links

Early 20th Century Root Music (Late 19th Century-1945)	3
1920s-30s, TinPan Alley, Broadway, Jazz in the 20s-30s, and Early Blues Music	5
1940s-1960s	8
1960s - 1980s Chapter 10-13	13
1980s - today Chapter 13-15	18

Unit Title:

Early 20th Century Root Music (Late 19th Century-1945)

Relevant Standards: Bold indicates priority

MU:Re7.2.C.1.a - Analyze aurally the elements of music (including form) of musical works, relating them to style, mood, and context, and describe how the analysis provides models for personal growth as composer, performer, and/or listener.

MU:Re8.1.E.5.a - Identify interpretations of the expressive intent and meaning of musical works, referring to the elements of music, contexts, and (when appropriate) the setting of the text.

Enduring Understanding(s):

Re7.2.CHow does understanding the structure and context of music inform a response?

Re7.2.CResponse to music is informed by analyzing context (social, cultural, and historical) and how creators and performers manipulate the elements of music.

Re8.1.E: How do we discern the musical creators' and performers' expressive intent?

Re8.1.E: Through their use of elements and structures of music, creators and performers provide

	clues to their expressive intent.
Demonstration of Learning:	Pacing for Unit
<ul style="list-style-type: none"> - Written Assessment - Aural Assessment 	5 Lessons
Family Overview (link below)	Integration of Technology:
In this unit, students will learn the roots of 20th Century American music from early folk music and the influence of immigration on the development of “American” music.	<i>Listening Playlists, Google Classroom, Google Slides</i>
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):
Minstrel Show Strophes Ragtime Waltz	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn
Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:
<ul style="list-style-type: none"> - History <ul style="list-style-type: none"> - Early American culture around the 1900s 	<ul style="list-style-type: none"> - Where early American Music comes from and the different types of music that were around in the early 1900s
Connections to Prior Units:	Connections to Future Units:
<ul style="list-style-type: none"> - This is the First Unit in the class. Most students have little prior knowledge of early American music in the 1900s 	<ul style="list-style-type: none"> - This unit shows the early music influence for later years. - Students will have a base for understanding how music evolved in the later decades.
Differentiation through Universal Design for Learning	
UDL Indicator	Teacher Actions:
<p>Perception 1.3 Represent a diversity of perspectives and identities in authentic ways</p> <p>Language & Symbols 2.5 Illustrate through multiple media</p> <p>Expression and Communication 5.2 Use multiple tools for construction, composition, and communication</p>	<ul style="list-style-type: none"> ● Attend to the ways in which people and cultures are being portrayed ● Present key concepts beyond representation via text with another or multiple formats (e.g., an illustration, dance/movement, diagram, table, model, video, comic strip, storyboard, photograph, animation, or physical or virtual manipulative). ● Use spell checkers, grammar checkers, word-prediction software. ● Use speech-to-text software (voice recognition), human dictation, recording.
Supporting Multilingual/English Learners	
Related CELP standards:	Learning Targets:

<p>9-12.1 Construct meaning from oral presentations and literary and informational text through grade-appropriate listening, reading, and viewing</p> <p>9-12.4 Construct grade-appropriate oral and written claims and support them with reasoning evidence</p>		<ul style="list-style-type: none"> - Identify a few key words and phrases in oral communications and simple and oral and written tasks. - verbally or nonverbally express an opinion about a familiar topic or event using a limited number of words and phrases acquired in conversations, reading, and being read to. 	
Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
Lesson 1 (2 classes)	<p>I can identify characteristics of Early American Songs</p> <p>I can define the style of Ragtime through its musical characteristics</p>	<ul style="list-style-type: none"> - Identify the musical form of Early American songs - Identify the musical form of Ragtime - Explain what minstrel shows were - Identify Ragtime music by listening and how the music was put together <p>Assessments:</p> <ul style="list-style-type: none"> - Quiz on Early American Music: Terms and Key Historical Figures. 	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn

Unit Title:	
<h2>1920s-30s, TinPan Alley, Broadway, Jazz in the 20s-30s, and Early Blues Music</h2>	
Relevant Standards: Bold indicates priority	
<p>MU:Re7.2.C.Ia - Analyze aurally the elements of music (including form) of musical works, relating them to style, mood, and context, and describe how the analysis provides models for personal growth as composer, performer, and/or listener.</p> <p>MU:Re8.1.C.IIa - Develop and support interpretations of varied works, demonstrating an understanding of the composers' intent by citing the use of elements of music (including form), compositional techniques, and the style/genre and context of each work.</p>	
Essential Question(s):	Enduring Understanding(s):
<p>Re7.2.C: How does understanding the structure and context of music inform a response?</p> <p>Re8.1.C: How do we discern the musical creators' and performers' expressive intent?</p>	<p>Re7.2.C: Response to music is informed by analyzing context (social, cultural, and historical) and how creators and performers manipulate the elements of music.</p> <p>Re8.1.C: Through their use of elements and structures</p>

	of music, creators and performers provide clues to their expressive intent.
Demonstration of Learning:	Pacing for Unit
<ul style="list-style-type: none"> - Written Assessment - Aural Assessment - Project Presentation 	3 Lessons
Family Overview (link below)	Integration of Technology:
In this unit Students will learn about the prolific era of Tin Pan Alley and its close association with the development of Broadway.	<i>Listening Playlists, Google Classroom, Google Slides</i>
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):
<p>Tin Pan Alley Vaudeville crooning microphone radio bridge refrain standards verse major Minor bar (measure) blue notes blues classic blues country blues gospel music hillbilly music race music tonic 12 bar blues Scat singing Big Bands Jukeboxes Territory bands Boogie-woogie Mariachi Western Swing Independent Record Labels Soli Indies Swing</p>	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn
Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:
<ul style="list-style-type: none"> - History <ul style="list-style-type: none"> - The Great Depression - Harlem Renaissance 	<ul style="list-style-type: none"> - The role early blues music and country music had in the development of modern music. - Country and Blues music have no connection with each other - Blues is Jazz music

Connections to Prior Units:		Connections to Future Units:	
<ul style="list-style-type: none"> - Ragtime and Early American Music directly influenced the emergence of Jazz and Blues/Country Music 		<ul style="list-style-type: none"> - Jazz will continue to evolve after the 1940s and Blues will directly influence the creation of R&B/Rock and Roll 	
Differentiation through Universal Design for Learning			
UDL Indicator		Teacher Actions:	
<p>Perception 1.3 Represent a diversity of perspectives and identities in authentic ways</p> <p>Language & Symbols 2.5 Illustrate through multiple media</p> <p>Expression and Communication 5.2 Use multiple tools for construction, composition, and communication</p>		<ul style="list-style-type: none"> • Attend to the ways in which people and cultures are being portrayed • Present key concepts beyond representation via text with another or multiple formats (e.g., an illustration, dance/movement, diagram, table, model, video, comic strip, storyboard, photograph, animation, or physical or virtual manipulative). • Use spell checkers, grammar checkers, word-prediction software. • Use speech-to-text software (voice recognition), human dictation, recording. 	
Supporting Multilingual/English Learners			
Related CELP standards:		Learning Targets:	
<p>9-12.1 Construct meaning from oral presentations and literary and informational text through grade-appropriate listening, reading, and viewing</p> <p>9-12.4 Construct grade-appropriate oral and written claims and support them with reasoning evidence</p>		<ul style="list-style-type: none"> - Identify a few key words and phrases in oral communications and simple and oral and written tasks. - verbally or nonverbally express an opinion about a familiar topic or event using a limited number of words and phrases acquired in conversations, reading, and being read to. 	
Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
1 (2 Classes) * Tin Pan Alley * Broadway *	I can identify the purpose of Tin Pan Alley and its connection to early American Music I can identify the characteristics of Broadway music in the 1920s	<ul style="list-style-type: none"> - Name the location of Tin Pan Alley - Identify what took place in Tin Pan Alley - Identify how it shaped 	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn

(1920s-30s)	I can understand the culture surrounding Tin Pan Alley and Broadway in the 1920s-1930s	early American Music - Identify the characteristics of Broadway music in 1920s Assessment: Quiz - Students can describe and define Tin Pan Alley and Broadway.	
2 (2 Classes) * Race Records * Early Blues Music * Hillbilly Records * Early Country Music	I can identify the musical characteristics of Early Blues/Country Music	I can... - Break down the form of early Blues music - Understand the song content of Early Blues Music - Repeat for "Country Music" Assessment: Quiz - Identify the form of a blues song/country song	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn
3 (2 Classes * Jazz in the 20s and 30s * Swing during the Great Depression)	I can label the style of music that influenced Jazz in the 20s and 30s I can identify how Swing music was prevalent through the Great Depression I can identify the culture surrounding Swing music	I can... - Identify music examples and characteristics of Jazz music in the 1920s-1930s - Identify how the Great Depression related to Swing music - Identify the events that led up to the creation of Swing music Assessment: Quiz - Define and describe "Jazz" music. Identify different styles of jazz music and where they came from in the US. Unit Test: - Cover each topic in the lesson sequence - Understand the historical movements that surrounded music innovations in the early 1900s	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn

Unit Title:

1940s-1960s

Relevant Standards: Bold indicates priority

MU:Re7.2.E.5.a - Identify how knowledge of context and the use of repetition, similarities, and contrasts inform the response to music.

MU:Re8.1.C.II.a - Develop and support interpretations of varied works, demonstrating an understanding of the composers' intent by citing the use of elements of music (including form), compositional techniques, and the style/genre and context of each work.

MU:Cn11.0.C.II.a - Demonstrate understanding of relationships between music and the other arts, other disciplines, varied contexts, and daily life.

Essential Question(s):

Re7.2.E- How does understanding the structure of the music influence a response?

Re8.1.C How do individuals choose music to experience?

Cn11.0.C How do the other arts, other disciplines, contexts, and daily life inform creating, performing, and responding to music?

Enduring Understanding(s):

Re7.2.E- Response to music is informed by analyzing context (social, cultural and historic) and how creators and performers manipulate the elements of music.

Re8.1.C Through their use of elements and structures of music, creators and performers provide clues to their expressive intent.

Cn11.0.C Understanding connections to varied contexts and daily life enhances musicians' creating, performing, and responding.

Demonstration of Learning:

- Written Assessment
- Aural Assessment
- Project Presentation

Pacing for Unit

9 Lessons

Family Overview (link below)

In this unit, students will identify the development of swing and jazz and its influence and reflection of society.

Integration of Technology:

Listening Playlists, Google Classroom, Google Slides

Unit-specific Vocabulary:

Big Bands
Top 40 radio programming
honky tonk music
Jump Blues
Magnetic Tape Recording
vocal harmony groups
distortion
melisma

Aligned Unit Materials, Resources, and Technology (beyond core resources):

American Popular Music, Larry Starr,
Christopher Waterman with Brad Osborn

<p>Chicago Electric Blues Distortion Feedback Big Bands Top 40 radio programming honky tonk music Jump Blues Magnetic Tape Recording vocal harmony groups distortion melisma Chicago Electric Blues Distortion Feedback bluegrass music, Chicago electric blues, country and western, cover version, distortion, feedback, honky-tonk music, jump blues, magnetic tape recording, melisma, payola, rhythm and blues, vocal harmony groups Brill Building, bugalu, cadence, concept album, counterpoint, Latin soul double-tracking, reverb, rockabilly, rock 'n' roll, slap-back</p>	
<p>Opportunities for Interdisciplinary Connections:</p>	<p>Anticipated misconceptions:</p>
<ul style="list-style-type: none"> - History <ul style="list-style-type: none"> - World War II - Civil Rights Movement 	<ul style="list-style-type: none"> - Women did not play a prominent role in Big Bands during WW2 - Elvis invented Rock and Roll - Motown did not have a big impact on the African American Community
<p>Connections to Prior Units:</p>	<p>Connections to Future Units:</p>
<ul style="list-style-type: none"> - Jazz influence on the development of popular music during this time period 	<ul style="list-style-type: none"> - The creation of more subgenres of music - The development of media and music - Musical Icons, Bands, and Artists becoming central figures in pop culture - Pop culture helped create MTV
<p>Differentiation through Universal Design for Learning</p>	
<p>UDL Indicator</p>	<p>Teacher Actions:</p>
<p>Perception 1.3 Represent a diversity of perspectives and identities in authentic ways</p> <p>Language & Symbols 2.5 Illustrate through multiple media</p> <p>Expression and Communication 5.2 Use multiple tools for construction, composition, and communication</p>	<ul style="list-style-type: none"> • Attend to the ways in which people and cultures are being portrayed • Present key concepts beyond representation via text with another or multiple formats (e.g., an illustration, dance/movement, diagram, table, model, video, comic strip, storyboard, photograph, animation, or physical or virtual manipulative). • Use spell checkers, grammar checkers, word-prediction software. Use speech-to-text software (voice recognition), human dictation, recording.

Supporting Multilingual/English Learners			
Related CELP standards:		Learning Targets:	
9-12.1 Construct meaning from oral presentations and literary and informational text through grade-appropriate listening, reading, and viewing 9-12.4 Construct grade-appropriate oral and written claims and support them with reasoning evidence		<ul style="list-style-type: none"> - Identify a few key words and phrases in oral communications and simple and oral and written tasks. - verbally or nonverbally express an opinion about a familiar topic or event using a limited number of words and phrases acquired in conversations, reading, and being read to. 	
Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
1 (1 Class) * Big Band Singers (1940s) * Frank Sinatra	I can identify characteristics of Big Band Music I can identify artists of the Big Band Era	I can... * name the instrumentation of Big Bands * discuss the more structured arrangements of Big Band Music * Name the prominent names associated with Big Bands Assessment: - Naming big band leaders and famous tunes by each big band. Describe the characteristics of Big Band music and compare them to the previous Jazz era	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn
2 (1 Class) Postwar era, R&B, Louis Jordan, Muddy Waters	I can identify societal influences of the Postwar era on music I can identify characteristics of Rhythm and Blues music I can identify artists of Rhythm and Blues	I can... * discuss the historical events that shaped the Postwar era of music. * name the characteristics of the R&B music * name prominent artists of R&B music Assessment: Quiz - Naming the different styles of music that became popular in the Postwar era. Famous music artists from each style.	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn
3 (1 Class) * Women in Postwar Era * R & B	I can identify female musicians of the Postwar era Rhythm and Blues I can identify the musical characteristics of Country and Western Music	I can... * discuss the prominent female musicians of the postwar period and their	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn

<p>* Country and Western</p>		<p>contributions. * discuss the structure and instrumentation of Country and Western Music Assessment: Quiz - Describe and Define Country Music and identify key musical artists.</p>	
<p>4 (2 Classes) * Early Rock and Roll * Chuck Berry * Little Richard</p>	<p>I can identify characteristics of early Rock and Roll music I can describe the influences and events that led to the invention of Rock and Roll I can identify artists of Early Rock and Roll</p>	<p>I can... * identify the structure and instrumentation of early Rock and Roll music * Identify the influential musicians of early Rock and Roll and their contributions to the genre Assessment: Quiz - Define the characteristics of Rock and Roll Music.</p>	<p>American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn</p>
<p>5 (1 Class) * Early Rock and Roll * Elvis Presley</p>	<p>I can identify characteristics of early Rock and Roll music I can identify artists of Early Rock and Roll</p>	<p>I can... * identify the structure and instrumentation of early Rock and Roll music * Identify the influential musicians of early Rock and Roll and their contributions to the genre Assessment: Project: Research project on one of the founding figures of Rock and Roll music and present them to the class (1-2 Classes).</p>	<p>American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn</p>
<p>6 (1 Class) * The Producers as Artists * Phil Spector</p>	<p>I can identify the characteristics related to the Artist/Producer I can identify producer/artists</p>	<p>* discuss the role of the Artist/Producer in the development of music. * discuss the influential Artist/Producers of the era and their contributions to music. Assessment:</p>	<p>American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn</p>
<p>7 (1 Class) *Berry Gordy * Motown</p>	<p>I can identify the characteristic traits of Motown music I can identify the societal influences that led to Motown Music I can identify artists associated with Motown music</p>	<p>* discuss the typical structure and themes of Motown music * I can discuss the cultural events that led to the development of the Motown sound. * I can discuss prominent figures in the creation and development of Motown</p>	<p>American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn</p>

		Assessment: Quiz - Musical Traits of Motown Music, Historical Importance of Motown. Music Artists	
8 (1 Class) * From Imitation to Experimentation * The Beach Boys	I can identify the cultural influences on music of the 60s I can identify artists involved in the experimentation.	* discuss the events of the time that drove the era of experimentation. * discuss the influential artists that experimented with music of the time Assessment:	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn
9 (2 Classes) * The Beatles The British Invasion	I can identify the influences that led to the British Invasion I can identify artists that sparked the British Invasion	* discuss the movement that introduced Blues music to the England * discuss the British influence that they brought to America * discuss the influential musicians that sparked the British Invasion * identify the results of the British influence on Blues and other genres of music. Quiz - Cultural events surrounding the British invasion, bands included in this movement, and musical characteristics	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn
		Unit Test - Post War Music - Evolution of music from Jazz to Rock/Motown	

Unit Title:

1960s - 1980s Chapter 10-13

Relevant Standards: Bold indicates priority

MU:Re7.1.E.8.a - Explain reasons for selecting music citing characteristics found in the music and connections to interest, purpose, and context.

MU:Re7.2.E.1a - Explain how the analysis of passages and understanding the way the elements of music are manipulated inform the response to music.

MU:Re8.1.E.8.a - Identify and support interpretations of the expressive intent and meaning of musical works,

citing as evidence the treatment of the elements of music, contexts, and (when appropriate) the setting of the text.

MU:Re9.1.E.8.a - Explain the influence of experiences, analysis, and context on interest in and evaluation of music.

MU:Cn11.0.E.5.a - Demonstrate understanding of relationships between music and the other arts, other disciplines, varied contexts, and daily life.

MU:Cr1.1.C.II.a - Describe and demonstrate multiple ways in which sounds and musical ideas can be used to represent extended sonic experiences or abstract ideas.

MU:Cr1.1.T.II.a - Generate melodic, rhythmic, and harmonic ideas for compositions and improvisations using digital tools and resources.

Essential Question(s):	Enduring Understanding(s):
<p>Re7.1.E - How do individuals choose music to experience?</p> <p>Re7.2.E - How does understanding the structure and context of the music influence a response?</p> <p>Re8.1.E - How do we discern the musical creators' and performers' expressive intent?</p> <p>Re9.1.E - How do we judge the quality of musical work(s) and performance(s)?</p> <p>Cn11.0.E - How do the other arts, other disciplines, contexts, and daily life inform creating, performing, and responding to music?</p> <p>Cr1.1.C - How do musicians generate creative ideas?</p> <p>Cr1.1.T - How do musicians generate creative ideas?</p>	<p>Re7.1.E - Individuals' selection of musical works is influenced by their interests, experiences, understandings, and purposes.</p> <p>Re7.2.E - Response to music is informed by analyzing context (social, cultural and historic) and how creators and performers manipulate the elements of music.</p> <p>Re8.1.E - Through their use of elements and structures of music, creators and performers provide clues to their expressive intent.</p> <p>Re9.1.E - The personal evaluation of musical work(s) and performance(s) is informed by analysis, interpretation, and established criteria.</p> <p>Cn11.0.E - Understanding connections to varied contexts and daily life enhances musicians' creating, performing, and responding.</p> <p>Cr1.1.C - The creative ideas, concepts, and feelings that influence musicians' work emerge from a variety of sources.</p> <p>Cr1.1.T - The creative ideas, concepts, and feelings that influence musicians' work emerge from a variety of sources.</p>
Demonstration of Learning:	Pacing for Unit
<ul style="list-style-type: none"> - Written Assessment - Aural Assessment - Project Presentation 	7 Lessons

Family Overview (link below)	Integration of Technology:
In this unit, students will learn about the development of rock and roll and the spin off genres that were popular in the 1960s - 1980s.	<i>Listening Playlists, Google Classroom, Google Slides</i>
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):
<p>counterculture, countrypolitan, sampled, soul music disco, funk, jazz rock, overdubbing, soft rock, Southern rock, synthesizers</p> <p>funk music, garage band, hip-hop culture, new wave, progressive country, punk rock, reggae, rock steady, salsa, ska</p> <p>funk music, garage band, hip-hop culture, new wave, progressive country, punk rock, reggae, rock steady, salsa, ska</p> <p>analog recording, digital recording, drum machines, MTV, samplers, sequences, synth-pop</p>	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn
Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:
<ul style="list-style-type: none"> - History <ul style="list-style-type: none"> - Development of technology, media, and electronics 	<ul style="list-style-type: none"> - Jazz and rock music are completely separate from each other - Disco music was not popular
Connections to Prior Units:	Connections to Future Units:
<ul style="list-style-type: none"> - Rock and Roll bringing musical artists into the mainstream media - Musicians becoming a big part of pop culture 	<ul style="list-style-type: none"> - Mass consumption of music videos - Growth of the image of musicians image - The use of electronic instruments becomes more prominent in modern music
Differentiation through Universal Design for Learning	
UDL Indicator	Teacher Actions:
<p>Perception 1.3 Represent a diversity of perspectives and identities in authentic ways</p> <p>Language & Symbols 2.5 Illustrate through multiple media</p> <p>Expression and Communication 5.2 Use multiple tools for construction, composition,</p>	<ul style="list-style-type: none"> ● Attend to the ways in which people and cultures are being portrayed ● Present key concepts beyond representation via text with another or multiple formats (e.g., an illustration, dance/movement, diagram, table, model, video, comic strip, storyboard, photograph, animation, or physical or virtual manipulative). ● Use spell checkers, grammar checkers, word-prediction software. Use speech-to-text

and communication	software (voice recognition), human dictation, recording.
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Supporting Multilingual/English Learners

Related CELP standards:

9-12.1 Construct meaning from oral presentations and literary and informational text through grade-appropriate listening, reading, and viewing

9-12.4 Construct grade-appropriate oral and written claims and support them with reasoning evidence

Learning Targets:

- Identify a few key words and phrases in oral communications and simple and oral and written tasks.
- verbally or nonverbally express an opinion about a familiar topic or event using a limited number of words and phrases acquired in conversations, reading, and being read to.

Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
1 (2 Classes) * Soul; James Brown, Aretha Franklin	I can identify the cultural surroundings of Soul music I can define Soul music as a genre and its musical characteristics I can identify key figures in Soul Music	I can... - Identify the characteristics of Soul music - Identify the key musical figures in Soul music (Specific examples) - Explain the culture surrounding Soul music and how it led to the creation of the music genre Assessment: Quiz - Musical characteristics of soul music and key musical artists.	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn
2 (1 Class) * Urban Folk * Bob Dylan	I can define the style of Urban Folk I can understand the culture of Urban Folk Music I can identify key musical figures in Folk Music	I can... - Name the musical characteristics of Folk music - Name the locations where Folk music thrived and became popular - Name the key musical figures in Urban Folk music Assessment: Quiz - Define and Name Urban Folk music and artists.	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn
3 (1 Class) * Psychedelic Rock	I can understand the characteristics of Psychedelic Rock I can define the culture surrounding this genre of Rock music	- Define the term Psychedelic Rock - Identify the characteristics of	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn

* Hendrix	I can identify the key figures surrounding Rock music during this time period	Psychedelic Rock - Name the cultural movements surrounding this genre of rock - Name key musical figures and specific music examples Assessment: Quiz - Define characteristics of Psychedelic Rock and compare to previous styles of Rock music.	
4 (1 Class) * 1970s rock * concept albums	I can define the characteristics of 1970s rock music I can provide examples of rock concept albums I can explain the meaning behind a "concept album"	I can... - Breakdown the form and instruments used in 1970s rock - Name key musical artists and music examples of 1970s rock - Name major concept albums and describe what the term "Concept Album" means Project: Create a Concept Album (Integrate Technology into)	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn
5 (2 Classes) * 1970s Disco, Funk	I can identify the characteristics of the 1970s Disco and Funk music movement	- Name specific characteristics of Disco and Funk music - Identify key artists and musical instruments used in these genres of music Assessment: Quiz - Key Musical artists of Funk and Disco Music	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn
6 (1 Class) * Salsa, Punk, New Wave	I can identify the musical characteristics of Salsa, Punk, and New Wave I can connect the culture of American society with Salsa, Punk, and New Wave music	- Name specific examples of Salsa, Punk, and New Wave Music - Identify the instruments used for each style of music and the region where this music became popular Assessment: Quiz - Define the musical characteristics of Salsa, Punk, and New Wave Music and key musical artists.	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn
7 (2 Classes) * The 1980s: Digital	I can understand the impact that MTV technology had on the music culture of the 1980s	I can... - Explain what MTV was and how it used music	American Popular Music, Larry Starr, Christopher Waterman with Brad

technology MTV		through the 1980s - Name musical artists featured on MTV and explain how they became popular/successful Assessment: Quiz - Explain how MTV was created. Describe the culture surrounding its creation and the impact it had on music in the 1980s	Osborn
		Unit Test or Project - Deeper dive into the music genres created during this time period - Funk, Disco, 70s Rock/Psychedelic Rock, Folk, Punk, New Wave, Salsa	

Unit Title:

1980s - today Chapter 13-15

Relevant Standards: Bold indicates priority

MU:Re8.1.C.II.a - Develop and support interpretations of varied works, demonstrating an understanding of the composers' intent by citing the use of elements of music (including form), compositional techniques, and the style/genre and context of each work.

MU:Re9.1.E.II.a - Evaluate works and performances based on research as well as personally- and collaboratively-developed criteria, including analysis and interpretation of the structure and context.

MU:Cn11.0.E.II.a - Demonstrate understanding of relationships between music and the other arts, other disciplines, varied contexts, and daily life.

Essential Question(s):

Re8.1.C - How do we discern the musical creators' and performers' expressive intent?

Re9.1.E - How do we judge the quality of musical work(s) and performance(s)?

Cn11.0.E - How do the other arts, other disciplines, contexts, and daily life inform creating, performing,

Enduring Understanding(s):

Re8.1.C - Through their use of elements and structures of music, creators and performers provide clues to their expressive intent.

Re9.1.E - The personal evaluation of musical work(s) and performance(s) is informed by analysis, interpretation, and established criteria.

Cn11.0.E - Understanding connections to varied contexts and daily life enhances musicians' creating,

and responding to music?	performing, and responding.
Demonstration of Learning:	Pacing for Unit
<ul style="list-style-type: none"> - Written Assessment - Aural Assessment - Project Presentation 	8 Lessons
Family Overview (link below)	Integration of Technology:
In this unit, students will learn about modern American music and the advances in recording and sharing technologies. Students will explore the cultural elements that led to some of the pop and alternative music genres of the late 20th century to today.	<i>Listening Playlists, Google Classroom, Google Slides</i>
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):
<p>analog recording, digital recording, drum machines, MTV, samplers, sequences, synth-pop</p> <p>alternative music, electronic dance music, gangsta rap, grunge, hardcore, house music, mashup, raves, riot grrrl, techno, world music</p> <p>Auto-Tune, emo, emo rap, garage rock revival, iPod, iTunes, MP3, MP4, Napster, Pandora, Pro Tools, Recording Industry Association of America, Spotify, streaming, Tidal, vocoder, YouTube</p>	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn
Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:
<ul style="list-style-type: none"> - History 	<ul style="list-style-type: none"> - MTV is for reality shows and regular TV programming
Connections to Prior Units:	Connections to Future Units:
<ul style="list-style-type: none"> - Influence of R&B, Motown, and Soul in the creation of Hip-Hop - Advances and experimentation in music technology/equipment 	
Differentiation through Universal Design for Learning	
UDL Indicator	Teacher Actions:
<p>Perception 1.3 Represent a diversity of perspectives and identities in authentic ways</p> <p>Language & Symbols 2.5 Illustrate through multiple media</p> <p>Expression and Communication 5.2 Use multiple tools for construction, composition, and communication</p>	<ul style="list-style-type: none"> ● Attend to the ways in which people and cultures are being portrayed ● Present key concepts beyond representation via text with another or multiple formats (e.g., an illustration, dance/movement, diagram, table, model, video, comic strip, storyboard, photograph, animation, or physical or virtual manipulative). ● Use spell checkers, grammar checkers, word-prediction software. Use speech-to-text software (voice recognition), human dictation,

recording.

Supporting Multilingual/English Learners

Related CELP standards:

9-12.1 Construct meaning from oral presentations and literary and informational text through grade-appropriate listening, reading, and viewing

9-12.4 Construct grade-appropriate oral and written claims and support them with reasoning evidence

Learning Targets:

- Identify a few key words and phrases in oral communications and simple and oral and written tasks.
- verbally or nonverbally express an opinion about a familiar topic or event using a limited number of words and phrases acquired in conversations, reading, and being read to.

Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
1 (2 Classes) * 1980s Albums * Pop stars * Michael Jackson	I can identify characteristics of 1980s music I can identify pop stars of the 1980s	<ul style="list-style-type: none"> - Identify the instruments used in 1980s pop music - Name musical groups and artists that were popular in the 1980s - Define what "Pop" means in music - Provide specific examples of "pop" music and explain how it became popular 	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn
2 (1 Class) * 1980s Pop stars * Madonna * Prince	I can identify characteristics of 1980s music I can identify pop stars of the 1980s	I can... <ul style="list-style-type: none"> - Identify the instruments used in 1980s pop music - Name musical groups and artists that were popular in the 1980s - Define what "Pop" means in music - Provide specific examples of "pop" music and explain how it became popular Assessment: Quiz - Define Pop Music and name the musical artists associated with the genre	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn
3 (1 Class) * Early hip hop	I can identify the cultural influences that led to early Hip Hop music I can identify artists of early Hip Hop music	I can... <ul style="list-style-type: none"> - Identify the instruments used in 1980s pop music - Name musical groups and artists that were popular in the 1980s - Define what "Pop" means 	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn

		<p>in music</p> <ul style="list-style-type: none"> - Provide specific examples of "pop" music and explain how it became popular 	
<p>4 (2 Classes)</p> <ul style="list-style-type: none"> * Hip Hop Breaks Out (1980s) 	<p>I can identify the cultural influences that led to Hip Hop music</p> <p>I can identify artists of Hip Hop music</p>	<p>I can...</p> <ul style="list-style-type: none"> - Identify the musical characteristics of Hip Hop Music - Explain where/how Hip Hop music became popular - Name specific Hip Hop artists in the 1980s <p>Assessment:</p> <p>Quiz - Describe the culture surrounding Hip-Hop, Origins of Hip-Hop, and name key musical artists of Hip-Hop.</p>	<p>American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn</p>
<p>5 (2 Classes)</p> <ul style="list-style-type: none"> * Gangsta Rap in the 1990s * Queen Latifah's response * Hip Hop in the New Millennium 	<p>I can identify cultural influences that led to Gangsta Rap</p> <p>I can identify artists of Hip Hop in the 21st Century</p>	<p>I can...</p> <ul style="list-style-type: none"> - Explain how Rap was discovered in used in American culture - Name modern music examples of Hip Hop/Rap music <p>Project - Comparing modern Hip-Hop/Rap music to classic Hip-Hop Music. How has it changed/evolved?</p>	<p>American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn</p>
<p>6 (1 Class)</p> <ul style="list-style-type: none"> * Techno * Alternative Rock * Grunge 	<p>I can identify various forms of Alternative Rock genres</p> <p>I can identify the cultural influences on Alternative rock</p>	<p>I can...</p> <ul style="list-style-type: none"> - Define what "alternative rock" means - Identify the musical qualities of alternative rock - Name specific alternative rock groups <p>Assessment:</p> <p>Quiz - Describe Alternative Rock and give a musical example of Alternative Rock</p>	<p>American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn</p>
<p>7 (1 Class)</p> <ul style="list-style-type: none"> * Alternative Women's Voices * 21st Century Divas 	<p>I can identify female artists of 21st Century Alternative Rock Music</p> <p>I can identify the traits of 21st Century Alternative music</p>	<p>I can...</p> <ul style="list-style-type: none"> - Name key women musical figures of the 21st century and explain their importance. <p>Assessment:</p>	<p>American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn</p>

8 (2 Classes) * Trends in the Internet Age	I can identify various trends associated with the development of music in the internet and digital age.	I can... Identify all of the modern technologies used to create, record, produce, and stream music in today's society.	American Popular Music, Larry Starr, Christopher Waterman with Brad Osborn
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Course Title:	Content Area:	Grade Level:	Credit (if applicable)
Music Theory 1 - ECE	Music	9-12	.5

Course Description:

This course provides a basic understanding of the elements of music including: clefs, scales, intervals, melody, rhythm, and chords. Ear training, notation, and music literacy are integral components of the class.

Aligned Core Resources:

The Musicians Guide to Theory and Analysis, Third Edition
Clendinning, Jane and Elizabeth Marvin
Ney York
W.W. Norton 2016

Workbook for *The Musicians Guide*

Connection to the [BPS Vision of the Graduate](#)

Demonstrate Academic Knowledge and Skills
CONTENT MASTERY
 Develop and draw from a baseline understanding of knowledge in academic disciplines from our Bristol curriculum
CRITICAL THINKING AND PROBLEM SOLVING
 Collect, assess and analyze relevant information
 Transfer knowledge to other situations

Effectively communicate in a global society
COMMUNICATIONS AND TECHNOLOGY LITERACY
 Use digital technology, communication tools, and/or networks to access, manage, integrate, evaluate, and create
INFORMATION LITERACY
 Access information on efficiently (time) and effectively (sources)
 Evaluate information critically and competently
 Use information accurately and creatively for the issue or problem at hand

Successfully employ skills for self-sufficiency
GOAL DIRECTED
 Set goals with tangible and intangible success criteria
 Persist to accomplish difficult tasks and to overcome academic and personal barriers to meet goals

Additional Course Information:
Knowledge/Skill Dependent courses/prerequisites

*This is a UCONN ECE Course that is certified by the university.
 This course can acquire college credits.*

📎 [MUSI 1011 - Fundamentals 1 - Syllabus.pdf](#)

Link to Completed [Equity Audit](#)

[Music Theory 1 - Equity Curriculum Review](#)

Standard Matrix

District Learning Expectations and Standards	Beat, meter, rhythm	Pitch and Pitch Class	Scales & Key Signature, Solfege	Intervals	Triads	Grand Staff Triads	Seventh Chords
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Creating							
MU:Cr1.1 Generate and conceptualize artistic ideas and work.							
MU:Cr2.1 Organize and develop artistic ideas and work.	X	X	X				
MU:Cr3.1 Refine and complete artistic work.						X	X
Performing							
MU:Pr4.1 Select, analyze and interpret artistic work for presentation.							
MU:Pr5.1 Develop and refine artistic techniques and work for presentation.							
MU:Pr6.1 Convey meaning through the presentation of artistic work.							
Responding							
MU:Re7.1 Perceive and analyze artistic work.	X	X	X	X	X	X	X
MU:Re8.1 Interpret intent and meaning in artistic work.			X				
MU:Re9.1 Apply criteria to evaluate artistic work.	X	X	X	X	X	X	X
Connecting							
MU:Cn10.1 Synthesize and							

relate knowledge and personal experiences to make art.							
MU:Cn11.1 Relate artistic ideas and works with societal, cultural and historical context to deepen understanding							

Unit Links

1a. Beat, meter, rhythm	3
1b. Pitch and Pitch Class	5
2. Scales & Key Signature, Solfege	8
3. Intervals	10
4. Triads	12
5. Grand Staff Triads	14
6. Seventh Chords	16

Unit Title:

1a. Beat, meter, rhythm

Relevant Standards: **Bold indicates priority**

MU:Cr2.1.C.1a - Assemble and organize sounds or short musical ideas to create initial expressions of selected experiences, moods, images, or storylines.

MU:Re7.2.C.1a - Analyze aurally the elements of music (including form) of musical works, relating them to style, mood, and context, and describe how the analysis provides models for personal growth as composer, performer, and/or listener.

MU:Re9.1.C.1a - Describe the effectiveness of the technical and expressive aspects of selected music and performances, demonstrating understanding of fundamentals of music theory.

Essential Question(s):

Cr2.1 How do musicians make creative decisions?

Enduring Understanding(s):

Cr2.1: Musicians' creative choices are influenced by

<p>Re7.2 How does understanding the structure and context of music inform a response?</p> <p>Re9.1 How do we judge the quality of musical work(s)?</p>	<p>their expertise, context, and expressive intent.</p> <p>Re7.2: Response to music is informed by analyzing context (social, cultural, and historical) and how creators and performers manipulate the elements of music.</p> <p>Re9.1 The personal evaluation of musical work(s) and performance(s) is informed by analysis, interpretation, and established criteria.</p>
Demonstration of Learning:	Pacing for Unit
Identification, decoding, and writing of musical rhythms. Unit Quiz	5 classes
Family Overview (link below)	Integration of Technology:
In this unit (Beat, Meter, and Rhythm) students will learn the musical symbols that determine the length of a note, how it appears in printed music and how rhythms are perceived.	-Using laptops/Chromebooks for MusicTheory.net (note identification and note construction) -Daily activities/classwork on the Smart Board
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):
Staff Note names Duration Pitch Intensity Timbre Beat Stem, note head, beam Subdivision of beats Rhythm dot Rest values Time Signature Tie v slurs The dot & double dot Simple and compound meter Tempo terms (Andante, Moderato, Allegro)	Handouts Staff Paper Notebook Computer
Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:
N/A	Beat and rhythm are the same
Connections to Prior Units:	Connections to Future Units:
N/A	This unit is the foundation for all future units
Differentiation through Universal Design for Learning	
UDL Indicator	Teacher Actions:
<p>Language & Symbols</p> <p>2.1 Clarify vocabulary and symbols</p> <p>2.2 Clarify syntax and structure</p> <p>2.3 Support decoding of text, mathematical notation, and symbols</p>	<ul style="list-style-type: none"> • Pre-teach vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge • Provide graphic symbols with alternative text descriptions • Clarify unfamiliar syntax (in language or in math formulas) or underlying structure (in diagrams,

<p>Expression & Communication</p> <p>5.2 Use multiple tools for construction and composition</p>	<p>graphs, illustrations, extended expositions or narratives) through alternatives</p> <ul style="list-style-type: none"> • Provide Computer-Aided-Design (CAD), music notation (writing) software, or mathematical notation software
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Supporting Multilingual/English Learners

Related CELP standards:	Learning Targets:
<p>9-12.1 An EL can construct meaning from oral presentations and literary and informational text through grade appropriate listening, reading, and viewing.</p> <p>9-12.7 An EL can adapt language choices to purpose, task, and audience when speaking and writing</p> <p>9-12.9 An EL can create clear and coherent grade-appropriate speech and text.</p> <p>9-12.10 An EL can make accurate use of standard English to communicate in grade appropriate speech and writing</p>	<ul style="list-style-type: none"> • I can identify a few key words and phrases in oral communications and simple oral and written texts • I can understand and respond to simple yes/no questions about familiar topics • I can communicate basic information about a topic • I can use frequently occurring words and phrases

Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
1-3	<p>-I can identify rhythm symbols (whole note, half note, quarter note, eighth note, sixteenth note and rests)</p> <p>-I can write rhythm symbols that are congruent with the time signature (counting rhythms)</p>	<p>1) I can name each symbol correctly</p> <p>2) I can identify how many beats each symbol gets congruent with the time signature</p> <p>3) I can draw each symbol</p>	
4-7	<p>-I can identify the tempo of recorded music with correct tempo terms (Andante, Moderato, Allegro)</p> <p>-I can identify meter types of recorded music (simple vs compound)</p>	<p>1) I can define tempo markings and give examples of appropriate beats per minute</p> <p>2) I can define meters and write music that corresponds to the indicated meter.</p>	

Unit Title:

1b. Pitch and Pitch Class

Relevant Standards: Bold indicates priority	
<p>MU:Cr2.1.C.1a - Assemble and organize sounds or short musical ideas to create initial expressions of selected experiences, moods, images, or storylines.</p> <p>MU:Re7.2.C.1a - Analyze aurally the elements of music (including form) of musical works, relating them to style, mood, and context, and describe how the analysis provides models for personal growth as composer, performer, and/or listener.</p> <p>MU:Re9.1.C.1a - Describe the effectiveness of the technical and expressive aspects of selected music and performances, demonstrating understanding of fundamentals of music theory.</p>	
Essential Question(s):	Enduring Understanding(s):
<p>Cr2.1 How do musicians make creative decisions?</p> <p>Re7.2 How does understanding the structure and context of music inform a response?</p> <p>Re9.1 How do we judge the quality of musical work(s)?</p>	<p>Cr2.1: Musicians' creative choices are influenced by their expertise, context, and expressive intent.</p> <p>Re7.2: Response to music is informed by analyzing context (social, cultural, and historical) and how creators and performers manipulate the elements of music.</p> <p>Re9.1 The personal evaluation of musical work(s) and performance(s) is informed by analysis, interpretation, and established criteria.</p>
Demonstration of Learning:	Pacing for Unit
<p>Identification, decoding, and writing of musical pitches. Unit quiz</p>	<p>4 classes</p>
Family Overview (link below)	Integration of Technology:
<p>In this unit (Pitch and Pitch Class), students will learn the arrangement of pitches (notes) on the staff. They will also learn symbols that alter the pitch both higher and lower.</p>	<p>www.musictheory.net</p>
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):
<p>Clef Pitch Ledger Line Octave Octave Register Accidental Flat Sharp Natural Double flat/sharp Enharmonic</p>	<p>Handouts Staff Paper Notebook Computer</p>
Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:
<p>History of notation may allow some discussion about the time periods in which notation was developed</p>	<p>Some students may have experience reading TAB, which is NOT the same as a traditional staff</p>
Connections to Prior Units:	Connections to Future Units:
<p>Music Theory 1: Unit 1a</p>	<p>Music Theory 1: Unit 2 Music Theory 1: Unit 3</p>

Music Theory 1: Unit 4
 Music Theory 1: Unit 5
 Music Theory 1: Unit 6

Differentiation through Universal Design for Learning

UDL Indicator

Teacher Actions:

Language & Symbols

- 2.1 Clarify vocabulary and symbols
- 2.2 Support decoding of text, mathematical notation, and symbols

Expression & Communication

- 5.2 Use multiple tools for construction and composition

- Pre-teach vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge
- Provide graphic symbols with alternative text descriptions
- Clarify unfamiliar syntax (in language or in math formulas) or underlying structure (in diagrams, graphs, illustrations, extended expositions or narratives) through alternatives
- Provide Computer-Aided-Design (CAD), music notation (writing) software, or mathematical notation software

Supporting Multilingual/English Learners

Related CELP standards:

Learning Targets:

- 9-12.1
 An EL can . . . construct meaning from oral presentations and literary and informational text through grade appropriate listening, reading, and viewing.
- 9-12.7
 An EL can . . . adapt language choices to purpose, task, and audience when speaking and writing
- 9-12.9
 An EL can . . . create clear and coherent grade-appropriate speech and text.
- 9-12.10
 An EL can . . . make accurate use of standard English to communicate in grade appropriate speech and writing

- I can write and identify rhythm symbols and count them congruent with the time signature
- I can write and identify pitches on the treble and bass staves

Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
8-9	1) I can demonstrate the relationship between pitch and register by writing the pitches on the treble and bass staves	1) I can name the clefs 2) I can draw the clefs 3) I can identify what each clef signifies (G clef tells where G is, etc) 4) I can name each line/space in treble and bass clefs 5) I can draw each	

		accidental 6) I can identify each accidental and how they alter the pitch	
10-11	2) I can identify the different accidentals and how they affect pitch	I can write/identify a pitch on the staff correctly	

Unit Title:	
<h2>2. Scales & Key Signature, Solfege</h2>	
Relevant Standards: Bold indicates priority	
<p>MU:Cr2.1.C.1a - Assemble and organize sounds or short musical ideas to create initial expressions of selected experiences, moods, images, or storylines.</p> <p>MU:Re7.2.C.1a - Analyze aurally the elements of music (including form) of musical works, relating them to style, mood, and context, and describe how the analysis provides models for personal growth as composer, performer, and/or listener.</p> <p>MU:Re8.1.C.1a Develop and explain interpretations of varied works, demonstrating an understanding of the composers' intent by citing technical and expressive aspects as well as the style/genre of each work.</p> <p>MU:Re9.1.C.1a - Describe the effectiveness of the technical and expressive aspects of selected music and performances, demonstrating understanding of fundamentals of music theory.</p>	
Essential Question(s):	Enduring Understanding(s):
<p>Cr2.1 How do musicians make creative decisions?</p> <p>Re7.2 How does understanding the structure and context of music inform a response?</p> <p>Re8.1 How do we discern the musical creators' and performers' expressive intent?</p> <p>Re9.1 How do we judge the quality of musical work(s)?</p>	<p>Cr2.1: Musicians' creative choices are influenced by their expertise, context, and expressive intent.</p> <p>Re7.2: Response to music is informed by analyzing context (social, cultural, and historical) and how creators and performers manipulate the elements of music.</p> <p>Re8.1 Through their use of elements and structures of music, creators and performers provide clues to their expressive intent.</p> <p>Re9.1 The personal evaluation of musical work(s) and performance(s) is informed by analysis, interpretation, and established criteria.</p>
Demonstration of Learning:	Pacing for Unit
Identification, decoding, and writing of musical scales and Key Signatures. Unit quiz	6 classes
Family Overview (link below)	Integration of Technology:
In this unit (Scales, Key Signature and Solfege), students will arrange notes into established musical patterns	www.musictheory.net

(scales). Students will also begin to perform written music showing the relationship between written and performed notes.	
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):
Whole/half step Tone and semitones Pattern of intervals for major scale Tonic, supertonic, mediant, subdominant, dominant Submediant (superdominant), leading tone Do, Re, Mi, Fa, Sol, La, Ti Order of flats/sharps, Natural, Harmonic, Melodic Minor	Handouts Staff Paper Notebook Computer
Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:
N/A	
Connections to Prior Units:	Connections to Future Units:
Music Theory 1: Unit 1a Music Theory 1: Unit 1b	Music Theory 1: Unit 3 Music Theory 1: Unit 4
Differentiation through Universal Design for Learning	
UDL Indicator	Teacher Actions:
<p>Language & Symbols 2.1 Clarify vocabulary and symbols 2.2 Clarify syntax and structure</p> <p>Expression & Communication 5.2 Use multiple tools for construction and composition</p>	<ul style="list-style-type: none"> • Pre-teach vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge • Provide graphic symbols with alternative text descriptions • Provide Computer-Aided-Design (CAD), music notation (writing) software, or mathematical notation software
Supporting Multilingual/English Learners	
Related CELP standards:	Learning Targets:
<p>9-12.1 An EL can . . . construct meaning from oral presentations and literary and informational text through grade appropriate listening, reading, and viewing.</p> <p>9-12.7 An EL can . . . adapt language choices to purpose, task, and audience when speaking and writing</p> <p>9-12.9</p>	<ul style="list-style-type: none"> • I can identify a few key words and phrases in oral communications and simple oral and written texts • I can understand and respond to simple yes/no questions about familiar topics • I can communicate basic information about a topic • I can use frequently occurring words and phrases

An EL can . . . create clear and coherent grade-appropriate speech and text.			
9-12.10 An EL can . . . make accurate use of standard English to communicate in grade appropriate speech and writing			
Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
12-14	1) I can count hops (half/whole steps) using a keyboard. 2) I can identify the whole and ½ step patterns of Major scales. 3) I can name single hop (half-step) intervals and two-hop (whole step) intervals.	1) I can identify whole and half steps 2) I can write Major scales using whole and half steps with accidentals	
15-17	1) I can identify the order and pattern of sharps and flats for all Major Key Signatures	1) I can identify whole and half steps 2) I can write Major scales using whole and half steps with accidentals	

Unit Title:	
3. Intervals	
Relevant Standards: Bold indicates priority	
MU:Re7.2.C.1a - Analyze aurally the elements of music (including form) of musical works, relating them to style, mood, and context, and describe how the analysis provides models for personal growth as composer, performer, and/or listener.	
MU:Re9.1.C.1a - Describe the effectiveness of the technical and expressive aspects of selected music and performances, demonstrating understanding of fundamentals of music theory.	
Essential Question(s):	Enduring Understanding(s):
Re7.2 How does understanding the structure and context of music inform a response? Re9.1 How do we judge the quality of musical work(s)?	Re7.2: Response to music is informed by analyzing context (social, cultural, and historical) and how creators and performers manipulate the elements of music. Re9.1 The personal evaluation of musical work(s) and performance(s) is informed by analysis, interpretation, and established criteria.
Demonstration of Learning:	Pacing for Unit
Identification, decoding, and writing of musical intervals. Unit quiz	6 classes
Family Overview (link below)	Integration of Technology:

In this unit (Intervals), students will learn the relationship that exists between consecutive notes and be able to label them.	www.musictheory.net
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):
Interval Generic Interval Specific Interval Quality terms (Major, minor, diminished, augmented) Consonance/Consonant Intervals Dissonance/Dissonant Intervals Perfect Intervals	Handouts Staff Paper Notebook Computer
Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:
N/A	
Connections to Prior Units:	Connections to Future Units:
Music Theory 1: Unit 3	Music Theory 1: Unit 4
Differentiation through Universal Design for Learning	
UDL Indicator	Teacher Actions:
<p>Language & Symbols 2.1 Clarify vocabulary and symbols 2.2 Clarify syntax and structure</p> <p>Expression & Communication 5.2 Use multiple tools for construction and composition</p>	<ul style="list-style-type: none"> • Pre-teach vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge • Provide graphic symbols with alternative text descriptions • Provide Computer-Aided-Design (CAD), music notation (writing) software, or mathematical notation software
Supporting Multilingual/English Learners	
Related CELP standards:	Learning Targets:
<p>9-12.1 An EL can . . . construct meaning from oral presentations and literary and informational text through grade appropriate listening, reading, and viewing.</p> <p>9-12.7 An EL can . . . adapt language choices to purpose, task, and audience when speaking and writing</p> <p>9-12.9</p>	<ul style="list-style-type: none"> • I can identify a few key words and phrases in oral communications and simple oral and written texts • I can understand and respond to simple yes/no questions about familiar topics • I can communicate basic information about a topic • I can use frequently occurring words and phrases

An EL can ... create clear and coherent grade-appropriate speech and text.			
9-12.10 An EL can ... make accurate use of standard English to communicate in grade appropriate speech and writing			
Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
18-20	1) I can identify the number of letter names in determining intervals (generic 2nds, 3rds, 4ths, etc, and specific intervals)	1) I can write and Identify all intervals 2) I can correctly identify intervals BY LISTENING	
21-23	2) I can identify and construct diatonic and chromatic intervals.	1) I can write and Identify all intervals 2) I can correctly identify intervals BY LISTENING	

Unit Title:	
4. Triads	
Relevant Standards: Bold indicates priority	
<p>MU:Re7.2.C.1a - Analyze aurally the elements of music (including form) of musical works, relating them to style, mood, and context, and describe how the analysis provides models for personal growth as composer, performer, and/or listener.</p> <p>MU:Re9.1.C.1a - Describe the effectiveness of the technical and expressive aspects of selected music and performances, demonstrating understanding of fundamentals of music theory.</p>	
Essential Question(s):	Enduring Understanding(s):
<p>Re7.2 How does understanding the structure and context of music inform a response?</p> <p>Re9.1 How do we judge the quality of musical work(s)?</p>	<p>Re7.2: Response to music is informed by analyzing context (social, cultural, and historical) and how creators and performers manipulate the elements of music.</p> <p>Re9.1 The personal evaluation of musical work(s) and performance(s) is informed by analysis, interpretation, and established criteria.</p>
Demonstration of Learning:	Pacing for Unit
Identification, decoding, and writing of musical Triads. Unit quiz	5 classes
Family Overview (link below)	Integration of Technology:
In this unit (Triads), students will learn about notes sounding at the same time creating harmonies called triads. They will identify and label them using musical	www.musictheory.net

examples both written and aural.	
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):
Major, minor, diminished, augmented triads Roman numeral cases rule (ex. Upper case for Major, lower case for minor) Arabic numerals (6, 6/3, 6/4 inversion symbols)	Handouts Staff Paper Notebook Computer
Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:
N/A	
Connections to Prior Units:	Connections to Future Units:
Music Theory 1: Unit 3	Music Theory 1: Unit 6 Music Theory 1: Unit 7
Differentiation through Universal Design for Learning	
UDL Indicator	Teacher Actions:
<p>Language & Symbols</p> <p>2.1 Clarify vocabulary and symbols</p> <p>2.2 Clarify syntax and structure</p> <p>Expression & Communication</p> <p>5.2 Use multiple tools for construction and composition</p>	<ul style="list-style-type: none"> • Pre-teach vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge • Provide graphic symbols with alternative text descriptions • Provide Computer-Aided-Design (CAD), music notation (writing) software, or mathematical notation software
Supporting Multilingual/English Learners	
Related CELP standards:	Learning Targets:
<p>9-12.1 An EL can . . . construct meaning from oral presentations and literary and informational text through grade appropriate listening, reading, and viewing.</p> <p>9-12.7 An EL can . . . adapt language choices to purpose, task, and audience when speaking and writing</p> <p>9-12.9 An EL can . . . create clear and coherent grade-appropriate speech and text.</p> <p>9-12.10 An EL can . . . make accurate use of standard English to communicate in grade appropriate speech and writing</p>	<ul style="list-style-type: none"> • I can identify a few key words and phrases in oral communications and simple oral and written texts • I can understand and respond to simple yes/no questions about familiar topics • I can communicate basic information about a topic • I can use frequently occurring words and phrases

Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
24-26	1) I can identify triad types by using the key signature or by the interval method	1) I can write and Identify the 4 different triad types given the starting pitch 2) I can write and Identify triads using appropriate Roman and Arabic Numerals	
27-28	2) I can identify triad types by listening	3) I can correctly identify triad types aurally	

Unit Title:	
<h2>5. Grand Staff Triads</h2>	
Relevant Standards: Bold indicates priority	
<p>MU:Cr3.2.C.1a Share music through the use of notation, performance, or technology, and demonstrate how the elements of music have been employed to realize expressive intent.</p> <p>MU:Re7.2.C.1a - Analyze aurally the elements of music (including form) of musical works, relating them to style, mood, and context, and describe how the analysis provides models for personal growth as composer, performer, and/or listener.</p> <p>MU:Re9.1.C.1a - Describe the effectiveness of the technical and expressive aspects of selected music and performances, demonstrating understanding of fundamentals of music theory.</p>	
Essential Question(s):	Enduring Understanding(s):
<p>Cr3.2 When is creative work ready to share?</p> <p>Re7.2 How does understanding the structure and context of music inform a response?</p> <p>Re9.1 How do we judge the quality of musical work(s)?</p>	<p>Cr3.2 Musicians' presentation of creative work is the culmination of a process of creation and communication</p> <p>Re7.2 Response to music is informed by analyzing context (social, cultural, and historical) and how creators and performers manipulate the elements of music.</p> <p>Re9.1 The personal evaluation of musical work(s) and performance(s) is informed by analysis, interpretation, and established criteria.</p>
Demonstration of Learning:	Pacing for Unit
<p>Identification, decoding, and writing of musical notation and Triads using the Grand Staff. Unit quiz</p>	<p>3 classes</p>
Family Overview (link below)	Integration of Technology:
<p>In this unit (Grand Staff Triads), students will place triads into music written for piano or choirs learning about the</p>	<p>www.musictheory.net</p>

rules about each note's placement.			
Unit-specific Vocabulary:		Aligned Unit Materials, Resources, and Technology (beyond core resources):	
Soprano, Alto, Tenor, Bass - ranges and tessitura, Voice Leading Rules (doubling, etc) Simple position triads vs Grand Staff triads		Handouts Staff Paper Notebook Computer	
Opportunities for Interdisciplinary Connections:		Anticipated misconceptions:	
N/A			
Connections to Prior Units:		Connections to Future Units:	
Music Theory 1: Unit 4		Music Theory 1: Unit 7	
Differentiation through Universal Design for Learning			
UDL Indicator		Teacher Actions:	
Language & Symbols 2.1 Clarify vocabulary and symbols 2.2 Clarify syntax and structure		<ul style="list-style-type: none"> • Pre-teach vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge • Provide graphic symbols with alternative text descriptions 	
Supporting Multilingual/English Learners			
Related CELP standards:		Learning Targets:	
9-12.1 An EL can . . . construct meaning from oral presentations and literary and informational text through grade appropriate listening, reading, and viewing. 9-12.7 An EL can . . . adapt language choices to purpose, task, and audience when speaking and writing 9-12.9 An EL can . . . create clear and coherent grade-appropriate speech and text. 9-12.10 An EL can . . . make accurate use of standard English to communicate in grade appropriate speech and writing		<ul style="list-style-type: none"> • I can identify a few key words and phrases in oral communications and simple oral and written texts • I can understand and respond to simple yes/no questions about familiar topics • I can communicate basic information about a topic • I can use frequently occurring words and phrases 	
Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
29-31	1) I can write and analyze chords found in four-part writing	1) I can identify the order of the voice parts and where they lie (tessitura), 2) I can show the placement of the voice	

		part in the grand staff, 3) I can explain/demonstrate the voicing rules regarding distance between voice parts and doubling rules.	
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Unit Title:	
<h2>6. Seventh Chords</h2>	
Relevant Standards: Bold indicates priority	
<p>MU:Cr3.1.C.HSI.a - Identify, describe, and apply teacher-provided criteria to assess and refine the technical and expressive aspects of evolving drafts leading to final versions.</p> <p>MU:Re7.2.C.HSI.a - Analyze aurally the elements of music (including form) of musical works, relating them to style, mood, and context, and describe how the analysis provides models for personal growth as composer, performer, and/or listener.</p> <p>MU:Re9.1.C.HSI.a - Describe the effectiveness of the technical and expressive aspects of selected music and performances, demonstrating understanding of fundamentals of music theory.</p>	
Essential Question(s):	Enduring Understanding(s):
<p>Cr3.1 How do musicians improve the quality of their creative work?</p> <p>Re7.2 How does understanding the structure and context of music inform a response?</p> <p>Re9.1 How do we judge the quality of musical work(s)?</p>	<p>Cr3.1 Musicians evaluate, and refine their work through openness to new ideas, persistence, and the application of appropriate criteria.</p> <p>Re7.2 Response to music is informed by analyzing context (social, cultural, and historical) and how creators and performers manipulate the elements of music.</p> <p>Re9.1 The personal evaluation of musical work(s) and performance(s) is informed by analysis, interpretation, and established criteria.</p>
Demonstration of Learning:	Pacing for Unit
Identification, decoding, and writing of musical 7th Chords. Unit Quiz	5 classes
Family Overview (link below)	Integration of Technology:
In this unit (Seventh Chords), students will expand their knowledge of the triad (3-note chords) to include 4-note chords. They will learn to identify the six types of seventh chords and place chord members onto the Grand Staff.	www.musictheory.net
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):
Types of 7th: Major, minor, minor-major, dominant, fully	Handouts

diminished, half diminished 7, 6/5, 4/3, 4/2 inversions		Staff Paper Notebook Computer	
Opportunities for Interdisciplinary Connections:		Anticipated misconceptions:	
N/A			
Connections to Prior Units:		Connections to Future Units:	
Music Theory 1: Unit 4		This course will connect to Music Theory 2 and AP Music Theory	
Differentiation through Universal Design for Learning			
UDL Indicator		Teacher Actions:	
Language & Symbols 2.1 Clarify vocabulary and symbols 2.2 Clarify syntax and structure Expression & Communication 5.2 Use multiple tools for construction and composition		<ul style="list-style-type: none"> Pre-teach vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge Provide graphic symbols with alternative text descriptions Provide Computer-Aided-Design (CAD), music notation (writing) software, or mathematical notation software 	
Supporting Multilingual/English Learners			
Related CELP standards:		Learning Targets:	
9-12.1 An EL can . . . construct meaning from oral presentations and literary and informational text through grade appropriate listening, reading, and viewing. 9-12.7 An EL can . . . adapt language choices to purpose, task, and audience when speaking and writing 9-12.9 An EL can . . . create clear and coherent grade-appropriate speech and text. 9-12.10 An EL can . . . make accurate use of standard English to communicate in grade appropriate speech and writing		<ul style="list-style-type: none"> I can identify a few key words and phrases in oral communications and simple oral and written texts I can understand and respond to simple yes/no questions about familiar topics I can communicate basic information about a topic I can use frequently occurring words and phrases 	
Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
32-34	1) I can write and identify the six types of 7th chords	1) I can identify 7th chords by identifying the quality of the 5th, the quality of the 3rd, and the quality of the 7th.	

35-36	1) I can write and identify 7th chords using Roman and Arabic numerals	2) I can identify/write the different types of 7th chords.	

Course Title:	Content Area:	Grade Level:	Credit (if applicable)
Music Theory 2 - ECE	Music	9-12	.5

Course Description:

This course is a continuation of Music Theory 1. It will expand a student's vocabulary and understanding of music through the analysis of harmonic and melodic structure as well as more advanced melodic and rhythmic techniques. The last part of the semester will deal with instrumentation, orchestration, and arranging skills. At the conclusion of this course, students will have a strong background in the general theoretical principles of music. This course will prepare students for AP Theory and college entrance exams for music majors.

Aligned Core Resources:

The Musicians Guide to Theory and Analysis, Third Edition
Clendinning, Jane and Elizabeth Marvin
Ney York
W.W. Norton 2016

Workbook for *The Musicians Guide*

Connection to the [BPS Vision of the Graduate](#)

Demonstrate Academic Knowledge and Skills
CONTENT MASTERY
 Develop and draw from a baseline understanding of knowledge in academic disciplines from our Bristol curriculum
CRITICAL THINKING AND PROBLEM SOLVING
 Collect, assess and analyze relevant information
 Transfer knowledge to other situations

Effectively communicate in a global society
COMMUNICATIONS AND TECHNOLOGY LITERACY
 Use digital technology, communication tools, and/or networks to access, manage, integrate, evaluate, and create
INFORMATION LITERACY
 Access information on efficiently (time) and effectively (sources)
 Evaluate information critically and competently
 Use information accurately and creatively for the issue or problem at hand

Successfully employ skills for self-sufficiency
GOAL DIRECTED
 Set goals with tangible and intangible success criteria
 Persist to accomplish difficult tasks and to overcome academic and personal barriers to meet goals

Additional Course Information:
Knowledge/Skill Dependent courses/prerequisites

Link to Completed [Equity Audit](#)

Prerequisite - Music Theory 1

[Music Theory 2 - Equity Curriculum Review](#)

 **MUSI 1012 - Fundamentals 2 - Syllabus.pdf**

Standard Matrix

District	More Fun with Scales	Compound Intervals	3. Figured	4. Cadences	5.	6. Phrases	7. Texture	8.
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analyze artistic work.								
MU:Re8.1 Interpret intent and meaning in artistic work.						X	X	X
MU:Re9.1 Apply criteria to evaluate artistic work.	P	P	X	X	X	X	X	X
Connecting								
MU:Cn10.0 Synthesize and relate knowledge and personal experiences to make art.								
MU:Cn11.1 Relate artistic ideas and works with societal, cultural and historical context to deepen understanding.								

Unit Links

1. More fun with Scales	4
2. Compound Intervals	6
3. Figured Bass - Chord Connections	8
4. Cadences	10
5. Non-Harmonic Tones/Non-Chord Tones (NHTs/NCTs)	12
6. Phrases and Periods	15
7. Texture Terms and Textural Reductions	17
8. Secondary Functions	19

Unit Title:

1. More fun with Scales

Relevant Standards: Bold indicates priority

MU:Cr2.1.C.1.a - Assemble and organize sounds or short musical ideas to create initial expressions of selected experiences, moods, images, or storylines.

MU:Re7.2.C.1.a - Analyze aurally the elements of music (including form) of musical works, relating them to style, mood, and context, and describe how the analysis provides models for personal growth as composer, performer, and/or listener.

MU:Re9.1.C.1.a - Describe the effectiveness of the technical and expressive aspects of selected music and performances, demonstrating understanding of fundamentals of music theory.

Essential Question(s):

Enduring Understanding(s):

Cr2.1 How do musicians make creative decisions?

Re7.2 How does understanding the structure and context of music inform a response?

Re9.1 How do we judge the quality of musical work(s)?

Cr2.1: Musicians' creative choices are influenced by their expertise, context, and expressive intent.

Re7.2: Response to music is informed by analyzing context (social, cultural, and historical) and how creators and performers manipulate the elements of music.

Re9.1 The personal evaluation of musical work(s) and performance(s) is informed by analysis, interpretation, and established criteria.

Demonstration of Learning:

Pacing for Unit

Identification, decoding, and writing of alternate scales
Quiz

2 classes

Family Overview (link below)

Integration of Technology:

In this unit (More Fun with Scales), students will learn more note patterns that form the basis for more exotic scales.

www.musictheory.net

Unit-specific Vocabulary:

Aligned Unit Materials, Resources, and Technology (beyond core resources):

Chromatic
Pentatonic
Whole Tone
Diatonic
Non-diatonic
Pitch Inventory

Handouts
Staff Paper
Notebook
Computer

Opportunities for Interdisciplinary Connections:

Anticipated misconceptions:

N/A

There are only Major and Minor scales

Connections to Prior Units:

Connections to Future Units:

Music Theory 1: Unit 2 Scales, Key Signatures and Solfege

This unit will explore scales other than Major or minor

Differentiation through [Universal Design for Learning](#)

UDL Indicator	Teacher Actions:
<p>Language & Symbols 2.1 Clarify vocabulary and symbols 2.2 Support decoding of text, mathematical notation, and symbols</p> <p>Building Knowledge 3.1 Connect prior knowledge to new learning</p> <p>Strategy Development 6.3 Organize information and resources</p>	<ul style="list-style-type: none"> • Pre-teach vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge. • Offer graphic symbols with alternative text descriptions. • Clarify unfamiliar syntax (in language or in math formulas) or underlying structure (in diagrams, graphs, illustrations, extended expositions, or narratives) through alternatives • Offer clarification of notation through lists of key terms. • Anchor instruction by linking to and activating relevant prior knowledge (e.g., using visual imagery, concept anchoring, or concept mastery routines). • Use checklists and guides for note-taking.

Supporting Multilingual/English Learners

Related CELP standards:	Learning Targets:
<p>9-12.1 An EL can ... construct meaning from oral presentations and literary and informational text through grade appropriate listening, reading, and viewing.</p> <p>9-12.7 An EL can ... adapt language choices to purpose, task, and audience when speaking and writing</p> <p>9-12.9 An EL can ... create clear and coherent grade-appropriate speech and text.</p> <p>9-12.10 An EL can ... make accurate use of standard English to communicate in grade appropriate speech and writing</p>	<ul style="list-style-type: none"> • I can identify a few key words and phrases in oral communications and simple oral and written texts • I can understand and respond to simple yes/no questions about familiar topics • I can communicate basic information about a topic • I can use frequently occurring words and phrases

Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
1	-I can identify non major/minor scales.	-I can explain the different interval structure for chromatic, whole tone and pentatonic scale, -I can take notes from a melodic fragment to determine the scale used to form it.	
2	-I can inventory notes from a melody to identify scale(s) used.		

Unit Title:

2. Compound Intervals

Relevant Standards: Bold indicates priority

MU:Cr2.1.C.1a - Assemble and organize sounds or short musical ideas to create initial expressions of selected experiences, moods, images, or storylines.

MU:Re7.2.C.1a - Analyze aurally the elements of music (including form) of musical works, relating them to style, mood, and context, and describe how the analysis provides models for personal growth as composer, performer, and/or listener.

MU:Re9.1.C.1a - Describe the effectiveness of the technical and expressive aspects of selected music and performances, demonstrating understanding of fundamentals of music theory.

Essential Question(s):

Cr2.1 How do musicians make creative decisions?

Re7.2 How does understanding the structure and context of music inform a response?

Re9.1 How do we judge the quality of musical work(s)?

Enduring Understanding(s):

Cr2.1: Musicians' creative choices are influenced by their expertise, context, and expressive intent.

Re7.2: Response to music is informed by analyzing context (social, cultural, and historical) and how creators and performers manipulate the elements of music.

Re9.1 The personal evaluation of musical work(s) and performance(s) is informed by analysis, interpretation, and established criteria.

Demonstration of Learning:

Identification, decoding, and writing of compound intervals.

Unit quiz

Pacing for Unit

1 class

Family Overview (link below)

In this unit (Compound Intervals), students will learn to identify large distances between notes and be able to simplify the interval for labeling.

Integration of Technology:

www.musictheory.net

Unit-specific Vocabulary:

Compound Intervals:
9th (Mm)
10th (Mm)
11th (P)
12th (P)
15th (P)

Aligned Unit Materials, Resources, and Technology (beyond core resources):

Handouts
Staff Paper
Notebook
Computer

Opportunities for Interdisciplinary Connections:

N/A

Anticipated misconceptions:

Intervals are only within an octave

Connections to Prior Units:		Connections to Future Units:	
Music Theory 1: Unit 3 - Intervals		This unit will prepare students to identify intervals needed in figured bass and be able to reduce them to simple intervals	
Differentiation through Universal Design for Learning			
UDL Indicator		Teacher Actions:	
<p>Language & Symbols 2.1 Clarify vocabulary and symbols 2.2 Support decoding of text, mathematical notation, and symbols</p> <p>Building Knowledge 3.1 Connect prior knowledge to new learning</p> <p>Strategy Development 6.3 Organize information and resources</p>		<ul style="list-style-type: none"> • Pre-teach vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge. • Offer graphic symbols with alternative text descriptions. • Clarify unfamiliar syntax (in language or in math formulas) or underlying structure (in diagrams, graphs, illustrations, extended expositions, or narratives) through alternatives • Offer clarification of notation through lists of key terms. • Anchor instruction by linking to and activating relevant prior knowledge (e.g., using visual imagery, concept anchoring, or concept mastery routines). • Use checklists and guides for note-taking. 	
Supporting Multilingual/English Learners			
Related CELP standards:		Learning Targets:	
9-12.1 An EL can . . . construct meaning from oral presentations and literary and informational text through grade appropriate listening, reading, and viewing. 9-12.7 An EL can . . . adapt language choices to purpose, task, and audience when speaking and writing 9-12.9 An EL can . . . create clear and coherent grade-appropriate speech and text. 9-12.10 An EL can . . . make accurate use of standard English to communicate in grade appropriate speech and writing		<ul style="list-style-type: none"> • I can identify a few key words and phrases in oral communications and simple oral and written texts • I can understand and respond to simple yes/no questions about familiar topics • I can communicate basic information about a topic • I can use frequently occurring words and phrases 	
Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
3	I can label intervals over an octave.	-I can add or subtract octave displacement to determine the simple interval equivalent	

Unit Title:

3. Figured Bass - Chord Connections

Relevant Standards: Bold indicates priority

MU:Cr2.1.C.1a - Assemble and organize sounds or short musical ideas to create initial expressions of selected experiences, moods, images, or storylines.

MU:Cr3.1.C.1a - Identify, describe, and apply teacher-provided criteria to assess and refine the technical and expressive aspects of evolving drafts leading to final versions.

MU:Re7.2.C.1a - Analyze aurally the elements of music (including form) of musical works, relating them to style, mood, and context, and describe how the analysis provides models for personal growth as composer, performer, and/or listener.

MU:Re9.1.C.1a - Describe the effectiveness of the technical and expressive aspects of selected music and performances, demonstrating understanding of fundamentals of music theory.

Essential Question(s):

Cr2.1 How do musicians make creative decisions?

Cr3.1 How do musicians improve the quality of their creative work?

Re7.2 How does understanding the structure and context of music inform a response?

Re9.1 How do we judge the quality of musical work(s)?

Enduring Understanding(s):

Cr2.1: Musicians' creative choices are influenced by their expertise, context, and expressive intent.

Cr3.1: Musicians evaluate, and refine their work through openness to new ideas, persistence, and the application of appropriate criteria.

Re7.2: Response to music is informed by analyzing context (social, cultural, and historical) and how creators and performers manipulate the elements of music.

Re9.1 The personal evaluation of musical work(s) and performance(s) is informed by analysis, interpretation, and established criteria.

Demonstration of Learning:

Identification, decoding, and writing of Figured Bass.

Unit quiz

Pacing for Unit

3 classes

Family Overview (link below)

In this unit (Figured Bass), students will learn about the Baroque practice of a musical shorthand. Figures (numbers under a bass note) imply full chords that are not notated.

Integration of Technology:

www.musictheory.net

Unit-specific Vocabulary:**Aligned Unit Materials, Resources, and Technology**

	(beyond core resources):
Inversion notation: 6, 6/3, 6/4, (with and without slashes), 7, 6/5, 4/3, 4/2 open/closed score Slash (/), plus sign (+) to raise a pitch	Handouts Staff Paper Notebook Computer
Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:
This unit could be connected with historical information about the Baroque era in which this notation was used	Improvisation only happens in Jazz
Connections to Prior Units:	Connections to Future Units:
Music Theory 1: Unit 4 - Triads	Music Theory 2: Unit 4 - Cadences Music Theory 2: Unit 8 - Secondary Function
Differentiation through Universal Design for Learning	
UDL Indicator	Teacher Actions:
<p>Language & Symbols 2.1 Clarify vocabulary and symbols 2.2 Support decoding of text, mathematical notation, and symbols</p> <p>Building Knowledge 3.1 Connect prior knowledge to new learning</p> <p>Strategy Development 6.3 Organize information and resources</p>	<ul style="list-style-type: none"> • Pre-teach vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge. • Offer graphic symbols with alternative text descriptions. • Clarify unfamiliar syntax (in language or in math formulas) or underlying structure (in diagrams, graphs, illustrations, extended expositions, or narratives) through alternatives • Offer clarification of notation through lists of key terms. • Anchor instruction by linking to and activating relevant prior knowledge (e.g., using visual imagery, concept anchoring, or concept mastery routines). • Use checklists and guides for note-taking.
Supporting Multilingual/English Learners	
Related CELP standards:	Learning Targets:
9-12.1 An EL can . . . construct meaning from oral presentations and literary and informational text through grade appropriate listening, reading, and viewing. 9-12.7	<ul style="list-style-type: none"> • I can identify a few key words and phrases in oral communications and simple oral and written texts • I can understand and respond to simple yes/no questions about familiar topics • I can communicate basic information about a topic

<p>An EL can . . . adapt language choices to purpose, task, and audience when speaking and writing</p> <p>9-12.9 An EL can . . . create clear and coherent grade-appropriate speech and text.</p> <p>9-12.10 An EL can . . . make accurate use of standard English to communicate in grade appropriate speech and writing</p>		<ul style="list-style-type: none"> I can use frequently occurring words and phrases 	
Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
4	-I understand what the figured bass symbols mean.	-I can add implied notes from a figured bass and add them to the inner voices in four-part writing.	
5	-I can reduce open score chords to a single staff.	-I can translate open score into Figured Bass	
6	-I can identify the implied notes from a figured bass.	-I can realize the notation from Figured Bass	

Unit Title:	
4. Cadences	
Relevant Standards: Bold indicates priority	
<p>MU:Cr2.1.C.1a - Assemble and organize sounds or short musical ideas to create initial expressions of selected experiences, moods, images, or storylines.</p> <p>MU:Cr3.1.C.1a - Identify, describe, and apply teacher-provided criteria to assess and refine the technical and expressive aspects of evolving drafts leading to final versions.</p> <p>MU:Re7.2.C.1a - Analyze aurally the elements of music (including form) of musical works, relating them to style, mood, and context, and describe how the analysis provides models for personal growth as composer, performer, and/or listener.</p> <p>MU:Re9.1.C.1a - Describe the effectiveness of the technical and expressive aspects of selected music and performances, demonstrating understanding of fundamentals of music theory.</p>	
Essential Question(s):	Enduring Understanding(s):
Cr2.1 How do musicians make creative decisions?	Cr2.1: Musicians' creative choices are influenced by their expertise, context, and expressive intent.
Cr3.1 How do musicians improve the quality of their	Cr3.1: Musicians evaluate, and refine their work through

creative work? Re7.2 How does understanding the structure and context of music inform a response? Re9.1 How do we judge the quality of musical work(s)?	openness to new ideas, persistence, and the application of appropriate criteria. Re7.2: Response to music is informed by analyzing context (social, cultural, and historical) and how creators and performers manipulate the elements of music. Re9.1 The personal evaluation of musical work(s) and performance(s) is informed by analysis, interpretation, and established criteria.
Demonstration of Learning:	Pacing for Unit
Identification, decoding, and writing of musical cadences. Unit quiz	2 classes
Family Overview (link below)	Integration of Technology:
In this unit (Cadences), students will learn about chord sequences at the end of musical phrases.	-Playing recordings to identify cadences (CDs, Bluetooth device, computer) <i>www.musictheory.net</i>
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):
Cadence Perfect Authentic Cadence Imperfect Authentic Cadence Plagal Cadence Half Cadence Phrygian Cadence Deceptive Cadence Voice Leading rules	Handouts Staff Paper Notebook Computer
Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:
N/A	All songs end the same.
Connections to Prior Units:	Connections to Future Units:
Music Theory 1: Unit 4 - Triads Music Theory 2: Unit 3 - Figured Bass	Music Theory 2: Unit 8 - Secondary Function
Differentiation through Universal Design for Learning	
UDL Indicator	Teacher Actions:
Language & Symbols 2.1 Clarify vocabulary and symbols 2.2 Support decoding of text, mathematical notation, and symbols Building Knowledge 3.1 Connect prior knowledge to new learning	<ul style="list-style-type: none"> • Pre-teach vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge. • Offer graphic symbols with alternative text descriptions. • Clarify unfamiliar syntax (in language or in math formulas) or underlying structure (in diagrams, graphs, illustrations, extended expositions, or narratives) through alternatives • Offer clarification of notation through lists of key

<p>Strategy Development</p> <p>6.3 Organize information and resources</p>	<p>terms.</p> <ul style="list-style-type: none"> • Anchor instruction by linking to and activating relevant prior knowledge (e.g., using visual imagery, concept anchoring, or concept mastery routines). • Use checklists and guides for note-taking.
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Supporting Multilingual/English Learners

Related CELP standards:	Learning Targets:
<p>9-12.1 An EL can . . . construct meaning from oral presentations and literary and informational text through grade appropriate listening, reading, and viewing.</p> <p>9-12.7 An EL can . . . adapt language choices to purpose, task, and audience when speaking and writing</p> <p>9-12.9 An EL can . . . create clear and coherent grade-appropriate speech and text.</p> <p>9-12.10 An EL can . . . make accurate use of standard English to communicate in grade appropriate speech and writing</p>	<ul style="list-style-type: none"> • I can identify a few key words and phrases in oral communications and simple oral and written texts • I can understand and respond to simple yes/no questions about familiar topics • I can communicate basic information about a topic • I can use frequently occurring words and phrases

Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
7	-I can define the different types of Cadences in music. -I can identify the types of cadences in musical examples.	-I can identify the different cadence types (and their application in musical phrases).	
8	-I can write cadences in four-part harmony	I can write four part cadences using voice leading rules.	

Unit Title:

5. Non-Harmonic Tones/Non-Chord Tones (NHTs/NCTs)

Relevant Standards: Bold indicates priority

MU:Cr3.1.C.1a - Identify, describe, and apply teacher-provided criteria to assess and refine the technical and expressive aspects of evolving drafts leading to final versions.

MU:Re7.2.C.1a - Analyze aurally the elements of music (including form) of musical works, relating them to style, mood, and context, and describe how the analysis provides models for personal growth as composer, performer, and/or listener.

MU:Re9.1.C.1a - Describe the effectiveness of the technical and expressive aspects of selected music and performances, demonstrating understanding of fundamentals of music theory.

Essential Question(s):	Enduring Understanding(s):
<p>Cr3.1 How do musicians improve the quality of their creative work?</p> <p>Re7.2 How does understanding the structure and context of music inform a response?</p> <p>Re9.1 How do we judge the quality of musical work(s)?</p>	<p>Cr3.1: Musicians evaluate, and refine their work through openness to new ideas, persistence, and the application of appropriate criteria.</p> <p>Re7.2: Response to music is informed by analyzing context (social, cultural, and historical) and how creators and performers manipulate the elements of music.</p> <p>Re9.1 The personal evaluation of musical work(s) and performance(s) is informed by analysis, interpretation, and established criteria.</p>
Demonstration of Learning:	Pacing for Unit
<p>Identification, decoding, and writing of harmonic cadences..</p> <p>Unit quiz</p>	4 classes
Family Overview (link below)	Integration of Technology:
<p>In this unit (Non-Chord Tones), students will identify notes that don't fit in the chord, their label and their expected resolution.</p>	www.musictheory.net
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):
<p>Passing tone (PT) (accented and unaccented)</p> <p>Neighboring Tone (NT) (upper and lower)</p> <p>Escape Tone (ET)</p> <p>Appoggiatura (APP)</p> <p>Anticipation (ANT)</p> <p>Retardation (RET)</p> <p>Suspension (SUS), 4-3, 9-8, 7-6</p> <p>Non-chord tone/Non-harmonic tone</p> <p>Resolution</p> <p>Voice Leading rules</p>	<p>Handouts</p> <p>Staff Paper</p> <p>Notebook</p> <p>Computer</p>
Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:
N/A	
Connections to Prior Units:	Connections to Future Units:
<p>Music Theory 1: Unit 4 - Triads</p> <p>Music Theory 2: Unit 3 - Figured Bass</p>	AP Music Theory
Differentiation through Universal Design for Learning	
UDL Indicator	Teacher Actions:

<p>Language & Symbols 2.1 Clarify vocabulary and symbols 2.2 Support decoding of text, mathematical notation, and symbols</p> <p>Building Knowledge 3.1 Connect prior knowledge to new learning</p> <p>Expression and Communication 5.2 Use multiple tools for construction, composition, and creativity</p> <p>Strategy Development 6.3 Organize information and resources</p>	<ul style="list-style-type: none"> • Pre-teach vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge. • Offer graphic symbols with alternative text descriptions. • Clarify unfamiliar syntax (in language or in math formulas) or underlying structure (in diagrams, graphs, illustrations, extended expositions, or narratives) through alternatives • Offer clarification of notation through lists of key terms. • Anchor instruction by linking to and activating relevant prior knowledge (e.g., using visual imagery, concept anchoring, or concept mastery routines). • Use Computer-Aided-Design (CAD), music notation (writing) software, or mathematical notation software. • Use checklists and guides for note-taking.
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Supporting Multilingual/English Learners

Related CELP standards :	Learning Targets:
<p>9-12.1 An EL can . . . construct meaning from oral presentations and literary and informational text through grade appropriate listening, reading, and viewing.</p> <p>9-12.7 An EL can . . . adapt language choices to purpose, task, and audience when speaking and writing</p> <p>9-12.9 An EL can . . . create clear and coherent grade-appropriate speech and text.</p> <p>9-12.10 An EL can . . . make accurate use of standard English to communicate in grade appropriate speech and writing</p>	<ul style="list-style-type: none"> • I can identify a few key words and phrases in oral communications and simple oral and written texts • I can understand and respond to simple yes/no questions about familiar topics • I can communicate basic information about a topic • I can use frequently occurring words and phrases

Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
9-10	-I can identify non-chord tones in musical examples by analyzing the underlying chord and finding notes that don't belong. -I can appropriately label the different types of non chord tones	1) I can identify and label all non-harmonic tones in a melody or 4-part score	
11-12	-I understand the required resolutions of the different types of NCTs.	1)I can properly notate non chord tones in a melody or 4-part score	

Unit Title:

6. Phrases and Periods

Relevant Standards: Bold indicates priority

MU:Cr3.1.C.Ia - Identify, describe, and apply teacher-provided criteria to assess and refine the technical and expressive aspects of evolving drafts leading to final versions.

MU:Re7.2.C.IIa - Analyze aurally and/or by reading the scores of musical works the elements of music (including form), compositional techniques and procedures, relating them to style, mood, and context; and explain how the analysis provides models for personal growth as composer, performer, and/or listener.

MU:Re8.1.C.Ia - Develop and explain interpretations of varied works, demonstrating an understanding of the composers' intent by citing technical and expressive aspects as well as the style/genre of each work.

MU:Re9.1.C.Ia - Describe the effectiveness of the technical and expressive aspects of selected music and performances, demonstrating understanding of fundamentals of music theory.

Essential Question(s):

- Cr3.1** How do musicians improve the quality of their creative work?
- Re7.2** How does understanding the structure and context of music inform a response?
- Re8.1** How do we discern the musical creators' and performers' expressive intent?
- Re9.1** How do we judge the quality of musical work(s)?

Enduring Understanding(s):

- Cr3.1:** Musicians evaluate, and refine their work through openness to new ideas, persistence, and the application of appropriate criteria.
- Re7.2:** Response to music is informed by analyzing context (social, cultural, and historical) and how creators and performers manipulate the elements of music.
- Re8.1** Through their use of elements and structures of music, creators and performers provide clues to their expressive intent.
- Re9.1** The personal evaluation of musical work(s) and performance(s) is informed by analysis, interpretation, and established criteria.

Demonstration of Learning:

Identification, decoding, and writing of Phrases and Periods.

Unit quiz

Pacing for Unit

4 classes

Family Overview (link below)

In this unit (Phrases and Periods), students will look at larger sections of written music to look for patterns both melodic and harmonic.

Integration of Technology:

www.musictheory.net

Unit-specific Vocabulary:

Motive
Sequence
3-2-1 ending
Period
Parallel Period

Aligned Unit Materials, Resources, and Technology (beyond core resources):

Handouts
Staff Paper
Notebook
Computer

Contrasting Period Double Period 3-phrase period			
Opportunities for Interdisciplinary Connections:		Anticipated misconceptions:	
N/A			
Connections to Prior Units:		Connections to Future Units:	
Music Theory 2: Unit 4 - Cadences		AP Music Theory	
Differentiation through Universal Design for Learning			
UDL Indicator		Teacher Actions:	
Expression and Communication 5.2 Use multiple tools for construction, composition, and creativity		<ul style="list-style-type: none"> Use Computer-Aided-Design (CAD), music notation (writing) software, or mathematical notation software. 	
Supporting Multilingual/English Learners			
Related CELP standards:		Learning Targets:	
9-12.1 An EL can . . . construct meaning from oral presentations and literary and informational text through grade appropriate listening, reading, and viewing. 9-12.7 An EL can . . . adapt language choices to purpose, task, and audience when speaking and writing 9-12.9 An EL can . . . create clear and coherent grade-appropriate speech and text. 9-12.10 An EL can . . . make accurate use of standard English to communicate in grade appropriate speech and writing		<ul style="list-style-type: none"> I can identify a few key words and phrases in oral communications and simple oral and written texts I can understand and respond to simple yes/no questions about familiar topics I can communicate basic information about a topic I can use frequently occurring words and phrases 	
Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
13	1) I can identify a motive in a piece of music.	1) I can correctly identify the motive in a musical excerpt	
14	2) I can identify the melodic structure of a piece of music (motive, focal point, etc).	2) I can identify the elements of a melody (motive, sequence, 3-2-1	

		ending, focal point)	
15	3) I can identify phrases and determine if they form a period and determine which type of period is formed.	3) I can diagram a phrase with phrase length and how the phrases relate to each other	
16	4) I can diagram phrases and tell how they relate to each other (A, B, A', etc).		

Unit Title:

7. Texture Terms and Textural Reductions

Relevant Standards: Bold indicates priority

MU:Cr3.1.C.1a - Identify, describe, and apply teacher-provided criteria to assess and refine the technical and expressive aspects of evolving drafts leading to final versions.

MU:Re7.2.C.11a - Analyze aurally and/or by reading the scores of musical works the elements of music (including form), compositional techniques and procedures, relating them to style, mood, and context; and explain how the analysis provides models for personal growth as composer, performer, and/or listener.

MU:Re8.1.C.1a - Develop and explain interpretations of varied works, demonstrating an understanding of the composers' intent by citing technical and expressive aspects as well as the style/genre of each work.

MU:Re9.1.C.1a - Describe the effectiveness of the technical and expressive aspects of selected music and performances, demonstrating understanding of fundamentals of music theory.

Essential Question(s):

- Cr3.1** How do musicians improve the quality of their creative work?
- Re7.2** How does understanding the structure and context of music inform a response?
- Re8.1** How do we discern the musical creators' and performers' expressive intent?
- Re9.1** How do we judge the quality of musical work(s)?

Enduring Understanding(s):

- Cr3.1:** Musicians evaluate, and refine their work through openness to new ideas, persistence, and the application of appropriate criteria.
- Re7.2:** Response to music is informed by analyzing context (social, cultural, and historical) and how creators and performers manipulate the elements of music.
- Re8.1** Through their use of elements and structures of music, creators and performers provide clues to their expressive intent.
- Re9.1** The personal evaluation of musical work(s) and performance(s) is informed by analysis, interpretation, and established criteria.

Demonstration of Learning:

Identification, decoding, and writing of musical Textures.

Unit Quiz

Pacing for Unit

4 classes

Family Overview (link below)

Integration of Technology:

<p>In this unit (Texture), students will explore different ways chords and melodies are presented in music. They will consider how many parts are present, and whether the vertical harmony or horizontal melody is primary.</p>	<p>www.musictheory.net</p>
<p>Unit-specific Vocabulary:</p>	<p>Aligned Unit Materials, Resources, and Technology (beyond core resources):</p>
<p>Monophonic Homophonic Heterophony Melody with accompaniment Polyphony Harmonic Rhythm</p>	<p>Handouts Staff Paper Notebook Computer</p>
<p>Opportunities for Interdisciplinary Connections:</p>	<p>Anticipated misconceptions:</p>
<p>N/A</p>	
<p>Connections to Prior Units:</p>	<p>Connections to Future Units:</p>
<p>N/A</p>	<p>AP Music Theory</p>
<p>Differentiation through Universal Design for Learning</p>	
<p>UDL Indicator</p>	<p>Teacher Actions:</p>
<p>Language & Symbols 2.1 Clarify vocabulary and symbols 2.2 Support decoding of text, mathematical notation, and symbols</p> <p>Expression and Communication 5.2 Use multiple tools for construction, composition, and creativity</p>	<ul style="list-style-type: none"> • Pre-teach vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge. • Offer graphic symbols with alternative text descriptions. • Clarify unfamiliar syntax (in language or in math formulas) or underlying structure (in diagrams, graphs, illustrations, extended expositions, or narratives) through alternatives • Offer clarification of notation through lists of key terms. • Use Computer-Aided-Design (CAD), music notation (writing) software, or mathematical notation software.
<p>Supporting Multilingual/English Learners</p>	
<p>Related CELP standards:</p>	<p>Learning Targets:</p>
<p>9-12.1 An EL can . . . construct meaning from oral presentations and literary and informational text through grade appropriate listening, reading, and viewing.</p> <p>9-12.7 An EL can . . . adapt language choices to purpose, task,</p>	<ul style="list-style-type: none"> • I can identify a few key words and phrases in oral communications and simple oral and written texts • I can understand and respond to simple yes/no questions about familiar topics • I can communicate basic information about a topic • I can use frequently occurring words and

and audience when speaking and writing		phrases	
9-12.9 An EL can . . . create clear and coherent grade-appropriate speech and text.			
9-12.10 An EL can . . . make accurate use of standard English to communicate in grade appropriate speech and writing			
Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
17-20	I can identify the quality of texture in musical examples.	1) I can use appropriate texture term to identify musical elements in printed music 2) I can write a textural reduction of a piano score 3) I can identify the Harmonic Rhythm of a musical excerpt	

Unit Title:	
8. Secondary Functions	
Relevant Standards: Bold indicates priority	
<p>MU:Cr2.1.C.1a - Assemble and organize sounds or short musical ideas to create initial expressions of selected experiences, moods, images, or storylines.</p> <p>MU:Cr3.1.C.1a - Identify, describe, and apply teacher-provided criteria to assess and refine the technical and expressive aspects of evolving drafts leading to final versions.</p> <p>MU:Re7.2.C.1a - Analyze aurally and/or by reading the scores of musical works the elements of music (including form), compositional techniques and procedures, relating them to style, mood, and context; and explain how the analysis provides models for personal growth as composer, performer, and/or listener.</p> <p>MU:Re8.1.C.1a - Develop and explain interpretations of varied works, demonstrating an understanding of the composers' intent by citing technical and expressive aspects as well as the style/genre of each work.</p> <p>MU:Re9.1.C.1a - Describe the effectiveness of the technical and expressive aspects of selected music and performances, demonstrating understanding of fundamentals of music theory.</p>	
Essential Question(s):	Enduring Understanding(s):
<p>Cr2.1 How do musicians make creative decisions?</p> <p>Cr3.1 How do musicians improve the quality of their creative work?</p> <p>Re7.2 How does understanding the structure and</p>	<p>Cr2.1: Musicians' creative choices are influenced by their expertise, context, and expressive intent.</p> <p>Cr3.1: Musicians evaluate, and refine their work through openness to new ideas, persistence, and the application of appropriate criteria.</p> <p>Re7.2: Response to music is informed by analyzing</p>

<p>context of music inform a response?</p> <p>Re8.1 How do we discern the musical creators' and performers' expressive intent?</p> <p>Re9.1 How do we judge the quality of musical work(s)?</p>	<p>context (social, cultural, and historical) and how creators and performers manipulate the elements of music.</p> <p>Re8.1 Through their use of elements and structures of music, creators and performers provide clues to their expressive intent.</p> <p>Re9.1 The personal evaluation of musical work(s) and performance(s) is informed by analysis, interpretation, and established criteria.</p>
Demonstration of Learning:	Pacing for Unit
<p>Identification, decoding, and writing of secondary dominant chords and functions.</p> <p>Unit Quiz</p>	7 classes
Family Overview (link below)	Integration of Technology:
<p>In this unit (Secondary Functions), students will expand their understanding of chord progressions to include chords that are outside the key signature.</p>	www.musictheory.net
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):
<p>Secondary Dominants V/V, V/ii, V/vi, V/IV, vii6/V</p>	<p>Handouts Staff Paper Notebook Computer</p>
Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:
N/A	
Connections to Prior Units:	Connections to Future Units:
<p>Music Theory 1: Unit 4 - Triads Music Theory 2: Unit 3 - Figured Bass Music Theory 2: Unit 4 - Cadences</p>	AP Music Theory
Differentiation through Universal Design for Learning	
UDL Indicator	Teacher Actions:
<p>Language & Symbols 2.1 Clarify vocabulary and symbols 2.2 Support decoding of text, mathematical notation, and symbols</p> <p>Expression and Communication 5.2 Use multiple tools for construction, composition, and creativity</p> <p>Strategy Development 6.3 Organize information and resources</p>	<ul style="list-style-type: none"> • Pre-teach vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge. • Offer graphic symbols with alternative text descriptions. • Clarify unfamiliar syntax (in language or in math formulas) or underlying structure (in diagrams, graphs, illustrations, extended expositions, or narratives) through alternatives • Offer clarification of notation through lists of key terms. • Use Computer-Aided-Design (CAD), music notation (writing) software, or mathematical notation software. • Use checklists and guides for note-taking.

Supporting Multilingual/English Learners

Related CELP standards:	Learning Targets:
<p>9-12.1 An EL can ... construct meaning from oral presentations and literary and informational text through grade appropriate listening, reading, and viewing.</p> <p>9-12.7 An EL can ... adapt language choices to purpose, task, and audience when speaking and writing</p> <p>9-12.9 An EL can ... create clear and coherent grade-appropriate speech and text.</p> <p>9-12.10 An EL can ... make accurate use of standard English to communicate in grade appropriate speech and writing</p>	<ul style="list-style-type: none"> • I can identify a few key words and phrases in oral communications and simple oral and written texts • I can understand and respond to simple yes/no questions about familiar topics • I can communicate basic information about a topic • I can use frequently occurring words and phrases

Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
21-22	-I can identify a secondary chord as being outside of the key signature of the musical example.	1) I can write & identify secondary functions in any key	
23-24	-I can identify and define how this chord is a temporary tonicization of the preceding chord by using appropriate Roman and Arabic Numerals.		
25-27	-I can resolve the members of the secondary dominant chord properly into the following chord using voice leading rules.	2) I can appropriately write resolution chords to secondary functions	

Course Title:	Content Area:	Grade Level:	Credit (if applicable)
Shooting Stars	Science	5	N/A

Course Description:

Students will explore the phenomena of shooting stars to learn more about stars, patterns in space, and the phases of matter in this unit. They are presented with a discovery question in Learning Sequence 1, and continue to explore and refine their answer to the question throughout the following sequences.

In Learning Sequence 1, students explore the concept of shooting stars through watching an introductory video. After watching, they are presented with the unit's discovery question: Is a shooting star a star? They'll base their initial answer off of prior knowledge, and form an agree-disagree line to discuss and revise their ideas. In small groups, students generate a list of questions around the phenomena-"Is a shooting star really a star?". They share their top three questions with the class, and the class organizes the top questions into a driving question board. The driving question board guides the learning in future learning sequences. Later in the unit, students will return to the DQB to answer or respond to their initial questions.

In Learning Sequence 2, students investigate and research stars to generate a list of characteristics common to all stars, and summarize their list to create a definition. Students also investigate the magnitude of stars and use their observations to determine the comparative distance of different stars to Earth. Using the generated list, students look back to their initial anchor phenomenon observations and begin to revise their thinking about the shooting star. As students develop an understanding of stars and their brightness, they will be able to apply the concept of brightness as evidence that the shooting star can not be an actual star. Students end the learning sequence with a self-written definition of a star and updating their Summary Table.

In this Learning Sequence 3, students explore the patterns associated with the sun, earth, and moon. Students explore and model various celestial patterns including day and night, (seasons is only touched upon, this is taught again in Expedition Antarctica) shadows, and the moon phases. Then they analyze shooting star data to determine the shooting stars have the same predictable nature as other celestial events. Through research, students realize that meteor showers are predictable and happen during the same times each year. As the Earth passes through fields of comet debris, some of the debris enters the earth's atmosphere, creating "shooting stars" or meteor showers. Ultimately, students will use their research to claim that shooting stars are not stars. They will explain that because of Earth's orbit and the predictability of location and time, the Earth passes through the same debris field annually, making meteor showers predictable.

In Learning Sequence 4, students have figured out that shooting stars are not stars but are meteors that enter the atmosphere and burn up creating the streak we see across the night sky. Despite the burning, the amount of matter in the meteor is conserved. This Learning Sequence helps students understand that matter cannot disappear. Students will conduct experiments to investigate physical properties of substances. They will determine that matter is conserved as it changes states or is mixed. They will plan investigations, and make and record observations throughout each exploration activity and teacher demonstrations. Students will measure and collect data, making graphical representations of their findings. Students will test samples based on physical properties to identify an actual meteorite. At the end of the sequence, students explain that matter is conserved related to the burning of a meteor as it enters Earth's atmosphere.

In Learning Sequence 5, students review the states of matter from their matter conservation experiments and question the state of matter of a star and a shooting star. Students investigate states of matter and the organizational difference of the particles in those different states. Students apply their understanding of the organizational and particle differences to develop a model representing the three states of matter: solid, liquid, gas. Then, students explore the state of plasma. Stars are composed of matter and are in the state called plasma. Students research the arrangement of the particles in plasma and extend their three dimensional models to include plasma. The sequence ends with explanatory models of each solid, liquid, gas, and plasma.

The final task asks students to apply what they've learned throughout the unit to generate a model that

represents the similarities and differences between a “shooting star” and a star. Students use evidence/learned content from each of the learning sequences to make the comparison and can choose a format of how to present their ideas.

Aligned Core Resources:	Connection to the BPS Vision of the Graduate
N/A	<p>Collaboration</p> <ul style="list-style-type: none"> • Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal • Assume shared responsibility for collaborative work and value the individual contributions made by each team member <p>Communication</p> <ul style="list-style-type: none"> • Articulates thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts <p>Critical Thinking and Problem Solving</p> <ul style="list-style-type: none"> • Collect, assess and analyze relevant information • Reason effectively. • Make sound judgements and decisions. Identify, define and solve authentic problems and essential questions. • Reflect critically on learning experience, processes and solutions. • Transfer knowledge to other situations
Additional Course Information: Knowledge/Skill Dependent courses/prerequisites	Link to Completed Equity Audit
N/A	Grade 5 Science Equity Audit

Standard Matrix

District Learning Expectations and Standards	Unit 1	Unit 2	Unit 3
5-PS1-1 . Develop a model to describe that matter is made of particles too small to be seen.	X		X
5-PS1-2 . Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.	X		
5-PS1-3 . Make observations and measurements to identify materials based on their properties.	X		
5-PS1-4 . Conduct an investigation to determine whether the mixing of two or more substances results in new substances.	X		
5-PS2-1 . Support an argument that the gravitational force exerted by Earth on objects is directed down.			X
5-PS3-1 . Use models to describe that energy in animals’ food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.		X	

ESS1.A : The Universe and its Stars: The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.	X		
5-ESS1-2 . Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.	X	X	X
5-ESS2-1 . Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.			X
5-ESS2-2 . Describe and graph the amounts of saltwater and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.			X
5-ESS3-1 . Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.		X	
5-LS1-1 . Support an argument that plants get the materials they need for growth chiefly from air and water.		X	
5-LS2-1 . Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.		X	
3-5-ETS1-1 . Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.		X	
3-5-ETS1-2 . Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.			X

Unit Links

If unit headings are formatted as a heading, then we can link a Table of Contents to better organize and provide faster access to each unit

[Shooting Stars](#)

[Golden Jellies](#)

[Expedition Antarctica](#)

Unit Title:

Shooting Stars

Relevant Standards: Bold indicates priority

- [ESS1.A](#): The Universe and its Stars: The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.

SEP	Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions.
DCI	Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.
CCC	Patterns in the natural world can be observed, used to describe phenomena, and used as evidence. Science assumes natural events happen today as they happened in the past. Many events are repeated.

- [5-PS1-1](#). Develop a model to describe that matter is made of particles too small to be seen.

SEP	Use models to describe phenomena.
DCI	Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gasses are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects.
CCC	Natural objects exist from the very small to the immensely large.

- [5-PS1-2](#). Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.

SEP	Measure and graph quantities such as weight to address scientific and engineering questions and problems
DCI	<ul style="list-style-type: none"> • PS1.A: Structure and Properties of Matter The amount (weight) of matter is conserved when it changes form, even in transitions in

	<table border="1"> <tr> <td></td> <td> <ul style="list-style-type: none"> ● PS1.B: Chemical Reactions No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) </td> </tr> <tr> <td>CCC</td> <td> <ul style="list-style-type: none"> ● Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. ● Science assumes consistent patterns in natural systems. </td> </tr> </table>		<ul style="list-style-type: none"> ● PS1.B: Chemical Reactions No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) 	CCC	<ul style="list-style-type: none"> ● Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. ● Science assumes consistent patterns in natural systems. 		
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<ul style="list-style-type: none"> ● 5-PS1-3. Make observations and measurements to identify materials based on their properties. 	<table border="1"> <tr> <td>SEP</td> <td>Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.</td> </tr> <tr> <td>DCI</td> <td>Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic scale mechanism of evaporation and condensation.)</td> </tr> <tr> <td>CCC</td> <td>Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.</td> </tr> </table>	SEP	Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.	DCI	Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic scale mechanism of evaporation and condensation.)	CCC	Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.
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<ul style="list-style-type: none"> ● 5-ESS1-2. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. 	<table border="1"> <tr> <td>SEP</td> <td>Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.</td> </tr> <tr> <td>DCI</td> <td>The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles,</td> </tr> </table>	SEP	Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.	DCI	The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles,		
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CCC	Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena.				
Essential Question(s):	Enduring Understanding(s):				
<ul style="list-style-type: none"> ● Is a shooting star really a star? ● What is a star? ● What are the patterns of the Earth, sun, moon, and shooting stars? ● Is matter lost or destroyed when a meteoroid enters Earth's atmosphere? ● What is matter? <ul style="list-style-type: none"> ○ What state of matter is a shooting star? 	<ul style="list-style-type: none"> ● Describe that matter is made of particles too small to be seen. ● Understand that regardless of the type of change matter undergoes, the total weight of matter is conserved. ● Understand patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. 				
Demonstration of Learning:	Pacing for Unit				
<ul style="list-style-type: none"> ● LS4 - CFA <ul style="list-style-type: none"> ○ Does the amount of mass change as a meteoroid enters the Earth's atmosphere? ○ Students write 3-5 sentences in their Science Notebooks about the conservation of matter and meteorites entering the atmosphere to gather ideas and questions ● Culminating Task <ul style="list-style-type: none"> ○ In this task, students apply what they've learned throughout the unit to generate a model that represents the similarities and differences between a shooting star and a star. <ul style="list-style-type: none"> ■ Options: A report, A Slides presentation, A poster or brochure, Accept any reasonable suggestions 	6 weeks				
Family Overview (link below)	Integration of Technology:				
Family Overview - Unit 1	<i>Intentionally aligned use of digital tools and resources to support acquisition of content, researching, organizing and communicating learning</i> <ul style="list-style-type: none"> ● Digital Science Notebook ● Graphing Weights of Substances 				

	<ul style="list-style-type: none"> • PHET Interactive Simulations 																																																						
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):																																																						
<table border="1"> <tr><td>Analyze</td><td>Model</td><td>Phenomena</td></tr> <tr><td>Matter</td><td>Solid</td><td>Liquid</td></tr> <tr><td>Gas</td><td>Plasma</td><td>Particle</td></tr> <tr><td>Observation</td><td>Effects</td><td>Measure</td></tr> <tr><td>Immense</td><td>Graph</td><td>Quantity</td></tr> <tr><td>Substances</td><td>Conservation</td><td>Form</td></tr> <tr><td>Evidence</td><td>Chemical reactions</td><td>Standard units</td></tr> <tr><td>Weight</td><td>Time</td><td>Temperature</td></tr> <tr><td>Scientific Questions</td><td>Engineering questions</td><td>Problems</td></tr> <tr><td>Data</td><td>Properties</td><td>Investigation</td></tr> <tr><td>Fair Test</td><td>Variable</td><td>Control</td></tr> <tr><td>Trial</td><td>Substance</td><td>Cause/Effect Relationship</td></tr> <tr><td>Change</td><td>Change</td><td>Argument</td></tr> <tr><td>Graphical Display</td><td>Bar Graph</td><td>Pictograph</td></tr> <tr><td>Orbit</td><td>Revolution</td><td>Axis</td></tr> <tr><td>Rotation</td><td>North/South Pole</td><td>Classify</td></tr> <tr><td>Apparent brightness/magnitude</td><td></td><td></td></tr> <tr><td></td><td></td><td></td></tr> </table>	Analyze	Model	Phenomena	Matter	Solid	Liquid	Gas	Plasma	Particle	Observation	Effects	Measure	Immense	Graph	Quantity	Substances	Conservation	Form	Evidence	Chemical reactions	Standard units	Weight	Time	Temperature	Scientific Questions	Engineering questions	Problems	Data	Properties	Investigation	Fair Test	Variable	Control	Trial	Substance	Cause/Effect Relationship	Change	Change	Argument	Graphical Display	Bar Graph	Pictograph	Orbit	Revolution	Axis	Rotation	North/South Pole	Classify	Apparent brightness/magnitude						<ul style="list-style-type: none"> • Books in Bin: <ul style="list-style-type: none"> ○ From Galileo to the Mars Rover and Beyond-Exploring Space ○ Hidden Figures ○ Margaret and the Moon ○ Next Time You See a Sunset ○ Seven Wonders of the Solar System ○ Stars (Jump Into Science) ○ Voyager's Greatest Hits-the Epic Trek to Interstellar Space ○ When the Sun Goes Dark, Star Stuff-Carl Sagan ○ When I heard the Learn'd astronomer ○ Elon Musk and the Quest for a Fantastic Future; Space Exploration ○ The Sun, S. Simon • Epic! Book Collection • Shooting Stars At Night - LS1 • Optional: Virtual Field Trip to International Space Station • The Anvil of Creation Video • Sci Show Kids Star Video • Crash Course Kids Stars Video • Day & Night Time Lapse Video • Day on Earth Study Jams video • Shadows Crash Course Video • Moon Phases Demonstration Video • Moon Phases Crash Course • Scale Model Video • Meteor Showers Article • Meteor Showers 101 National Geographic • Properties Video • Sugar Dissolving Video • Elephant Toothpaste • Conservation of Matter Video • Meteor vs. Meteorite Video • Meteorite Identification Article • Plasma Article • PHET Interactive Simulations • Meteors 101 National Geographic
Analyze	Model	Phenomena																																																					
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Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:																																																						
Literacy connections: <ul style="list-style-type: none"> • Students are asking and answering questions. 	<ul style="list-style-type: none"> • The Sun is not a star • The Sun disappears at night • The surface of the Sun is without visible features 																																																						

<ul style="list-style-type: none"> Students draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. Recalling information and data from multiple sources <p>Mathematics connections:</p> <ul style="list-style-type: none"> Measuring and estimating Reason abstractly and quantitatively. Use appropriate tools strategically Recognize volume as an attribute of solid figures Represent real world and mathematical problems by graphing 		<ul style="list-style-type: none"> The Sun rises exactly in the east and sets exactly in the west every day All stars are the same brightness in space The Sun is very close to Earth Stars are a similar distance away from Earth The height the sun reaches in the sky on any given day is the same everywhere on earth The highest point the sun reaches in the sky is the same throughout the year The number of hours of daylight is the same anywhere on earth The number of hours of daylight a place receives is due to how far the earth is from the sun Mass is not conserved during chemical reactions New mass is created during chemical reactions Mass can become lighter or less in a chemical reaction Matter that we can't see has disappeared Air does not take up space Matter exists only when we can see or feel it Particles of a solid, liquid or gas are not moving The gaseous state of a substance weighs less than its liquid or solid form If two substances share a characteristic property, they are the same substance
Connections to Prior Units:		Connections to Future Units:
<p>Connections to:</p> <ul style="list-style-type: none"> Grade 1 Unit 1: Shadows on the Playground Grade 2 Unit 1: 4th Little Pig 		<p>Connections to:</p> <ul style="list-style-type: none"> Grade 6 Unit 3: Energy Drinks Grade 7 Unit 3: Jetpackson Earth and in Space Grade 7 Unit 4: Congo Medicine Drop Grade 8 Unit 3: Navigating the Seas throughout Human History
Differentiation through <i>Universal Design for Learning</i>		
UDL Indicator	Teacher Actions:	
Comprehension 3.3	<ul style="list-style-type: none"> Provide interactive models that guide exploration and new understandings Progressively release information (e.g., sequential highlighting) 	
Supporting Multilingual/English Learners		
Related <i>CELP standards:</i>	Learning Targets:	
4-5.5 conduct research and evaluate and communicate findings to answer questions or solve problems.	I can gather information from multiple resources to demonstrate my learning of shooting stars.	
Learning Sequence	Learning Target & Success Criteria	Resources
1	I can make observations and ask questions on shooting stars. <input type="checkbox"/> I can make 2-3 observations.	<ul style="list-style-type: none"> science notebook

	<input type="checkbox"/> I can ask what, where, when, why questions.	<ul style="list-style-type: none"> • Epic! Book Collection • loom video as an option
2	<p>I can list characteristics of stars from a variety of sources.</p> <input type="checkbox"/> I listed 3-5 characteristics <p>I can generate a simple definition of a star</p> <input type="checkbox"/> I used the characteristics to define a star <input type="checkbox"/> I did not use the word star in my definition <p>I can explain why the sun appears larger and brighter than other stars</p> <input type="checkbox"/> I included the relationship of distance <input type="checkbox"/> I used evidence from flashlight activity in my explanation <p>I can make a claim about whether or not a shooting star is a star</p> <input type="checkbox"/> I used the characteristics of stars, including size, to make my claim	<ul style="list-style-type: none"> • STARFORGE: The Anvil Creation • scishow kids stars; crash course kids stars • Science Learning Hub • National Geographic article Stars • CK-12 Resources: Stars, Sun • EPIC: Galaxies and Stars: star resource • EPIC! Digital Library - G5 U1B Lis • Think, Pair, Share strategy
3	<p>I can explain the rotation of the Earth about an axis as the pattern of day and night</p> <input type="checkbox"/> I explained how the Earth rotates on an axis <input type="checkbox"/> I explained the pattern of day and night <p>I can use evidence to explain the changing patterns of sun-related shadows throughout the day</p> <input type="checkbox"/> I explained how and why shadows change throughout the day <p>I can explain what causes the phases of the moon</p> <input type="checkbox"/> I explained the reason for the different moon phases <p>I can demonstrate with a simulation the regular patterns of the orbit of the Earth around the sun and the orbit of the moon around the earth</p> <input type="checkbox"/> I demonstrated the pattern of the earth orbit around the sun and the moon around the earth <p>I can explain that shooting stars are really predictable patterns of meteor showers</p> <input type="checkbox"/> I explained the predictable patterns of meteor showers	<ul style="list-style-type: none"> • Time Lapse Video • Study Jam Video • Shadows crash course kids • Moongiant website • Video Demo Earth, Moon, Sun relationship-28 minute video from Glastonbury Planetarium • CK-12 Resources: Lunar Phases • CK-12: Meteors
4	<p>I can identify and provide examples of the three common states of matter</p> <input type="checkbox"/> I identified the three states of matter <input type="checkbox"/> I gave 2 to 3 examples of each state of matter	<ul style="list-style-type: none"> • meteorite video • sugar dissolving • Elephant Toothpaste Demonstration Procedure • Vacation or

	<p>I can describe common materials by their physical properties</p> <p><input type="checkbox"/> I described a material using at least 3 different physical properties</p> <p>I can conduct investigations involving changing states of matter</p> <p><input type="checkbox"/> I conducted an investigation on changing states of matter</p> <p>I can conduct an investigation to determine if mixing two substances results in a new substance</p> <p><input type="checkbox"/> I conducted an investigation of mixing two substances</p> <p><input type="checkbox"/> I described why mixing two substances created a new substance</p> <p>I can record data and represent it with a graph to show a relationship</p> <p><input type="checkbox"/> I recorded and graphed the data</p> <p><input type="checkbox"/> I used the data to explain the relationship between of the two substances</p> <p>I can use data to determine if matter is conserved</p> <p><input type="checkbox"/> I explained the term conservation</p> <p><input type="checkbox"/> I used evidence to prove my claim</p> <p>I can explain what happens when a meteoroid hits earth's atmosphere with a model</p> <p><input type="checkbox"/> I created a model of a meteoroid traveling through the earth atmosphere</p> <p><input type="checkbox"/> I labeled the three different terms meteoroids, meteors and meteorite</p> <p><input type="checkbox"/> I explained the relationship between meteoroids, meteors and meteorite</p> <p>I can use physical properties of a meteorite to identify specimens</p> <p><input type="checkbox"/> I tested the specimens using the tools safely</p> <p><input type="checkbox"/> I collected evidence on each specimen on my recording sheet</p> <p><input type="checkbox"/> I used evidence to prove which specimen was a meteorite</p>	<p>Conservation (Of Mass)</p> <ul style="list-style-type: none"> • meteorite video • Difference between meteor and meteorite
5	<p>I can describe the 3 states of matter and provide examples</p> <p><input type="checkbox"/> I described the 3 states of matter</p> <p><input type="checkbox"/> I gave 2-3 examples of each state of matter</p> <p>I can identify the fourth state of matter, plasma, in a star</p> <p><input type="checkbox"/> I can identify the fourth state of matter</p> <p>I can demonstrate understanding of particle arrangement and behavior with an explanatory model of the four states of matter</p> <p><input type="checkbox"/> I demonstrated, using my model, the four states of matter</p> <p><input type="checkbox"/> I showed differences in particle arrangement of the four states of matter</p>	<ul style="list-style-type: none"> • States of Matter: Basics
6	<p>I can-generate and present an explanatory model that represents the similarities and differences between a star and a "shooting star"(culminating task)</p> <p><input type="checkbox"/> I showed at least 4 ways meteors are different from or similar to</p>	

	<p>stars</p> <ul style="list-style-type: none"><input type="checkbox"/> I showed at least 3 - 5 pieces of evidence to support my model<input type="checkbox"/> I used respected sources and past investigations from the unit to support my mode<input type="checkbox"/> I presented my model in an organized presentation	
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Unit Title:

Golden Jellies

Course Description

This unit is designed to build student's understanding of life on Earth and the factors which allow species to survive and thrive and humanity's role in this. Students study the Golden Jellyfish of Lake Palau as an anchoring phenomena. The Jellyfish of Lake Palau are a non stinging jellyfish that have evolved in isolation in Lake Palau's salt lake. The jellyfish has a symbiosis with zooxanthellae (algae). The zooxanthellae live in the tissues of the Jelly and convert sunlight to sugar using photosynthesis. This sugar is the food source for both the zooxanthellae and the jelly. Because of the zooxanthellae need for direct sunlight, the Golden Jellyfish travel across lake Palau daily to guarantee direct sunlight.

Students share their experiences and prior knowledge about jellyfish, then observe a video of a man swimming through Lake Palau with the Golden Jellyfish. Their prior understanding and observations will have some contradictions. After watching the video students will generate questions and create a driving question board to guide the rest of the unit.

Through the learning in the sequence 2, students come to understand the role of sunlight and other abiotic factors to the success of an organism within an ecosystem. The golden jellyfish of Lake Palau are in a unique ecosystem and meet their needs in a unique way, a symbiotic relationship with photosynthetic algae. Students research the role of sunlight, abiotic factors and the algae (plant/food) in the success of the Jellies in Lake Palau

In sequence 3, students build their understanding of the word ecosystem, as they begin to map how matter moves through the biotic and abiotics factors found within the system. Students relate this system's thinking to the Lake Palau ecosystem, where students learn the means through which matter travels. Students build an understanding of the types of organisms present and their relationship with one another in the process of moving matter and energy.

The golden jellyfish has zooxanthellae (algae) that lives within its tissues. The zooxanthellae use sunlight to make sugar (food) for both itself and the Golden Jellyfish. As a result of this partnership, the golden jellyfish needs access to direct sunlight to get food. To improve the amount of food accessed during the day, the Golden Jellyfish travels across Lake Palau with the sun. This pattern of the sun (daily and seasonal) is essential to the success of the two species-zooxanthellae and golden jellyfish. In sequence 4, students understand the symbiosis and the daily migration of the jellies to improve access to food.

The location of Palau and its famous Jellyfish lake is amidst the most popular shipping route in the world. While Palau itself has limited visitors and a small human population, the trade route impacts the region in a variety of ways. The greater the number of ships traveling through the South Pacific increases the risk for an oil spill or other harmful pollutants to enter the ecosystem. All pollution impacts the trophic levels of the Palau environment. Learning sequence 5 asks students to predict how human interactions may be affecting the population of the golden jellyfish.

In the culminating performance task, students show their understanding of ecosystem dynamics by developing a final model of how the Golden Jellyfish survives and thrives in Lake Palau.

Relevant Standards: Bold indicates priority

<p>5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.</p>	<table border="1"> <tr> <td>SEP</td> <td>Use models to describe phenomena.</td> </tr> <tr> <td>DCI</td> <td> <ul style="list-style-type: none"> The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary) </td> </tr> <tr> <td>CCC</td> <td>Energy can be transferred in various ways and between objects.</td> </tr> </table>	SEP	Use models to describe phenomena.	DCI	<ul style="list-style-type: none"> The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary) 	CCC	Energy can be transferred in various ways and between objects.
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<p>5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.</p>	<table border="1"> <tr> <td>SEP</td> <td>Support an argument with evidence, data, or a model.</td> </tr> <tr> <td>DCI</td> <td>Plants acquire their material for growth chiefly from air and water.</td> </tr> <tr> <td>CCC</td> <td>Matter is transported into, out of, and within systems.</td> </tr> </table>	SEP	Support an argument with evidence, data, or a model.	DCI	Plants acquire their material for growth chiefly from air and water.	CCC	Matter is transported into, out of, and within systems.
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CCC	Matter is transported into, out of, and within systems.						
<p>5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.</p>	<table border="1"> <tr> <td>SEP</td> <td> <ul style="list-style-type: none"> Develop a model to describe phenomena. Science explanations describe the mechanisms for natural events. </td> </tr> <tr> <td>DCI</td> <td> <ul style="list-style-type: none"> The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gasses, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. </td> </tr> </table>	SEP	<ul style="list-style-type: none"> Develop a model to describe phenomena. Science explanations describe the mechanisms for natural events. 	DCI	<ul style="list-style-type: none"> The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gasses, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. 		
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<p>5-ESS1-2. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky</p>	<table border="1"> <tr> <td>SEP</td> <td>Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.</td> </tr> <tr> <td>DCI</td> <td>The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.</td> </tr> <tr> <td>CCC</td> <td>Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena.</td> </tr> </table>	SEP	Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.	DCI	The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.	CCC	Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena.
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CCC	Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena.						
<p>5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.</p>	<table border="1"> <tr> <td>SEP</td> <td>Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.</td> </tr> <tr> <td>DCI</td> <td>Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.</td> </tr> <tr> <td>CCC</td> <td> <ul style="list-style-type: none"> • A system can be described in terms of its components and their interactions. • Science findings are limited to questions that can be answered with empirical evidence. </td> </tr> </table>	SEP	Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.	DCI	Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.	CCC	<ul style="list-style-type: none"> • A system can be described in terms of its components and their interactions. • Science findings are limited to questions that can be answered with empirical evidence.
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<p>3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost</p>	<table border="1"> <tr> <td>SEP</td> <td>Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.</td> </tr> <tr> <td>DCI</td> <td>Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets</td> </tr> </table>	SEP	Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.	DCI	Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets		
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	the specified criteria for success or how well each takes the constraints into account.				
CCC	People's needs and wants change over time, as do their demands for new and improved technologies.				
Essential Question(s):	Enduring Understanding(s):				
<ul style="list-style-type: none"> • What questions do we have about the jellyfish of Lake Palau? • What do species need to survive and thrive? • Why is an ecosystem a system? • How does matter move through the system? • How do the predictable patterns of the Sun affect living things, including zooxanthellae and Golden Jellyfish, on Earth? • What impact are human activities having on the Earth and what can humans do to protect the Earth and the Earth's resources? 	<ul style="list-style-type: none"> • Describe the ways the geosphere, biosphere, hydrosphere and/or atmosphere interact. • Understand that plants get the materials they need for growth chiefly from air and water. • Describe the movement of matter among plants, animals, decomposers, and the environment and that energy in animals' food was once energy from the sun. • Understand patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. 				
Demonstration of Learning:	Pacing for Unit				
<ul style="list-style-type: none"> • CFA LS2 <ul style="list-style-type: none"> ◦ Student Assessment Task ◦ Rubric • CFA LS3 <ul style="list-style-type: none"> ◦ Why is an ecosystem a system? ◦ Template • CFA LS 4 <ul style="list-style-type: none"> ◦ How do the predictable patterns of the sun affect living things? ◦ Google Form • Culminating Task: Human Impact <ul style="list-style-type: none"> ◦ Examples ◦ Research Resources 	6 weeks				
Family Overview (link below)	Integration of Technology:				
Family Overview - Unit 2	<i>Intentionally aligned use of digital tools and resources to support acquisition of content, researching, organizing and communicating learning</i> <ul style="list-style-type: none"> • Digital Student Science Notebook • Synthesizing Information from Multiple Resources <ul style="list-style-type: none"> ◦ Temperate Deciduous Forest Jamboard <ul style="list-style-type: none"> ▪ Student Research Resources ◦ Human Impact • Mangrove Ecosystem Simulation 				
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):				

Phenomena	Energy	Repair
Body Warmth	Chemical Process	Transferred
Support	Systems	Decomposers
Environment	Ecosystem	Organisms
Food Web	Fungi	Bacteria
Recycle	Survive	Species
Balance	Microbes	Components
Interactions	Graphical Display	Bar Graph
Pie Chart	Interactions	Classify
Analyze	Protect	Human Activities
Agriculture	Industry	Major Effects
Vegetation	Criteria	Constraints
Proposal	Compared	Demands
Improved	Technologies	Communities

- [Intro to Golden Jellies Video](#)
- [Smithsonian Museum SlideShow Coral Reefs](#)
- [Discover Files Abiotic & Biotic Factors Article](#)
- [EPIC! Books Collection](#)
- [Lake Paula Information](#) (for Jigsaw)
- [Jellyfish Lake Article](#)
- [Snorkeling Amongst the Jellies Article](#)
- [Ecosystems Study Jams](#)
- [Flow of Matter Article](#)
- [Sun Seeking Plant Time Lapse Video](#)
- [Plant Following Light Video](#)
- [Earth's Rotation Video](#)
- [Golden Jellies Migration Video](#)
- [Gotta Eat! Crash Course Video](#)

Opportunities for Interdisciplinary Connections:

Literacy connections:

- Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.
- Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.
- Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.
- Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.
- Include multimedia components (e.g.,

Anticipated misconceptions:

- All jellyfish only live in saltwater
- Jellyfish are fish
- The jellyfish were placed in Lake Palau
- Humans have no impact on the environment
- All jellyfish are dangerous

<p>graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.</p> <p>Mathematics connections:</p> <ul style="list-style-type: none"> • Use appropriate tools strategically. • Convert among different-sized standard measurement units within a given measurement system • Represent real world and mathematical problems. 		
Connections to Prior Units:		Connections to Future Units:
<p>Connections to:</p> <ul style="list-style-type: none"> • Kindergarten Unit 2: Mystery Class Pet • Grade 1 Unit 1: Shadows on the Playground • Grade 2 Unit 2: Beavers • Grade 4 Unit 2: Bear Sense • Grade 4 Unit 3: Forces That Move Earth 		<p>Connections to:</p> <ul style="list-style-type: none"> • Grade 6 Unit 1: Engineering a Bio-Bottle
Differentiation through <i>Universal Design for Learning</i>		
UDL Indicator		Teacher Actions:
Representation 3.1		<ul style="list-style-type: none"> • Anchor instruction by linking to and activating relevant prior knowledge (e.g., using visual imagery, concept anchoring, or concept mastery routines) • Pre-teach critical prerequisite concepts through demonstration or models
Supporting Multilingual/English Learners		
Related <i>CELP standards:</i>		Learning Targets:
4-5.4 construct grade appropriate oral and written claims and support them with reasoning and evidence.		I can gather information from multiple resources to demonstrate my learning of how the Golden Jellies survive and thrive in Lake Palau.
Learning Sequence	Learning Target & Success Criteria	Resources
1	<p>I can share experiences and current understandings of jellyfish</p> <p><input type="checkbox"/> I shared my knowledge about jellyfish</p> <p>I can make observations and ask questions about the Golden Jellies of Lake Palau</p> <p><input type="checkbox"/> I made observations about the Golden Jellyfish</p> <p><input type="checkbox"/> I asked what, where, when, why questions.</p> <p><input type="checkbox"/> I asked at least 3 questions about Golden Jellyfish</p> <p>I can identify patterns from the Golden jellies that are the same or different from current understandings on jellyfish</p> <p><input type="checkbox"/> I explained the movement pattern of the Golden Jellyfish</p> <p><input type="checkbox"/> I added to my understanding of how the Golden Jellyfish was</p>	<ul style="list-style-type: none"> • Great Migrations from • Great Migrations from National Geographic • Intro to Golden Jellies Video

	different that other Jellyfish	
2	<p>I can define ecosystem and apply related unit vocabulary</p> <p><input type="checkbox"/> I defined the term ecosystem</p> <p>I can compare healthy and unhealthy ecosystems to begin to understand what they need to thrive</p> <p><input type="checkbox"/> I defined an healthy and unhealthy ecosystem</p> <p><input type="checkbox"/> I showed examples of what an ecosystem needed to thrive</p> <p><input type="checkbox"/> I was able to identify the differences between a healthy and unhealthy ecosystem</p> <p>I can show how a local organism fits in its ecosystem, with focus on abiotic factors</p> <p><input type="checkbox"/> I identified the abiotic factors in an ecosystem</p> <p><input type="checkbox"/> I created a model of how a local organism fits into our local system</p> <p>I can identify the role the sun plays in ecosystems</p> <p><input type="checkbox"/> I explained the role of the sun in an ecosystem</p>	<ul style="list-style-type: none"> • National Geographic,Epic • Photosynthesis: Changing Sunlight Into Food • Photosynthesis: Changing Sunlight Into Food • PebbleGo • Information on the geography of Micronesia • Stanford Students Study Heat in Coral Reef video • Climate Change Palau video • Coral Reef System Studies Stanford Students video • Virtual Field trip video
3	<p>I can identify key factors that work together in an ecosystem though Readers Theatre</p> <p><input type="checkbox"/> I identified the factors that work together in an ecosystem</p> <p><input type="checkbox"/> I created a poster showing my understanding of food chain based on the Readers Theatre</p> <p>I can obtain information on the how the Golden Jellies interact with biotic and abiotic factors</p> <p><input type="checkbox"/> I demonstrated how the Golden Jellyfish interacts with the biotic and abiotic factors of their ecosystem</p> <p>I can create an explanatory model to show how matter and energy move through the Golden Jelly ecosystem and at least one other ecosystem</p> <p><input type="checkbox"/> I created a model on how matter and energy move through the Golden Jellyfish ecosystem</p> <p><input type="checkbox"/> I created a model on how matter and energy move through the a different ecosystem</p> <p>I can compare the Golden Jelly Ecosystem to a different ecosystem</p> <p><input type="checkbox"/> I compared the Golden Jellyfish ecosystem to another ecosystem</p>	<ul style="list-style-type: none"> • Lake Palau ecosystem information from PBS • Ecosystem Resource • Flow of Matter from CK-12 • The State of Coral Reef Ecosystem in Palau • international trade routes

<p>4</p>	<p>I can identify patterns of how organisms respond to sunlight <input type="checkbox"/> I explained how organisms respond to light</p> <p>I can explain the necessary pattern of movement of the Golden Jellies across Lake Palau <input type="checkbox"/> I explained why the Golden Jellyfish move in a predictable pattern</p> <p>I can explain why all living things need food <input type="checkbox"/> I explained why all living things need food</p> <p>I can explain what would happen to Jellies and their ecosystem if there was interruption to the sunlight <input type="checkbox"/> I explained the effect of the interruption of sunlight to the Golden Jellyfish ecosystem</p> <p>I can explain how the predictable patterns of sun affect living things(CFA prompt) <input type="checkbox"/> I explained how predictable patterns of the sun affect living things</p>	<ul style="list-style-type: none"> • Algae Beads • Photosynthesis: Changing Sunlight Into Food • Gotta Eat!- Crash Course Kids 1.1 • Sun-Seeking Plant Time Lapse • Time Lapse- Plant Following Light • Patterns • golden jellies movement • Gr5 Jellies LS4 CFA
<p>5</p>	<p>I can define and research a problem that relates to human interference with ecosystems <input type="checkbox"/> I researched human interference with an ecosystem <input type="checkbox"/> I used multiple resources to research <input type="checkbox"/> I created a presentation to show how humans interference with ecosystems</p> <p>I can explain what humans are doing to solve ecosystem problems <input type="checkbox"/> I can share how humans are solving ecosystem problems</p> <p>I can identify which part (biotic or abiotic) is most disrupted in various ecosystem <input type="checkbox"/> I identified which is more disruptive to these ecosystems, biotic or abiotic.</p> <p>I can investigate clean up methods through oil spill simulation <input type="checkbox"/> I created a model habitat which will suffer an oil spill. <input type="checkbox"/> I created a claim about what methods will clean up the simulated oil spill <input type="checkbox"/> I tested different tools to clean the habitat as best as possible. <input type="checkbox"/> I presented the method and materials that best cleaned up the simulated oil spill and the advantages of using this method</p>	<ul style="list-style-type: none"> • A swim through Jellyfish lake video • Natural Resources (CK-12) • People and the Planet (getEPIC) numerous topics • Environmental Activist (getEPIC) numerous topics
<p>6</p>	<p>I can gather information from multiple resources to demonstrate my learning of how humans impact ecosystems. <input type="checkbox"/> I used multiple resources to show my learning on the human impact on ecosystems <input type="checkbox"/> I presented this information in a organized presentation</p>	<ul style="list-style-type: none"> • Research Resources

Unit Title:

Course Name (BOE Approved Date)

Expedition Antarctica

Course Description:

Students begin this learning sequence on an expedition research team based in Antarctica. In the unit, their expedition team must make the hike to base camp from a distance due to weather complications. They know the coordinates of their final destination and have survival supplies, but must use tools and scientific discoveries to make their way to safety. Throughout the unit, students encounter a unique series of situations requiring them to discover and apply scientific knowledge to handle the trek.

In this learning sequence 1, students are introduced to their mission and review current weather phenomena in Antarctica. After becoming stranded away from base, they review key materials and resources they will need for their hike to safety. They create a QFT to create questions about how they will manage their hike and their survival needs.

In learning sequence 2, students observe the path the sun appears to travel across the sky, reviewing Earth's movement to navigate the path to safety. They review movements that create both day and night and the seasons. Students will examine how the movement of the Earth causes different observable patterns in different geographical locations. They use this understanding to make predictions and decisions about their journey.

In learning sequence 3, the research expedition team realizes they are running out of water! Students explore the distribution of water on Earth to gather information on safe drinking water. Using cups as a model, or other models, they will predict the distribution of the Earth's water, then research data to evaluate and revise their models. Students will complete graphs comparing salt water, fresh water and the amount of freshwater in reservoirs to determine next steps for their Antarctica mission.

Students address their lack of safe freshwater in Antarctica in learning sequence 4. After identifying water resources and distribution patterns from the previous sequence, they problem-solve different ways to obtain fresh drinking water. They predict, test, and explore methods for safe drinking water.

With their water resources back to safe levels, students follow the map toward the main research base in learning sequence 5. Their path passes both new and old glaciers, and gives the scientists an extra chance to learn about them. In this sequence, students discover how a glacier is formed and how they change over time.

In learning sequence 6, the expedition research team is almost to the research base and back to open communication. Their map indicates a giant iceberg in their path, but there is no iceberg to be found! In this sequence, students explore the phenomena of flipping icebergs. By the end of the lesson, students identify the forces involved in making icebergs flip and continue on their path toward the research base.

For the culminating task, students will apply their learning from all of the learning sequences to write a story detailing a day in their Expedition Research travels. The story must include vocabulary words from earlier learning, as well as a model or illustration documenting their knowledge. Students will present their stories and learning models to the class.

Relevant Standards: Bold indicates priority

5-PS1-1. Develop a model to describe that **matter is made of particles too small to be seen** (just revisited from Bundle 1)

SEP	Use models to describe phenomena.
DCI	Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gasses are made from matter particles

	<table border="1"> <tr> <td></td> <td>that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects.</td> </tr> <tr> <td>CCC</td> <td>Natural objects exist from the very small to the immensely large.</td> </tr> </table>		that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects.	CCC	Natural objects exist from the very small to the immensely large.		
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CCC	Natural objects exist from the very small to the immensely large.						
<p>5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down.</p>	<table border="1"> <tr> <td>SEP</td> <td>Support an argument with evidence, data, or a model.</td> </tr> <tr> <td>DCI</td> <td>The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.</td> </tr> <tr> <td>CCC</td> <td>Cause and effect relationships are routinely identified and used to explain change.</td> </tr> </table>	SEP	Support an argument with evidence, data, or a model.	DCI	The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.	CCC	Cause and effect relationships are routinely identified and used to explain change.
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DCI	The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.						
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<p>5-ESS1-2. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. (revisited from Bundle 1)</p>	<table border="1"> <tr> <td>SEP</td> <td>Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.</td> </tr> <tr> <td>DCI</td> <td>The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.</td> </tr> <tr> <td>CCC</td> <td>Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena.</td> </tr> </table>	SEP	Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.	DCI	The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.	CCC	Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena.
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CCC	Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena.						
<p>5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.</p>	<table border="1"> <tr> <td>SEP</td> <td>Develop a model using an example to describe a scientific principle.</td> </tr> <tr> <td>DCI</td> <td>Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to</td> </tr> </table>	SEP	Develop a model using an example to describe a scientific principle.	DCI	Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to		
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	<table border="1"> <tr> <td></td> <td>determine patterns of weather.</td> </tr> <tr> <td>CCC</td> <td>A system can be described in terms of its components and their interactions.</td> </tr> </table>		determine patterns of weather.	CCC	A system can be described in terms of its components and their interactions.		
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<p>5-ESS2-2. Describe and graph the amounts of saltwater and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.</p>	<table border="1"> <tr> <td>SEP</td> <td>Describe and graph quantities such as area and volume to address scientific questions.</td> </tr> <tr> <td>DCI</td> <td>Nearly all of Earth’s available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.</td> </tr> <tr> <td>CCC</td> <td>Standard units are used to measure and describe physical quantities such as weight and volume.</td> </tr> </table>	SEP	Describe and graph quantities such as area and volume to address scientific questions.	DCI	Nearly all of Earth’s available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.	CCC	Standard units are used to measure and describe physical quantities such as weight and volume.
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<p>3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.</p>	<table border="1"> <tr> <td>SEP</td> <td>Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.</td> </tr> <tr> <td>DCI</td> <td> <ul style="list-style-type: none"> • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. </td> </tr> <tr> <td>CCC</td> <td>Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.</td> </tr> </table>	SEP	Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.	DCI	<ul style="list-style-type: none"> • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. 	CCC	Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
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CCC	Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.						
<p>Essential Question(s):</p>	<p>Enduring Understanding(s):</p>						
<ul style="list-style-type: none"> • What would this research team need to survive? • What will you need to learn about Antarctica to survive? • How does the movement of the Earth affect day/night and seasons? • How much of the water on Earth is freshwater and how much is saltwater? • In what ways do humans create and store safe drinking water? • How do glaciers form and what conditions impact them? • How do earth’s systems work together? 	<ul style="list-style-type: none"> • Describe and graph data to provide evidence about the distribution of water on Earth. • Understand patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. 						

<ul style="list-style-type: none"> • Why do icebergs flip? 	
Demonstration of Learning:	Pacing for Unit
<ul style="list-style-type: none"> • Culminating Task: Travel Journal <ul style="list-style-type: none"> ○ Each student will create and share a travel journal from one day on your trek from drop off point to McMurdo Station, highlighting at least one scientific phenomena or situation that was encountered, investigated, and figured out (24 hour sunlight, obtaining fresh water, glacier formation and movement, icebergs flipping) This scientific highlight must be complete in its explanation and use at least 8 vocabulary terms correctly. ○ You should include labeled sketches as they apply. ○ Rubric 	6 weeks
Family Overview (link below)	Integration of Technology:
Family Overview - Unit 3	<i>Intentionally aligned use of digital tools and resources to support acquisition of content, researching, organizing and communicating learning</i> <ul style="list-style-type: none"> • LIVE Cam from McMurdo Station • Google Earth • PHET Simulation
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):

Support	Argument	Evidence	
Data	Gravity	Earth's center	
Change	Iceberg	Cause/Effect Relationship	
Graphical Display	Bar Graph	Pictorial Graph	
Pie Chart	Patterns	Orbit	
Revolution	Axis	Rotation	
North/South Pole	Antarctica	Analyze	
Systems	Geosphere	Molten Rock	
Sediment	Hydrosphere	Atmosphere	
Biosphere	Processes	Ecosystem	
Organism	Shapes/Landforms	Climate	
Components	Interactions	Glacier	
Compress	Ice Crystals	Calve	
Bergie Seltzer			
			<ul style="list-style-type: none"> Icebergs and Glaciers by Seymour Simon Colin O'Brady Reading Day & Night in Hemispheres video Colin O'Brady Interview video Day & Night in Antarctica Article Classification of Bodies of Water Article Groundwater Reading Water Distribution of Earth Video NASA Show me the Water video Saline Water: Desalination Article Water Desalination Video NASA Glacier for kids A Glacier's Life Cycle Crash Course Spheres Part 1 Crash Course Spheres Part 2 Glaciers for Kids video Iceberg Flip Video Crash Course Gravity (Optional)
Opportunities for Interdisciplinary Connections:			Anticipated misconceptions:
<p>Literacy Connections:</p> <ul style="list-style-type: none"> Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question. Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. <p>Mathematical Connections:</p> <ul style="list-style-type: none"> Reason abstractly and quantitatively. Recognize volume as an attribute of solid figures and understand concepts of 			<ul style="list-style-type: none"> Sunlight does not warm the land The seasons in Antarctica are the same as they are in the northern hemisphere Freshwater is plentiful The equator always has the most hours of daylight; the north and south poles always have the fewest hours of daylight The number of hours of daylight on a given day is the same everywhere on earth All water is drinkable You can drink salt water to survive Freshwater is more prevalent than saltwater Wind and water cannot wear away the solid rock of a mountain Landforms look similar today as they did many millions of years ago. For example, a river on earth today hasn't changed over time Landforms can change in size, but not by the motion of wind and water A passive (stationary) object cannot exert a force

<ul style="list-style-type: none"> • volume measurement. • Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. 		
Connections to Prior Units:	Connections to Future Units:	
Connections to: <ul style="list-style-type: none"> • Grade 1 Unit 1: Shadows on the Playground • Grade 3 Unit 3: The Case of the Missing Monarchs • Grade 4 Unit 1: National Parks 	Connections to: <ul style="list-style-type: none"> • Grade 6 Unit 2: Destructive Weather 	
Differentiation through Universal Design for Learning		
UDL Indicator	Teacher Actions:	
Representation 3.2	<ul style="list-style-type: none"> • Highlight or emphasize key elements in text, graphics, diagrams, formulas 	
Supporting Multilingual/English Learners		
Related CELP standards:	Learning Targets:	
4-5.7 adapt language choices to purpose, task, and audience when speaking and writing.	I can gather information from multiple resources to demonstrate my learning of situations encountered while surviving Antarctica.	
Learning Sequence	Learning Target & Success Criteria	Resources
1	<p>I can locate Antarctica on a map and identify possible challenges of exploration in Antarctica</p> <ul style="list-style-type: none"> <input type="checkbox"/> I located antarctica on a map <input type="checkbox"/> I identified at least 3 challenges of exploring Antarctica <p>I can review the provided survival supplies and explore the purpose of unfamiliar items.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I reviewed survival supply and the need for these items <p>I can identify additional survival items with reasoning</p> <ul style="list-style-type: none"> <input type="checkbox"/> I created a list of additional survival items and why they are needed in this environment <p>I can generate questions on how to survive the trek from emergency drop off point to McMurdo Station</p> <ul style="list-style-type: none"> <input type="checkbox"/> I created a set of questions on how to survive in Antarctica in challenging situations 	<ul style="list-style-type: none"> • Welcome to Antarctica Slide Deck • Quadrant Slide • Google Earth • Colin O'Brady Reading • Student Response Document
2	<p>I can describe patterns of daylight hours in CT and Antarctica</p> <ul style="list-style-type: none"> <input type="checkbox"/> I described the patterns of daylight in Connecticut and 	<ul style="list-style-type: none"> • Agree/Disagree Line

	<p>Antarctica</p> <p>I can graph and compare the hours of daylight in CT and Antarctica</p> <ul style="list-style-type: none"> <input type="checkbox"/> I graphed the hours of daylight in Connecticut and Antarctica <input type="checkbox"/> I identified the differences in the hours of daylight in Connecticut and Antarctica <p>I can use the data to develop an explanation for the extended daylight hours during the Antarctic summer</p> <ul style="list-style-type: none"> <input type="checkbox"/> I explained why Antarctica has expended sunlight during Antarctica summer <p>I can describe the pros and cons of how the extended daylight hours impact the Antarctic trek</p> <ul style="list-style-type: none"> <input type="checkbox"/> I explained the pros and cons of the extended daylight <input type="checkbox"/> I explained how extended daylight hours impact the Antarctic trek 	<ul style="list-style-type: none"> • Engage Slideshow • Time & Date Website • Student Graphing Activity • Day & Night in Hemispheres video • Colin O'Brady Interview video • Day & Night in Antarctica Article
3	<p>I can make observations on the water supply around the world</p> <ul style="list-style-type: none"> <input type="checkbox"/> I made at least 3 observation about the world's water supply <p>I can identify freshwater and saltwater reservoirs</p> <ul style="list-style-type: none"> <input type="checkbox"/> I identified freshwater and saltwater reservoirs <p>I can make predictions on the percentages of water in reservoirs</p> <ul style="list-style-type: none"> <input type="checkbox"/> I made a prediction on the percentage of water in reservoirs <p>I can use nonfiction text/media resources to record and compare water distribution data to predictions</p> <ul style="list-style-type: none"> <input type="checkbox"/> I used nonfiction text/media resources to gather information about water distribution <input type="checkbox"/> I compared my water prediction to to actual water distribution <p>I can represent fresh and salt water distribution on earth with a graph or a model</p> <ul style="list-style-type: none"> <input type="checkbox"/> I graphed or modeled the water distribution on earth <p>I can explain how Bristol gets it water supply</p> <ul style="list-style-type: none"> <input type="checkbox"/> I explained how Bristol gets its water supply 	<ul style="list-style-type: none"> • Earth's Water Student slide deck • Classification of Bodies of Water Article • World Water Distribution Activity • CER Template <ul style="list-style-type: none"> ◦ Short Template • Water Fact Sheet • Groundwater Reading • Water Distribution of Earth Video • NASA Show me the Water video • Make a Prediction Classwide Google Doc
4	<p>I can identify fresh and saltwater resources in Antarctica</p> <ul style="list-style-type: none"> <input type="checkbox"/> I identified fresh and saltwater resources in Antarctica <p>I can generate ideas on how to obtain potable water</p> <ul style="list-style-type: none"> <input type="checkbox"/> I explained what is potable water <input type="checkbox"/> I generated ideas on how to obtain potable water <p>I can use knowledge of states of matter and the water cycle to set up an experimental desalination center</p> <ul style="list-style-type: none"> <input type="checkbox"/> I defined the three states of matter <input type="checkbox"/> I defined the water cycle <input type="checkbox"/> I worked with a group to set up distillation stations in multiple 	<ul style="list-style-type: none"> • Saline Water: Desalination Article • Desalination Investigation • Water Desalination Video

	<p>settings</p> <p>I can provide evidence that the desalination sets up in the classroom made fresh water</p> <p><input type="checkbox"/> I provided evidence that the distillation station creates fresh water</p> <p>I can describe desalination methods used around the world</p> <p><input type="checkbox"/> I described different desalination methods used around the world</p> <p>I can identify and explain the preferable method to obtain fresh water in Antarctica given limited supplies</p> <p><input type="checkbox"/> I choose the best method to obtain fresh water in Antarctica given limited supplies</p>	
5	<p>I can make observations and ask questions on glaciers</p> <p><input type="checkbox"/> I made observations about glaciers</p> <p><input type="checkbox"/> I created at least 3 questions related to glaciers</p> <p>I can explain how glaciers form and move</p> <p><input type="checkbox"/> I explained how glaciers formed and move</p> <p>I can investigate how light and temperature impact glacier melt with station activity</p> <p><input type="checkbox"/> I completed an investigation on the impact of light and temperature effect a glacier melt</p> <p><input type="checkbox"/> I was able to support what was the impact of light and temperature effect a glacier melt</p> <p>I can analyze glacier melt data</p> <p><input type="checkbox"/> I analyzed glacier melt date</p> <p>I can develop an explanatory model of a glacier</p> <p><input type="checkbox"/> I created a model of a glacier</p> <p>I can identify and describe the four systems (hydrosphere, atmosphere, geosphere, and biosphere) that scientists use to represent Earth</p> <p><input type="checkbox"/> I explained what is a sphere</p> <p><input type="checkbox"/> I identified the four systems that scientists use to represent the earth</p> <p>I can provide evidence for interactions between the spheres</p> <p><input type="checkbox"/> I showed evidence on how the spheres interact with each other</p>	<ul style="list-style-type: none"> • Engage Slide Deck • 3-2-1 Template • NASA Glacier for kids • Glacier Investigation Student Handout • 3 stay 1 stray protocol • A Glacier's Life Cycle • Spheres Handout • Glaciers for Kids video
6	<p>I can make observations and ask questions on iceberg characteristics and behaviors</p> <p><input type="checkbox"/> I made observations about icebergs</p> <p><input type="checkbox"/> I asked multiple questions about the characteristics and</p>	<ul style="list-style-type: none"> • I Notice, I Wonder • Iceberg Resources for Kids • Iceberg Student

	<p>behaviors of icebergs</p> <p>I can investigate iceberg floating and flipping behavior</p> <p><input type="checkbox"/> I investigated why icebergs float and flip</p> <p>I can explain why an iceberg flips</p> <p><input type="checkbox"/> I explained why icebergs flip</p> <p>I can provide evidence to which sphere the iceberg (hydrosphere) most closely interacts with</p> <p><input type="checkbox"/> I proved with evidence which sphere icebergs most closely interact with</p> <p><input type="checkbox"/></p> <p>I can sketch and summarize the “life” of an iceberg</p> <p><input type="checkbox"/> I created a sketch of the “life” of an iceberg</p> <p><input type="checkbox"/> I wrote a brief summary on the “life” of an iceberg</p> <p>I can generate and share a travel log from Expedition Antarctica(culminating task)</p> <p><input type="checkbox"/> I created a travel log about our exploration of Antarctica. My journal entryl included information about:</p> <ol style="list-style-type: none"> a. 24 hour sunlight b. obtaining fresh water c. glacier formation and movement d. icebergs flipping 	<p>Handout</p> <ul style="list-style-type: none"> • Iceberg Flip Video • LS 6 CER
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Curriculum Writing Notes:

Address UDL and CELP AFTER learning targets are written, in process they'll be developed after all learning targets and success criteria. These targets with UDL and CELP will be a model of what could/should be done for all learning targets but can't be completed (to keep the process concise). Through the curriculum writing process, teachers can build a deeper understanding of how to approach this differentiation.

Enduring understanding/Essential questions may be easier to develop at the end of the process.

Committees can alter the format but these are the required pieces.

Course Title:	Content Area:	Grade Level:	Credit (if applicable)
Grade 4 Science	Science	Grade 4	N/A
Course Description:			
Aligned Core Resources:		Connection to the BPS Vision of the Graduate	
N/A		Collaboration <ul style="list-style-type: none"> Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal Assume shared responsibility for collaborative work and value the individual contributions made by each team member Communication <ul style="list-style-type: none"> Articulates thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts Critical Thinking and Problem Solving <ul style="list-style-type: none"> Collect, assess and analyze relevant information Reason effectively. Make sound judgements and decisions. Identify, define and solve authentic problems and essential questions. Reflect critically on learning experience, processes and solutions. Transfer knowledge to other situations 	
Additional Course Information: <i>Knowledge/Skill Dependent courses/prerequisites</i>		Link to Completed Equity Audit	
N/A		Grade 4 Science Equity Audit	
Standard Matrix			

District Learning Expectations and Standards	Unit 1	Unit 2	Unit 3
4-PS3-1 Use evidence to construct an explanation relating the speed of an object to the energy of that object.	X		
4-PS3-3 Ask questions and predict outcomes about the changes in energy that occur when objects collide.	X		
4-ESS1-1 Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time	X		
4-ESS2-1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.	X		
3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.	X		
4-PS3-2 . Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.		X	
4-PS4-2 . Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.		X	
4-PS4-3 . Generate and compare multiple solutions that use patterns to transfer information.*		X	
4-LS1-1 . Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.		X	
4-LS1-2 . Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.		X	
4-PS3-4 . Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.			X
4-PS4-1 . Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.			X
4-ESS2-2 . Analyze and interpret data from maps to describe patterns of Earth's features.			X
4-ESS3-1 . Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.			X
4-ESS3-2 . Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.			X

Unit Links

If unit headings are formatted as a heading, then we can link a Table of Contents to better organize and provide

faster access to each unit

[Unit 1: National Parks](#)

[Unit 2: Bear Sense](#)

[Unit 3: Forces That Move Earth](#)

Unit Title:

Unit 1: National Parks

Relevant Standards: Bold indicates priority

4-PS3-1 Use evidence to construct an explanation relating the speed of an object to the energy of that object.

SEP	Constructing Explanations and Designing Solutions <ul style="list-style-type: none">Use evidence (e.g., measurements, observations, patterns) to construct an explanation.
DCI	PS3.A: Definitions of Energy <ul style="list-style-type: none">The faster a given object is moving, the more energy it possesses.
CCC	Energy and Matter <ul style="list-style-type: none">Energy can be transferred in various ways and between objects.

4-PS3-3 Ask questions and predict outcomes about the changes in energy that occur when objects collide.

SEP	Asking Questions and Defining Problems <ul style="list-style-type: none">Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.
DCI	PS3.A: Definitions of Energy <ul style="list-style-type: none">Energy can be moved from place to place by moving objects or through sound, light, or electric currents. PS3.B: Conservation of Energy and Energy Transfer <ul style="list-style-type: none">Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. PS3.C: Relationship Between Energy and Forces

	<table border="1"> <tr> <td></td> <td> <ul style="list-style-type: none"> When objects collide, the contact forces transfer energy so as to change the objects' motions </td> </tr> <tr> <td>CCC</td> <td> Energy and Matter <ul style="list-style-type: none"> Energy can be transferred in various ways and between objects. </td> </tr> </table>		<ul style="list-style-type: none"> When objects collide, the contact forces transfer energy so as to change the objects' motions 	CCC	Energy and Matter <ul style="list-style-type: none"> Energy can be transferred in various ways and between objects. 		
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<p>4-ESS1-1 Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time</p>	<table border="1"> <tr> <td>SEP</td> <td> Constructing Explanations and Designing Solutions <ul style="list-style-type: none"> Identify the evidence that supports particular points in an explanation </td> </tr> <tr> <td>DCI</td> <td> ESS1.C: The History of Planet Earth <ul style="list-style-type: none"> Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. </td> </tr> <tr> <td>CCC</td> <td> Patterns <ul style="list-style-type: none"> Patterns can be used as evidence to support an explanation. </td> </tr> </table>	SEP	Constructing Explanations and Designing Solutions <ul style="list-style-type: none"> Identify the evidence that supports particular points in an explanation 	DCI	ESS1.C: The History of Planet Earth <ul style="list-style-type: none"> Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. 	CCC	Patterns <ul style="list-style-type: none"> Patterns can be used as evidence to support an explanation.
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<p>4-ESS2-1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.</p>	<table border="1"> <tr> <td>SEP</td> <td> Planning and Carrying Out Investigations <ul style="list-style-type: none"> Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. </td> </tr> <tr> <td>DCI</td> <td> ESS2.A: Earth Materials and Systems <ul style="list-style-type: none"> Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. ESS2.E: Biogeology <ul style="list-style-type: none"> Living things affect the physical characteristics of their regions. </td> </tr> <tr> <td>CCC</td> <td> Cause and Effect <ul style="list-style-type: none"> Cause and effect relationships are routinely identified, tested, and used to explain change. </td> </tr> </table>	SEP	Planning and Carrying Out Investigations <ul style="list-style-type: none"> Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. 	DCI	ESS2.A: Earth Materials and Systems <ul style="list-style-type: none"> Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. ESS2.E: Biogeology <ul style="list-style-type: none"> Living things affect the physical characteristics of their regions. 	CCC	Cause and Effect <ul style="list-style-type: none"> Cause and effect relationships are routinely identified, tested, and used to explain change.
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<p>Essential Question(s):</p>	<p>Enduring Understanding(s):</p>						
<ul style="list-style-type: none"> • Why do landforms change? • How did the landforms that make up Grand Staircase - Escalante National Park come to take their current shape? • What forces cause weathering and erosion? • What is energy and how does it relate to the changing landscape? • What can humans do to prevent or decrease the damage caused by erosion in an area? • How can patterns of rock formations and fossils help us learn about the history of Earth? • 	<ul style="list-style-type: none"> • Make observations about the landscape in various regions of the United States • Generate possible explanations for process/forces that may have shaped land over time at the Arches • Ask questions about how/why the landscape varies across the United States 						
<p>Demonstration of Learning:</p>	<p>Pacing for Unit</p>						
<ul style="list-style-type: none"> • Use evidence (e.g., measurements, observations, patterns) to construct an explanation. 4-PS3-1 • Identify the evidence that supports particular points in an explanation. 4-ESS1-1P • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. 3-5-ETS1-2 • Asking Questions and Defining Problems • Ask questions that can be investigated and predict reasonable outcomes based on patterns 	<p>6 weeks</p>						

<p>such as cause and effect relationships. 4-PS3-3</p> <ul style="list-style-type: none"> • Planning and Carrying Out Investigations • Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. 4-ESS2-1 																																											
<p>Family Overview (link below)</p>	<p>Integration of Technology:</p>																																										
<p>Family Overview Unit 1 Grade 4</p>	<p><i>Intentionally aligned use of digital tools and resources to support acquisition of content, researching, organizing and communicating learning</i></p>																																										
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<p>Opportunities for Interdisciplinary Connections:</p>	<p>Anticipated misconceptions:</p>																																										
<p>Literacy connections:</p> <ul style="list-style-type: none"> • Students are asking and answering questions • Referring to a text 	<p>Students may believe that:</p> <ul style="list-style-type: none"> • Rocks can't be broken down 																																										

<ul style="list-style-type: none"> ● Recalling information and data from multiple sources <p>Math Connections:</p> <ul style="list-style-type: none"> ● Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. ● Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line-symmetric figures and draw lines of symmetry. ● Operations and Algebraic Thinking 	<ul style="list-style-type: none"> ● Rocks do not change ● Weathering and erosion are the same thing. The two words can be used interchangeably ● Erosion happens quickly ● Erosion is always bad ● Plants don't affect rocks and soil ● Humans cause all erosion ● Humans cannot impact erosion ● Mountains are all the same age
<p>Connections to Prior Units:</p>	<p>Connections to Future Units:</p>
<p>K-PS2.B: When objects touch or collide, they push on one another and can change motion.</p> <p>2-ESS2.A: Wind and Water can change the shape of land.</p> <p>2-ESS1.C: Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe.</p> <p>3-PS2.A: Each force acts on one particular object and has both strength and direction. An object at rest typically has multiple forces acting on it, but they add up to zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion.</p> <p>K-2-ETS1.A: A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. Asking questions, making observations and gathering information is helpful in thinking about problems. Before beginning to design a solution, it is important to clearly understand the problem. (B) Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (C) Because there is always more than one possible solution to a problem, it is useful to compare and test designs.</p>	<p>Grade 7 Unit 2: Fossils on Mount Everest connection to fossil content</p> <ul style="list-style-type: none"> ● MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
<p>Differentiation through Universal Design for Learning</p>	
<p>UDL Indicator</p>	<p>Teacher Actions:</p>
<p>3.3 Guide information processing and visualization</p>	<ul style="list-style-type: none"> ● Give explicit prompts for each step in a sequential process ● Provide interactive models that guide

	<ul style="list-style-type: none"> exploration and new understandings Provide multiple entry points to a lesson and optional pathways through content 	
Supporting Multilingual/English Learners		
Related <i>CELP standards:</i>	Learning Targets:	
<p>An EL can conduct research and evaluate and communicate findings to answer questions or solve problems</p> <p>An EL can participate in grade appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments and questions.</p>	<p>I can conduct short research projects to answer a question</p> <p>I can participate in extended conversations, discussions, and extended written exchanges using academic and domain specific vocabulary build on the ideas</p>	
Learning Sequence	Learning Target & Success Criteria	Assessments/ Resources
1	<ul style="list-style-type: none"> I can make observations about the landscape in various regions of the United State <ul style="list-style-type: none"> I can generate possible explanations for process/forces that may have shaped land over time at the Arches I can ask questions about how/why the landscape varies across the United States 	class summary table
2	<ul style="list-style-type: none"> I can make observations of various landscape/rock formations from Escalante Grand Staircase <ul style="list-style-type: none"> I can investigate forces that act on shape the land I can define and provide examples of weathering and erosion I can summarize the similarities and differences between weathering and erosion I can construct an explanation of the cause and effect of landform changes over time 	Weathering and Erosion at Grinnell Glacier Basin in Glacier National Park
3	<ul style="list-style-type: none"> I can conduct an investigation to observe the transfer of energy between objects <ul style="list-style-type: none"> I can use data to explain how the mass of an object and the speed of an object can impact a resulting collision I can identify energy transfer with evidence in landscape change I can compare high energy vs slow energy weathering and erosion events I can explain how water can shape the land 	Students use Images around the United States to explain how water has changed the land. Students will identify evidence of erosion and the energy source of that erosion event. Students will use their evidence to determine if the event occurred over a short term or long term.
4	<ul style="list-style-type: none"> I can Identify an erosion problem on school grounds <ul style="list-style-type: none"> I can identify an erosion problem on school grounds I can make observations of how living things affect the 	<ul style="list-style-type: none"> Respond as individuals to slide 8

	<ul style="list-style-type: none"> ○ physical characteristics of their regions ○ I can generate a variety of solutions to prevent or decrease the rate of erosion considering constraints ○ I can build and test erosion solutions in simulation ○ I can use qualitative and quantitative data to improve design solutions ○ I can reflect on simulated engineering design process 	<ul style="list-style-type: none"> ● Share out responses as a class ● Add important ideas to class summary table
5	<ul style="list-style-type: none"> ● I can demonstrate how patterns of rock layers can form and explain relative age <ul style="list-style-type: none"> ○ I can explain that fossil presence and location indicate rock layer age and formation ○ I can identify and describe how major Earth forces (earthquakes, volcanoes, mountain building) cause changes in rock layers and the landscape 	<p>The culminating task for this unit brings students back to the map of the US regions and asks the students to generate a model of current landscape, forces that led to its development and predict future landscape in that geographic location. Students use a State or National park to research (encourage at least one CT state park for relevancy in the class). Students use appropriate academic vocabulary and provide scientific evidence and reasoning for landscape explanations and predictions.</p> <p>Culminating Task Resource</p>

Unit Title:					
Unit 2: Bear Sense					
Relevant Standards: Bold indicates priority					
<p>4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.</p>	<table border="1"> <tr> <td>SEP</td> <td> Planning and Carrying Out Investigations <ul style="list-style-type: none"> ● Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. </td> </tr> <tr> <td>DCI</td> <td> PS3.A: Definitions of Energy <ul style="list-style-type: none"> ● Energy can be moved from place to place by </td> </tr> </table>	SEP	Planning and Carrying Out Investigations <ul style="list-style-type: none"> ● Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. 	DCI	PS3.A: Definitions of Energy <ul style="list-style-type: none"> ● Energy can be moved from place to place by
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<p>4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.</p>	<table border="1"> <tr> <td>SEP</td> <td> <p>Developing and Using Models</p> <ul style="list-style-type: none"> • Develop a model to describe phenomena </td> </tr> <tr> <td>DCI</td> <td> <p>PS4.B: Electromagnetic Radiation</p> <ul style="list-style-type: none"> • An object can be seen when light reflected from its surface enters the eyes. </td> </tr> <tr> <td>CCC</td> <td> <p>Cause and Effect</p> <ul style="list-style-type: none"> • Cause and effect relationships are routinely identified. </td> </tr> </table>	SEP	<p>Developing and Using Models</p> <ul style="list-style-type: none"> • Develop a model to describe phenomena 	DCI	<p>PS4.B: Electromagnetic Radiation</p> <ul style="list-style-type: none"> • An object can be seen when light reflected from its surface enters the eyes. 	CCC	<p>Cause and Effect</p> <ul style="list-style-type: none"> • Cause and effect relationships are routinely identified.
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<p>4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.*</p>	<table border="1"> <tr> <td>SEP</td> <td> <p>Constructing Explanations and Designing Solutions</p> <ul style="list-style-type: none"> • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. </td> </tr> <tr> <td>DCI</td> <td> <p>PS4.C: Information Technologies and Instrumentation</p> <ul style="list-style-type: none"> • Digitized information can be transmitted over long distances </td> </tr> </table>	SEP	<p>Constructing Explanations and Designing Solutions</p> <ul style="list-style-type: none"> • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. 	DCI	<p>PS4.C: Information Technologies and Instrumentation</p> <ul style="list-style-type: none"> • Digitized information can be transmitted over long distances 		
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<p>4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.</p>	<table border="1"> <tr> <td>SEP</td> <td> <p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> • Construct an argument with evidence, data, and/or a model. </td> </tr> <tr> <td>DCI</td> <td> <p>LS1.A: Structure and Function</p> <ul style="list-style-type: none"> • Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. </td> </tr> <tr> <td>CCC</td> <td> <p>Systems and System Models</p> <ul style="list-style-type: none"> • A system can be described in terms of its components and their interactions. </td> </tr> </table>	SEP	<p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none"> • Construct an argument with evidence, data, and/or a model. 	DCI	<p>LS1.A: Structure and Function</p> <ul style="list-style-type: none"> • Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. 	CCC	<p>Systems and System Models</p> <ul style="list-style-type: none"> • A system can be described in terms of its components and their interactions.
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<p>4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.</p>	<table border="1"> <tr> <td>SEP</td> <td> <p>A system can be described in terms of its components and their interactions.</p> <ul style="list-style-type: none"> • Use a model to test interactions concerning the functioning of a natural system. </td> </tr> <tr> <td>DCI</td> <td> <p>LS1.D: Information Processing</p> <ul style="list-style-type: none"> • Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions. </td> </tr> <tr> <td>CCC</td> <td> <p>Systems and System Models</p> <ul style="list-style-type: none"> • A system can be described in terms of its components and their interactions. </td> </tr> </table>	SEP	<p>A system can be described in terms of its components and their interactions.</p> <ul style="list-style-type: none"> • Use a model to test interactions concerning the functioning of a natural system. 	DCI	<p>LS1.D: Information Processing</p> <ul style="list-style-type: none"> • Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions. 	CCC	<p>Systems and System Models</p> <ul style="list-style-type: none"> • A system can be described in terms of its components and their interactions.
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<p>3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.</p>	<table border="1"> <tr> <td>SEP</td> <td> Constructing Explanations and Designing Solutions <ul style="list-style-type: none"> • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem </td> </tr> <tr> <td>DCI</td> <td> ETS1.B: Developing Possible Solutions <ul style="list-style-type: none"> • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. </td> </tr> <tr> <td>CCC</td> <td> Influence of Science, Engineering, and Technology on Society and the Natural World <ul style="list-style-type: none"> • Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands </td> </tr> </table>	SEP	Constructing Explanations and Designing Solutions <ul style="list-style-type: none"> • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem 	DCI	ETS1.B: Developing Possible Solutions <ul style="list-style-type: none"> • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. 	CCC	Influence of Science, Engineering, and Technology on Society and the Natural World <ul style="list-style-type: none"> • Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands
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<p>Essential Question(s):</p>	<p>Enduring Understanding(s):</p>						
<ul style="list-style-type: none"> • How will understanding bear senses allow for effective bear deterrent designs? • How do organisms detect, process and use information about the environment? • How does sound travel through different materials? How is energy transferred between objects or systems? • How does light affect sight? • How does heat affect odor intensity, and how does color affect temperature? • How can we use electricity to detect a bear's presence? • How can we use light or sound patterns to send a message? • How can various design solutions be compared and improved? • 	<ul style="list-style-type: none"> • Apply their understanding of energy to design, test, and refine a device that converts energy from one form to another. • Develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. • Use a model of waves to describe patterns of waves in terms of amplitude and wavelength, and that waves can cause objects to move. • Develop a model and describe that an object can be seen when light reflected from its surface enters the eye. • Develop an understanding that energy can be transferred from place to place by sound, light, heat, and electric currents or from object to object through collision 						
<p>Demonstration of Learning:</p>	<p>Pacing for Unit</p>						
<p>CFA Pavlov's Dogs Design, Draft, Revise, Evaluate Bear Deterrent Box</p>	<p>6 weeks</p>						
<p>Family Overview (link below)</p>	<p>Integration of Technology:</p>						

Family Overview Letter Bundle 2	<p>Intentionally aligned use of digital tools and resources to support acquisition of content, researching, organizing and communicating learning</p> <ul style="list-style-type: none"> • Energy Form changes Demonstration -Phet Interactive Model • Color vision Light Simulator -Phet Interactive Model 																																																						
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):																																																						
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predict	pattern	cause																																																					
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Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:																																																						
<p><u>ELA/Literacy -</u></p> <ul style="list-style-type: none"> • Supporting a point of view with reasons and information 	<p>Students may believe that:</p> <ul style="list-style-type: none"> • Once a bear has tasted human food, they will not eat wild food 																																																						

<ul style="list-style-type: none"> ● Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. ● Conduct short research projects that build knowledge through investigation of different aspects of a topic. <p><u>Mathematics -</u></p> <ul style="list-style-type: none"> ● Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded across the line into matching parts. Identify line-symmetric figures and draw lines of symmetry. ● Operations and Algebraic Thinking ● Reason abstractly and quantitatively. ● Model with mathematics. ● Use appropriate tools strategically. 	<ul style="list-style-type: none"> ● If you keep your garbage and compost in a garage, bears will not be attracted to your yard ● Bears have bad eyesight ● Reflected light is just shine or glare not something associated with seeing objects ● Light is not reflected in a predictable manner and angle ● Light travels from our eyes so we can see. ● Bears' super sense of smell makes up for poor eyesight ● Sound can only travel through air ● Sound moves faster in air than in solids (air is "thinner" and forms less of a barrier)
<p>Connections to Prior Units:</p>	<p>Connections to Future Units:</p>
<p>K-2-ETS1.A: A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. Asking questions, making observations and gathering information are helpful in thinking about problems. Before beginning to design a solution, it is important to clearly understand the problem. (B) Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (C) Because there is always more than one possible solution to a problem, it is useful to compare and test designs.</p> <p>1-PS4.A: Sound can make matter vibrate, and vibrating matter can make a sound.</p> <p>1-PS4.B: Objects can be seen if light is available to illuminate them or they give off their own light.</p> <p>1-PS4.C: People use a variety of devices to communicate and send and receive information over long distances.</p> <p>1-LS1.A: All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp, objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air. Plants also have different parts (roots, stems, leaves, flowers, and fruit) that help them survive and grow.</p> <p>1-LS1.D: Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive.</p> <p>3-5 ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time or cost.</p> <p>3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are</p>	

<p>considered to identify aspects of a model or prototype that can be improved.</p> <p>3-PS2.A: The patterns of an object's motion in various situations can be observed and measured: when that past motion exhibits a regular pattern, future motion can be predicted from it.</p> <p>3-LS3.B: Different organisms vary in how they look and function because they have different inherited information.</p>		
Differentiation through <i>Universal Design for Learning</i>		
UDL Indicator		Teacher Actions:
3.3 Guide information processing and visualization		<ul style="list-style-type: none"> Give explicit prompts for each step in a sequential process Provide interactive models that guide exploration and new understandings Provide multiple entry points to a lesson and optional pathways through content
Supporting Multilingual/English Learners		
Related <i>CELP standards:</i>		Learning Targets:
<p>An EL can conduct research and evaluate and communicate findings to answer questions or solve problems</p> <p>An EL can participate in grade appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments and questions.</p>		<p>I can conduct short research projects to answer a question</p> <p>I can participate in extended conversations, discussions, and extended written exchanges using academic and domain specific vocabulary build on the ideas</p>
Learning Sequence	Learning Target & Success Criteria	Assessments/ Resources
<p>1</p>	<ul style="list-style-type: none"> I can make observations on bear behavior <ul style="list-style-type: none"> I can generate initial questions to begin investigation of bear behavior, bear senses, and bear interactions with humans I can identify the unit problem we will collaboratively solve: how can we limit negative bear/human interaction? 	<ul style="list-style-type: none"> Record and share with Notice/Wonder chart Create a Driving Question Board Begin class summary table summary table
<p>2</p>	<ul style="list-style-type: none"> I can identify and provide examples of animals' five senses <ul style="list-style-type: none"> I can explore senses at stations and connect how perceptions and memories guide responses- I can explain at least one way that a plant and animal responds for survival I can begin a bear deterrent design applying the cause and effect relationship between sense perceptions 	<ul style="list-style-type: none"> Build concept map of 5 senses Record sensory station data and complete written response: How do senses impact our actions?

	and remembered responses as a means of altering behaviors-P	<ul style="list-style-type: none"> ● Explain one animal and plant ● survival behavior/structure ● Draft bear deterrent design
3	<p>I can make observations and use data to explain how different materials conduct sound wave energy</p> <ul style="list-style-type: none"> ● Draw and label a sound wave model ● Incorporate sound energy transfer into the bear deterrent design 	<ul style="list-style-type: none"> ● Use <u>Claim Evidence Reasoning</u> template to explain impact of material on sound energy ● Build class anchor chart on sound, including a visual of amplitude and wavelength ● Add to class summary table and revise bear deterrent designs
4	<ul style="list-style-type: none"> ● I can make observations of how different amounts of light can impact what I see <ul style="list-style-type: none"> ○ I can use an explanatory model to explain that light is necessary to see any object. ○ I can explain how a specialized animal structure can impact vision. ○ I can modify the bear deterrent design using the principles of light on sight. 	<ul style="list-style-type: none"> ● Share observations from engage/explore investigation ● Build class concept map on sight ● Develop and use an explanatory model of light-sight ● Add to class summary table and revise bear deterrent designs
5	<ul style="list-style-type: none"> ● I can explain the impact of temperature on odor intensity <ul style="list-style-type: none"> ○ I can generate and graph data from an investigation ○ I can analyze data and use it to support my claim ○ I can incorporate the interactions of color, temperature, and odor intensity into the bear deterrent design 	<ul style="list-style-type: none"> ● Use CER template to explain cause/effect relationship of temperature-smell investigation ● Create class graph on Color/Temperature ● Analyze data and use it support a claim-short form CER template ● Add to class summary table and revise bear deterrent designs <p>CFA: Student Assessment Task</p>
6	<ul style="list-style-type: none"> ● I can demonstrate kinetic energy <ul style="list-style-type: none"> ○ I can investigate how an electric current can be used to transfer energy to light energy 	<ul style="list-style-type: none"> ● Design a kinetic energy transfer with material set ● Develop a complete

	<ul style="list-style-type: none"> ○ I can transmit a simple message with light or sound patterns ○ I can apply electrical energy to the bear deterrent design ○ I can present and compare various bear deterrent designs (culminating task) 	<p>circuit with wire, battery, light bulb</p> <ul style="list-style-type: none"> ● Generate methods to transmit Danger/Help message with lights or sound patterns ● Add to class summary table and revise bear deterrent designs ● Identify strengths and weaknesses in the final presentation of class bear deterrent designs
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Unit Title:

Unit 3: Forces That Move Earth

Relevant Standards: Bold indicates priority

4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

SEP	<p>Constructing Explanations and Designing Solutions</p> <ul style="list-style-type: none"> ● Apply scientific ideas to solve design problems.
DCI	<p>PS3.B: Conservation of Energy and Energy Transfer</p> <ul style="list-style-type: none"> ● Energy can also be transferred from place to place by electric currents, which can then be used to locally produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. <p>PS3.D: Energy in Chemical Processes and Everyday Life</p> <ul style="list-style-type: none"> ● The expression “produce energy”

	<table border="1"> <tr> <td></td> <td> <p>typically refers to the conversion of stored energy into a desired form for practical use. ETS1.A: Defining Engineering Problems (from 3-5 ETS 1-1)</p> <ul style="list-style-type: none"> • Possible solutions to a problem are limited by the available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. </td> </tr> <tr> <td>CCC</td> <td> <p>Energy and Matter</p> <ul style="list-style-type: none"> • Energy can be transferred in various ways and between objects. </td> </tr> </table>		<p>typically refers to the conversion of stored energy into a desired form for practical use. ETS1.A: Defining Engineering Problems (from 3-5 ETS 1-1)</p> <ul style="list-style-type: none"> • Possible solutions to a problem are limited by the available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. 	CCC	<p>Energy and Matter</p> <ul style="list-style-type: none"> • Energy can be transferred in various ways and between objects.
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<p>4 ESS2-2. Analyze and interpret data from maps to describe patterns of Earth’s features.</p>	<table border="1"> <tr> <td>SEP</td> <td> <p>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> • Analyze and interpret data to make sense of phenomena using logical reasoning. </td> </tr> <tr> <td>DCI</td> <td> <p>ESS2.B: Plate Tectonics and Large-Scale System Interactions</p> <ul style="list-style-type: none"> • The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. </td> </tr> <tr> <td>CCC</td> <td> <p>Patterns</p> <ul style="list-style-type: none"> • Patterns can be used </td> </tr> </table>	SEP	<p>Analyzing and Interpreting Data</p> <ul style="list-style-type: none"> • Analyze and interpret data to make sense of phenomena using logical reasoning. 	DCI	<p>ESS2.B: Plate Tectonics and Large-Scale System Interactions</p> <ul style="list-style-type: none"> • The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. 	CCC	<p>Patterns</p> <ul style="list-style-type: none"> • Patterns can be used
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<p>4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.</p>	<table border="1"> <tr> <td>SEP</td> <td> Constructing Explanations and Designing Solutions <ul style="list-style-type: none"> • Apply scientific ideas to solve design problems. • Use scientific information to design 2 or more solutions. </td> </tr> <tr> <td>DCI</td> <td> ESS3.B: Natural Hazards <ul style="list-style-type: none"> • A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. ETS1.B: Developing Possible Solutions <ul style="list-style-type: none"> • Testing a solution involves investigating how well it performs under a range of likely conditions. </td> </tr> <tr> <td>CCC</td> <td> Energy and Matter <ul style="list-style-type: none"> • Energy can be transferred in various ways and between objects. Cause and Effect <ul style="list-style-type: none"> • Cause and effect relationships are routinely identified, tested, and used to explain change. Patterns <ul style="list-style-type: none"> • Patterns in the natural world can be observed, used to describe phenomena, and used as evidence. </td> </tr> </table>	SEP	Constructing Explanations and Designing Solutions <ul style="list-style-type: none"> • Apply scientific ideas to solve design problems. • Use scientific information to design 2 or more solutions. 	DCI	ESS3.B: Natural Hazards <ul style="list-style-type: none"> • A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. ETS1.B: Developing Possible Solutions <ul style="list-style-type: none"> • Testing a solution involves investigating how well it performs under a range of likely conditions. 	CCC	Energy and Matter <ul style="list-style-type: none"> • Energy can be transferred in various ways and between objects. Cause and Effect <ul style="list-style-type: none"> • Cause and effect relationships are routinely identified, tested, and used to explain change. Patterns <ul style="list-style-type: none"> • Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.
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Essential Question(s):	Enduring Understanding(s):				
<ul style="list-style-type: none"> What forces are responsible for the movement of the Earth's surface (and everything on it)? What energy and forces are acting on the Earth's crust during an earthquake? What are waves and how do they affect the Earth's crust and humans? Where does energy come from? How are renewable and nonrenewable resources impacting our environment? How can we utilize renewable energy? 	<ul style="list-style-type: none"> They apply their knowledge of natural Earth processes to generate and compare multiple solutions to reduce the impacts of such processes on humans. The crosscutting concepts of patterns; cause and effect; energy and matter; systems and system models; interdependence of science, engineering, and technology; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. Students are expected to develop an understanding that energy can be transferred from place to place by sound, light, heat, and electric currents or from object to object through collisions. They apply their understanding of energy to design, test, and refine a device that converts energy from one form to another. 				
Demonstration of Learning:	Pacing for Unit				
	6 Weeks				
Family Overview (link below)	Integration of Technology:				
Family Overview Unit 3 Grade 4	<i>Intentionally aligned use of digital tools and resources to support acquisition of content, researching, organizing and communicating learning</i> <ul style="list-style-type: none"> Tectonic Plates, Earthquakes, and Volcanoes Interactive Map PBS Mountain Maker, Earth Shaker Interactive Map PBS Kids Build - Seismic Shake-Up energy conversion simulation 				

Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):																		
<table border="1"> <thead> <tr> <th>Design</th> <th>Problem</th> <th>Solution</th> </tr> </thead> <tbody> <tr> <td>Energy</td> <td>Stored Energy</td> <td>Practical Use</td> </tr> <tr> <td>Transfer</td> <td>Transform</td> <td>Electric</td> </tr> <tr> <td>Electric Current</td> <td>Motion</td> <td>Sound</td> </tr> <tr> <td>Heat</td> <td>Light</td> <td>Resource</td> </tr> <tr> <td>Material</td> <td>Criteria</td> <td>Constraints</td> </tr> </tbody> </table>	Design	Problem	Solution	Energy	Stored Energy	Practical Use	Transfer	Transform	Electric	Electric Current	Motion	Sound	Heat	Light	Resource	Material	Criteria	Constraints	<ul style="list-style-type: none"> ● Summary Table-Forces that Move Earth Article ● Shake Table Demo Teacher Build Earthquakes ● Loomed Earthquakes ● USGS - The Science of Earthquakes ● Loomed USGS website reading ● The Science of an Earthquake ● Loomed version 12-17 ● Layers of earth demo ● mountain formation ● Mountains ● sci show kids earthquakes ● Wave Simulation Video ● WAVES ● Loomed version Waves! ● Tsunami ● tsunami TEDEd ● tsunami animation ● comparing Tsunamis To Other Waves ● nat geo kids ● Tsunami FAQ ● Wave and Current ● forces moving earth ● Bill Nye electricity ● energy overview ● renewable energy ● Loomed Climate Change and Energy ● recorded TEXT ● interview
Design	Problem	Solution																	
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Material	Criteria	Constraints																	
Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:																		
<p><u>ELA/Literacy -</u></p> <ul style="list-style-type: none"> ● Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. ● Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears. ● Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably 	<p>Students may believe:</p> <ul style="list-style-type: none"> ● The Earth has always looked the way it does now ● The Earth's crust does not change and/or move. ● That earthquakes only occur on the west coast of the United States (California) ● Continents do not move ● People can stop an earthquake ● Earthquakes happen randomly across the earth's surface ● The ground opens up during an earthquake ● That as waves move, matter moves along with them ● That sound waves move faster in air than in solids or liquids ● That waves do not have energy 																		

Mathematics - <ul style="list-style-type: none"> Reason abstractly and quantitatively. Use appropriate tools strategically Model with mathematics. 		
Connections to Prior Units:		Connections to Future Units:
<p>K-2 ETS1.A: A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. Asking questions, making observations and gathering information are helpful in thinking about problems. Before beginning to design a solution, it is important to understand the problem. (B) Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (C) Because there is always more than one possible solution to a problem, it is useful to compare and test designs.</p> <p>K-ESS3.B: Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that the communities can prepare for and respond to these events.</p> <p>2-ESS1.C: Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe.</p>		
Differentiation through <i>Universal Design for Learning</i>		
UDL Indicator		Teacher Actions:
3.3 Guide information processing and visualization		<ul style="list-style-type: none"> Give explicit prompts for each step in a sequential process Provide interactive models that guide exploration and new understandings Provide multiple entry points to a lesson and optional pathways through content
Supporting Multilingual/English Learners		
Related <i>CELP standards:</i>		Learning Targets:
<p>An EL can conduct research and evaluate and communicate findings to answer questions or solve problems</p> <p>An EL can participate in grade appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments and questions.</p>		<p>I can conduct short research projects to answer a question</p> <p>I can participate in extended conversations, discussions, and extended written exchanges using academic and domain specific vocabulary build on the ideas</p>
Lesson Sequence	Learning Target & Success Criteria	Assessments/ Resources

1	<ul style="list-style-type: none"> ● I can make observations on multiple examples of destruction. <ul style="list-style-type: none"> ○ I can generate and group questions on the possible causes of multiple examples of destruction ○ I can locate “destruction” sites on world map to consider patterns ○ I can develop an initial model to explain how an event happened 	<ul style="list-style-type: none"> ● Summary Table-Forces that Move Earth
2	<ul style="list-style-type: none"> ● I can make observations and use information to understand Moodus noises <ul style="list-style-type: none"> ○ I can design and test earthquake proof structures ○ I can compare design effectiveness with supporting data in post building design analysis ○ I can obtain and use information from multiple sources to understand and explain cause-effect relationships of earthquakes ○ I can explain and show what happens with various plate boundary movements ○ I can describe and explain earthquake patterns on a map ○ I can use evidence from the Interactive Map to explain relationships of tectonic plates to earthquakes and volcanoes 	<ul style="list-style-type: none"> ● Students regroup earthquake ideas from class concept map/anchor chart to their own maps, working in small groups or individuals
3	<ul style="list-style-type: none"> ● I can explore sound with cup communicators <ul style="list-style-type: none"> ○ I can explain how the cup communicators transfer sound ○ I can investigate water waves and record observations ○ I can describe water waves with relevant vocabulary ○ I can compare surface water waves and tsunami waves with venn diagram and explanatory models ○ I can obtain and organize information to explain the impact of tsunamis on land and people ○ I can revise initial models from LS 1 to determine cause/effect of destruction ○ I can explain patterns of earthquakes, volcanoes, and tsunami locations on World Tectonic Plate Boundary Map 	<ul style="list-style-type: none"> ● Locate sites electronically
4	<ul style="list-style-type: none"> ● I can generate ideas and ask questions about the demands of energy for human transportation <ul style="list-style-type: none"> ○ I can observe and record types of energy use at school and at home ○ I can categorize energy types and their sources ○ I can determine energy source trends and their implications ○ I can compare renewable and nonrenewable energy resources ○ I can design and test windmills to demonstrate energy transfer ○ I can analyze windmill data ○ I can design and present a creative advertising 	LS 4 CFA

	campaign to promote the uses and benefits of wave energy or geothermal energy	
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Course Title:	Content Area:	Grade Level:	Credit (if applicable)
Grade 3 Science	Science	Grade 3	N/A
Course Description:			
<p>The performance expectations in third grade help students formulate answers to questions such as:</p> <p>What is typical weather in different parts of the world and during different times of the year? How can the impact of weather-related hazards be reduced? How do organisms vary in their traits? How are plants, animals, and environments of the past similar or different from current plants, animals, and environments? What happens to organisms when their environment changes? How do equal and unequal forces on an object affect the object? How can magnets be used?"</p> <p>Third grade performance expectations include PS2, LS1, LS2, LS3, LS4, ESS2, and ESS3 Disciplinary Core Ideas from the NRC Framework. Students are able to organize and use data to describe typical weather conditions expected during a particular season. By applying their understanding of weather-related hazards, students are able to make a claim about the merit of a design solution that reduces the impacts of such hazards. Students are expected to develop an understanding of the similarities and differences of organisms' life cycles. An understanding that organisms have different inherited traits, and that the environment can also affect the traits that an organism develops, is acquired by students at this level. In addition, students are able to construct an explanation using evidence for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. Students are expected to develop an understanding of types of organisms that lived long ago and also about the nature of their environments. Third graders are expected to develop an understanding of the idea that when the environment changes some organisms survive and reproduce, some move to new locations, some move into the transformed environment, and some die. Students are able to determine the effects of balanced and unbalanced forces on the motion of an object and the cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. They are then able to apply their understanding of magnetic interactions to define a simple design problem that can be solved with magnets. The crosscutting concepts of patterns; cause and effect; scale, proportion, and quantity; systems and system models; interdependence of science, engineering, and technology; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. In the third grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in asking questions and defining problems; developing and using models, planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information. Students are expected to use these practices to demonstrate understanding of the core ideas.</p>			
Aligned Core Resources:		Connection to the <i>BPS Vision of the Graduate</i>	
N/A		<p>Collaboration</p> <ul style="list-style-type: none"> ● Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal ● Assume shared responsibility for collaborative work and value the individual contributions made by each team member <p>Critical Thinking and Problem Solving</p> <ul style="list-style-type: none"> ● Collect, assess and analyze relevant information ● Reason effectively. ● Make sound judgements and decisions. Identify, define and solve authentic problems and 	

	<p>essential questions.</p> <ul style="list-style-type: none"> • Reflect critically on learning experience, processes and solutions. • Transfer knowledge to other situations
Additional Course Information: Knowledge/Skill Dependent courses/prerequisites	Link to Completed Equity Audit
N/A	Grade 3 Science Equity Audit

Standard Matrix

District Learning Expectations and Standards	Unit 1	Unit 2	Unit 3
3-PS2-1 Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.	X		
3-PS2-2 Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.	X		
3-PS2-3 Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.	X		
3-PS2-4 Define a simple design problem that can be solved by applying scientific ideas about magnets.	X		
3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	X		
3-LS1-1 Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.		X	X
3-LS3-1 Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.		X	
3-LS3-2 Use evidence to support the explanation that traits can be influenced by the environment.		X	
3-LS4-1 Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.		X	
3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.			X
3-LS2-1 Construct an argument that some animals form groups that help members survive.			X
3-LS4-2 Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.			X
3-LS4-3 Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.			X

3-LS4-4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.			X
3-ESS2-2 Obtain and combine information to describe climates in different regions of the world.			X
3-ESS3-1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.			X
3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.			X
3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.			X

Unit Links

If unit headings are formatted as a heading, then we can link a Table of Contents to better organize and provide faster access to each unit

[Unit 1: The Case of Odd Motion](#)

[Unit 2: The Case of Harper's Fossil Find](#)

[Unit 3: The Case of the Missing Monarchs](#)

Unit Title:

Unit 1: The Case of Odd Motion

Relevant Standards: Bold indicates priority

3-PS2-1 Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

SEP	Planning and Carrying Out Investigations <ul style="list-style-type: none">Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
DCI	PS2.A: Forces and Motion <ul style="list-style-type: none">Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. PS2.B: Types of Interactions <ul style="list-style-type: none">Objects in contact exert forces on each other.
CCC	Cause and Effect <ul style="list-style-type: none">Cause and effect relationships are routinely identified.

3-PS2-2 Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

SEP	Planning and Carrying Out Investigations <ul style="list-style-type: none">Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
DCI	PS2.A: Forces and Motion <ul style="list-style-type: none">The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it.
CCC	Patterns <ul style="list-style-type: none">Patterns of change can be used to make

3-PS2-3 Ask questions to determine cause and effect

<p>relationships of electric or magnetic interactions between two objects not in contact with each other.</p>	<table border="1"> <tr> <td>SEP</td> <td> Asking Questions and Defining Problems <ul style="list-style-type: none"> Ask questions that can be investigated based on patterns such as cause and effect relationships. </td> </tr> <tr> <td>DCI</td> <td> PS2.B: Types of Interactions <ul style="list-style-type: none"> Electric, and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depends on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. </td> </tr> <tr> <td>CCC</td> <td> Cause and Effect <ul style="list-style-type: none"> Cause and effect relationships are routinely identified, tested, and used to explain change. </td> </tr> </table>	SEP	Asking Questions and Defining Problems <ul style="list-style-type: none"> Ask questions that can be investigated based on patterns such as cause and effect relationships. 	DCI	PS2.B: Types of Interactions <ul style="list-style-type: none"> Electric, and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depends on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. 	CCC	Cause and Effect <ul style="list-style-type: none"> Cause and effect relationships are routinely identified, tested, and used to explain change.
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<p>3-PS2-4 Define a simple design problem that can be solved by applying scientific ideas about magnets.</p>	<table border="1"> <tr> <td>SEP</td> <td> Asking Questions and Defining Problems <ul style="list-style-type: none"> Define a simple problem that can be solved through the development of a new or improved object or tool. </td> </tr> <tr> <td>DCI</td> <td> PS2.B: Types of Interactions <ul style="list-style-type: none"> Electric, and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depends on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. </td> </tr> <tr> <td>CCC</td> <td>N/A</td> </tr> </table>	SEP	Asking Questions and Defining Problems <ul style="list-style-type: none"> Define a simple problem that can be solved through the development of a new or improved object or tool. 	DCI	PS2.B: Types of Interactions <ul style="list-style-type: none"> Electric, and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depends on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. 	CCC	N/A
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CCC	N/A						
<p>3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.</p>	<table border="1"> <tr> <td>SEP</td> <td> Planning and Carrying Out Investigations <ul style="list-style-type: none"> Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. </td> </tr> <tr> <td>DCI</td> <td> ETS1.B: Developing Possible Solutions <ul style="list-style-type: none"> Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. ETS1.C: Optimizing the Design Solution <ul style="list-style-type: none"> Different solutions need to be tested in </td> </tr> </table>	SEP	Planning and Carrying Out Investigations <ul style="list-style-type: none"> Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. 	DCI	ETS1.B: Developing Possible Solutions <ul style="list-style-type: none"> Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. ETS1.C: Optimizing the Design Solution <ul style="list-style-type: none"> Different solutions need to be tested in 		
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CCC	N/A																		
Essential Question(s):	Enduring Understanding(s):																		
<ul style="list-style-type: none"> • What makes objects move the way they do? • How do different strengths of forces affect motion? How does the direction of a force affect motion? • How do the properties of an object affect how an object moves when a force is applied? • How can some unseen forces that act on an object be investigated and explained? • What can magnetic forces do? How can we use the properties of magnets to solve a problem? • What forces caused this new case of odd motion? 	<ul style="list-style-type: none"> • Determine the effects of balanced and unbalanced forces on the motion of an object. • Identify the cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. • Apply understanding of magnetic interactions to define a simple design problem that can be solved with magnets. 																		
Demonstration of Learning:	Pacing for Unit																		
Claim, Evidence, Reason for the Case of the Floating Tree	6 weeks																		
Family Overview (link below)	Integration of Technology:																		
Family Overview Unit 1 Grade 3	<i>Intentionally aligned use of digital tools and resources to support acquisition of content, researching, organizing and communicating learning.</i> <ul style="list-style-type: none"> • Forces and Motion: Basics- Phet Interactive Model • Balloons and Static Electricity- Phet Interactive Model 																		
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):																		
<table border="1"> <tr> <td>plan</td> <td>conduct</td> <td>investigation</td> </tr> <tr> <td>data</td> <td>evidence</td> <td>variables</td> </tr> <tr> <td>fair test</td> <td>trials</td> <td>controlled</td> </tr> <tr> <td>force</td> <td>strength</td> <td>direction</td> </tr> <tr> <td>net force</td> <td>speed, motion</td> <td>exert</td> </tr> <tr> <td>observe</td> <td>measure</td> <td>phenomenon</td> </tr> </table>	plan	conduct	investigation	data	evidence	variables	fair test	trials	controlled	force	strength	direction	net force	speed, motion	exert	observe	measure	phenomenon	<ul style="list-style-type: none"> • Football Punt (2:27 - 3:31 without sound) • Levitation Wand • Forces Make Things Move by Kimberly Brubaker Bradley • I Face the Wind by Vicki Cobb • What's an Engineer? video • Defining Gravity: Crash Course Kids #4.1 video • I Fall Down by Vicki Cobb • Gravity is a Mystery by Franklyn Branley • Gravity by Jason Chin • How does Static Electricity Work video • The Sticky Balloon Trick! video
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data	evidence	variables																	
fair test	trials	controlled																	
force	strength	direction																	
net force	speed, motion	exert																	
observe	measure	phenomenon																	

design solution	pattern	prediction	<ul style="list-style-type: none"> • Attract and Repel - A Look at Magnets by Jennifer Boothroyd • Fun with Magnets! video
cause and effect	relationships	electric	
magnetic	properties	magnets	
orientation	relative to	problem	
tool	distance	magnetic forces	
failure points	elements	design	
criteria	constraints		
Opportunities for Interdisciplinary Connections:			Anticipated misconceptions:
<p>Literacy connections:</p> <ul style="list-style-type: none"> • Students are asking and answering questions • Referring to a text • Recalling information and data from multiple sources <p>Mathematics connections:</p> <ul style="list-style-type: none"> • Measuring and estimating • Creating scaled graphs to track data • Use appropriate tools strategically 			<ul style="list-style-type: none"> • The terms “energy” and force are interchangeable • If an object is at rest, no forces act on it • Force is a property of an object • Large objects always exert a greater force than smaller objects • Friction always hinders motion, thus reducing friction is always desired • An object a person is sitting or standing on doesn’t push back with equal force • If something is moving, there must be a greater force on it • The faster an object is moving the greater force on it • Force is a property of an object. An object has force, and when it runs out of force, it stops moving • All things fall down due to gravity but heavy things always fall fastest
Connections to Prior Units:			Connections to Future Units:
<p>Connections to:</p> <ul style="list-style-type: none"> • K Unit 3: Push, Pull, Play! with forces content. • K-2 units with engineering and design problems. 			<p>Connections to:</p> <ul style="list-style-type: none"> • Grade 4 Unit 1: National Parks with the effects of forces on an object • Grade 4 Unit 2: Bear Sense with observing and measuring patterns in the motion of objects. • Grade 5 Unit 3: Expedition Antarctica with strength and direction of forces.
Differentiation through Universal Design for Learning			
UDL Indicator			Teacher Actions:
3.3 Guide information processing and visualization			<ul style="list-style-type: none"> • Give explicit prompts for each step in a sequential process • Provide interactive models that guide exploration and new understandings

		<ul style="list-style-type: none"> • Provide multiple entry points to a lesson and optional pathways through content
Supporting Multilingual/English Learners		
Related <i>CELP standards:</i>	Learning Targets:	
<p>An EL can construct grade appropriate oral and written claims and support them with reasoning and evidence.</p> <p>An EL can participate in grade appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments and questions.</p>	<p>I can use words and phrases acquired in conversations, reading, and being read to, and academic and domain specific words</p> <p>I can ask questions to gain information or clarify understanding</p>	
Lesson Sequence	Learning Target & Success Criteria	Assessments/ Resources
1	<p>I can make observations and ask questions about cause and effect relationships of motion.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I observe each video and demonstrate. <input type="checkbox"/> I can record what I noticed and wondered. <input type="checkbox"/> I can share my observations with the class. 	<ul style="list-style-type: none"> • Evidence log
2	<p>I can make observations and draw conclusions about cause and effect relationships of motion.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can move objects in a variety of ways. <input type="checkbox"/> I can observe the movements and write down what affects their movement. <p>I can plan and conduct an investigation.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can conduct an investigation with controls. <input type="checkbox"/> I can investigate the impact of the strength of a push or pull on an object's motion. <input type="checkbox"/> I can record my data and create a bar graph representing data. <p>I can make observations and provide an explanation.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can explain patterns in my data. <input type="checkbox"/> I can define the following words: push, pull, force, rest, speed, change in direction, change in motion, change in speed, force strength, control. <p>I can make observations and ask questions about cause and effect relationships of motion.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can observe and ask questions about motion. <input type="checkbox"/> I can explain how different strengths of forces and direction affect motion. <input type="checkbox"/> I can generate a claim with evidence on how the surface impacts the motion of the ball or the car. <p>I can develop an explanatory model to demonstrate an understanding of the strength and direction of forces.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can work collaboratively to develop an explanatory model. <input type="checkbox"/> I can create an explanatory model that demonstrates an 	<ul style="list-style-type: none"> • Force investigation • Forces Make Things Move by Kimberly Brubaker Bradley • Forces and Motion: Basics- Phet Interactive Model • I Face the Wind by Vicki Cobb

	<p>understanding of strength and direction of forces. I can make observations and provide an explanation.</p> <p><input type="checkbox"/> I can work collaboratively to record observations and explanations on motion.</p> <p><input type="checkbox"/> I can decide what information should be included in our evidence log.</p>	
3	<p>I can compare and contrast object properties and predict how that may affect their movement.</p> <p><input type="checkbox"/> I can understand and explain what an engineer is.</p> <p><input type="checkbox"/> I can compare and contrast object properties</p> <p><input type="checkbox"/> I can predict how force may affect movement of objects with different properties.</p> <p>I can plan and conduct an investigation.</p> <p><input type="checkbox"/> I can conduct the design challenge investigation.</p> <p><input type="checkbox"/> I can record my data for each trial.</p> <p><input type="checkbox"/> I can share my results with the class.</p> <p>I can make observations and draw conclusions about cause and effect relationships of motion.</p> <p><input type="checkbox"/> I can draw conclusions from my data.</p> <p><input type="checkbox"/> I can share my observations and conclusion with the class.</p> <p><input type="checkbox"/> I can understand that there is a cause and effect relationship.</p> <p>I can make observations and draw conclusions about cause and effect relationships of motion.</p> <p><input type="checkbox"/> I examined each odd motion.</p> <p><input type="checkbox"/> I can write on a sticky note and describe what I know about each object.</p> <p><input type="checkbox"/> I can share my thinking with the class.</p>	<ul style="list-style-type: none"> • Design Challenge • What's an Engineer? Video
4	<p>I can plan and conduct an investigation.</p> <p><input type="checkbox"/> I can conduct an investigation to help me better understand gravity.</p> <p><input type="checkbox"/> I can draw and label a picture that shows gravitational force.</p> <p>I can explain the effects of an unseen force on an object.</p> <p><input type="checkbox"/> I can build background knowledge on gravity.</p> <p><input type="checkbox"/> I can create an explanatory model that shows how to prevent an object from falling.</p> <p>I can explain the effects of an unseen force on an object.</p> <p><input type="checkbox"/> I can learn about and research electrostatic force.</p> <p><input type="checkbox"/> I can draw and label a picture that show electrostatic force.</p> <p><input type="checkbox"/> I define the following words: static electricity, electrostatic force, attract, repel, and charge.</p>	<ul style="list-style-type: none"> • Assessment: Magnetic explanatory model • Defining Gravity: Crash Course Kids #4.1 video • I Fall Down by Vicki Cobb • Gravity is a Mystery by Franklyn Branley • Gravity by Jason Chin • Balloons and Static Electricity-Phet Interactive Model • How does Static Electricity Work

		video <ul style="list-style-type: none"> • The Sticky Balloon Trick! video
5	<p>I can plan and conduct an investigation.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can complete each station and record what I noticed and wondered. <input type="checkbox"/> I can share my thinking with the class. <p>I can explain how magnetic forces work.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can research using sources to learn more about magnetic forces. <input type="checkbox"/> I can explain and create a class poster explaining magnetic forces. <p>I can develop an explanatory model to solve a real world problem using magnetic force.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can define a problem including magnets. <input type="checkbox"/> I can construct a model to demonstrate the solution to my magnet question. <input type="checkbox"/> I can design a new idea or improve upon an already existing idea with a magnet. <p>I can make observations and provide an explanation.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can create a model explaining the force. <input type="checkbox"/> I can use vocabulary to describe the force. <p>Summative Assessment</p> <p>I can make observations and draw conclusions about cause and effect relationships of motion.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can make observations and draw conclusions about the video. <input type="checkbox"/> I can make connections between the video and what we've learned about forces and motion. <input type="checkbox"/> I can complete a Scene Analysis with evidence for the final assessment. 	<ul style="list-style-type: none"> • Assessment: Floating Tree Scene Analysis • Attract and Repel - A Look at Magnets by Jennifer Boothroyd • Fun with Magnets! video

Unit Title:			
Unit 2: The Case of Harper's Fossil Find			
Relevant Standards: Bold indicates priority			
<u>3-LS1-1</u> Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.	<table border="1"> <tr> <td>SEP</td> <td>Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and</td> </tr> </table>	SEP	Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and
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<p>3-LS3-1 Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.</p>	<table border="1"> <tr> <td>SEP</td> <td> <p>Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.</p> <ul style="list-style-type: none"> • Analyze and interpret data to make sense of phenomena using logical reasoning. </td> </tr> </table>	SEP	<p>Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.</p> <ul style="list-style-type: none"> • Analyze and interpret data to make sense of phenomena using logical reasoning. 				
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	DCI	<p>LS3.A: Inheritance of Traits</p> <ul style="list-style-type: none"> • Many characteristics of organisms are inherited from their parents. <p>LS3.B: Variation of Traits</p> <ul style="list-style-type: none"> • Different organisms vary in how they look and function because they have different inherited information.
<p>3-LS3-2 Use evidence to support the explanation that traits can be influenced by the environment.</p>	CCC	<p>Patterns</p> <ul style="list-style-type: none"> • Similarities and differences in patterns can be used to sort and classify natural phenomena.
	SEP	<p>Constructing Explanations and Designing Solutions</p> <p>Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.</p> <ul style="list-style-type: none"> • Use evidence (e.g., observations, patterns) to support an explanation.
	DCI	<p>LS3.A: Inheritance of Traits</p> <ul style="list-style-type: none"> • Other characteristics result from individuals' interactions with the environment, which can range

		<p>from diet to learning. Many characteristics involve both inheritance and environment.</p> <p>LS3.B: Variation of Traits</p> <ul style="list-style-type: none"> • The environment also affects the traits that an organism develops.
<p>3-LS4-1 Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.</p>	<p>CCC</p>	<p>Cause and Effect</p> <ul style="list-style-type: none"> • Cause and effect relationships are routinely identified and used to explain change.
	<p>SEP</p>	<p>Analyzing and Interpreting</p> <p>Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.</p> <ul style="list-style-type: none"> • Analyze and interpret data to make sense of phenomena using logical reasoning.
	<p>DCI</p>	<p>LS4.A: Evidence of Common Ancestry and Diversity</p> <ul style="list-style-type: none"> • Some kinds of plants and animals that once lived on Earth are no longer found anywhere. (Note: moved from K-2) • Fossils provide evidence about the types of organisms that lived long ago and also about the

	<table border="1"> <tr> <td></td> <td>nature of their environments.</td> </tr> <tr> <td>CCC</td> <td> <p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> Observable phenomena exist from very short to very long time periods. <p>Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems</p> <ul style="list-style-type: none"> Science assumes consistent patterns in natural systems. </td> </tr> </table>		nature of their environments.	CCC	<p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> Observable phenomena exist from very short to very long time periods. <p>Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems</p> <ul style="list-style-type: none"> Science assumes consistent patterns in natural systems.
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Essential Question(s):	Enduring Understanding(s):				
<ul style="list-style-type: none"> What can we notice and wonder about organisms and their environments? What are fossils and what can we learn from them? How are organisms today similar and different from their ancestors? What patterns can be described in various organisms' life cycles? Why do offspring look similar to their parents? How do environmental conditions impact an organism's traits? 	<ul style="list-style-type: none"> develop an understanding of the similarities and differences of organisms' life cycles acquire an understanding that organisms have different inherited traits, and that the environment can also affect the traits that an organism develops construct an explanation using evidence for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing develop an understanding of types of organisms that lived long ago and also about the nature of their environments develop an understanding of the idea that when the environment changes some organisms survive and reproduce, some move to new locations, some move into the transformed environment, and some die 				
Demonstration of Learning:	Pacing for Unit				
Claim, evidence, reasoning describing an organism using a novel fossil: type of fossil, type of organism, diet, and life cycle	6 weeks				
Family Overview (link below)	Integration of Technology:				
Family Overview Unit 2 Grade 3	<i>Intentionally aligned use of digital tools and resources to support acquisition of content, researching, organizing and communicating learning</i>				

	<ul style="list-style-type: none"> • Discover a Crossbreed - inheritance simulation 																						
Unit-specific Vocabulary:	Aligned Unit Materials, Resources, and Technology (beyond core resources):																						
<table border="1"> <tr> <td>organism</td> <td>environment</td> <td>paleontologist</td> </tr> <tr> <td>fossil</td> <td>trace fossil</td> <td>true fossil</td> </tr> <tr> <td>omnivore</td> <td>carnivore</td> <td>herbivore</td> </tr> <tr> <td>predator</td> <td>prey</td> <td>trait</td> </tr> <tr> <td>inherited trait</td> <td>offspring</td> <td>ancestors</td> </tr> <tr> <td>life cycle</td> <td>heredity</td> <td>acquired trait</td> </tr> <tr> <td>behavior</td> <td>learned behavior</td> <td></td> </tr> </table>	organism	environment	paleontologist	fossil	trace fossil	true fossil	omnivore	carnivore	herbivore	predator	prey	trait	inherited trait	offspring	ancestors	life cycle	heredity	acquired trait	behavior	learned behavior		<ul style="list-style-type: none"> • What is a Paleontologist video • <i>Curious About Fossils</i> by Kate Waters • <i>Fossils Tell of Long Ago</i> by Alikei • Tooth by Tooth by Sarah C. Levine • What Can Fossil Footprints Tell Us? Article • 10 Facts About Dinosaur Eggs article • <i>Fossil</i> by Bill Thompson • <i>Grandmother Fish</i> by Jonathan Tweet • Oviraptor by Susan H. Gray • Life Cycle of a Butterfly by Meg Gaertner • Discover a Crossbreed simulation • Heredity: Pass it On! by Rebecca Hirsh • Traits and Attributes by Natalie Hyde • <i>Inheritance of Traits: Why is my Dog Bigger than Your Dog?</i> By Jen Green • Oviraptor by Jennifer Zeiger • Why Are Flamingos Pink? video • Learned Behavior in Capuchin Monkeys video 	
organism	environment	paleontologist																					
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life cycle	heredity	acquired trait																					
behavior	learned behavior																						
Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:																						
<p>Literacy Connections:</p> <ul style="list-style-type: none"> • Synthesizing information from multiple sources • Using texts to build background knowledge • Using text evidence to support a claim <p>Mathematics Connections:</p> <ul style="list-style-type: none"> • Analyze and interpret data 	<ul style="list-style-type: none"> • Fossils can include preserved tissue or indirect evidence left behind • Both trace and true fossils give clues about organisms' lives • All living things, animal and non-animal, can leave fossils • Parents do not pass down all of their traits to their offspring • Learned behavior can be acquired unconsciously • Despite differences in the way they develop, all organisms go through 4 major life cycles stages: birth, growth, reproduction, and death 																						
Connections to Prior Units:	Connections to Future Units:																						
Differentiation through Universal Design for Learning																							
UDL Indicator	Teacher Actions:																						
3.4 Maximize transfer and generalization	<ul style="list-style-type: none"> • Provide organizers and sticky notes • Provide templates, graphic organizers, concept maps to support note-taking • Offer opportunities over time to revisit key ideas and linkages between ideas 																						

Supporting Multilingual/English Learners		
Related <i>CELP standards:</i>	Learning Targets:	
An EL can construct grade appropriate oral and written claims and support them with reasoning and evidence.	I can use words and phrases acquired in conversations, reading, and being read to, and academic and domain specific words.	
An EL can conduct research and evaluate and communicate findings to answer questions or solve problems.	I can present findings using sources to answer questions.	
Lesson Sequence	Learning Target & Success Criteria	Assessments/ Resources
1	<p>I can make observations and generate questions to begin to understand the organism and its environment.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can understand what a paleontologist is. <input type="checkbox"/> I can make observations about the organism and its environment in my science notebook. <input type="checkbox"/> I can generate questions when observing the organism in my science notebook. 	<ul style="list-style-type: none"> • Student Notebook (ongoing throughout unit) • Class Summary Table (ongoing throughout unit)
2	<p>I can draw conclusions about an organism and its environment from examining fossil evidence.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can make observations about fossils. <input type="checkbox"/> I can make predictions about fossils and their environment based on fossil evidence. <p>I can draw conclusions about an organism and its environment from examining fossil evidence.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can explain the difference between a trace and a true fossil. <input type="checkbox"/> I can use fossil clues to make inferences about an organism and its environment <p>I can analyze true fossils and present day organisms in order to identify patterns in skull structures and teeth.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can make observations about what an animal eats based on their skull structures and teeth. <input type="checkbox"/> I can present a claim about Harper’s Fossil and support it with evidence based on patterns in skull structures and teeth. <p>I can analyze trace fossils in order to identify patterns in tracks.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can analyze trace fossils and explain/make predictions about their patterns. <input type="checkbox"/> I can describe what I learned using footprint trace fossils. <p>I can analyze trace fossils in order to identify patterns in tracks.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can analyze trace fossils and explain/make predictions about their patterns. <input type="checkbox"/> I can describe what I learned using footprint trace fossils. <p>I can research eggs to help me better understand Harpers Fossil Find.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can work in partnerships and research facts about eggs. <input type="checkbox"/> I can share what I learned with the group by Repeating and 	<ul style="list-style-type: none"> • <i>Curious About Fossils</i> by Kate Waters • <i>Fossils Tell of Long Ago</i> by Alike • <i>Tooth by Tooth</i> by Sara Levine • What can Fossil Footprints Tell Us? article • footprint puzzle • Trace Fossil Scene • student sheet • 10 Facts About Dinosaur Eggs article

	<p>Rephrasing what I learned.</p> <p><input type="checkbox"/> I can use the information I learned about eggs to explain Harpers Fossil find.</p>	
3	<p>I can compare the appearance and function of inherited traits in fossils and present day organisms.</p> <p><input type="checkbox"/> I can identify at least one inherited trait from a fossil in the text that is similar to a present day organism.</p> <p><input type="checkbox"/> I can describe at least two similarities in the appearance of the trait in each organism.</p> <p><input type="checkbox"/> I can describe at least two similarities in the function of the trait in each organism.</p> <p>I can make inferences about a fossilized organism based on its traits.</p> <p><input type="checkbox"/> I can accurately match fossils to living organisms based on their traits.</p> <p><input type="checkbox"/> I can correctly infer where a fossilized organism lived and explain how the traits I observed in the fossil helped me draw my conclusion.</p> <p><input type="checkbox"/> I can explain how organisms changed over time based on their traits.</p> <p>I can define and identify “inherited traits”.</p> <p><input type="checkbox"/> I can accurately explain what “inheritance” means.</p> <p><input type="checkbox"/> I can explain the relationship between two organisms based on inherited traits.</p> <p>I can use fossil clues to make predictions about Harper's Fossil and its life.</p> <p><input type="checkbox"/> I can describe at least two ways that fossils give clues about how oviraptors lived.</p>	<ul style="list-style-type: none"> • <i>Fossil</i> by Bill Thompson • Fossil cards • <i>Grandmother Fish</i> by Jonathan Tweet • Oviraptor by Susan H. Gray
4	<p>I can observe and record data on the life cycle of a living organism.</p> <p><input type="checkbox"/> I can draw a picture and label what I notice.</p> <p><input type="checkbox"/> I can observe the organisms and record at least 3 things that I noticed or wondered about.</p> <p>I can compare and contrast the life cycles of different organisms.</p> <p><input type="checkbox"/> I can identify the stages of at least three different life cycles.</p> <p><input type="checkbox"/> I can identify at least two similarities and two differences between the life cycles of different organisms.</p> <p><input type="checkbox"/> I can make an inference about which life cycle Harper's fossil is most similar to and explain my thinking with evidence.</p>	<ul style="list-style-type: none"> • Observation Notebook (ongoing)
5	<p>I can predict what offspring would look like based on parent appearance.</p> <p><input type="checkbox"/> I can predict at least three traits that an offspring might inherit from its parents.</p> <p><input type="checkbox"/> I can identify traits in an offspring that were inherited from each parent.</p> <p>I can identify and define hereditary traits.</p> <p><input type="checkbox"/> I can explain what a hereditary trait is.</p>	<ul style="list-style-type: none"> • Discover a Crossbreed simulation • Heredity: Pass it On! By Rebecca Hirsh • Traits and Attributes by Natalie Hyde • Inheritance of Traits: Why is my Dog Bigger than

	<p><input type="checkbox"/> I can identify at least three traits that are hereditary in animals and plants.</p> <p>I can make inferences about an organism's life based on its inherited traits.</p> <p><input type="checkbox"/> I can make a claim about whether I believe the egg belongs to the oviraptor or another creature.</p> <p><input type="checkbox"/> I can identify at least three pieces of evidence related to inherited traits that support my claim.</p> <p><input type="checkbox"/> I can explain how my evidence connects to my claim.</p> <p>I can explain how inheritance affects an organism's appearance.</p> <p><input type="checkbox"/> I can identify traits that an offspring has inherited.</p> <p><input type="checkbox"/> I can explain the relationship between inherited traits and the way an organism looks.</p>	<p>Your Dog? by Jen Green</p> <ul style="list-style-type: none"> • Oviraptor by Jennifer Zeiger
6	<p>I can differentiate between inherited traits vs acquired traits.</p> <p><input type="checkbox"/> I can look at pictures and determine if it is an inherited or acquired trait.</p> <p><input type="checkbox"/> I can explain my thinking using evidence.</p> <p>I can explain if a trait is a learned behavior or influenced by the environment and how it affects the organism.</p> <p><input type="checkbox"/> I can watch the two videos and explain if the trait is learned or influenced by the environment.</p> <p><input type="checkbox"/> I can explain how the trait affects the organism.</p> <p>I can explain if a trait is a learned behavior or influenced by the environment and how it affects the organism.</p> <p><input type="checkbox"/> I can observe and analyze information about eggs to determine if egg color is an environmental or inherited trait.</p> <p><input type="checkbox"/> I can use what I learned about eggs to make a claim about whether the oviraptor is more closely related to a bird or a reptile.</p>	<ul style="list-style-type: none"> • Why Are Flamingoes Pink? video • Learned Behavior in Capuchin Monkeys video

Unit Title:		
Unit 3: The Case of the Missing Monarchs		
Relevant Standards: Bold indicates priority		
<p><u>3-LS1-1</u> Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.</p>	SEP	<p>Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using</p>

	<p>models to represent events and design solutions. Develop models to describe phenomena.</p> <p>Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence Science findings are based on recognizing patterns.</p>
	<p>DCI</p> <p>LS1.B: Growth and Development of Organisms</p> <ul style="list-style-type: none"> Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.
	<p>CCC</p> <p>Patterns</p> <ul style="list-style-type: none"> Patterns of change can be used to make predictions.
<p>3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.</p>	<p>SEP</p> <p>Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.</p> <ul style="list-style-type: none"> Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate

	<table border="1"> <tr> <td></td> <td>relationships.</td> </tr> <tr> <td>DCI</td> <td> ESS2.D: Weather and Climate <ul style="list-style-type: none"> Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. </td> </tr> <tr> <td>CCC</td> <td> Patterns <ul style="list-style-type: none"> Patterns of change can be used to make predictions. </td> </tr> </table>		relationships.	DCI	ESS2.D: Weather and Climate <ul style="list-style-type: none"> Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. 	CCC	Patterns <ul style="list-style-type: none"> Patterns of change can be used to make predictions.
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<p>3-LS2-1 Construct an argument that some animals form groups that help members survive.</p>	<table border="1"> <tr> <td>SEP</td> <td> Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). <ul style="list-style-type: none"> Construct an argument with evidence, data, and/or a model. </td> </tr> <tr> <td>DCI</td> <td> LS2.D: Social Interactions and Group Behavior <ul style="list-style-type: none"> Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically </td> </tr> </table>	SEP	Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). <ul style="list-style-type: none"> Construct an argument with evidence, data, and/or a model. 	DCI	LS2.D: Social Interactions and Group Behavior <ul style="list-style-type: none"> Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically 		
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<p>3-LS4-2 Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.</p>	<table border="1"> <tr> <td>SEP</td> <td> Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. <ul style="list-style-type: none"> • Use evidence (e.g., observations, patterns) to construct an explanation. </td> </tr> <tr> <td>DCI</td> <td> LS4.B: Natural Selection <ul style="list-style-type: none"> • Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. </td> </tr> <tr> <td>CCC</td> <td> Cause and Effect <ul style="list-style-type: none"> • Cause and effect relationships are routinely identified and used to explain change. </td> </tr> </table>	SEP	Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. <ul style="list-style-type: none"> • Use evidence (e.g., observations, patterns) to construct an explanation. 	DCI	LS4.B: Natural Selection <ul style="list-style-type: none"> • Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. 	CCC	Cause and Effect <ul style="list-style-type: none"> • Cause and effect relationships are routinely identified and used to explain change.
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<p>3-LS4-3 Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.</p>	<table border="1"> <tr> <td>SEP</td> <td> <p>Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).</p> <ul style="list-style-type: none"> • Construct an argument with evidence </td> </tr> <tr> <td>DCI</td> <td> <p>LS4.C: Adaptation</p> <ul style="list-style-type: none"> • For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. </td> </tr> <tr> <td>CCC</td> <td> <p>Cause and Effect</p> <ul style="list-style-type: none"> • Cause and effect relationships are routinely identified and used to explain change. </td> </tr> </table>	SEP	<p>Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).</p> <ul style="list-style-type: none"> • Construct an argument with evidence 	DCI	<p>LS4.C: Adaptation</p> <ul style="list-style-type: none"> • For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. 	CCC	<p>Cause and Effect</p> <ul style="list-style-type: none"> • Cause and effect relationships are routinely identified and used to explain change.
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<p>3-LS4-4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.</p>	<table border="1"> <tr> <td>SEP</td> <td> <p>Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).</p> </td> </tr> </table>	SEP	<p>Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).</p>				
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		<ul style="list-style-type: none"> • Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.
	DCI	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</p> <ul style="list-style-type: none"> • When the environment changes in ways that affect a place’s physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.(secondary) <p>LS4.D: Biodiversity and Humans</p> <ul style="list-style-type: none"> • Populations live in a variety of habitats, and change in those habitats affects the organisms living there.
	CCC	<p>Systems and System Models</p> <ul style="list-style-type: none"> • A system can be described in terms of its components and their interactions. <p>Connections to Engineering, Technology, and Applications of Science Interdependence of</p>

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<p>3-ESS2-2 Obtain and combine information to describe climates in different regions of the world.</p>	<table border="1"> <tr> <td> <p>SEP</p> </td> <td> <p>Obtaining, Evaluating, and Communicating Information</p> <p>Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods.</p> <ul style="list-style-type: none"> • Obtain and combine information from books and other reliable media to explain phenomena. </td> </tr> <tr> <td> <p>DCI</p> </td> <td> <p>ESS2.D: Weather and Climate</p> <ul style="list-style-type: none"> • Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. </td> </tr> <tr> <td> <p>CCC</p> </td> <td> <p>Patterns</p> <ul style="list-style-type: none"> • Patterns of change can be used to make predictions. </td> </tr> </table>	<p>SEP</p>	<p>Obtaining, Evaluating, and Communicating Information</p> <p>Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods.</p> <ul style="list-style-type: none"> • Obtain and combine information from books and other reliable media to explain phenomena. 	<p>DCI</p>	<p>ESS2.D: Weather and Climate</p> <ul style="list-style-type: none"> • Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. 	<p>CCC</p>	<p>Patterns</p> <ul style="list-style-type: none"> • Patterns of change can be used to make predictions.
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<p>3-ESS3-1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.</p>	<table border="1"> <tr> <td> <p>SEP</p> </td> <td> <p>Engaging in Argument from Evidence</p> </td> </tr> </table>	<p>SEP</p>	<p>Engaging in Argument from Evidence</p>				
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DCI	<p>ESS3.B: Natural Hazards</p> <ul style="list-style-type: none"> • A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.
CCC	<p>Cause and Effect</p> <ul style="list-style-type: none"> • Cause and effect relationships are routinely identified, tested, and used to explain change. <p>Connections to Engineering, Technology, and Applications of Science</p> <p>Influence of Engineering, Technology, and Science on Society and the Natural World</p> <ul style="list-style-type: none"> • Engineers improve existing technologies or develop new ones to increase

	<div style="background-color: #d9ead3; width: 100%; height: 100%;"></div> <div> <p>their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones).</p> <p>Connections to Nature of Science Science is a Human Endeavor</p> <ul style="list-style-type: none"> • Science affects everyday life. </div>				
<p>3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.</p>	<table border="1"> <tr> <td style="background-color: #d9e1f2; width: 100%; height: 100%; vertical-align: top;"> <p>SEP</p> </td> <td> <p>Asking Questions and Defining Problems Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.</p> <ul style="list-style-type: none"> • Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. </td> </tr> <tr> <td style="background-color: #fce4d6; width: 100%; height: 100%; vertical-align: top;"> <p>DCI</p> </td> <td> <p>ETS1.A: Defining and Delimiting Engineering Problems</p> <ul style="list-style-type: none"> • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution </td> </tr> </table>	<p>SEP</p>	<p>Asking Questions and Defining Problems Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.</p> <ul style="list-style-type: none"> • Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. 	<p>DCI</p>	<p>ETS1.A: Defining and Delimiting Engineering Problems</p> <ul style="list-style-type: none"> • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution
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<p>DCI</p>	<p>ETS1.A: Defining and Delimiting Engineering Problems</p> <ul style="list-style-type: none"> • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution 				

		<p>is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.</p>
<p>3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.</p>	<p>CCC</p>	<p>Influence of Science, Engineering, and Technology on Society and the Natural World</p> <ul style="list-style-type: none"> • People’s needs and wants change over time, as do their demands for new and improved technologies.
	<p>SEP</p>	<p>Constructing Explanations and Designing Solutions</p> <p>Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.</p> <ul style="list-style-type: none"> • Generate and compare multiple solutions to a problem based on how well they meet the criteria

	<table border="1"> <tr> <td></td> <td>and constraints of the design problem.</td> </tr> <tr> <td>DCI</td> <td> <p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. </td> </tr> <tr> <td>CCC</td> <td> <p>Influence of Science, Engineering, and Technology on Society and the Natural World</p> <ul style="list-style-type: none"> • Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. </td> </tr> </table>		and constraints of the design problem.	DCI	<p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none"> • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. 	CCC	<p>Influence of Science, Engineering, and Technology on Society and the Natural World</p> <ul style="list-style-type: none"> • Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
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Essential Question(s):	Enduring Understanding(s):						
<ul style="list-style-type: none"> • How and why is the monarch butterfly population changing? • Why does the monarch butterfly migrate? • What is the difference between weather and climate? • How can climate be described in different 	<ul style="list-style-type: none"> • Understand how to organize and use data to describe typical weather conditions expected during a particular season • Understand weather-related hazards • Make a claim about the merit of a design solution that reduces the impacts of 						

<p>regions of the world?</p> <ul style="list-style-type: none"> • How do specific traits and behaviors help an organism survive in a particular habitat? • How can non-weather changes to environments impact the monarch butterfly? What can humans do to reduce these changes and impacts? • How can weather related hazards change environments? • How can humans reduce the impact of a drought on the monarch butterfly? 	<p>weather-related hazards</p> <ul style="list-style-type: none"> • Develop an understanding of the similarities and differences of organisms' life cycles 																					
<p>Demonstration of Learning:</p>	<p>Pacing for Unit</p>																					
<p>Creation of an explanatory model that explains what is happening to the eastern monarch population and how people can help</p>	<p>6 weeks</p>																					
<p>Family Overview (link below)</p>	<p>Integration of Technology:</p>																					
<p>Family Overview Unit 3 Grade 3</p>	<p><i>Intentionally aligned use of digital tools and resources to support acquisition of content, researching, organizing and communicating learning</i></p> <ul style="list-style-type: none"> • Journey North - tracking monarch migration 																					
<p>Unit-specific Vocabulary:</p>	<p>Aligned Unit Materials, Resources, and Technology (beyond core resources):</p>																					
<table border="1"> <tr> <td>naturalist</td> <td>migration</td> <td>habitat</td> </tr> <tr> <td>egg</td> <td>caterpillar</td> <td>chrysalis</td> </tr> <tr> <td>pupa</td> <td>metamorphosis</td> <td>larva</td> </tr> <tr> <td>weather</td> <td>climate</td> <td>precipitation</td> </tr> <tr> <td>polar</td> <td>temperate</td> <td>arid</td> </tr> <tr> <td>tropical</td> <td>mountains</td> <td>climate zones</td> </tr> <tr> <td>adaptation</td> <td>drought</td> <td>weather-related hazard</td> </tr> </table>	naturalist	migration	habitat	egg	caterpillar	chrysalis	pupa	metamorphosis	larva	weather	climate	precipitation	polar	temperate	arid	tropical	mountains	climate zones	adaptation	drought	weather-related hazard	<ul style="list-style-type: none"> • News Clip • Traveling Butterflies book on Epic! • Monarch Butterfly by Gail Gibbons (Loomed version) • National Geographic Readers: Great Migrations Butterflies By Laura Marsh on epic! Books • Give Me Five Template • Text Monarch and Milkweed-Inside of front and back cover • Weather vs. Climate video • Weather video • Book- How the Weather Works-recommend pages 1 & 2 what causes weather, 9 & 10 predicting weather, 13 & 14 what is climate • Document-Weather Collecting Journal • Video-weather watchers. • Video-Rain, Rain Comes our Way • Habitat Resource with Recording Sheet • Weather CFA • Video-Crash Course on Weather • Adaptation organizer • Adaptations Links • monarchs LS 4 elaborate • Video on Moths • Video on Cardinals • Survival game picture cards • CER/CFA
naturalist	migration	habitat																				
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tropical	mountains	climate zones																				
adaptation	drought	weather-related hazard																				

	<ul style="list-style-type: none"> • Butterfly Table LS-5 • On EPIC, National Geographic Readers: Great Migrations Butterflies pages 36-37, 40-45 • Monarch Butterfly Migration pages 25-29 • Impact of fire • Sci show kids wildfire helps • Loomed Epic Text, Wildfires • Myth Busting About Wildlife and Fire • NAT GEO - Fire Helps! (positive impacts) • CER Template • ABC News Monarch clip • Crash Course Kids-Severe Weather • How Weather Works Text (p.11-12) • Video Close Up on Hurricanes • Optional: Epic Library on severe weather • Drought impact on wildlife-Text • Video on drought • Water for butterflies-text • Video to see the design process • Design challenge organizer
Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:
<p>Literacy Connections:</p> <ul style="list-style-type: none"> • Summarizing informational texts • Identifying main idea and key details of texts • Synthesizing information from a variety of choices • Using evidence to support a claim <p>Mathematics Connections:</p> <ul style="list-style-type: none"> • Collecting and analyzing weather data • Graphing weather data • Interpreting data/graphs about the monarch population 	<ul style="list-style-type: none"> • Weather vs climate: weather is the short-term change in atmosphere, climate is the long-term pattern of weather • Fire can have both determinants and benefits for the environment • Each year survival of the monarch may vary due to weather conditions/human impact
Connections to Prior Units:	Connections to Future Units:
Differentiation through Universal Design for Learning	
UDL Indicator	Teacher Actions:
3.2 Highlight patterns, critical features, big ideas, and relationships	<ul style="list-style-type: none"> • Highlight or emphasize key elements in text, graphics, and diagrams • Use graphic organizers to emphasize key ideas and relationships • Use cues and prompts to draw attention to

		critical features
Supporting Multilingual/English Learners		
Related <i>CELP standards:</i>		Learning Targets:
<p>An EL can construct grade appropriate oral and written claims and support them with reasoning and evidence.</p> <p>An EL can conduct research and evaluate and communicate findings to answer questions or solve problems.</p>		<p>I can use words and phrases acquired in conversations, reading, and being read to, and academic and domain specific words.</p> <p>I can present findings using sources to answer questions.</p>
Lesson Sequence	Learning Target & Success Criteria	Assessments/ Resources
1	<p>I can share my prior knowledge about butterflies.</p> <p><input type="checkbox"/> I can identify at least three pieces of prior knowledge I have about butterflies.</p> <p>I can identify patterns of change in the monarch butterfly population from data.</p> <p><input type="checkbox"/> I can generate at least 5 questions that help determine why the monarch population is declining.</p> <p><input type="checkbox"/> I can identify questions that are the most important to help determine why the monarch population is declining.</p> <p><input type="checkbox"/> I can organize questions into categories with similar questions.</p>	<ul style="list-style-type: none"> • News Clip • Traveling Butterflies book on Epic!
2	<p>I can identify stages of the monarch butterfly life cycle.</p> <p><input type="checkbox"/> I can describe each stage of the monarch life cycle using at least two text details.</p> <p><input type="checkbox"/> I can explain at least one way the monarch's life cycle is similar and different to another organism's life cycle using evidence from the text and prior knowledge.</p> <p>I can make observations and ask questions about monarch migration using data from a map.</p> <p><input type="checkbox"/> I can explore the Journey North website to learn more about sightings of monarch eggs, larva, and butterflies.</p> <p><input type="checkbox"/> I can record what I noticed and wondered about.</p> <p>I can gather information to make a claim about monarch migration.</p> <p><input type="checkbox"/> I can make a claim about why monarch butterflies migrate.</p> <p><input type="checkbox"/> I can use sources to learn about why and where monarch butterflies migrate.</p>	<ul style="list-style-type: none"> • Evidence Log • Monarch Butterfly by Gail Gibbons (Loomed version) • Journey North Website • National Geographic Readers: Great Migrations Butterflies By Laura Marsh on epic! Books • Give Me Five Template • Text Monarch and Milkweed-Inside of front and back cover

3	<p>I can explain the difference between weather and climate.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can look at a variety of sources to learn about weather and climate. <input type="checkbox"/> I can explain the difference between weather and target. <p>I can record and analyze the weather data to understand patterns and make predictions about weather.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can record weather data for 5 days and graph my results. <input type="checkbox"/> I can predict the weather for the 6th day based on my analysis of the data. <p>I can obtain information to describe climate zones and habitats from different regions of the world.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can research a habitat. <input type="checkbox"/> Using my organizer I can record information describing the temperature, precipitation, seasonal changes, climate/weather, and landscape. <input type="checkbox"/> I can share the information I learned with my class. <p>I can explain the difference between weather and climate.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can think about what I already know about weather/climate. <input type="checkbox"/> I can watch the video to learn about weather/climate. <input type="checkbox"/> I can answer both questions about weather/climate. 	<ul style="list-style-type: none"> • Evidence Log • Video-Weather vs. Climate video • Book- How the Weather Works-recommended pages 1 & 2 what causes weather, 9 & 10 predicting weather, 13 & 14 what is climate • Document-Weather Collecting Journal • Video-weather watchers. • Video-Rain, Rain Comes our Way • Habitat Resource with Recording Sheet • Weather CFA • Video-Crash Course on Weather
4	<p>I can make predictions about desirable survival traits per habitat.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can make a prediction about physical traits or behavioral traits they might have adapted to help them survive in each region/area. <p>I can explain how an organism's adaptive traits help it survive in a particular environment.</p> <ul style="list-style-type: none"> <input type="checkbox"/> I can select an animal. <input type="checkbox"/> I can use the resources to research my animals. <input type="checkbox"/> I can write caveman notes on my organizer. <input type="checkbox"/> I can share the information with my classmates. 	<ul style="list-style-type: none"> • Adaptation organizer • Adaptation Research Links • Adaptations Links • monarchs LS 4 elaborate • Video on Moths • Video on Cardinals • Survival game picture cards • CER/CFA
5	<p>I can make predictions about how <u>environmental changes</u> can affect the monarch butterfly population.</p>	<ul style="list-style-type: none"> • Read the Author's note at the end of Monarch and

	<p> <input type="checkbox"/> I understand what an environmental change is. <input type="checkbox"/> I can determine what/how environmental changes affect the Monarch. <input type="checkbox"/> I can evaluate the changes and determine the two most impactful. </p> <p>I can explain how humans affect butterfly migrations and what they can do to help them survive.</p> <p> <input type="checkbox"/> I can learn about problems that butterflies face when migrating. <input type="checkbox"/> I can determine ways humans can help butterflies survive. </p> <p>I can make a claim on the effect of fire on a habitat and its organisms.</p> <p> <input type="checkbox"/> I understand what an environmental change is. <input type="checkbox"/> I can determine what/how environmental changes affect the Monarch. <input type="checkbox"/> I can evaluate the changes and determine the two most impactful. </p> <p>I can make a claim on the merit of a solution.</p> <p> <input type="checkbox"/> I can choose one solution and make a claim. <input type="checkbox"/> I can evaluate criteria and constraints of a solution. <input type="checkbox"/> I can present my claim to a specific audience. </p>	<p>Milkweed</p> <ul style="list-style-type: none"> • Butterfly Table • On EPIC, National Geographic Readers: Great Migrations Butterflies pages 36-37, 40-45 • On EPIC, Monarch Butterfly Migration pages 25-29 • Impact of fire video • Sci show kids wildfire helps video • Loomed Epic Text, Wildfires • Myth Busting About Wildlife and Fire • NAT GEO - Fire Helps! POSITIVE IF NEEDED, CER Template • ABC News Monarch clip
6	<p>I can identify weather related hazards and their possible impacts to environments.</p> <p> <input type="checkbox"/> I can identify weather related hazards and how they impact the environment. <input type="checkbox"/> I can identify one weather related hazard that might impact the monarch butterfly population and support my reasoning. </p> <p>I can explain how a drought would impact the monarch butterfly.</p> <p> <input type="checkbox"/> I can explain what a drought is. <input type="checkbox"/> I can explain what happens to plants and animals during a drought. <input type="checkbox"/> I can describe what humans can do to help feed and give water to butterflies. <input type="checkbox"/> I can create a model to explain how droughts affect butterflies </p>	<ul style="list-style-type: none"> • Crash Course Kids-Severe Weather • How Weather Works (p.11-12) • Close Up on Hurricanes • Optional: Epic Library on severe weather • drought impact on wildlife,

	<p>and their habitat.</p> <p>I can create a plan to help butterflies by reducing the impact of a drought in Bristol, CT.</p> <ul style="list-style-type: none"><input type="checkbox"/> I can create a plan to help butterflies by reducing the impact of a drought in Bristol, CT.<input type="checkbox"/> I can fill out my organizer and create a stretch and/or build a project.	<ul style="list-style-type: none">● <u>video on drought, water for butterflies</u>● <u>Watch this video to see the design process.</u>● <u>Design challenge organizer</u>
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Course Title	Content Area	Grade Level	Credit (if applicable)		
Marketing II	CTE-Business	10-12	0.5 BPS		
Course Description					
This advanced course offers students hands-on experience in real-world marketing concepts. Students will develop a deep understanding of marketing strategies, including sales techniques, merchandising principles, promotional strategies, social media marketing, pricing, and profit analysis. Students will be able to apply their theoretical learning through the operation of a school-based enterprise. Students enrolled in this course will have the opportunity to earn a school-based enterprise certification. This course equips students with practical skills and knowledge essential for pursuing careers in Marketing, Business Management, Entrepreneurship, and Retail Operations while fostering creativity, teamwork, and leadership.					
Aligned Core Resources			Connection to the <i>BPS Vision of the Graduate</i>		
MBA Research: Marketing Clusters			Collaboration Social and Cross-Cultural Skills Global Awareness Media Literacy Communication Communications and Technology Literacy Information Literacy Goal Directed Financial Literacy Critical Thinking and Problem Solving		
Additional Course Information: Knowledge/Skill Dependent courses/prerequisites			Link to <i>Completed Equity Audit</i>		
Marketing I			Marketing II Equity Curriculum Review		
Standard Matrix					
District Learning Expectations and Standards MBA Research Standards for Marketing	Unit 1: Market Research and Planning	Unit 2: Operations, Distribution, & HR	Unit 3: Pricing and Product Management	Unit 4: Promotion and Selling	Unit 5: Financial Analysis
Marketing Understands the tools, techniques, and systems that businesses use to create exchanges and satisfy organizational objectives	X	X	X	X	X
Financial Analysis Understands tools, strategies, and systems used to maintain, monitor, control, and plan the use of financial resources	X		X	X	X
Operations Understands the processes and systems implemented to monitor, plan, and control the day-to-day activities required for continued business functioning		X			
Market Information Management Understands the concepts, systems, and tools needed to gather, access, synthesize, evaluate, and disseminate information for use in making business decisions	X		X		X
Market Planning Understands the concepts and strategies utilized to determine and target marketing strategies to a select audience	X		X	X	
Product/Service Management	X		X		

Understands the concepts and processes needed to obtain, develop, maintain, and improve a product or service mix in response to market opportunities and to build brand for the organization					
Pricing Understands concepts and strategies utilized in determining and adjusting prices to maximize return and meet customers' perceptions of value			X		X
Distribution/Channel Management Understands the concepts and processes needed to identify, select, monitor, and evaluate sales channels		X	X		
Promotion Understands the concepts and strategies needed to communicate information about products, services, images, and/or ideas to achieve a desired outcome				X	
Selling Understands the concepts and actions needed to determine client needs and wants and respond through planned, personalized communication that influences purchase decisions and enhances future business opportunities				X	
Human Resources Management Understands the tools, techniques, and systems that businesses use to plan, staff, lead, and organize its human resources		X			

Unit Links

- [Unit 1: Market Research and Planning](#)
- [Unit 2: Operations, Distribution, & HR](#)
- [Unit 3: Pricing and Product Management](#)
- [Unit 4: Promotion and Selling](#)
- [Unit 5: Financial Analysis](#)

Unit Title													
Unit 1: Market Research and Planning													
Relevant Standards: Bold indicates priority													
MBA Research Standards for Marketing: Marketing , Financial Analysis, Market Information Management, Market Planning , Product/Service Management													
Essential Question(s)	Enduring Understanding(s)												
<ul style="list-style-type: none"> How do businesses identify and define their target market? What factors are considered when identifying a market? Why is ongoing monitoring and evaluation essential for marketing success? What information is typically included in a customer profile? How do businesses gather data to create a customer profile? 	<ul style="list-style-type: none"> Marketers collect data to identify trends and respond to customer needs in a changing competitive environment. Marketers collect data from numerous resources including primary and secondary research. Accurate customer profiles are essential for understanding and anticipating customer needs, which leads to customer satisfaction and loyalty 												
Demonstration of Learning	Pacing for Unit												
<ul style="list-style-type: none"> Students will conduct primary and secondary research to collect and analyze data for a given market. Students will develop a presentation to showcase business decisions from data analysis. 	5 classes of instruction 3 classes of project based learning												
Family Overview	Integration of Technology												
Family Overview Link	Google Sheets for data analysis Google Forms for data collection												
Unit-specific Vocabulary	Aligned Unit Materials, Resources, and Technology (beyond core resources)												
<table border="0"> <tr> <td>Market Segmentation</td> <td>Geographic Segmentation</td> </tr> <tr> <td>Mass Marketing</td> <td>Demographic Segmentation</td> </tr> <tr> <td>Target Marketing</td> <td>Segmentation</td> </tr> <tr> <td>Niche Marketing</td> <td>Behavior Segmentation</td> </tr> <tr> <td>Target Customer Profile</td> <td>Market Need</td> </tr> <tr> <td>Psychographic</td> <td>Customer Demand</td> </tr> </table>	Market Segmentation	Geographic Segmentation	Mass Marketing	Demographic Segmentation	Target Marketing	Segmentation	Niche Marketing	Behavior Segmentation	Target Customer Profile	Market Need	Psychographic	Customer Demand	US Census Data Bureau of Labor Statistics (BLS) Data Google Trends data Social media analytics
Market Segmentation	Geographic Segmentation												
Mass Marketing	Demographic Segmentation												
Target Marketing	Segmentation												
Niche Marketing	Behavior Segmentation												
Target Customer Profile	Market Need												
Psychographic	Customer Demand												
Opportunities for Interdisciplinary Connections	Anticipated misconceptions												
By integrating psychology, sociology, data science, research, and statistics , marketers can gain deeper insights into consumer behavior, make data-driven decisions, and track emerging trends effectively	<ul style="list-style-type: none"> Market research is just about surveys Using only secondary research is sufficient Assuming all customers want the same thing Customer wants/needs do not change 												
Connections to Prior Units	Connections to Future Units												
N/A	Unit 1: Customer Profiles → Unit 2: Customer Service Unit 1: Customer Profile → Unit 3: Customer Demographics and Preferences Unit 1: Market Research → Unit 4: Using Market Research to inform merchandise planning												
Differentiation through Universal Design for Learning													
UDL Indicator	Teacher Actions												
Lessons 1 & 2: Describing and Using Marketing Data in Decision-Making													
Engagement: <ul style="list-style-type: none"> Use real-world marketing case studies that connect to students' interests (e.g., tech, fashion, sports). This can spark engagement by highlighting the relevance of marketing data in areas they find meaningful. 													

- Offer opportunities for collaboration by allowing students to work in groups to analyze marketing data, which can foster peer interaction and shared learning experiences.

Representation:

- Present content through varied formats, such as videos, infographics, or podcasts on data-driven marketing, to meet diverse learning preferences.
- Use concept mapping tools or graphic organizers to help students understand the relationships among marketing data, decision-making, and business outcomes.

Action/Expression:

- Allow students to present their understanding in multiple formats—such as written reports, video presentations, or data visualizations—so they can demonstrate their learning in ways that align with their strengths.
- Incorporate technology, such as Google Sheets, to visualize data trends to help students analyze and interpret marketing data.

Lesson 3: Tracking Marketing Trends

Engagement:

- Have students track and report on current marketing trends in industries they are interested in.
- Incorporate trend-tracking simulations or tools, such as Google Trends or social media analytics, to highlight real world applications.

Representation:

- Provide articles, videos, and examples that illustrate how tracking trends can impact business decisions.
- Visualize trends through graphs and charts to support students who benefit from concrete, visual representation of abstract concepts.

Action/Expression:

- Have students create reports or presentations summarizing a trend's impact on marketing. This could be a written document, infographic, or verbal report, providing flexibility.
- Offer templates or tools for data tracking, such as a guided spreadsheet, to help students organize and analyze trend data.

Lesson 4-5: Analyzing Customer Behavior

Engagement:

- Create role-play or simulation activities where students act as marketing analysts making recommendations based on customer behavior.
- Allow students to select customer profiles or behavior case studies based on companies they relate to.

Representation:

- Use various models of customer behavior, from text descriptions to videos and interactive simulations, to show the impact of customer behavior on business decisions.
- Provide visual aids, like charts that illustrate consumer purchasing behavior, to help students process complex data.

Action/Expression:

- Give students choices in how they analyze and present customer behavior insights, such as through written reports, charts, or multimedia presentations.

Lesson 6-8: Conducting Market Research and Applying Data Outcomes

Engagement:

- Design a project-based learning scenario where students act as marketing consultants for a business or product, making real-world connections to the concepts.
- Offer choice in the type of product or service they research, allowing them to connect with industries or topics they find compelling.

Representation:

- Provide examples of primary and secondary research methods in various formats, such as instructional videos, sample reports, and research templates.
- Break down research steps and data analysis methods into accessible, guided instructions, ensuring that students understand each phase of the research process.

Action/Expression:

- Allow students to showcase their findings through presentations, reports, or marketing plans, giving them choice in how they demonstrate their understanding and analysis.
- Use interactive tools like Google Forms for surveys and Google Sheets for data analysis to help students engage in hands-on research experiences.

Supporting Multilingual/English Learners

Related CELP standards:

Learning Targets

1. Describing the need for marketing data

- Level 1: Identify marketing data (e.g., customer age, sales) through visuals or labels. Use single words or simple phrases to describe why data is useful.
- Level 2: Use sentence frames to explain basic reasons for using marketing data (e.g., "We use data to know what customers like").
- Level 3: Describe the need for marketing data in simple sentences, explaining how data helps understand customer needs.
- Level 4: Explain the importance of data for making marketing decisions, providing examples in paragraph form or a short presentation.
- Level 5: Write a detailed explanation or present on why data is essential in marketing, discussing specific examples and implications for strategy.

2. Identifying data monitored for marketing decision-making

- Level 1: Point to or label types of data used in marketing (e.g., sales, customer feedback).
- Level 2: Use short phrases to name types of marketing data and briefly state why they're used.
- Level 3: Describe in simple sentences different types of data and their uses in marketing (e.g., "Sales data shows what products are popular").
- Level 4: List and explain several types of data marketers monitor, with details on how they impact decisions.
- Level 5: Analyze different types of marketing data and explain how each informs various aspects of decision-making, using specific examples.

3. Tracking marketing trends

- Level 1: Recognize simple trend patterns in visuals (e.g., "more people buy online") and label them.
- Level 2: Use basic sentences to describe simple trends (e.g., "Sales are going up").
- Level 3: Describe basic trends over time and state why tracking trends helps businesses (e.g., "Trends show what is popular").
- Level 4: Track and explain marketing trends, using charts or data summaries, and discuss how trends impact marketing.
- Level 5: Provide in-depth analysis on how tracking trends can lead to strategic marketing shifts, with examples from case studies or real-world scenarios.

4. Analyzing customer behavior

- Level 1: Identify simple actions customers take (e.g., buying, browsing) and match these to visuals.
- Level 2: Use short phrases to describe basic customer behaviors (e.g., "Customers like discounts").
- Level 3: Explain basic customer behaviors in short sentences and state how behavior influences marketing.
- Level 4: Discuss examples of how customer behavior impacts marketing strategies, using specific examples.
- Level 5: Analyze complex patterns in customer behavior and detail how these insights guide marketing decisions and adjustments in real time.

5. Conducting market research and planning marketing strategies according to data outcomes in a real-world situation

- Level 1: Recognize examples of simple market research methods (e.g., surveys) through visuals or words.
- Level 2: Use sentence frames to describe simple research steps or results (e.g., "We ask people what they buy").
- Level 3: Conduct basic research activities with guidance and describe findings in simple terms (e.g., "Many people like this product").
- Level 4: Conduct a market research task (e.g., survey or analysis) and plan a basic strategy based on findings, explaining the rationale behind decisions.
- Level 5: Independently conduct detailed market research, analyze outcomes, and develop a complex marketing strategy that adapts to real-world situations, presenting insights and supporting decisions with data.

Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
1	I can describe the need for marketing data.	<ul style="list-style-type: none">I can describe data-driven marketing.I can discuss marketing data and provide examples of how the information is used.I can use data in the decision-making process to make informed marketing decisions.	

2	I can identify data monitored for marketing decision-making.	<ul style="list-style-type: none"> • Describe in detail the decisions made based on marketing data. • Include product decisions, price decisions, place (distribution) decisions and promotion decisions.
3	I can track marketing trends.	<ul style="list-style-type: none"> • I can describe the importance of tracking trends in business, and provide examples of types of industry trend analysis. • I can discuss the challenges and opportunities of tracking trends in marketing.
4-5	I can analyze customer behavior.	<ul style="list-style-type: none"> • I can explain the importance of customer behavior to drive business decisions and customer growth.
6-8	I can conduct market research and plan marketing strategies according to the data outcomes in a real world situation.	<ul style="list-style-type: none"> • I can conduct primary and secondary market research. • I can analyze data outcomes. • I use data to develop a customer profile. • I can analyze and report marketing trends.

Unit Title																															
Unit 2: Operations, Distribution, & Human Resources																															
Relevant Standards: Bold indicates priority																															
MBA Research Standards for Marketing: Marketing, Distribution/Channel Management, Human Resources Management, Operations																															
Essential Question(s)	Enduring Understanding(s)																														
<ul style="list-style-type: none"> How do employees utilize equipment and tools to complete tasks? How does customer service impact customer satisfaction? How do inventory counts contribute to maintaining accurate stock levels and supporting business operations? How does effective human resource management contribute to creating a positive and productive business environment? 	<ul style="list-style-type: none"> Businesses provide employees with training to effectively complete tasks. Good customer service is important to achieve customer satisfaction. Tracking inventory is important to maintain accurate stock levels. Incentivizing employees with tangible benefits is an important aspect of employee retention 																														
Demonstration of Learning	Pacing for Unit																														
Students will complete a project to demonstrate their ability to create business operations, distribution and human resources.	5 classes of instruction 3 classes of project based learning																														
Family Overview (link below)	Integration of Technology																														
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Unit-specific Vocabulary	Aligned Unit Materials, Resources, and Technology (beyond core resources)																														
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Opportunities for Interdisciplinary Connections	Anticipated misconceptions																														
By applying psychology, sociology, data science, research, and statistics , businesses can optimize operational efficiency, improve employee performance, enhance customer service, and make data-driven decisions.	<ul style="list-style-type: none"> Once operations and procedures are established they never change. Distribution is only through physical retail locations Human resources is only about hiring and firing 																														
Connections to Prior Units:	Connections to Future Units:																														
Unit 1: Customer Profiles → Unit 2: Customer Service	Unit 2: Distribution → Unit 4: Selling Unit 2: Inventory → Unit 5: Financial Record Keeping Unit 2: Staffing → Unit 5: Budgeting																														
Differentiation through <i>Universal Design for Learning</i>																															

UDL Indicator	Teacher Actions:
<p>Lesson 1: I can follow instructions for use of equipment, tools, and machinery.</p> <p><i>Engagement:</i></p> <ul style="list-style-type: none"> ● Allow students to work in small groups to practice using the equipment and tools. <p><i>Representation:</i></p> <ul style="list-style-type: none"> ● Provide step-by-step video demonstrations or visual aids showing how to use the equipment/tools, alongside written instructions. ● Offer interactive simulations or virtual labs for students who may not have immediate access to the physical equipment. ● Provide annotated diagrams or photos highlighting key components of the equipment. <p><i>Action/Expression:</i></p> <ul style="list-style-type: none"> ● Have students demonstrate their understanding by verbally explaining how they would use the equipment. ● Offer written or video-based assessments to ensure they can describe proper usage of tools and machinery. <p>Lesson 2: I can explain the relationship between customer service and distribution.</p> <p><i>Engagement:</i></p> <ul style="list-style-type: none"> ● Encourage discussion and debate on real-world scenarios where poor customer service impacted distribution processes (e.g., delayed shipments). ● Incorporate activities like group problem-solving or case studies to increase engagement. <p><i>Representation:</i></p> <ul style="list-style-type: none"> ● Provide visual representations such as flowcharts, diagrams, or infographics showing how customer service and distribution are connected. ● Use real-world case studies or role-playing videos to illustrate the impact of customer service on distribution. <p><i>Action/Expression:</i></p> <ul style="list-style-type: none"> ● Let students present their understanding through written reports, oral presentations, or multimedia projects. ● Have students create a visual diagram or infographic showing the relationship between customer service and distribution. <p>Lesson 3: I can complete inventory counts.</p> <p><i>Engagement:</i></p> <ul style="list-style-type: none"> ● Allow students to complete inventory counts in teams, promoting peer collaboration and support. ● Include hands-on practice with real or virtual inventory tasks to foster engagement. <p><i>Representation:</i></p> <ul style="list-style-type: none"> ● Provide digital tools, such as apps or spreadsheets, to track inventory counts, which can be more interactive and engaging. ● Use visual aids (e.g., charts, tables, and graphs) to demonstrate how inventory is recorded and counted. <p><i>Action/Expression:</i></p> <ul style="list-style-type: none"> ● Students can demonstrate their skills in various ways: manually completing an inventory sheet, entering data into an inventory system, or explaining the process to the class. <p>Lesson 4: I can discuss the nature of human resources management.</p> <p><i>Engagement:</i></p> <ul style="list-style-type: none"> ● Have students engage in case study analysis or role-play activities where they act as HR managers solving issues within a company. ● Use interactive online HR simulations to increase engagement and deepen understanding of HR practices. <p><i>Representation:</i></p> <ul style="list-style-type: none"> ● Provide a variety of materials such as articles, videos, and podcasts on HR management practices. ● Use role-playing or skits to show real-life examples of HR issues like recruitment, employee conflict resolution, and performance reviews. <p><i>Action/Expression:</i></p> <ul style="list-style-type: none"> ● Let students present HR management concepts in formats such as essays, presentations, or videos. ● Have them create a portfolio of HR management strategies, policies, or job descriptions. <p>Lesson 5: I can assess employee performance.</p> <p><i>Engagement:</i></p> <ul style="list-style-type: none"> ● Allow students to evaluate case studies of employee performance or practice through role-play scenarios. ● Provide opportunities for peer assessments to engage students in evaluating each other's performance. <p><i>Representation:</i></p> <ul style="list-style-type: none"> ● Provide rubrics and exemplars to help students understand the criteria for assessing employee 	

performance.

- Use video demonstrations of performance assessments (e.g., conducting performance reviews) to show best practices.

Action/Expression:

- Students can complete written performance appraisals, create presentations, or demonstrate assessment techniques in role-play scenarios.
- Allow students to reflect on their own performance assessment strategies through journals or discussions.

Lesson 6-8: I can create operational, distribution, and human resources decisions for a business.

Engagement:

- Encourage students to participate in business planning simulations where they make operational, distribution, and HR decisions.
- Use group projects to allow students to collaborate on real-world decision-making scenarios.

Representation:

- Provide clear frameworks or decision-making models for creating operational, distribution, and HR decisions.
- Use case studies or simulations where students can explore real-world business decisions in these areas.
- Offer diagrams or flowcharts illustrating how different decisions impact various business operations.

Action/Expression:

- Have students create business plans or decision-making documents that reflect operational, distribution, or HR strategies.
- Offer students different ways to express their decision-making process, such as through written reports, oral presentations, or multimedia projects.

Supporting Multilingual/English Learners

Related *CELP standards:*

Learning Targets:

1. Following instructions for use of equipment, tools, and machinery

Level 1: Can follow simple, one-step verbal or written instructions with visual support. Requires frequent repetition or clarification of instructions.

Level 2: Can follow short, multi-step instructions with some support. Asks clarifying questions to ensure understanding of the instructions.

Level 3: Can independently follow multi-step instructions related to equipment use. Interprets simple safety or operational diagrams with minimal support.

Level 4: Can follow detailed, complex multi-step instructions. Can make requests for clarification and paraphrase instructions to ensure understanding.

Level 5: Can fully understand and follow complex, industry-specific instructions with little to no support. Can provide instructions to others using appropriate terminology.

2. Explaining the relationship between customer service and distribution

Level 1: Can use pictures or visuals to explain the basic concept of customer service and distribution. Provides basic answers in one or two words or phrases.

Level 2: Can explain the connection between customer service and distribution using simple phrases or sentences. Provides basic examples or descriptions with some help.

Level 3: Can explain the relationship between customer service and distribution using a few sentences with some accuracy. Uses basic vocabulary (e.g., "customer satisfaction," "shipping," "delivery").

Level 4: Can explain the relationship clearly, providing several details and examples. Discusses the impact of customer service on distribution efficiency or challenges.

Level 5: Can offer a comprehensive, in-depth explanation that analyzes the relationship from multiple perspectives. Justifies decisions related to customer service and distribution with sophisticated language.

3. Completing inventory counts

Level 1: Can recognize numbers and simple terms related to inventory (e.g., counting objects or quantities with visual support). Needs significant help interpreting inventory lists.

Level 2: Can count items and match them to inventory lists with some support. Can write basic inventory numbers with some errors.

Level 3: Can independently count inventory items and record numbers with occasional errors. Matches items with labels and basic product names.

Level 4: Can conduct inventory counts independently, identify discrepancies, and report them. Can read simple

inventory lists and understand quantities, prices, and product names.

Level 5: Can analyze and complete complex inventory counts, including handling multiple categories and product variations. Documents inventory counts and discrepancies in a professional format with little to no assistance.

4. Discussing the nature of human resources management

Level 1: Can recognize and identify basic human resources terms (e.g., hiring, employees). May use pictures or visuals to describe basic HR processes.

Level 2: Can describe basic HR concepts using simple language (e.g., "HR helps people get jobs"). Can explain basic HR ideas with limited detail.

Level 3: Can discuss the basic principles of human resources management (e.g., hiring, training, employee relations). Can use simple vocabulary to describe the function of HR within a business.

Level 4: Can describe the role of human resources in greater detail, including policies and practices (e.g., recruitment, retention, performance reviews). Uses industry-specific vocabulary with some accuracy.

Level 5: Can explain the responsibilities and challenges of human resources management using detailed examples. Can participate in discussions using formal HR-related terminology.

5. Assessing employee performance

Level 1: Can identify basic traits of employee performance (e.g., hard-working, on time). May need help understanding simple performance reviews or basic evaluations.

Level 2: Can describe basic characteristics of employee performance in simple terms (e.g., "good worker," "needs improvement"). Can use basic criteria to assess performance with guidance.

Level 3: Can assess employee performance based on simple criteria (e.g., punctuality, quality of work). Can write a short evaluation using basic performance descriptors.

Level 4: Can assess performance using multiple criteria and justify ratings.

Can write a more detailed evaluation that includes strengths and areas for improvement.

Level 5: Can conduct performance assessments based on a variety of factors, providing well-organized feedback. Can engage in discussions about performance reviews and provide constructive feedback.

6. I can create operational, distribution, and human resources decisions for a business.

Level 1: Can provide simple responses about business decisions using visuals (e.g., diagrams or simple charts). Needs help making connections between operational, distribution, and HR factors.

Level 2: Can describe basic business decisions using simple language. Can provide basic ideas for improving business operations, with some support.

Level 3: Can create basic business decisions, considering operational, distribution, and HR factors, with limited support. Can write short descriptions or plans for business decisions.

Level 4: Can create detailed business decisions, explaining their rationale for operational, distribution, and HR choices. Provides clear written plans and explanations, using appropriate terminology.

Level 5: Can create complex business decisions, offering detailed justifications for choices in operations, distribution, and HR management. Writes comprehensive business plans or proposals with minimal support.

Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
1	I can follow instructions for use of equipment, tools and machinery	<ul style="list-style-type: none"> I can describe the types of equipment, tools and machinery used in a retail environment. I can discuss training and checks and balances in regard to equipment used in a retail environment. 	
2	I can explain the relationship between customer service and distribution.	<ul style="list-style-type: none"> I can discuss how to establish positive customer relationships. I can explain how the timing of orders, stock rotation and product availability affects a businesses ability to provide customers with goods and services. 	
3	I can complete inventory counts.	<ul style="list-style-type: none"> I can explain the process for inventory control. 	
4	I can discuss the nature of human resources management.	<ul style="list-style-type: none"> I can describe the acquisition and selection process for store employees. I can provide a description of how employees are motivated to do their job well. I can discuss how businesses maintain and provide tangible benefits to their employees. 	

5	I can assess employee performance.	<ul style="list-style-type: none"> ● I can explain the various methods used to measure and evaluate employee performance. ● I can describe student responsibilities in evaluating employee performance (peer evaluation, self-evaluation)
6-8	I can create operational, distribution and human resources decisions for a business.	<ul style="list-style-type: none"> ● I can design daily operational procedures ● I can create channels of product distribution ● I can delegate and evaluate employee performance

Unit Title	
Unit 3: Pricing and Product Management	
Relevant Standards: Bold indicates priority	
MBA Research Standards for Marketing: Pricing, Product/Service Management	
Essential Question(s)	Enduring Understanding(s)
<ul style="list-style-type: none"> • What is the role of pricing in the overall marketing strategy of a business? • How does pricing affect the perceived value of a product or service? • What are the different pricing strategies that businesses can use? • How do market conditions and consumer behavior impact pricing decisions? • What factors should be considered when planning a merchandise assortment? • How do customer demographics and preferences influence merchandise planning? • How can data and market research be used to inform merchandise planning decisions? 	<ul style="list-style-type: none"> • Pricing is a crucial element of the marketing strategy that directly impacts a business's profitability, market positioning, and competitive advantage. • The price of a product or service affects how customers see its value, making them think it's either a high-quality or low-quality option based on how much it costs. • Changes in the economy, what competitors are doing, and how customers are buying can all influence how businesses decide to price their products or services. • Using data and market research helps businesses understand customer habits, market trends, and what competitors are doing, so they can make smart decisions about what products to offer.
Demonstration of Learning	Pacing for Unit
Students will create a product line and select appropriate pricing strategies and profit margins for a retail environment.	5 classes of instruction 3 classes of project based learning.
Family Overview (link below)	Integration of Technology
Family Overview Link	
Unit-specific Vocabulary	Aligned Unit Materials, Resources, and Technology (beyond core resources)
Under/Over Pricing Vendors Return on Investment (ROI) Merchandise Assortment Market Share Product Line Break-Even Point Product Width Price Elasticity Product Depth Price Elastic/Inelastic Product Length Pricing Strategies Product Consistency Product Mix - Segmented Brand - Psychological Brand Mix - Promotional Merchandise Assortment - Geographical Stock Turnover - International) Reductions Discount and Allowances - Markdown Retail Image - Discounts - Shortages	
Opportunities for Interdisciplinary Connections	Anticipated misconceptions
Blending mathematical calculations, statistical analysis, psychological insights, research-based strategies, and economic theory in creating, evaluating, and refining pricing strategies.	<ul style="list-style-type: none"> • Price is equal to cost • Lowering prices always increases sales • Higher prices mean better quality • Product management is only about creating new products.
Connections to Prior Units	Connections to Future Units

Unit 1: Customer Profile → Unit 3: Customer Demographics and Preferences	Unit 3: Merchandise Assortment → Unit 4: Promotional Plans Unit 3: Pricing Strategies → Unit 5: Cash Flow and Profitability
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Differentiation through *Universal Design for Learning*

UDL Indicator	Teacher Actions
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Lesson 1: I can explain the nature and scope of the pricing function.

Engagement:

- Real-World Connections: Start with a discussion of real-world pricing scenarios (e.g., pricing strategies of popular brands or during sales events) to make the content relevant and engaging.
- Choice: Allow students to choose a product or service to analyze in terms of its pricing function (e.g., luxury goods, tech products, or groceries), catering to different interests.

Representation:

- Multiple Formats: Present the nature and scope of pricing through a variety of mediums, such as:
- Infographics and diagrams outlining different pricing strategies (e.g., cost-plus, value-based, and competitive pricing).
- Videos or podcasts that discuss the role of pricing in business and its connection to other functions (like marketing and sales).
- Case Studies: Use case studies of businesses that have adjusted their pricing based on market conditions.

Action/Expression:

- Written/Oral Explanation: Students can demonstrate their understanding by either writing a report or giving a short presentation explaining the nature and scope of pricing.
- Mind Maps/Concept Maps: Students can create a visual representation (e.g., a mind map) that shows how the pricing function connects to other business functions like cost control, profitability, and customer perception.

Lesson 2: I can explain factors affecting pricing decisions.

Engagement:

- Scenario-Based Learning: Provide different scenarios where students must determine pricing factors for a given product (e.g., launching a new tech product, seasonal pricing for clothing).
- Interactive Polls or Quizzes: Use technology tools like Kahoot! or Google Forms to engage students in identifying and discussing factors (e.g., supply and demand, competition, consumer behavior).

Representation:

- Graphic Organizers: Use charts or tables to help students visualize and categorize the different factors affecting pricing decisions (e.g., market conditions, competitor pricing, cost of production).
- Videos/Case Studies: Show video clips or case studies that highlight real-world businesses adjusting their pricing decisions based on factors like cost, competition, or consumer demand.

Action/Expression:

- Role-Playing: Have students role-play as business managers who must make pricing decisions based on different influencing factors.
- Writing or Presenting a Pricing Strategy: Students could write a brief strategy or create a presentation explaining how specific factors (like cost, competition, or market conditions) would affect the price of a particular product.

Lesson 3: I can identify components of a retail image.

Engagement:

- Exploration: Encourage students to explore retail environments (physical stores or websites) and identify different components that contribute to a retail image (e.g., store layout, signage, advertising, customer service).
- Field Trips/Virtual Tours: If possible, organize a field trip to local stores or use virtual tours of flagship stores (e.g., luxury brands or big-box retailers) to observe components of retail image.

Representation:

- Visual Examples: Provide a variety of visual examples (photos, videos, or websites) that show different retail images and ask students to identify the components.
- Comparative Analysis: Show side-by-side comparisons of retail images (e.g., a high-end boutique versus a discount store) and have students analyze what makes each store's image unique.

Action/Expression:

- Design a Retail Image: Have students design their own retail image for a business, considering elements like signage, layout, branding, and customer experience. They can express this through digital design tools (e.g., Canva) or sketches.
- Present an Analysis: Have students create a report or presentation analyzing the retail image of a brand or business and explaining the components that make up its image.

Lesson 4: I can plan merchandise assortments.

Engagement:

- Simulated Store Planning: Have students work in groups to plan a merchandise assortment for a hypothetical store. Allow for creativity in deciding what products to sell based on factors like seasonality, target market, and budget.
- Games/Challenges: Create a "store planning challenge" where students have a limited budget and must choose a variety of products to stock in their store.

Representation:

- Templates/Guides: Provide structured templates or guides that outline the steps for planning a merchandise assortment, including product categories, inventory levels, and customer preferences.
- Data and Graphs: Use sales data and inventory turnover rates to help students understand how to plan assortments based on demand and profitability.

Action/Expression:

- Create an Assortment Plan: Have students design a merchandise assortment plan for a store, choosing products from a selection of options based on target market needs and trends. This can be done through spreadsheets, visual layouts, or presentation tools.
- Presentation: Students can present their merchandise assortments to the class, explaining their rationale and how they balanced variety, price, and demand.

Lesson 5-7: I can plan merchandise assortments and determine an appropriate pricing structure.

Engagement:

- Project-Based Learning: Assign a project where students plan both merchandise assortments and pricing strategies for a new business. They could work in teams and compete to present the most successful store concept.
- Real-World Problem Solving: Present a scenario where a business is struggling with its pricing and merchandise selection. Students must work together to create a comprehensive plan that addresses both areas.

Representation:

- Step-by-Step Guidelines: Provide detailed instructions or a guide for how to combine merchandise assortment planning with pricing decisions, including factors like markup, pricing tiers, and product mix.
- Real-World Examples: Show examples of businesses that have successfully integrated merchandise planning with pricing strategies (e.g., a retail chain's holiday sale plan or a boutique's pricing strategy for new arrivals).

Action/Expression:

- Integrated Plan: Have students create a complete merchandising and pricing plan for a hypothetical retail store. This plan should include product assortment, pricing strategy, promotional tactics, and inventory control.
- Peer Review/Feedback: Have students present their plans to the class or in small groups for peer review. They should receive constructive feedback on both their assortment planning and pricing structure.

Supporting Multilingual/English Learners

Related <i>CELP standards:</i>	Learning Targets
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<p>1. Explaining the nature and scope of the pricing function</p> <p>Level 1: Can identify basic terms related to pricing (e.g., "price," "cost") with visual support. May provide one or two word responses when asked about pricing.</p> <p>Level 2: Can describe the general idea of pricing with some support (e.g., "Price is how much something costs"). Can use simple sentences to explain the pricing function in a business context.</p> <p>Level 3: Can explain the nature of pricing, including its role in a business, in a few sentences. Describes basic pricing functions, such as determining cost and setting price.</p> <p>Level 4: Can explain the scope of pricing, considering multiple aspects such as cost, competition, and consumer demand. Can provide examples of different pricing strategies and their purposes.</p> <p>Level 5: Can provide a detailed explanation of the nature and scope of the pricing function, including advanced</p>	
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pricing concepts such as price elasticity and market positioning. Can offer a comprehensive analysis of how pricing impacts overall business strategy.

2. Explaining factors affecting pricing decisions.

Level 1: Can recognize simple factors that affect price, such as "expensive" and "cheap," with visual support. May need help identifying the factors involved.

Level 2: Can name basic factors affecting pricing, like demand and cost, with some explanation. May need support to explain how these factors influence price.

Level 3: Can describe common factors affecting pricing, such as cost of production, competition, and demand, in simple sentences. Provides some examples of how each factor affects pricing decisions.

Level 4: Can explain multiple factors affecting pricing in detail, such as market conditions, target audience, and competitor pricing. Discusses how businesses use these factors to determine optimal pricing.

Level 5: Can analyze and explain a wide range of factors affecting pricing, including external factors like economic conditions and customer perceptions.

Offers a sophisticated explanation of the interplay between various factors in pricing strategy.

3. Identifying components of a retail image

Level 1: Can identify basic visual components of a retail store, such as "sign," "store," or "products." May need visual aids to help identify components of a retail image.

Level 2: Can name and describe a few key components of a retail image (e.g., "store layout," "signage") with some help. Can provide basic examples of what makes a store look attractive or professional.

Level 3: Can identify and describe several key components of a retail image (e.g., store design, customer service, marketing materials) and how they contribute to the store's overall image. Provides clear descriptions of how components work together to create a cohesive retail image.

Level 4: Can identify and explain the components of a retail image in detail, including both tangible (e.g., store layout, product display) and intangible aspects (e.g., customer experience, brand messaging). Describes how a strong retail image influences customer perception and buying behavior.

Level 5: Can provide an in-depth analysis of the components of a retail image, considering both internal and external factors. Can discuss how a retail image is aligned with brand identity and customer expectations.

4. Planning merchandise assortments

Level 1: Can recognize basic types of merchandise (e.g., "shirts," "shoes") with visual support. May need help identifying different categories of products.

Level 2: Can list some categories of merchandise (e.g., "clothes," "accessories") and describe them briefly. Can provide simple suggestions for merchandise assortment.

Level 3: Can plan basic merchandise assortments by grouping products based on category or customer need. Can explain why certain products belong together in an assortment.

Level 4: Can plan a more complex assortment, considering factors like customer demographics, seasonality, and sales trends. Provides detailed reasoning behind the choice of products included in the assortment.

Level 5: Can create a comprehensive merchandise assortment plan, balancing variety, pricing, and customer preferences. Justifies choices based on market research, trends, and sales data, creating a well-rounded and profitable assortment.

4. Planning merchandise assortments and determine an appropriate pricing structure

Level 1: Can select a few items to include in a basic assortment with visual aids. Needs support in determining appropriate prices for these items.

Level 2: Can create simple assortments and suggest basic price points for items. May rely on support to understand the relationship between pricing and product assortment.

Level 3: Can plan a basic merchandise assortment with consideration for product variety and price range. Can determine appropriate pricing for items based on simple factors such as cost and competition.

Level 4: Can create a detailed merchandise assortment, taking into account customer preferences, trends, and seasonality. Determines pricing based on a variety of factors, such as cost, competition, and market positioning.

Level 5: Can create an advanced merchandise assortment plan, analyzing customer data, product lifecycle, and profitability. Determines an optimal pricing structure that maximizes profitability while ensuring customer satisfaction and market competitiveness.

Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
1	I can explain the nature and scope of the pricing function.	<ul style="list-style-type: none"> I can provide detailed and specific examples of the pricing strategies I can discuss the impact pricing strategies have on 	

		sales.
2	I can explain factors affecting pricing decisions.	<ul style="list-style-type: none"> • I can discuss various ways product's prices were determined and explain how prices impact a business. • I can provide specific examples of pricing decisions that involve a variety of products and various cost determinations. • I can discuss how pricing decisions are evaluated for effectiveness. • I can analyze the success and/or failure of the pricing plan
3	I can identify components of a retail image.	<ul style="list-style-type: none"> • I can provide a detailed description of a product. • I can discuss how products are viewed by customers.
4	I can plan merchandise assortments.	<ul style="list-style-type: none"> • I can discuss the components of a product line's brand mix. • I can explain the process for planning merchandise assortment.
5-7	I can plan merchandise assortments and determine an appropriate pricing structure.	<ul style="list-style-type: none"> • I can select an appropriate pricing strategy, determine cost of goods sold, calculate markup, and track success through profit earned.

Unit Title	
Unit 4: Promotion and Selling	
Relevant Standards: Bold indicates priority	
MBA Research Standards for Marketing: Marketing, Promoting, Selling	
Essential Question(s)	Enduring Understanding(s)
<ul style="list-style-type: none"> How does the choice of a promotional channel affect the reach and impact of a brand's message? What are effective selling strategies in a retail environment? How can effective promotional strategies and selling techniques influence consumer behavior and drive business success? 	<ul style="list-style-type: none"> Businesses choose specific promotional channels to convey a brand's message Effective selling strategies in a retail environment involve understanding customer needs, building relationships, and creating positive shopping experiences to influence purchasing decisions and foster long-term loyalty. Creating a successful promotional plan requires a comprehensive approach, including understanding customer needs, tracking marketing activities, and effectively communicating product benefits through advertisements.
Demonstration of Learning	Pacing for Unit
Students will create a promotional campaign to reach brand objectives.	11 class sessions
Family Overview (link below)	Integration of Technology
Family Overview Link	Online Graphic Design Software Video Editing Software Social Media Content Creation Tools
Unit-specific Vocabulary	Aligned Unit Materials, Resources, and Technology (beyond core resources)
Product Promotion Rebates Institutional Promotion Coupons Sales Promotion Visual Merchandising Promotional Strategy Displays Promotional Mix Cross Merchandising Reach Promotional Events Frequency Customer Relationship Cost Per Thousand (CPT) Management (CRM) Cost Per Click (CPC) Personal Selling Digital Marketing Business to Business Social Media Marketing Selling Influencer Marketing Selling Process Brand Loyalty - Pre-approach Content Marketing - Approach the Viral Marketing Customer Guerrilla Marketing - Determine Needs Endorsement - Present the Product Publicity - Handle Questions + Sponsorship Objectives Sweepstakes - Close the Sale Loyalty Programs - Suggestive Selling Samples - Follow Up	
Opportunities for Interdisciplinary Connections	Anticipated misconceptions

<p>Math, statistics, psychology, research, economics, and technology work together to design, evaluate, and optimize promotional campaigns and customer engagement strategies.</p>	<ul style="list-style-type: none"> • Promotion is only advertising • Selling is only cold calling • The only goal of promotion is to increase sales • Promotional success is easy to measure • Promotions can fix a bad product • Promotions are only for new products
<p>Connections to Prior Units</p>	<p>Connections to Future Units</p>
<p>Unit 1: Market Research → Unit 4: Using Market Research to inform merchandise planning Unit 2: Distribution → Unit 4: Selling Unit 3: Merchandise Assortment → Unit 4: Promotional Plans</p>	<p>Unit 4: Promotional Plans → Unit 5: Promotional Budget</p>
<p>Differentiation through <i>Universal Design for Learning</i></p>	
<p>UDL Indicator</p>	<p>Teacher Actions</p>
<p>Lesson: I can explain the nature of a promotional plan. <i>Engagement:</i></p> <ul style="list-style-type: none"> • Real-World Examples: Start with examples of promotional plans from well-known brands. Show how they structure campaigns for specific events like holidays or product launches. • Group Work: Let students collaborate to design a promotional plan for a hypothetical product, fostering interaction and peer learning. <p><i>Representation:</i></p> <ul style="list-style-type: none"> • Visual Aids: Provide diagrams, templates, and flowcharts outlining the components of a promotional plan, such as objectives, budget, target audience, media channels, and timelines. • Videos/Case Studies: Show case studies or video clips of successful promotional campaigns. Break down the elements that contributed to their success. <p><i>Action/Expression:</i></p> <ul style="list-style-type: none"> • Create a Promotional Plan: Have students create their own promotional plans for a product or service, using templates or digital tools to organize their ideas. • Presentation: Ask students to present their promotional plans, allowing them to express their ideas through slideshows, videos, or posters. <p>Lesson 2: I can explain the use of visual merchandising in retailing. <i>Engagement:</i></p> <ul style="list-style-type: none"> • Store Visits: If possible, organize a visit to a local retail store or conduct a virtual tour of famous retailers (e.g., Apple Store, high-end fashion retailers) to observe their visual merchandising. • Discussion: Facilitate a class discussion about the impact of visual merchandising on consumer behavior and sales. <p><i>Representation:</i></p> <ul style="list-style-type: none"> • Images and Videos: Use visual examples of effective visual merchandising (displays, store layouts, signage) to help students understand the concept. • Comparative Analysis: Present two contrasting examples of visual merchandising: one well-executed and one less effective. Have students analyze what makes one more successful than the other. <p><i>Action/Expression:</i></p> <ul style="list-style-type: none"> • Design a Visual Display: Have students design a visual display for a product or store using digital tools (e.g., Canva, SketchUp) or through physical models. • Reflection: Students can write a reflective piece or give a presentation explaining how they would use visual merchandising to enhance a retail environment. <p>Lesson 3: I can use cross-merchandising techniques. <i>Engagement:</i></p> <ul style="list-style-type: none"> • Hands-On Activity: Give students a selection of products and have them work in groups to create a cross-merchandising display. For example, pairing a camera with a memory card or pairing complementary clothing items. • Case Study: Show examples of successful cross-merchandising in stores (e.g., combining cooking utensils with ingredients in a kitchenware section). <p><i>Representation:</i></p> <ul style="list-style-type: none"> • Product Pairing Examples: Provide a variety of examples of cross-merchandising strategies (e.g., books with 	

book lights, snacks with movies).

- Interactive Demonstrations: Use a digital tool or app to show how cross-merchandising can be implemented in virtual retail environments.

Action/Expression:

- Create a Cross-Merchandising Plan: Have students create a cross-merchandising strategy for a product category, explaining the rationale behind each pairing.
- Role-Playing: Students can role-play as retail managers or sales associates, presenting cross-merchandising ideas to a “customer” or team.

Lesson 4: I can identify ways to track the effectiveness of selected promotion activities.

Engagement:

- Real-World Examples: Provide examples of businesses tracking the success of their promotional activities (e.g., through sales metrics, surveys, or online analytics).
- Interactive Tools: Introduce students to tools used to track promotion effectiveness, such as Google Analytics, customer feedback surveys, or point-of-sale data.

Representation:

- Visual Data: Provide charts, graphs, and case studies showing how promotional effectiveness is tracked and analyzed (e.g., before-and-after sales figures).
- Step-by-Step Guides: Offer clear guidelines on methods of tracking promotional success, such as conversion rates, ROI, or customer engagement metrics.

Action/Expression:

- Create a Tracking Plan: Ask students to design a plan for tracking the effectiveness of a promotion they’ve created, specifying key metrics and tools they would use.
- Data Analysis: Provide a set of promotional data and ask students to analyze it to determine the effectiveness of a campaign.

Lesson 5: I can understand the use of an advertisement's components to communicate with targeted audiences.

Engagement:

- Ad Breakdown: Show students examples of advertisements and have them break down the components: headline, visuals, call-to-action, and targeted messaging.
- Discussion: Facilitate discussions on how different ads appeal to different audiences and what makes them effective or ineffective.

Representation:

- Component Analysis: Provide an infographic or chart explaining the key components of an advertisement, such as tone, imagery, text, and how each targets specific audiences.
- Case Studies: Use real-world advertisements and analyze how they target particular demographics (e.g., Coca-Cola’s holiday campaigns targeting families vs. their youth-targeted campaigns).

Action/Expression:

- Create an Advertisement: Have students design an advertisement (print, digital, or video) targeting a specific demographic. They must include all key components (visuals, messaging, call-to-action).
- Peer Review: Students can present their advertisements to peers for feedback, evaluating the effectiveness of each element.

Lesson 6: I can determine customer/client needs.

Engagement:

- Customer Personas: Use customer personas or case studies to illustrate how businesses determine customer needs through research, surveys, or feedback.
- Role-Playing: Have students role-play as customer service representatives or salespeople trying to identify customer needs in a simulated scenario.

Representation:

- Visual Tools: Provide tools like surveys, questionnaires, or customer feedback forms that help businesses assess customer needs.
- Market Research Data: Show examples of how businesses gather and interpret customer data to understand needs.

Action/Expression:

- Survey Creation: Ask students to design a survey or interview guide to assess customer needs for a specific product or service.
- Report Writing: Have students write a report or give a presentation on how to determine customer needs using various research techniques.

Lesson 7: I can acquire a foundational knowledge of selling to understand its nature and scope.

Engagement:

- Interactive Scenarios: Use role-playing to simulate sales interactions, where students practice identifying customer needs and presenting solutions.
- Real-World Insights: Invite guest speakers from sales professions to talk about their experiences and the importance of selling techniques.

Representation:

- Sales Process Breakdown: Provide visual aids like flowcharts or step-by-step guides that explain the sales process from prospecting to closing a sale.
- Video Demonstrations: Show videos of effective sales presentations or real-world sales environments to illustrate key concepts.

Action/Expression:

- Role-Play Sales Interactions: Have students practice sales techniques by role-playing customer interactions where they identify needs and present solutions.
- Sales Presentation: Ask students to create and deliver a sales presentation for a product, demonstrating their understanding of the sales process.

Lesson 8: I can acquire product knowledge to communicate product benefits and to ensure appropriateness of product for the customer.

Engagement:

- Product Demos: Allow students to interact with actual products or product prototypes to explore their features and benefits.
- Real-Life Context: Use examples from the marketplace where product knowledge has led to successful sales or customer satisfaction.

Representation:

- Product Information Sheets: Provide clear, detailed product descriptions, features, and benefits to help students learn how to communicate these aspects effectively.
- Video Demonstrations: Use video reviews or demonstrations of products to show how product knowledge is communicated in real-world contexts.

Action/Expression:

- Create a Product Pitch: Have students prepare a product pitch that clearly outlines the benefits and suitability of the product for a specific customer.
- Customer Interaction: Ask students to role-play a scenario where they use their product knowledge to match a customer with the right product.

Lesson 9-11: I can apply the components and coordinating elements of advertisements to reach a target audience.

Engagement:

- Ad Design Challenge: Have students collaborate in teams to design advertisements aimed at a specific audience (e.g., millennials, parents, athletes).
- Analyze Ads: Show ads from various industries and have students analyze how different elements (imagery, text, and tone) are coordinated to appeal to specific target groups.

Representation:

- Advertising Breakdown: Provide a breakdown of how to coordinate elements of an ad (e.g., visual elements, language, and messaging) to resonate with the target audience.
- Case Studies: Use case studies of successful advertising campaigns, demonstrating how each component aligns with the target market.

Action/Expression:

- Create an Ad Campaign: Students create a full ad campaign, integrating all the components (visuals, messaging, and media) to target a particular audience effectively.
- Ad Critique: Have students present their ad campaigns to the class and critique each other's work, evaluating how well they applied the components to the target audience.

Supporting Multilingual/English Learners

Related [CELP standards](#)

Learning Targets

1. Explaining the nature of a promotional plan

Level 1: Can recognize promotional activities or advertisements (e.g., flyers, sales). May be able to identify a promotion in simple terms (e.g., "sale" or "discount").

Level 2: Can describe the basic concept of a promotional plan (e.g., "a plan to tell people about a sale"). Can mention a few elements of a promotional plan (e.g., discounts, advertisements).

Level 3: Can explain the nature of a promotional plan, including its purpose and basic components (e.g., goals, target audience, budget). Describes the role of promotions in business.

Level 4: Can describe the full scope of a promotional plan, discussing its elements in detail (e.g., objectives, strategies, channels). Can explain how different types of promotions are used to achieve business goals.

Level 5: Can provide a detailed and strategic explanation of how a promotional plan is developed, including market research and evaluation methods. Can analyze the effectiveness of different promotional tactics.

2. Explaining the use of visual merchandising in retailing

Level 1: Can recognize basic visual merchandising components (e.g., store displays, signs) with visual support. May identify simple examples (e.g., window displays, product placements).

Level 2: Can describe basic elements of visual merchandising (e.g., "displays make the store look nice" or "things are arranged neatly"). Can identify how displays attract customers' attention.

Level 3: Can explain the purpose of visual merchandising, including how it influences customer behavior (e.g., drawing attention to sales, creating a welcoming atmosphere). Can identify and describe examples of visual merchandising techniques in retail.

Level 4: Can explain the principles of effective visual merchandising, such as color, lighting, and product arrangement. Can discuss how these elements are used to enhance the shopping experience and increase sales.

Level 5: Can analyze and develop advanced visual merchandising strategies for a retail environment, considering customer psychology and market trends. Can create a detailed visual merchandising plan to align with store branding and promotional goals.

3. Using cross-merchandising techniques

Level 1: Can recognize simple cross-merchandising examples (e.g., "shoes with socks" or "coffee with mugs") with support. May need assistance identifying cross-merchandising in retail settings.

Level 2: Can describe simple cross-merchandising techniques, such as placing complementary items together (e.g., "t-shirts next to jeans"). Can suggest basic pairings of items that could be cross-merchandised.

Level 3: Can explain how cross-merchandising works to encourage additional purchases (e.g., "placing toothpaste next to toothbrushes"). Can apply basic cross-merchandising techniques to a specific store or product line.

Level 4: Can plan and implement effective cross-merchandising strategies to increase sales, considering customer behavior and product relationships. Can explain how cross-merchandising can enhance the shopping experience.

Level 5: Can develop advanced cross-merchandising plans, optimizing product placement for maximum sales and customer convenience. Can analyze the effectiveness of cross-merchandising strategies and adjust plans based on sales data.

4. Identifying ways to track the effectiveness of selected promotion activities.

Level 1: Can recognize basic ways promotions are tracked (e.g., "counting how many things sold"). May require support in understanding how promotions are evaluated.

Level 2: Can name simple tracking methods, such as counting items sold or measuring customer participation. Can identify basic metrics used to evaluate promotions (e.g., sales increase, customer interest).

Level 3: Can describe methods for tracking promotion effectiveness, such as sales data analysis or customer feedback surveys. Can explain how these methods help businesses evaluate the success of promotions.

Level 4: Can identify and implement multiple tracking techniques, such as ROI analysis, coupon redemption rates, and website traffic. Can analyze promotional data to assess the impact on business performance.

Level 5: Can design a comprehensive evaluation system to track the effectiveness of promotions across multiple channels. Can assess the long-term impact of promotional activities on brand awareness and customer loyalty.

5. Understanding the use of an advertisement's components to communicate with targeted audiences.

Level 1: Can recognize basic elements of an advertisement (e.g., picture, price) with support. May identify an ad's purpose (e.g., "It shows what's on sale").

Level 2: Can describe basic components of an ad (e.g., headline, image, price) and their general purpose. Can identify how an advertisement aims to attract customers.

Level 3: Can explain how different components of an advertisement (e.g., copy, visuals, call-to-action) work together to communicate a message to a target audience. Can describe how advertisements are tailored to specific audiences.

Level 4: Can explain in detail how an advertisement's components are strategically chosen to appeal to a target

market (e.g., tone, imagery, messaging). Can analyze the effectiveness of an advertisement in reaching its intended audience.

Level 5: Can develop and critique advertisements, ensuring that all components are aligned with target audience needs, behaviors, and preferences. Can use advanced marketing principles to create ads that effectively communicate brand values and promotions.

6. Determining customer/client needs

Level 1: Can recognize basic customer needs (e.g., “people need food” or “people need clothes”). May need support to identify specific needs in a business context.

Level 2: Can describe basic customer needs (e.g., “customers need good service” or “customers need low prices”). Can observe and mention common customer expectations.

Level 3: Can identify customer needs based on behaviors, feedback, or market research (e.g., “customers need a fast checkout process”). Can discuss how businesses meet customer needs through products and services.

Level 4: Can analyze customer needs in depth, using data, trends, and direct feedback to determine unmet needs. Can apply this understanding to improve business offerings and customer satisfaction.

Level 5: Can conduct detailed needs assessments for target markets or individual clients. Can develop strategies to meet customer needs, including personalized services or products, based on advanced research and analysis.

7. Acquiring foundational knowledge of selling to understand its nature and scope

Level 1: Can recognize basic selling terms (e.g., “selling,” “money”) with support. May understand selling as a simple exchange of products or services for money.

Level 2: Can describe the basic idea of selling, such as “selling is when someone buys something from a store.” Can identify basic aspects of selling, like customers and salespeople.

Level 3: Can explain the fundamental nature of selling, including the process of identifying customer needs and making a sale. Can describe the role of a salesperson in the selling process.

Level 4: Can explain the scope of selling, including various types of sales techniques (e.g., consultative, transactional) and the importance of customer relationships. Can discuss the impact of sales strategies on customer satisfaction and business outcomes.

Level 5: Can analyze the selling process from start to finish, incorporating advanced sales techniques (e.g., upselling, relationship selling). Can provide a detailed evaluation of different sales strategies and their effectiveness in various industries.

8. Acquiring product knowledge to communicate product benefits and ensure appropriateness of product for the customer

Level 1: Can identify basic features of a product (e.g., color, size) with support. May need help understanding how to communicate these features to others.

Level 2: Can describe a product’s basic benefits (e.g., “This shirt is soft and comfortable”) with support. Can recognize the relevance of product features to customer needs.

Level 3: Can explain the key benefits of a product, matching those benefits to specific customer needs. Can suggest appropriate products based on basic customer preferences.

Level 4: Can acquire detailed product knowledge and explain how features meet customer needs. Can advise customers on appropriate products based on a deeper understanding of their preferences and needs.

Level 5: Can analyze and communicate product benefits in detail, providing tailored recommendations that match customer requirements. Can ensure the appropriateness of the product for the customer through in-depth product knowledge and expertise.

9. Applying the components and coordinating elements of advertisements to reach a target audience.

Level 1: Can recognize basic components of an advertisement (e.g., images, text). May need support identifying how the advertisement is directed to a specific audience.

Level 2: Can describe the components of an advertisement and their purpose (e.g., “the picture is to catch attention”). Can identify how advertisements target different groups of people.

Level 3: Can explain how different components (e.g., copy, imagery, offer) are coordinated to communicate with a specific target audience. Can describe how advertisers select appropriate elements for different audience segments.

Level 4: Can design an advertisement that aligns components (e.g., message, design, channel) to effectively reach a specific target audience. Can explain the strategic use of advertisements to drive engagement.

Level 5: Can create detailed, sophisticated advertisements using a deep understanding of the target audience’s preferences and behaviors. Can evaluate the effectiveness of coordinated advertising components and adjust strategies based on audience feedback.

Lesson	Learning Target	Success Criteria/	Resources
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Sequence		Assessment	
1	I can explain the nature of a promotional plan.	<ul style="list-style-type: none"> I can describe promotional objectives for a business. I can describe a promotional budget and explain how it is incorporated into the promotional mix. 	
2	I can explain the use of visual merchandising in retailing.	<ul style="list-style-type: none"> I can describe how visual merchandising is implemented in a business. 	
3	I can use cross-merchandising techniques.	<ul style="list-style-type: none"> I can provide specific details a business uses for cross-merchandising strategies. 	
4	I can identify ways to track the effectiveness of selected promotion activities	<ul style="list-style-type: none"> I can describe promotional channels used to communicate with targeted audiences. I can evaluate the effectiveness of a business' promotional strategy. 	
5	I can understand the use of an advertisement's components to communicate with targeted audiences.	<ul style="list-style-type: none"> I can explain the components and coordinating elements of advertisements. 	
6	I can determine customer/client needs.	<ul style="list-style-type: none"> I can use data to determine customer/client needs and the actions that need to be taken to address these needs. I can utilize customer service techniques to ensure their needs are met. 	
7	I can acquire a foundational knowledge of selling to understand its nature and scope.	<ul style="list-style-type: none"> I can explain the nature and scope of the selling function. I can explain the role of customer service as a component of selling relationships I can describe key factors in building a clientele I can evaluate legal and ethical considerations in selling I can explore the types of technology used in the selling function. 	
8	I can acquire product knowledge to communicate product benefits and to ensure appropriateness of product for the customer.	<ul style="list-style-type: none"> I can analyze product information to identify product features and benefits. I can discuss motivational theories that impact buying behavior. 	
9 - 11	I can apply the components and coordinating elements of advertisements to reach a target audience.	<ul style="list-style-type: none"> I can design an effective promotional campaign to reach brand objectives. 	

Unit Title																					
Unit 5: Financial Analysis																					
Relevant Standards: Bold indicates priority																					
MBA Research Standards for Marketing: Marketing, Financial Analysis, Market Information Management																					
Essential Question(s)	Enduring Understanding(s)																				
<ul style="list-style-type: none"> • How does finance influence the overall success and strategic direction of a business? • Why is accurate and timely financial information essential for business operations and decision-making? • How do budgets serve as a financial planning and control tool in business? • What are strategies for maintaining accurate and reliable financial records? 	<ul style="list-style-type: none"> • Finance is crucial for making informed business decisions, managing resources effectively, and ensuring long-term sustainability. • Financial information is vital for evaluating performance, planning future activities, and making informed strategic decisions. • Budgets help businesses plan for future expenses and revenues, control spending, and allocate resources efficiently. • Maintaining accurate financial records is essential for tracking business performance, ensuring legal compliance, and supporting decision-making processes. 																				
Demonstration of Learning	Pacing for Unit																				
Students complete a Financial Analysis Project	4 class sessions																				
Family Overview (link below)	Integration of Technology																				
Family Overview Link																					
Unit-specific Vocabulary	Aligned Unit Materials, Resources, and Technology (beyond core resources)																				
<table border="0"> <tr> <td>Static budget</td> <td>Liabilities</td> </tr> <tr> <td>Performance-based budget</td> <td>Current Liabilities</td> </tr> <tr> <td>Zero-based budget</td> <td>Long-term Liabilities</td> </tr> <tr> <td>Variance-based budget</td> <td>Net Worth</td> </tr> <tr> <td>Personal Financial Statement</td> <td>Income Statement</td> </tr> <tr> <td>Balance sheets</td> <td>Cash Flow Statement</td> </tr> <tr> <td>Assets</td> <td>Liquidity Ratios</td> </tr> <tr> <td>- Current</td> <td>Leverage Ratios</td> </tr> <tr> <td>- Concurrent</td> <td>Activity Ratios</td> </tr> <tr> <td></td> <td>Profitability Ratios</td> </tr> </table>	Static budget	Liabilities	Performance-based budget	Current Liabilities	Zero-based budget	Long-term Liabilities	Variance-based budget	Net Worth	Personal Financial Statement	Income Statement	Balance sheets	Cash Flow Statement	Assets	Liquidity Ratios	- Current	Leverage Ratios	- Concurrent	Activity Ratios		Profitability Ratios	
Static budget	Liabilities																				
Performance-based budget	Current Liabilities																				
Zero-based budget	Long-term Liabilities																				
Variance-based budget	Net Worth																				
Personal Financial Statement	Income Statement																				
Balance sheets	Cash Flow Statement																				
Assets	Liquidity Ratios																				
- Current	Leverage Ratios																				
- Concurrent	Activity Ratios																				
	Profitability Ratios																				
Opportunities for Interdisciplinary Connections	Anticipated misconceptions																				
Math, statistics, economics, psychology, research, and technology combine to create a comprehensive understanding of finance in business. This knowledge is critical for running a successful organization, making informed decisions, and ensuring long-term profitability.	Financial analysis ins only for accountants High revenue means financial success All companies use the same financial metrics Short term performance is more important than long-term planning.																				
Connections to Prior Units	Connections to Future Units																				
Unit 2: Inventory → Unit 5: Financial Record Keeping Unit 2: Staffing → Unit 5: Budgeting Unit 3: Pricing Strategies → Unit 5: Cash Flow and Profitability Unit 4: Promotional Plans → Unit 5: Promotional Budget	N/A																				
Differentiation through <i>Universal Design for Learning</i>																					
UDL Indicator	Teacher Actions																				

Lesson 1: I can explain the role of finance in business.

Engagement:

- Real-World Examples: Begin with examples of how businesses (large and small) use finance to make decisions, grow, and sustain operations (e.g., how a company raises capital or invests in new projects).
- Interactive Discussion: Engage students in a discussion about how different departments in a business (marketing, operations, HR) rely on financial information to make decisions.

Representation:

- Visual Aids: Provide diagrams, infographics, or charts that illustrate the flow of money in a business (e.g., revenue, costs, profit, investment).
- Case Studies: Present real-world case studies of businesses and how finance plays a role in their success or failure. For example, how poor financial management led to bankruptcy or how effective financial planning contributed to growth.

Action/Expression:

- Create a Business Plan: Have students create a basic business plan that outlines the role of finance in their operations (e.g., budgeting, forecasting, investment).
- Group Project: In groups, students can design a financial strategy for a business scenario, explaining how financial decisions will affect the business.

Lesson 2: I can describe the need for financial information.

Engagement:

- Scenario-Based Learning: Present students with various business scenarios (e.g., launching a new product or expanding to a new market) and ask them to identify what financial information would be needed to make informed decisions.
- Class Polls/Discussions: Use polls or surveys to ask students about financial decisions they've made in personal life (e.g., budgeting, saving) and relate these to business finance needs.

Representation:

- Data and Visuals: Provide visual tools like financial reports, balance sheets, and cash flow statements to show what types of financial information are used in business decisions.
- Videos or Guest Speakers: Show videos explaining how businesses use financial data (e.g., market analysis, cost analysis) to inform decisions. Alternatively, invite a finance professional to talk about their role in a business.

Action/Expression:

- Analyze Financial Reports: Have students analyze a sample financial report, identifying key pieces of information (e.g., profitability, cash flow) that a business would need for decision-making.
- Create a Financial Dashboard: Ask students to design a financial dashboard that displays key information necessary for managing a business's finances.

Lesson 3: I can describe the nature of budgets.

Engagement:

- Budgeting Simulation: Engage students in a budgeting simulation where they have to create a budget for a hypothetical business or personal project, making trade-offs and decisions based on limited resources.
- Discussion: Have students brainstorm what different types of budgets are needed in a business (e.g., operating budget, marketing budget, capital budget) and why.

Representation:

- Visual Budget Templates: Provide clear examples of different types of budgets, such as operating budgets, cash flow budgets, and capital expenditure budgets, in both tabular and graphic formats.
- Interactive Budgeting Tools: Use tools like spreadsheets or budget software to show how budgets are created and tracked in real time, providing a practical demonstration.

Action/Expression:

- Create a Budget: Have students create a basic budget for a business scenario (e.g., a startup, a non-profit organization, or a school event). They should identify income sources, expenses, and any areas that need to be adjusted to stay within budget.
- Present a Budget: Ask students to present their budgets, explaining how they allocated resources and why they made specific financial decisions.

Lesson 4: I can maintain the financial records.

Engagement:

- Real-World Examples: Start with examples of how businesses maintain financial records, such as tracking expenses and income, managing invoices, and monitoring cash flow.

- Hands-On Practice: Provide students with real financial documents (e.g., receipts, invoices, payment records) and ask them to practice recording transactions.

Representation:

- Templates and Tools: Provide templates for common financial records like income statements, balance sheets, and cash flow statements. Use software like QuickBooks or Excel to demonstrate how records are tracked and updated.
- Step-by-Step Guides: Offer visual aids or checklists that guide students through the process of maintaining accurate financial records.

Action/Expression:

- Record Transactions: Have students simulate the process of maintaining financial records by recording a series of hypothetical business transactions in a ledger or spreadsheet.
- Create a Financial Recordkeeping System: Ask students to design a simple system for maintaining financial records for a small business, demonstrating their understanding of proper record-keeping practices.

Supporting Multilingual/English Learners

Related CELP standards:

Learning Targets

1. Explaining the role of finance in business.

Level 1: Can recognize the basic idea of finance in business (e.g., "finance is about money"). May identify simple examples of finance (e.g., "buying things" or "paying bills").

Level 2: Can describe the role of finance in business in basic terms (e.g., "Finance helps a business make money" or "Finance is needed to pay for things"). Can identify some financial activities within a business (e.g., budgeting, paying for supplies).

Level 3: Can explain the importance of finance in business, including its role in supporting daily operations, managing expenses, and ensuring profitability. Can discuss how businesses use finance to make decisions (e.g., investing in new products or managing cash flow).

Level 4: Can describe the role of finance in broader business strategy, such as financing growth, managing risks, and ensuring long-term sustainability. Can explain how finance supports business planning and decision-making.

Level 5: Can analyze the relationship between finance and other business functions (e.g., marketing, operations, human resources). Can evaluate the impact of financial decisions on business success and sustainability/

2. Describing the need for financial information

Level 1: Can recognize that businesses need money to operate. May understand that financial information is needed for basic activities like paying bills or buying supplies.

Level 2: Can describe why financial information is important for businesses (e.g., "so they know how much money they have"). Can identify simple uses of financial information, such as tracking sales or expenses.

Level 3: Can explain how financial information is used in decision-making, such as tracking income and expenses or preparing for taxes. Can describe the importance of financial records for understanding the business's health and success.

Level 4: Can discuss in detail how financial information supports various business functions, such as budgeting, forecasting, and investment decisions. Can explain how accurate financial data helps in strategic planning.

Level 5: Can analyze how businesses use financial information to make informed decisions, assess financial health, and ensure long-term profitability. Can discuss the importance of transparency and accuracy in financial reporting for stakeholders.

3. Describing the nature of budgets

Level 1: Can recognize that a budget involves managing money (e.g., "spending and saving"). May need support in understanding the purpose of a budget in business.

Level 2: Can describe a basic budget as a way to plan how money is spent (e.g., "a budget helps you not spend too much"). Can identify simple categories in a budget (e.g., income, expenses).

Level 3: Can explain the purpose of a budget in a business context, such as tracking income and controlling expenses. Can describe the basic components of a budget, including revenues and expenditures.

Level 4: Can describe the process of creating a budget, including setting financial goals, estimating income and expenses, and monitoring budget performance. Can explain how budgets help businesses plan for growth and control costs.

Level 5: Can develop and manage detailed budgets for different business areas, such as operations, marketing, and staffing. Can analyze budget performance, adjust financial plans based on actual outcomes, and make recommendations for improving financial efficiency.

4. Maintaining financial records

Level 1: Can recognize financial records, such as receipts or invoices. May need help understanding the purpose of maintaining these records.

Level 2: Can describe basic financial record-keeping activities, such as tracking receipts or organizing invoices. Can identify simple records that businesses keep for financial purposes.

Level 3: Can explain the importance of accurate financial record-keeping, including tracking income and expenses, maintaining receipts, and documenting transactions. Can describe different types of financial records (e.g., income statements, balance sheets).

Level 4: Can maintain organized financial records, ensuring they are accurate and up-to-date. Can track and categorize transactions, reconcile accounts, and prepare basic financial reports.

Level 5: Can manage and oversee comprehensive financial record-keeping systems. Can ensure the accuracy and integrity of financial data, prepare detailed financial statements, and assist in audits or financial reviews.

Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
1	I can explain the role of finance in business.	<ul style="list-style-type: none"> ● I can explain the significance of finance and how it can determine the ultimate success of the business. 	
2	I can describe the need for financial information.	<ul style="list-style-type: none"> ● I can discuss why financial information is needed to provide information about the operations, economic outlook, and cash flow of a business. ● I can explain why it is essential to read, understand and analyze financial information to effectively run a business. 	
3	I can describe the nature of budgets.	<ul style="list-style-type: none"> ● I can explain the importance of budgets for a business. ● I can describe how the budgeting process influences decision-making within the business. 	
4	I can maintain the financial records.	<ul style="list-style-type: none"> ● I can describe how financial records are kept and used for a business. ● I can discuss the importance of financial record keeping. ● I can describe the types of technology used for financial-information management in a business. 	

Course Title	Content Area	Grade Level	Credit (if applicable)
PLTW Cybersecurity	CTE	10, 11, 12	1.0 BPS 3.0 University New Haven
Course Description			
<p>PLTW Cybersecurity is a full-year course implemented in 10th grade or above. The design of the course exposes high school students to the ever-growing and far-reaching field of cybersecurity. Students accomplish this through problem-based learning, where students role-play and train as cybersecurity experts.</p> <p>PLTW Cybersecurity strongly connects to the National Cybersecurity Workforce Framework (also known as the NICE Framework or NCWF). Created by the National Institute of Standards and Technology (NIST), this framework identifies standards developed by numerous academic, industry, and government organizations. The framework objectives address topics that span K-12 education and guide learning progressions. The also incorporate many of the big ideas outlined by the College Board and addressed in AP CSP. In addition, the course integrates Computer Science Teachers Association (CSTA) standards.</p> <p>PLTW Cybersecurity gives students a broad exposure to the many aspects of digital and information security, while encouraging socially responsible choices and ethical behavior. It inspires algorithmic thinking, computational thinking, and especially, “outside-the-box” thinking. Students explore the many educational and career paths available to cybersecurity experts, as well as other careers that comprise the field of information security. The course contains the following units of study.</p>			
Connection to the <i>BPS Vision of the Graduate</i>		PLTW Standards Aligned to BPS Vision of the Graduate	
Collaboration	<p>COL.A Collaborate when processing information to gain insight and knowledge COL.A.1 Collaboration is an important part of solving data-driven problems. COL.A.2 Collaboration facilitates solving computational problems by applying multiple perspectives, experiences, and skill sets. COL.A.3 Communication between participants working on data-driven problems gives rise to enhanced insights and knowledge. COL.A.4 Collaboration in developing hypotheses and questions, and in testing hypotheses and answering questions, about data helps participants gain insight and knowledge. COL.A.5 Collaborating face-to-face and using online collaborative tools can facilitate processing information to gain insight and knowledge. COL.A.6 Investigating large data sets collaboratively can lead to insight and knowledge not obtained when working alone.</p> <p>COL.B Collaborate effectively as part of a team. COL.B.1 A collaboratively created computational artifact reflects effort by more than one person. COL.B.2 Effective collaborative teams consider the use of online collaborative tools. COL.B.3 Effective collaborative teams practice interpersonal communication, consensus building, conflict resolution, and negotiation. COL.B.4 Effective collaboration strategies enhance performance. COL.B.5 Collaboration facilitates the application of multiple perspectives (including sociocultural perspectives) and diverse talents and skills in developing computational artifacts. COL.B.6 A collaboratively created computational artifact can reflect personal expressions of ideas.</p> <p>COL.C Apply project management strategies effectively as part of a team. COL.C.1 Select and use computational tools that enable collaboration. COL.C.2 Work with a group to establish team norms. COL.C.3 Establish clear responsibilities and split workloads equitably.</p>		
Communications and Technology Literacy	<p>COM.A Communicate ideas, processes, and products to optimize audience perception and understanding. COM.A.1 Tailor and communicate information to diverse audiences. COM.A.2 Recognize and use the diverse skill sets of team members when solving problems.</p> <p>ERM.D Evaluate online and print sources for appropriateness and credibility.</p>		

	<p>ERM.D.1 Evaluate the credibility of a source by considering the reputation and credentials of the author(s), publisher(s), site owner(s), and/or sponsor(s).</p> <p>ERM.D.2 Evaluate the relevance of information from a source and whether it supports an appropriate claim or the purpose of the investigation.</p> <p>IOC.A Recognize that a digital presence affects future success, both personally and professionally</p> <p>IOC.A.1 Evaluate the impact to yourself and others when sharing digital information online.</p>			
Information Literacy	<p>ERM.D Evaluate online and print sources for appropriateness and credibility.</p> <p>ERM.D.1 Evaluate the credibility of a source by considering reputation and credentials of the author(s), publisher(s), site owner(s), and/or sponsor(s).</p> <p>ERM.D.2 Evaluate the relevancy of information from a source and whether it supports an appropriate claim or the purpose of the investigation.</p>			
Critical Thinking and Problem Solving	<p>CCP.A Apply creative and original thinking when confronted with a problem or new scenario.</p> <p>CCP.A.1 Translate ideas into tangible solutions by employing an iterative and exploratory process.</p> <p>CCP.D Describe moments within a process where curiosity, persistence, and the positive aspect of failure played an important role in gaining understanding about a problem or unexpected observation.</p> <p>CCP.D.1 Describe difficulties and/or opportunities you encountered and how they were resolved or incorporated.</p>			
Social and Cross-Cultural Skills Global Awareness Empathy	<p>CAR.A Describe career paths within the computing specialties.</p> <p>CAR.A.1 Describe a variety of careers within cybersecurity.</p> <p>CAR.A.2 Recognize the education and credentialing requirements for careers within cybersecurity.</p> <p>CAR.A.3 Demonstrate the initiative and independent learning required to stay current with evolving technology and career needs.</p> <p>ERM.A Abide by professional, ethical, and legal standards when handling data or protecting data.</p> <p>ERM.A.1 Develop a classroom code of conduct.</p> <p>ERM.A.2 Provide rationales for all ethical decisions.</p> <p>ERM.A.3 Engage others with respect and forethought.</p> <p>ERM.A.4 Weigh the ethical decisions and personal consequences when exploring and sharing digital information.</p> <p>ERM.A.6 Engage in debate with others to define ethical and unethical behavior.</p> <p>ERM.A.7 Identify the unique circumstances in which penetration testing is legal and ethical.</p> <p>ERM.A.8 Adhere to the rules of data privacy and the need to access information.</p>			
Civic Literacy	<p>ERM.B Discern how to use technology in ways that support community well-being.</p> <p>ERM.B.1 Evaluate whether a particular cyber behavior is acceptable in a social context.</p> <p>ERM.B.2 Consider the impact of personal cyber behavior on others.</p>			
Aligned Core Resources	Link to Completed Equity Audit	Additional Course Information: <i>Knowledge/Skill Dependent courses/prerequisites</i>		
PLTW Cybersecurity Online Modules https://my.pltw.org/	Equity Curriculum Review - Cybersecurity	N/A		
Standard Matrix				
Standards	Unit 1	Unit 2	Unit 3	Unit 4
CAR.A	<input checked="" type="checkbox"/> CAR.A.1 <input checked="" type="checkbox"/> CAR.A.2 <input type="checkbox"/> CAR.A.3	<input checked="" type="checkbox"/> CAR.A.1 <input type="checkbox"/> CAR.A.2 <input type="checkbox"/> CAR.A.3	<input checked="" type="checkbox"/> CAR.A.1 <input checked="" type="checkbox"/> CAR.A.2 <input checked="" type="checkbox"/> CAR.A.3	<input type="checkbox"/> CAR.A.1 <input type="checkbox"/> CAR.A.2 <input type="checkbox"/> CAR.A.3

COM.A	<input checked="" type="checkbox"/> COM.A.1 <input checked="" type="checkbox"/> COM.A.2	<input checked="" type="checkbox"/> COM.A.1 <input checked="" type="checkbox"/> COM.A.2	<input checked="" type="checkbox"/> COM.A.1 <input checked="" type="checkbox"/> COM.A.2	<input checked="" type="checkbox"/> COM.A.1 <input checked="" type="checkbox"/> COM.A.2
COM.B	<input checked="" type="checkbox"/> COM.B.1 <input type="checkbox"/> COM.B.2	<input checked="" type="checkbox"/> COM.B.1 <input type="checkbox"/> COM.B.2	<input checked="" type="checkbox"/> COM.B.1 <input type="checkbox"/> COM.B.2	<input checked="" type="checkbox"/> COM.B.1 <input type="checkbox"/> COM.B.2
COL.A	<input checked="" type="checkbox"/> COL.A.1 <input checked="" type="checkbox"/> COL.A.2 <input checked="" type="checkbox"/> COL.A.3 <input type="checkbox"/> COL.A.4 <input checked="" type="checkbox"/> COL.A.5	<input checked="" type="checkbox"/> COL.A.1 <input checked="" type="checkbox"/> COL.A.2 <input checked="" type="checkbox"/> COL.A.3 <input checked="" type="checkbox"/> COL.A.4 <input checked="" type="checkbox"/> COL.A.5 <input checked="" type="checkbox"/> COL.A.6	<input checked="" type="checkbox"/> COL.A.1 <input checked="" type="checkbox"/> COL.A.2 <input checked="" type="checkbox"/> COL.A.3 <input checked="" type="checkbox"/> COL.A.4 <input checked="" type="checkbox"/> COL.A.5 <input checked="" type="checkbox"/> COL.A.6	<input checked="" type="checkbox"/> COL.A.1 <input checked="" type="checkbox"/> COL.A.2 <input checked="" type="checkbox"/> COL.A.3 <input checked="" type="checkbox"/> COL.A.4 <input checked="" type="checkbox"/> COL.A.5 <input checked="" type="checkbox"/> COL.A.6
COL.B	<input type="checkbox"/> COL.B.1 <input type="checkbox"/> COL.B.2 <input type="checkbox"/> COL.B.3 <input checked="" type="checkbox"/> COL.B.4 <input checked="" type="checkbox"/> COL.B.5 <input checked="" type="checkbox"/> COL.B.6	<input checked="" type="checkbox"/> COL.B.1 <input checked="" type="checkbox"/> COL.B.2 <input checked="" type="checkbox"/> COL.B.3 <input checked="" type="checkbox"/> COL.B.4 <input checked="" type="checkbox"/> COL.B.5 <input checked="" type="checkbox"/> COL.B.6	<input checked="" type="checkbox"/> COL.B.1 <input checked="" type="checkbox"/> COL.B.2 <input checked="" type="checkbox"/> COL.B.3 <input checked="" type="checkbox"/> COL.B.4 <input checked="" type="checkbox"/> COL.B.5 <input checked="" type="checkbox"/> COL.B.6	<input checked="" type="checkbox"/> COL.B.1 <input checked="" type="checkbox"/> COL.B.2 <input checked="" type="checkbox"/> COL.B.3 <input checked="" type="checkbox"/> COL.B.4 <input checked="" type="checkbox"/> COL.B.5 <input checked="" type="checkbox"/> COL.B.6
COL.C	<input checked="" type="checkbox"/> COL.C.1 <input checked="" type="checkbox"/> COL.C.2 <input type="checkbox"/> COL.C.3	<input checked="" type="checkbox"/> COL.C.1 <input checked="" type="checkbox"/> COL.C.2 <input checked="" type="checkbox"/> COL.C.3	<input checked="" type="checkbox"/> COL.C.1 <input checked="" type="checkbox"/> COL.C.2 <input checked="" type="checkbox"/> COL.C.3	<input checked="" type="checkbox"/> COL.C.1 <input checked="" type="checkbox"/> COL.C.2 <input checked="" type="checkbox"/> COL.C.3
ERM.A	<input checked="" type="checkbox"/> ERM.A.1 <input type="checkbox"/> ERM.A.2 <input type="checkbox"/> ERM.A.3 <input checked="" type="checkbox"/> ERM.A.4 <input type="checkbox"/> ERM.A.5 <input type="checkbox"/> ERM.A.6 <input type="checkbox"/> ERM.A.7 <input type="checkbox"/> ERM.A.8	<input checked="" type="checkbox"/> ERM.A.1 <input checked="" type="checkbox"/> ERM.A.2 <input checked="" type="checkbox"/> ERM.A.3 <input checked="" type="checkbox"/> ERM.A.4 <input type="checkbox"/> ERM.A.5 <input checked="" type="checkbox"/> ERM.A.6 <input checked="" type="checkbox"/> ERM.A.7 <input checked="" type="checkbox"/> ERM.A.8	<input type="checkbox"/> ERM.A.1 <input checked="" type="checkbox"/> ERM.A.2 <input checked="" type="checkbox"/> ERM.A.3 <input checked="" type="checkbox"/> ERM.A.4 <input checked="" type="checkbox"/> ERM.A.5 <input checked="" type="checkbox"/> ERM.A.6 <input checked="" type="checkbox"/> ERM.A.7 <input checked="" type="checkbox"/> ERM.A.8	<input type="checkbox"/> ERM.A.1 <input type="checkbox"/> ERM.A.2 <input checked="" type="checkbox"/> ERM.A.3 <input checked="" type="checkbox"/> ERM.A.4 <input checked="" type="checkbox"/> ERM.A.5 <input type="checkbox"/> ERM.A.6 <input type="checkbox"/> ERM.A.7 <input checked="" type="checkbox"/> ERM.A.8
ERM.B	<input checked="" type="checkbox"/> ERM.B.1 <input checked="" type="checkbox"/> ERM.B.2	<input checked="" type="checkbox"/> ERM.B.1 <input checked="" type="checkbox"/> ERM.B.2	<input checked="" type="checkbox"/> ERM.B.1 <input checked="" type="checkbox"/> ERM.B.2	<input type="checkbox"/> ERM.B.1 <input type="checkbox"/> ERM.B.2
ERM.C	<input type="checkbox"/> ERM.C.1 <input type="checkbox"/> ERM.C.2	<input type="checkbox"/> ERM.C.1 <input type="checkbox"/> ERM.B.2	<input checked="" type="checkbox"/> ERM.C.1 <input type="checkbox"/> ERM.C.2	<input type="checkbox"/> ERM.C.1 <input type="checkbox"/> ERM.C.2
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CCPB	<input checked="" type="checkbox"/> CCPB.1 <input type="checkbox"/> CCPB.2	<input checked="" type="checkbox"/> CCPB.1 <input type="checkbox"/> CCPB.2	<input checked="" type="checkbox"/> CCPB.1 <input type="checkbox"/> CCPB.2	<input checked="" type="checkbox"/> CCPB.1 <input type="checkbox"/> CCPB.2
CCPC	<input checked="" type="checkbox"/> CCPC.1	<input checked="" type="checkbox"/> CCPC.1	<input checked="" type="checkbox"/> CCPC.1	<input checked="" type="checkbox"/> CCPC.1
CCPD	<input type="checkbox"/> CCPD.1	<input checked="" type="checkbox"/> CCPD.1	<input checked="" type="checkbox"/> CCPD.1	<input type="checkbox"/> CCPD.1
CCPE	<input type="checkbox"/> CCPE.1 <input type="checkbox"/> CCPE.2 <input checked="" type="checkbox"/> CCPE.3	<input checked="" type="checkbox"/> CCPE.1 <input checked="" type="checkbox"/> CCPE.2 <input checked="" type="checkbox"/> CCPE.3	<input checked="" type="checkbox"/> CCPE.1 <input type="checkbox"/> CCPE.2 <input checked="" type="checkbox"/> CCPE.3	<input type="checkbox"/> CCPE.1 <input type="checkbox"/> CCPE.2 <input type="checkbox"/> CCPE.3
CCPF	<input checked="" type="checkbox"/> CCPF.1 <input checked="" type="checkbox"/> CCPF.2	<input checked="" type="checkbox"/> CCPF.1 <input checked="" type="checkbox"/> CCPF.2	<input checked="" type="checkbox"/> CCPF.1 <input checked="" type="checkbox"/> CCPF.2	<input checked="" type="checkbox"/> CCPF.1 <input checked="" type="checkbox"/> CCPF.2
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IARPB	<input checked="" type="checkbox"/> IARP.B.1 <input type="checkbox"/> IARP.B.2	<input checked="" type="checkbox"/> IARP.B.1 <input checked="" type="checkbox"/> IARP.B.2	<input checked="" type="checkbox"/> IARP.B.1 <input checked="" type="checkbox"/> IARP.B.2	<input checked="" type="checkbox"/> IARP.B.1 <input type="checkbox"/> IARP.B.2
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DAT.B	<input checked="" type="checkbox"/> DAT.B.1 <input checked="" type="checkbox"/> DAT.B.2 <input checked="" type="checkbox"/> DAT.B.3 <input checked="" type="checkbox"/> DAT.B.4 <input checked="" type="checkbox"/> DAT.B.5	<input checked="" type="checkbox"/> DAT.B.1 <input type="checkbox"/> DAT.B.2 <input type="checkbox"/> DAT.B.3 <input type="checkbox"/> DAT.B.4 <input type="checkbox"/> DAT.B.5	<input type="checkbox"/> DAT.B.1 <input type="checkbox"/> DAT.B.2 <input type="checkbox"/> DAT.B.3 <input type="checkbox"/> DAT.B.4 <input type="checkbox"/> DAT.B.5	<input checked="" type="checkbox"/> DAT.B.1 <input checked="" type="checkbox"/> DAT.B.2 <input type="checkbox"/> DAT.B.3 <input checked="" type="checkbox"/> DAT.B.4 <input type="checkbox"/> DAT.B.5
DAT.C	<input type="checkbox"/> DAT.C.1 <input type="checkbox"/> DAT.C.2	<input checked="" type="checkbox"/> DAT.C.1 <input checked="" type="checkbox"/> DAT.C.2	<input checked="" type="checkbox"/> DAT.C.1 <input checked="" type="checkbox"/> DAT.C.2	<input checked="" type="checkbox"/> DAT.C.1 <input checked="" type="checkbox"/> DAT.C.2
IOC.A	<input checked="" type="checkbox"/> IOC.A.1 <input type="checkbox"/> IOC.A.2	<input checked="" type="checkbox"/> IOC.A.1 <input type="checkbox"/> IOC.A.2	<input type="checkbox"/> IOC.A.1 <input type="checkbox"/> IOC.A.2	<input type="checkbox"/> IOC.A.1 <input type="checkbox"/> IOC.A.2
IOC.B	<input type="checkbox"/> IOC.B.1 <input type="checkbox"/> IOC.B.2 <input type="checkbox"/> IOC.B.3 <input type="checkbox"/> IOC.B.4	<input checked="" type="checkbox"/> IOC.B.1 <input checked="" type="checkbox"/> IOC.B.2 <input checked="" type="checkbox"/> IOC.B.3 <input checked="" type="checkbox"/> IOC.B.4	<input checked="" type="checkbox"/> IOC.B.1 <input checked="" type="checkbox"/> IOC.B.2 <input checked="" type="checkbox"/> IOC.B.3 <input type="checkbox"/> IOC.B.4	<input type="checkbox"/> IOC.B.1 <input type="checkbox"/> IOC.B.2 <input type="checkbox"/> IOC.B.3 <input type="checkbox"/> IOC.B.4
CTT.A	<input checked="" type="checkbox"/> CTT.A.1 <input checked="" type="checkbox"/> CTT.A.2	<input checked="" type="checkbox"/> CTT.A.1 <input checked="" type="checkbox"/> CTT.A.2	<input checked="" type="checkbox"/> CTT.A.1 <input checked="" type="checkbox"/> CTT.A.2	<input checked="" type="checkbox"/> CTT.A.1 <input type="checkbox"/> CTT.A.2
CTT.B	<input checked="" type="checkbox"/> CCT.B.1 <input type="checkbox"/> CCT.B.2	<input checked="" type="checkbox"/> CCT.B.1 <input checked="" type="checkbox"/> CCT.B.2	<input checked="" type="checkbox"/> CCT.B.1 <input checked="" type="checkbox"/> CCT.B.2	<input checked="" type="checkbox"/> CCT.B.1 <input checked="" type="checkbox"/> CCT.B.2
CSN.A	<input checked="" type="checkbox"/> CSN.A.1 <input checked="" type="checkbox"/> CSN.A.2	<input type="checkbox"/> CSN.A.1 <input checked="" type="checkbox"/> CSN.A.2	<input checked="" type="checkbox"/> CSN.A.1 <input checked="" type="checkbox"/> CSN.A.2	<input checked="" type="checkbox"/> CSN.A.1 <input checked="" type="checkbox"/> CSN.A.2
CSN.B	<input checked="" type="checkbox"/> CSN.B.1 <input checked="" type="checkbox"/> CSN.B.2 <input checked="" type="checkbox"/> CSN.B.3 <input checked="" type="checkbox"/> CSN.B.4 <input checked="" type="checkbox"/> CSN.B.5 <input checked="" type="checkbox"/> CSN.B.6	<input checked="" type="checkbox"/> CSN.B.1 <input checked="" type="checkbox"/> CSN.B.2 <input type="checkbox"/> CSN.B.3 <input type="checkbox"/> CSN.B.4 <input checked="" type="checkbox"/> CSN.B.5 <input type="checkbox"/> CSN.B.6	<input checked="" type="checkbox"/> CSN.B.1 <input checked="" type="checkbox"/> CSN.B.2 <input checked="" type="checkbox"/> CSN.B.3 <input checked="" type="checkbox"/> CSN.B.4 <input checked="" type="checkbox"/> CSN.B.5 <input type="checkbox"/> CSN.B.6	<input checked="" type="checkbox"/> CSN.B.1 <input type="checkbox"/> CSN.B.2 <input type="checkbox"/> CSN.B.3 <input checked="" type="checkbox"/> CSN.B.4 <input checked="" type="checkbox"/> CSN.B.5 <input type="checkbox"/> CSN.B.6
CSN.C	<input checked="" type="checkbox"/> CSN.C.1 <input checked="" type="checkbox"/> CSN.C.2	<input checked="" type="checkbox"/> CSN.C.1 <input checked="" type="checkbox"/> CSN.C.2	<input checked="" type="checkbox"/> CSN.C.1 <input checked="" type="checkbox"/> CSN.C.2	<input type="checkbox"/> CSN.C.1 <input type="checkbox"/> CSN.C.2

	<input checked="" type="checkbox"/> CSN.C.3	<input checked="" type="checkbox"/> CSN.C.3	<input checked="" type="checkbox"/> CSN.C.3	<input type="checkbox"/> CSN.C.3
CSN.D	<input type="checkbox"/> CSN.D.1 <input type="checkbox"/> CSN.D.2 <input checked="" type="checkbox"/> CSN.D.3 <input checked="" type="checkbox"/> CSN.D.4 <input checked="" type="checkbox"/> CSN.D.5 <input checked="" type="checkbox"/> CSN.D.6	<input type="checkbox"/> CSN.D.1 <input type="checkbox"/> CSN.D.2 <input type="checkbox"/> CSN.D.3 <input type="checkbox"/> CSN.D.4 <input type="checkbox"/> CSN.D.5 <input type="checkbox"/> CSN.D.6	<input checked="" type="checkbox"/> CSN.D.1 <input checked="" type="checkbox"/> CSN.D.2 <input checked="" type="checkbox"/> CSN.D.3 <input checked="" type="checkbox"/> CSN.D.4 <input checked="" type="checkbox"/> CSN.D.5 <input checked="" type="checkbox"/> CSN.D.6	<input type="checkbox"/> CSN.D.1 <input type="checkbox"/> CSN.D.2 <input type="checkbox"/> CSN.D.3 <input type="checkbox"/> CSN.D.4 <input type="checkbox"/> CSN.D.5 <input checked="" type="checkbox"/> CSN.D.6
CSN.F	<input type="checkbox"/> CSN.F.1 <input type="checkbox"/> CSN.F.2 <input checked="" type="checkbox"/> CSN.F.3 <input type="checkbox"/> CSN.F.4 <input type="checkbox"/> CSN.F.5 <input checked="" type="checkbox"/> CSN.F.6 <input checked="" type="checkbox"/> CSN.F.7	<input type="checkbox"/> CSN.F.1 <input checked="" type="checkbox"/> CSN.F.2 <input checked="" type="checkbox"/> CSN.F.3 <input type="checkbox"/> CSN.F.4 <input type="checkbox"/> CSN.F.5 <input checked="" type="checkbox"/> CSN.F.6 <input checked="" type="checkbox"/> CSN.F.7	<input checked="" type="checkbox"/> CSN.F.1 <input checked="" type="checkbox"/> CSN.F.2 <input checked="" type="checkbox"/> CSN.F.3 <input checked="" type="checkbox"/> CSN.F.4 <input checked="" type="checkbox"/> CSN.F.5 <input checked="" type="checkbox"/> CSN.F.6 <input checked="" type="checkbox"/> CSN.F.7	<input type="checkbox"/> CSN.F.1 <input type="checkbox"/> CSN.F.2 <input type="checkbox"/> CSN.F.3 <input type="checkbox"/> CSN.F.4 <input checked="" type="checkbox"/> CSN.F.5 <input checked="" type="checkbox"/> CSN.F.6 <input type="checkbox"/> CSN.F.7
CSN.G	<input checked="" type="checkbox"/> CSN.G.1 <input type="checkbox"/> CSN.G.2 <input type="checkbox"/> CSN.G.3 <input checked="" type="checkbox"/> CSN.G.4	<input checked="" type="checkbox"/> CSN.G.1 <input checked="" type="checkbox"/> CSN.G.2 <input checked="" type="checkbox"/> CSN.G.3 <input checked="" type="checkbox"/> CSN.G.4	<input type="checkbox"/> CSN.G.1 <input checked="" type="checkbox"/> CSN.G.2 <input checked="" type="checkbox"/> CSN.G.3 <input checked="" type="checkbox"/> CSN.G.4	<input type="checkbox"/> CSN.G.1 <input type="checkbox"/> CSN.G.2 <input type="checkbox"/> CSN.G.3 <input type="checkbox"/> CSN.G.4
CSN.H	<input checked="" type="checkbox"/> CSN.H.1 <input checked="" type="checkbox"/> CSN.H.2 <input type="checkbox"/> CSN.H.3	<input checked="" type="checkbox"/> CSN.H.1 <input type="checkbox"/> CSN.H.2 <input checked="" type="checkbox"/> CSN.H.3	<input checked="" type="checkbox"/> CSN.H.1 <input checked="" type="checkbox"/> CSN.H.2 <input checked="" type="checkbox"/> CSN.H.3	<input type="checkbox"/> CSN.H.1 <input type="checkbox"/> CSN.H.2 <input type="checkbox"/> CSN.H.3
CSN.I	<input type="checkbox"/> CSN.I.1 <input type="checkbox"/> CSN.I.2	<input checked="" type="checkbox"/> CSN.I.1 <input checked="" type="checkbox"/> CSN.I.2	<input type="checkbox"/> CSN.I.1 <input type="checkbox"/> CSN.I.2	<input checked="" type="checkbox"/> CSN.I.1 <input type="checkbox"/> CSN.I.2
CSN.J	<input type="checkbox"/> CSN.J.1 <input type="checkbox"/> CSN.J.2 <input checked="" type="checkbox"/> CNS.J.3	<input checked="" type="checkbox"/> CSN.J.1 <input checked="" type="checkbox"/> CSN.J.2 <input checked="" type="checkbox"/> CNS.J.3	<input checked="" type="checkbox"/> CSN.J.1 <input checked="" type="checkbox"/> CSN.J.2 <input checked="" type="checkbox"/> CNS.J.3	<input type="checkbox"/> CSN.J.1 <input checked="" type="checkbox"/> CSN.J.2 <input type="checkbox"/> CNS.J.3
SA.A	<input type="checkbox"/> SA.A.1 <input type="checkbox"/> SA.A.2 <input type="checkbox"/> SA.A.3	<input type="checkbox"/> SA.A.1 <input type="checkbox"/> SA.A.2 <input type="checkbox"/> SA.A.3	<input type="checkbox"/> SA.A.1 <input type="checkbox"/> SA.A.2 <input type="checkbox"/> SA.A.3	<input checked="" type="checkbox"/> SA.A.1 <input checked="" type="checkbox"/> SA.A.2 <input checked="" type="checkbox"/> SA.A.3
SA.B	<input type="checkbox"/> SA.B.1	<input type="checkbox"/> SA.B.1	<input checked="" type="checkbox"/> SA.B.1	<input type="checkbox"/> SA.B.1
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Unit Links

[Unit 1: Personal Security](#)

[Unit 2: System Security](#)

[Unit 3: Network Security](#)

[Unit 4: Applied Cybersecurity](#)

Unit Title
Unit 1: Personal Security
Relevant Standards: Bold indicates priority
<p>COM.B Recognize documentation as an indispensable part of the security process. COM.B.1 Maintain a detailed record of the process and the steps used to solve a problem.</p> <p>CCP.B Create a computational artifact for creative expression. CCP.B.1 Identify a computational artifact as something created by a human using a computer and differentiate between a program, an image, audio, a video, a presentation, or a web page file.</p> <p>CCP.C Deconstruct a complex problem into simpler parts. CCP.C.1 Identify and apply solutions to subcomponents to achieve a system-wide solution.</p> <p>CCP.E Engage stakeholders in a problem and use their perspectives to shape the course of your development. CCP.E.3 Share meaningful insights about the context of an organization's threat environment that improve its risk management posture. (NICE A0120)</p> <p>CCP.F Apply and describe the process based on user-centered research to solve a problem. CCP.F.1 Apply and describe the process used during the development of a solution CCP.F.2 Acknowledge that stages of failure and technical hurdles are typical in processes that produce positive outcomes.</p> <p>IARP.B Analyze the evidence of an attack. IARP.B.1 Identify common types of malware.</p> <p>IARPC Design the correct level of protection by implementing the appropriate safeguards. IARPC.3 Protect against future information threats.</p> <p>DAT.A Find patterns and test hypotheses about digitally processed information to gain insight and knowledge. DAT.A.1 Identify systemic security issues based on the analysis of vulnerability and configuration data. (NICE A0001)</p> <p>DAT.B Identify personal data sharing that places people at risk and evaluate risky personal data-sharing practices. DAT.B.1 Understand that security and privacy concerns arise with data containing personal information. DAT.B.2 Understand data mining techniques used to perform social engineering. DAT.B.3 Create a risk assessment of personal data sharing and evaluate the potential for social engineering attacks. DAT.B.4 Evaluate attacks that occur via email. DAT.B.5 Manage browser security settings to facilitate safe browsing.</p> <p>CTT.A Select and apply appropriate computational tools and techniques to solve a problem or create value for others. CTT.A.1 Select collaboration tools for data collection, writing, or protecting data. CTT.A.2 Navigate and use unfamiliar documentation and public information to extend the student's own knowledge and to achieve a computational approach to solve a problem.</p> <p>CTT.B Apply tools with varying levels of abstraction within software, a computer, a network, and the internet. CTT.B.1 Recognize and discern between different levels of abstraction while working with computational tools.</p> <p>CSN.A Describe the modular components of a computer's hardware and software. CSN.A.1 Identify the hardware components of a computer. CSN.A.2 Identify the broad tasks that operating systems manage, such as process management and file management.</p> <p>CSN.B Identify user actions that strengthen the security of information stored on a computer. CSN.B.1 Navigate system files to locate files that are used to manage computer resources. CSN.B.2 Manage system processes and user processes. CSN.B.3 Create strong passphrases. CSN.B.4 Install and manage protective software, including updates and removal. CSN.B.5 Manage software using configuration tools and/or parameters. CSN.B.6 Manage important data by establishing backup procedures.</p> <p>CSN.C Monitor, analyze, and manage active processes on a computer or network of computers. CSN.C.1 Differentiate between user and system processes. CSN.C.2 Identify and analyze potentially malicious/foreign processes. CSN.C.3 Install, analyze and remove processes.</p> <p>CSN.D Gain understanding of how an operating system is structured and works by navigating the file system and</p>

modifying files, extensions, rights, and visibility to better protect data.

- CSN.D.3 Change file extensions and predict the effects of the change.
- CSN.D.4 Manage file types, access rights, and visibility of files.
- CSN.D.5 Organize a file system.
- CSN.D.6 Search a file system.

CSN.F Identify the components (software, hardware, protocols) that allow computers to network and communicate.

- CSN.F.3 Describe networking hardware.
- CSN.F.6 Identify network system sub-components responsible for security.
- CSN.F.7 Locate and solve security problem(s) within a network system's subcomponents.

CSN.G Analyze the evidence of web exploitations, both from front-end application and backend services perspective.

- CSN.G.1 Identify websites that appear untrustworthy or dangerous to the end user.
- CSN.G.4 Protect against web-based weaknesses.

CSN.I Identify user actions that strengthen the security of a networked system.

- CSN.I.1 Recognize that the security of a network depends on the security of its individual components.
- CSN.I.2 Manage settings and configuration files of software and/or drivers to maintain the security of the network.

CSN.J Use abstractions to manage and analyze information.

- CSN.J.3 Identify the abstracted nature of network communication

Essential Question(s):	Enduring Understanding(s):
<p>1.1 - Why do people engage in risky behavior in cyberspace? People engage in risky behavior online due to a lack of awareness, convenience, or misplaced trust. Understanding human behavior is critical to promoting safer online practices.</p> <p>1.3 - What are the consequences of inappropriate behavior in cyberspace? Inappropriate behavior in cyberspace can lead to personal, legal, and societal consequences, including identity theft, reputational damage, and legal penalties. Respect and accountability are vital in the digital world.</p> <p>2.1 - Why does information need protection? Information needs protection to preserve its confidentiality, integrity, and availability. Securing data prevents misuse, theft, and unauthorized access, ensuring trust in digital systems.</p> <p>2.2 - How do computers safely store information? Computers use encryption, secure storage methods, and access controls to safely store information. These techniques reduce the risk of data breaches and unauthorized access.</p> <p>4.1 - How can information be safely exchanged? Information can be safely exchanged by using secure protocols, encryption, and authentication mechanisms, which protect data during transmission and ensure it reaches the intended recipient.</p> <p>5.1 - How can malware be stopped? Malware can be stopped through proactive defenses, such as antivirus software, firewalls, timely updates, and user education to recognize and avoid potential threats.</p> <p>7.1 - What makes a good cyber team? A good cyber team is collaborative, adaptive, and skilled in various cybersecurity disciplines. Effective communication, diverse expertise, and a shared commitment to ethical practices ensure successful outcomes in complex scenarios.</p>	<p>Students will demonstrate their learning by:</p> <ul style="list-style-type: none"> ● Identifying safe and strong passwords ● Identifying suspicious content in email and on social media ● Identifying security improvements to social media accounts ● Conducting a thorough scan of the computer using antivirus software. ● Identifying and isolating suspicious processes or applications. ● Safely removing or quarantining identified malware

Demonstration of Learning:	
<p>A hands-on, scenario-based cybersecurity project where students are tasked with addressing a simulated security breach or malware incident. Students prepare a report or presentation that documents:</p> <ul style="list-style-type: none"> ● The steps they took to address the security incident. ● The tools and techniques they used for virus scanning, data recovery, and malware removal. ● A security improvement plan for the system, including backup and prevention strategies. 	

<ul style="list-style-type: none"> The results of the file behavior analysis and the outcomes of the system scan. 	<p>to prevent further damage.</p> <ul style="list-style-type: none"> Utilizing data recovery techniques to attempt restoration of lost files. Verifying integrity and completeness of restored files. Providing guidance on data backup practices to prevent future data loss. Performing a comprehensive scan of the system for suspicious files and directories. Analyzing file attributes and behavior patterns to identify potential threats.
<p>Family Overview</p>	<p>Pacing for Unit</p>
<p>PLTW Cybersecurity Family Overview (2024)</p>	<p>28 Days (Traditional) 14 Days (Block)</p>
<p>Unit-specific Vocabulary:</p>	<p>Integration of Technology and Aligned Unit Materials, Resources, and Technology</p>
<p>1.1 Introduction to Cybersecurity: Digital footprint, Virtual machine, Crack, Python script, Brute force attack, Dictionary attack, Encrypted, Algorithm, File extension, Authorize, Authenticate, CAPTCHA, Turing Award, Social media, Spam, Phishing, Phisher, Email source, Top-Level domain, Cyber team, Team norms</p> <p>1.2 Firewalls and Malware: Network topology, LAN, Switched topology, Router, Wireless, Services, Virus, Worm, Backdoor, Spyware, Trojan Horse, Adware, Pop-up, Operating system, Updated, Firewall, Server, Protocol, Port, Web Server, HTTP, Encrypt, Log files, Zip file, Wildcard, RAM, Environment variable, Process tree, URL, Cookies, Site certificate,</p>	
<p>Opportunities for Interdisciplinary Connections:</p>	<p>Anticipated misconceptions:</p>
<p>Potential interdisciplinary connection may integrate ethical considerations in cybersecurity with principles of civic responsibility and democratic values. Students will explore how advancements in technology intersect with civil liberties, rights, and governance, fostering critical thinking and ethical reasoning</p>	<ul style="list-style-type: none"> Cybersecurity is only applicable to government-related organizations. Individuals are not affected by and do not contribute to the security of cyberspace A good password is something that can be easily remembered or has special meaning Social networking is safe and everyone on social media can be trusted All email content is safe and can be trusted. Using the same password on all my accounts is a good and safe way for me to remember my passwords. When a computer has low or non-existent security, it only poses a risk for the users of that computer. Improving security of a network can only be done by experts. Files, folders, applications, and processes are all different from another and their management tasks have little in common. A brand new computer is automatically safe to use. When someone browses the internet, the websites they visit don't track or store much information about them, their browser, or their devices.

- Security experts already know everything they need to know to secure a computer.
- Security experts work in isolation all day
- Solving problems is a linear process and does not require any iteration.

Differentiation through *Universal Design for Learning*

UDL Indicator	Teacher Actions:
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1. I CAN describe the importance and scope of cyber security.

Engagement:
 Real-World Scenarios: Begin by discussing recent news stories about cyberattacks or data breaches (e.g., social media hacks, ransomware attacks) to illustrate the importance of cybersecurity.
 Discussion: Facilitate a class discussion on why cybersecurity is essential for individuals, businesses, and governments. Allow students to share their thoughts on how cybersecurity affects their personal lives and global events.

Representation:
 Infographics and Visuals: Use visual aids like diagrams, charts, or infographics to show the scope of cybersecurity (e.g., the types of cyber threats, the difference between cybersecurity and IT security).
 Videos/Documentaries: Show a short video or documentary that explains the global impact of cyberattacks on companies, governments, and individuals.

Action/Expression:
 Group Project: Have students work in groups to create a presentation or infographic that outlines the importance of cybersecurity in different sectors (business, healthcare, education, government).
 Reflective Writing: Ask students to write a brief reflection on how cybersecurity impacts their daily activities and what they do to protect themselves online.

2. I CAN analyze how various authentication strategies protect online information.

Engagement:
 Interactive Demo: Use an interactive demonstration of various authentication methods (e.g., passwords, biometrics, two-factor authentication) and allow students to participate in securing a fictional online account.
 Discussion/Brainstorming: Encourage students to brainstorm different types of authentication methods they've encountered, such as PIN codes, facial recognition, or hardware tokens.

Representation:
 Visual Comparisons: Provide side-by-side comparisons of different authentication strategies (e.g., password vs. biometric authentication) with pros and cons.
 Flowcharts/Diagrams: Use flowcharts or diagrams that show how authentication methods work step by step (e.g., how two-factor authentication enhances security).

Action/Expression:
 Hands-on Practice: Have students test out different authentication methods on simulated platforms (e.g., logging into websites with different authentication strategies).
 Create a Security Plan: Ask students to create a security plan for a fictional business or service, recommending appropriate authentication strategies to protect user data.

3. I CAN demonstrate the ability to protect myself and others from exposing personal information and social engineering attacks.

Engagement:
 Social Engineering Scenario: Introduce students to social engineering attacks by role-playing a phishing scam or a pretexting scenario where a "hacker" tries to gain information from a student.
 Discussion: Start a class discussion about the different types of social engineering attacks, such as phishing, baiting, or tailgating, and how they can occur both online and in physical settings.

Representation:
 Case Studies and Examples: Provide real-world examples of social engineering attacks and their consequences (e.g., emails that mimic bank communications).
 Video Examples: Show video clips or simulations of social engineering attacks to help students recognize red flags.

Action/Expression:
 Role-Playing: Have students participate in role-playing exercises where they practice responding to phishing attempts or other social engineering attacks.

Create Educational Materials: Ask students to create a poster, infographic, or video that educates others on how to recognize and protect against social engineering attacks.

4. I CAN configure a firewall to protect against malware.

Engagement:

Hands-On Lab Activity: Set up a hands-on activity where students configure a basic firewall on a virtual machine or network. Show them how to test and verify its effectiveness against malware.

Real-Life Application: Discuss scenarios where firewalls are essential, such as for protecting sensitive business data or securing a home network.

Representation:

Step-by-Step Tutorials: Provide a step-by-step visual guide or video on configuring a firewall and monitoring its performance.

Firewall Diagrams: Use diagrams to explain how firewalls function in a network, such as how they monitor and filter incoming and outgoing traffic.

Action/Expression:

Configure a Virtual Firewall: Students can configure firewalls on virtual machines or simulated systems and document their process.

Firewall Comparison: Have students compare different types of firewalls (e.g., hardware vs. software firewalls) and create a report on which is most effective for certain use cases.

5. I CAN apply safety measures for accessing and storing data.

Engagement:

Scenario-Based Learning: Present students with a variety of real-world scenarios (e.g., securing personal data on mobile devices, backing up company data, or protecting sensitive medical records) and ask them to discuss safety measures.

Discussion: Lead a discussion on common risks associated with accessing and storing data, such as unauthorized access, data loss, or identity theft.

Representation:

Checklists and Guidelines: Provide students with safety checklists or best practices for securely accessing and storing data (e.g., strong passwords, encryption, using cloud storage securely).

Visual Aids: Show diagrams of secure data storage practices (e.g., cloud encryption, physical storage devices with encryption, access control measures).

Action/Expression:

Data Protection Plan: Have students create a personal or business data protection plan, outlining steps they would take to access and store data securely.

Demonstration: Ask students to demonstrate how to apply safety measures for accessing and storing data, such as encrypting files or setting up secure cloud storage.

6. I CAN recognize and terminate suspicious processes.

Engagement:

Real-World Scenarios: Present a scenario where a computer might be infected with malware or running suspicious processes, and ask students to brainstorm how they would investigate the issue.

Interactive Demonstration: Walk through the process of identifying suspicious processes in Task Manager or Activity Monitor on a computer, explaining what each process does.

Representation:

Process Diagrams: Provide visual diagrams that show how to identify and interpret different system processes, including what typical system processes look like and how to recognize unusual activity.

Videos: Show a video that demonstrates the process of investigating and terminating suspicious processes safely.

Action/Expression:

Hands-On Investigation: Have students practice identifying and terminating suspicious processes in a virtual environment or using sandbox software.

Case Study Analysis: Ask students to analyze a case study of a system infection, identifying the suspicious processes involved and explaining how they would terminate them.

7. I CAN manage browser configuration including security settings, cookies, history, downloads, and access to resources.

Engagement:

Interactive Walkthrough: Guide students through a live demonstration of managing browser settings, including clearing history, disabling cookies, and adjusting security settings for various browsers.

Scenario-Based Learning: Ask students to consider a scenario where their browser is compromised (e.g., through tracking cookies or a malicious extension) and discuss how they would address it.

Representation:

Browser Configuration Diagrams: Provide diagrams or screenshots showing how to access and adjust different browser settings for security (e.g., blocking third-party cookies, adjusting privacy settings).

Step-by-Step Guides: Provide written or video guides for configuring browser security settings, clearing history, and managing cookies and downloads.

Action/Expression:

Hands-On Configuration: Have students individually adjust browser security settings on their own devices or virtual environments.

Browser Configuration Report: Ask students to write a report on how they would configure their browser to maximize security, explaining their reasoning for each setting.

Supporting Multilingual/English Learners

Related CELP standards:

Learning Targets:

Learning Target 1: I can describe the importance and scope of cyber security.

- **Level 1:** Can recognize basic terms related to cyber security (e.g., “computer safety,” “passwords”). May identify simple examples of cyber security, such as locking a device or using antivirus software.
- **Level 2:** Can describe the general purpose of cyber security, such as keeping personal information safe. Can identify basic cyber security threats (e.g., viruses, hackers).
- **Level 3:** Can explain the importance of cyber security in protecting personal data, sensitive business information, and online transactions. Can describe common types of cyber security threats (e.g., phishing, malware).
- **Level 4:** Can explain the scope of cyber security, discussing various aspects such as network security, data encryption, and threat detection. Can describe how cyber security practices impact individuals, businesses, and governments.
- **Level 5:** Can analyze the broader implications of cyber security on society and the global economy. Can assess the risks and strategies involved in protecting digital infrastructures, and explain the importance of staying up-to-date with evolving threats and best practices.

Learning Target 2: I can analyze how various authentication strategies protect online information.

- **Level 1:** Can recognize common authentication methods (e.g., “password,” “fingerprint”). May need support in understanding how they work to protect information.
- **Level 2:** Can describe basic authentication methods, such as passwords or PINs, and their role in protecting online accounts. Can identify the importance of keeping passwords secure.
- **Level 3:** Can explain different types of authentication strategies (e.g., two-factor authentication, biometrics, security questions) and how they enhance online security. Can describe the advantages and limitations of these methods.
- **Level 4:** Can analyze various authentication strategies, such as multi-factor authentication, and explain their effectiveness in protecting sensitive online information. Can discuss the role of encryption and secure communication protocols in authentication.
- **Level 5:** Can evaluate and compare the security of different authentication methods based on the context of use (e.g., personal accounts, corporate systems). Can recommend appropriate authentication strategies for different online environments.

Learning Target 3: I can demonstrate the ability to protect myself and others from exposing personal information and social engineering attacks.

- **Level 1:** Can recognize simple examples of social engineering (e.g., unsolicited emails or phone calls). May be able to identify basic ways to protect personal information.
- **Level 2:** Can describe common social engineering tactics, such as phishing or pretexting. Can identify actions that help protect personal information, like avoiding sharing passwords.
- **Level 3:** Can demonstrate awareness of social engineering attacks and how to avoid falling victim to them. Can explain how to protect personal information, such as using strong passwords and recognizing suspicious emails or phone calls.
- **Level 4:** Can identify specific social engineering techniques used in various online scams and describe proactive measures to prevent exposure. Can demonstrate how to secure personal information through privacy settings and cautious online behavior.

- **Level 5:** Can analyze and respond to complex social engineering scenarios, employing strategies to protect both personal and professional information. Can educate others on best practices for avoiding social engineering attacks and protecting sensitive data.

Learning Target 4: I can configure a firewall to protect against malware.

- **Level 1:** Can recognize the concept of a firewall and its basic purpose (e.g., "keeps bad stuff out"). May need assistance in understanding how to configure or use it.
- **Level 2:** Can describe what a firewall does (e.g., "blocks unwanted traffic") and can identify basic settings or options. Can recognize the importance of using a firewall for malware protection.
- **Level 3:** Can explain how a firewall works to protect against malware and can configure basic firewall settings, such as allowing or blocking specific applications or ports.
- **Level 4:** Can configure a firewall with specific rules to block malware and unauthorized access. Can describe how firewalls work in conjunction with other security tools to enhance system protection.
- **Level 5:** Can set up advanced firewall configurations to protect against malware and other cyber threats. Can analyze and adjust firewall settings based on network needs and security threats, and ensure that the firewall is optimized for maximum protection.

Learning Target 5: I can apply safety measures for accessing and storing data.

- **Level 1:** Can recognize that data needs to be protected (e.g., "don't share your passwords"). May need guidance on specific safety measures.
- **Level 2:** Can describe basic safety measures for accessing and storing data, such as using a password or encrypting files. Can identify simple ways to protect data from unauthorized access.
- **Level 3:** Can explain safety measures for securely accessing and storing data, such as using encryption, strong passwords, and multi-factor authentication. Can identify secure methods for transferring data.
- **Level 4:** Can apply safety measures to protect data while accessing it on various devices and platforms. Can securely store sensitive data using encryption, access controls, and backups.
- **Level 5:** Can design and implement comprehensive data protection strategies, including data access policies, secure storage protocols, and risk management practices. Can evaluate data security measures and make recommendations to improve data protection.

Learning Target 6: I can recognize and terminate suspicious processes.

- **Level 1:** Can recognize that suspicious processes may indicate a problem (e.g., "something isn't right" when the computer slows down). May need help identifying what constitutes a suspicious process.
- **Level 2:** Can identify basic signs of suspicious processes, such as high CPU usage or unknown programs running. May need support to terminate or manage these processes.
- **Level 3:** Can recognize and explain what constitutes suspicious processes or malware running on a device (e.g., unusual processes, unfamiliar names). Can terminate processes using basic task management tools.
- **Level 4:** Can identify and explain the behavior of suspicious processes, such as those associated with malware or unauthorized applications. Can terminate processes using advanced tools and ensure that no damage is done to the system.
- **Level 5:** Can analyze system performance to detect suspicious activity, terminate harmful processes, and mitigate risks. Can use diagnostic tools and logs to identify the source of suspicious processes and recommend solutions to prevent future issues.

Learning Target 7: I can manage browser configuration including security settings, cookies, history, downloads, and access to resources.

- **Level 1:** Can recognize that a browser has settings to adjust. May need guidance on how to manage basic security features.
- **Level 2:** Can describe basic browser settings, such as clearing history or enabling a pop-up blocker. Can adjust basic security settings, such as enabling or disabling cookies.
- **Level 3:** Can explain the function of different browser settings related to security, such as controlling cookies, clearing history, and managing downloads. Can configure a browser to block potentially harmful resources or unauthorized access.
- **Level 4:** Can manage browser security settings comprehensively, adjusting configurations for cookies, history, downloads, and access to resources. Can enable and manage settings to maximize privacy and security while browsing.
- **Level 5:** Can optimize browser configurations for security, implementing advanced settings such as sandboxing, blocking tracking scripts, and managing multiple security layers. Can educate others on how to configure browsers securely and safely access resources online.

Lesson	Learning Target	Success Criteria/Assessment/Resources
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Sequence		
1	I CAN describe the importance and scope of cyber security.	<ul style="list-style-type: none"> ● I can define cybersecurity ● I can identify insecure data sharing practices ● I can describe the impact of your digital presence.
2	I CAN analyze how various authentication strategies protect online information	<ul style="list-style-type: none"> ● I can protect my personal computer. ● I can differentiate between a strong and weak password. ● I can examine password cracking algorithms used in brute force attacks.
3	I CAN demonstrate the ability to protect myself and others from exposing personal information and social engineering attacks	<ul style="list-style-type: none"> ● I can identify unsafe practices related to social media and email. ● I can protect a social media profile. ● I can protect against spam and phishing. ● I can learn to evaluate suspicious email or websites. ● I can learn how to protect against social engineering attacks.
4	I CAN configure a firewall to protect against malware	<ul style="list-style-type: none"> ● I can discuss how network devices are connected ● I can identify types of malware
5	I CAN apply safety measures for accessing and storing data	<ul style="list-style-type: none"> ● I can discuss files and file types ● I can access files safely and identify ownership ● I can identify suspicious data on my computer ● I can encrypted files
6	I CAN recognize and terminate suspicious processes	<ul style="list-style-type: none"> ● I can manage processes and the files that launched them
7	I CAN manage browser configuration including security settings, cookies, history, downloads, and access to resources	<ul style="list-style-type: none"> ● I can differentiate between HTTP and HTTPS ● I can examine site certificates ● I can use my Google Chrome browser to improve security features.

Unit Title:

Unit 2: System Security

Relevant Standards: Bold indicates priority**COM.B Recognize documentation as an indispensable part of the security process.**

COM.B.1 Maintain a detailed record of the process and the steps used to solve a problem.

CCP.B Create a computational artifact for creative expression.

CCP.B.1 Identify a computational artifact as something created by a human using a computer and differentiate between a program, an image, audio, a video, a presentation, or a web page file.

CCP.C Deconstruct a complex problem into simpler parts.

CCP.C.1 Identify and apply solutions to subcomponents to achieve a system-wide solution.

CCP.D Describe moments within a process where curiosity, persistence, and the positive aspect of failure played an important role in gaining understanding about a problem or unexpected observation.

CCP.D.1 Describe difficulties and/or opportunities you encountered and how they were resolved or incorporated.

CCP.E Engage stakeholders in a problem and use their perspectives to shape the course of your development.

CCP.E.1 Apply cybersecurity and privacy principles to organizational requirements (relevant to confidentiality, integrity, availability, authentication, nonrepudiation). (NICE A0123)

CCP.E.2 Tailor technical and planning information to a customer's level of understanding. (NICE A0105)

CCP.E.3 Share meaningful insights about the context of an organization's threat environment that improve its risk management posture. (NICE A0120)

CCP.F Apply and describe the process based on user-centered research to solve a problem.

CCP.F.1 Apply and describe the process used during the development of a solution

CCP.F.2 Acknowledge that stages of failure and technical hurdles are typical in processes that produce positive outcomes.

IARP.A Use digital forensics investigative techniques to solve a cybercrime.

IARP.A.1 Define what constitutes a cybercrime.

IARP.B Analyze the evidence of an attack.

IARP.B.1 Identify common types of malware.

IARP.B.2 Use knowledge of historical malware attacks to evaluate modern threats.

IARP.C Design the correct level of protection by implementing the appropriate safeguards.

IARP.C.1 Describe the positive and negative outcomes of different solutions related to data confidentiality, integrity, and availability.

IARP.C.2 Compare the value of protecting information in terms of cost, levels of security, and ease of access to data.

IARP.C.3 Protect against future information threats.

IARP.D Detect and analyze the occurrence of a cybersecurity event.

IARP.D.1 Use pattern finding techniques to determine trends in attack data.

IARP.D.2 Identify malicious network traffic.

IARP.D.3 Analyze attack data to determine the source of the attack and the harmful effects it may have on the system.

IARPE Respond to a detected cybersecurity event.

IARPE.1 Communicate the event.

DAT.A Find patterns and test hypotheses about digitally processed information to gain insight and knowledge.

DAT.A.1 Identify systemic security issues based on the analysis of vulnerability and configuration data. (NICE A0001)

DAT.A.2 Apply front-end collection systems, including traffic collection, filtering, and selection, to identify security threats. (NICE K0143)

DAT.A.3 Use Boolean operators to construct simple and complex queries. (NICE S0285)

DAT.A.4 Identify hidden patterns or relationships. (NICE S0109)

DAT.B Identify personal data sharing that places people at risk and evaluate risky personal data-sharing practices.

DAT.B.1 Understand that security and privacy concerns arise with data containing personal information.

DAT.B.5 Manage browser security settings to facilitate safe browsing.

DAT.C Describe the variety of abstractions used to represent data.

DAT.C.1 Digital data is represented by abstractions at different levels.

DAT.C.2 Data is represented using different number bases such as decimal and hexadecimal.

IOC.B Analyze the impact of cybersecurity on our national security, infrastructure, economy, and public health.

- IOC.B.1 Identify the sectors of society that are at risk to cybersecurity breaches.
- IOC.B.2 Weigh the outcomes of various types of computer “hacking”, including black, white, and gray.
- IOC.B.3 Compare the motivations of different types of cybercrimes.
- IOC.B.4 Describe the impact computer security (or lack thereof) has had on society.

CTT.A Select and apply appropriate computational tools and techniques to solve a problem or create value for others.

- CTT.A.1 Select collaboration tools for data collection, writing, or protecting data.
- CTT.A.2 Navigate and use unfamiliar documentation and public information to extend the student's own knowledge and to achieve a computational approach to solve a problem.

CTT.B Apply tools with varying levels of abstraction within software, a computer, a network, and the internet.

- CTT.B.1 Recognize and discern between different levels of abstraction while working with computational tools.
- CTT.B.2 Recognize the commonalities of command line tools and their automated, scripted versions.

CSN.A Describe the modular components of a computer's hardware and software.

- CSN.A.2 Identify the broad tasks that operating systems manage, such as process management and file management.

CSN.B Identify user actions that strengthen the security of information stored on a computer.

- CSN.B.1 Navigate system files to locate files that are used to manage computer resources.
- CSN.B.2 Manage system processes and user processes.
- CSN.B.5 Manage software using configuration tools and/or parameters.

CSN.C Monitor, analyze, and manage active processes on a computer or network of computers.

- CSN.C.1 Differentiate between user and system processes.
- CSN.C.2 Identify and analyze potentially malicious/foreign processes.
- CSN.C.3 Install, analyze and remove processes.

CSN.F Identify the components (software, hardware, protocols) that allow computers to network and communicate.

- CSN.F.2 Diagram a network of computers.
- CSN.F.3 Describe networking hardware.
- CSN.F.6 Identify network system sub-components responsible for security.
- CSN.F.7 Locate and solve security problem(s) within a network system's subcomponents.

CSN.G Analyze the evidence of web exploitations, both from front-end application and backend services perspective.

- CSN.G.1 Identify websites that appear untrustworthy or dangerous to the end user.
- CSN.G.2 Analyze security weaknesses in client-side (front-end) applications.
- CSN.G.3 Analyze security weaknesses in server-side (back-end) web services.
- CSN.G.4 Protect against web-based weaknesses.

CSN.H Perform ethical hacking to discover systems strengths and weaknesses.

- CSN.H.1 Identify the risks and needs of ethical hacking.
- CSN.H.3 Analyze system security to discover vulnerabilities and exploits.

CSN.I Identify user actions that strengthen the security of a networked system.

- CSN.I.1 Recognize that the security of a network depends on the security of its individual components.
- CSN.I.2 Manage settings and configuration files of software and/or drivers to maintain the security of the network.

CSN.J Use abstractions to manage and analyze information.

- CSN.J.1 Use high- and/or low-level data analysis techniques to analyze network traffic.
- CSN.J.2 Use a variety of data representations to help analyze large or complex data.
- CSN.J.3 Identify the abstracted nature of network communication

Essential Question(s):	Enduring Understanding(s):
1.1: Why do people engage in risky behavior in cyberspace?	People engage in risky online behavior due to convenience, lack of awareness, curiosity, or overconfidence. Understanding human tendencies helps in developing strategies for safer online practices.
1.2: Is hacking ever appropriate?	While hacking is often associated with illegal activities, ethical hacking can be a legitimate and necessary practice to identify and fix vulnerabilities, ensuring stronger security systems.
1.3: What are the consequences of inappropriate behavior in cyberspace?	Inappropriate actions online can lead to personal, financial, legal, and societal repercussions. Responsible

behavior helps maintain a safer and more respectful digital environment.

2.1: Why does information need protection?

Information requires protection to maintain its privacy, reliability, and accessibility. Safeguarding data ensures trust and prevents exploitation or unauthorized use.

2.2: How do computers safely store information?

Computers use encryption, access controls, and secure storage systems to protect data, ensuring its confidentiality and integrity while minimizing risks from unauthorized access or corruption.

3.1: How does past knowledge help with data analysis?

Analyzing past trends and patterns enables better predictions and decisions, helping to identify risks and opportunities in both cybersecurity and broader contexts.

4.1: How can information be safely exchanged?

Secure exchanges rely on encryption, authentication, and safe transmission protocols, ensuring that data remains private and reaches its intended recipient without being intercepted.

4.2: What makes a network vulnerable?

Networks are vulnerable due to weak passwords, outdated software, misconfigurations, or a lack of security protocols, making them susceptible to attacks.

4.3: How can we minimize network vulnerabilities?

Network vulnerabilities can be reduced by implementing firewalls, regular updates, strong authentication measures, and continuous monitoring for potential threats.

5.1: How can malware be stopped?

Malware can be stopped through a combination of proactive defenses like antivirus software, firewalls, and education about safe online practices, as well as swift response to detected threats.

6.1: Where and how are cybersecurity skills used?

Cybersecurity skills are applied in diverse fields, including finance, healthcare, government, and technology, to protect systems, data, and people from cyber threats.

Demonstration of Learning:

Students are tasked with securing an e-commerce website. The company is facing a series of cybersecurity challenges, and the students are responsible for designing the network, implementing security protocols, and ensuring the system is secure, efficient, and compliant with best practices.

Students submit a comprehensive security plan and presentation that includes:

- A network topology diagram with an explanation of how the design meets security needs.
- A list of security measures applied (encryption, access control, firewalls, etc.) with explanations of how they contribute to confidentiality, integrity, and availability.
- A report detailing how the vulnerabilities were identified and mitigated.
- A demonstration of the functioning website with security features such as MFA, encryption, and error message configurations.
- A summary of the backup and update strategy, including security protocols for data protection.

Students will demonstrate their learning by:

- Applying CIA levels of security to an e-commerce network.
- Identifying hardware necessary to create networks.
- Identifying network topology and creating a diagram to meet the security needs.
- Removing an unnecessary service (SMTP mail)
- Configuring error messages to be less revealing of system information.
- Classifying data based on sensitivity
- Implementing encryption protocols (e.g., SSL/TLS) to protect sensitive data during transmission.
- Utilizing strong access controls and authentication mechanisms to safeguard data access.
- Identifying potential vulnerabilities such as SQL injection, cross-site scripting (XSS), and inadequate authentication mechanisms.
- Implementing firewalls, intrusion detection systems (IDS), and intrusion prevention systems (IPS) to monitor and block malicious activity.
- Regularly updating and patching software to protect against known vulnerabilities.
- Using multi-factor authentication (MFA) for employee access to sensitive systems and data.
- Ensuring secure backups of data to mitigate risks of data loss due to cyber incidents.
- Balancing security measures with user

	<p>experience to ensure smooth website functionality.</p> <ul style="list-style-type: none"> Optimizing website performance to handle high e-commerce traffic while maintaining security measures.
Family Overview	Pacing for Unit
PLTW Cybersecurity Family Overview (2024)	33 Days (Traditional) 17 Days (Block)
Unit-specific Vocabulary:	Integration of Technology & Aligned Unit Materials, Resources, and Technology
<p>Section 2.1: E-Commerce, CIA Triad, Confidentiality, Availability, Integrity, Internet of Things, Passive Analysis, Protocol, host, URL, Web server, port, information architecture, domain name, IP Address, Security Baseline, Firewall, Topology</p> <p>Section 2.2: Unauthorized Hacking, Authorized Hacking, Ethical Hackers, Script Kiddie, Insider, Hacktivist, Cyber Syndicate, Warfare/Espionage, DDoS, Botnet, Keylogger, On Path Attack, Ransomware, Rootkit, Programming Errors, Ping Flood, Ping of Death, Smurf Attack, Mailbomb, Teardrop, site Certificate, Decrypt, Penetration test, Log Files, Forceful Browsing, Attack Surface, Loose-Lipped Error</p> <p>Section 2.3: Client, Abstracted, Exploits, Tag, Comment, Cross-site scripting, Linux, SQL Injection, Routing Table, Packet Sniffer, Packet Filtering, MAC Address, Front-end, Back-end, pcap File, Organizationally Unique Identifier, Network Interface Card, Broadcast, Transmission Control Protocol (TCP), TCP handshake, Transport Layer Security (TLS),</p>	
Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:
<p>Potential interdisciplinary connection may integrate ethical considerations in cybersecurity with principles of civic responsibility and democratic values. Students will explore how advancements in technology intersect with civil liberties, rights, and governance, fostering critical thinking and ethical reasoning</p>	<ul style="list-style-type: none"> Data on the internet is always secured with high confidentiality, high integrity, and is always available to its users. Websites do not share user information and browsing habits with other services. All data on a website is stored on one computer Data on the internet is always secured with high confidentiality, high integrity, and is always available to its users. All types of hacking are bad. Successful cyberattacks can only be carried out by sophisticated experts. Vulnerabilities of a website are only caused by poor programming techniques. Using default configurations is not a security risk. The more services a server provides the better. Using default configurations is not a security risk. The more services a server provides the better. Email service is necessary for all servers. Error messages are cryptic and do not provide useful information. Websites can only be exploited on the server level. It's okay to exploit a website as long as you don't

- intend to use any information you may come across in the process.
- When information is sent or received over the internet, it is transferred all at once.
 - All malware is sophisticated and difficult to detect or stop.
 - Log-in usernames and passwords are always hidden or kept secret when transferred around the internet, especially passwords because they're masked in the user interface, like *****.
 - Once I am fully trained as a cybersecurity expert, my education will be complete.
 - Security experts work in isolation all day.
 - Solving problems is a linear process and does not require any iteration.

Differentiation through *Universal Design for Learning*

UDL Indicator

Teacher Actions:

1. I CAN use the CIA triad to design a network security plan.

Engagement:

Real-World Examples: Start by discussing high-profile security breaches where the CIA triad (Confidentiality, Integrity, and Availability) could have been applied to prevent or mitigate the attack.
 Scenario-Based Learning: Present a scenario (e.g., designing a security plan for an e-commerce site) and ask students how they would apply each element of the CIA triad.

Representation:

Infographics and Diagrams: Provide visual representations of the CIA triad and how each component relates to network security. Use simple diagrams to show the interplay between confidentiality, integrity, and availability in a network security plan.
 Step-by-Step Guides: Offer a step-by-step guide on how to design a network security plan using the CIA triad, explaining key concepts like encryption (Confidentiality), checksums (Integrity), and backup systems (Availability).

Action/Expression:

Create a Network Security Plan: Have students use the CIA triad to design a network security plan for a hypothetical company, considering aspects like data encryption, user authentication, and network uptime.
 Peer Review: Ask students to present their security plans to classmates, followed by peer feedback on how well they applied the CIA triad.

2. I CAN analyze computer systems while causing minimal impact.

Engagement:

Ethical Hacking Introduction: Begin with a discussion on ethical hacking, emphasizing the importance of conducting security analyses without disrupting system operations. Use real-world examples of ethical hackers performing security audits for companies.
 Safety and Ethics Discussion: Have students discuss the ethical considerations of system analysis and the consequences of causing disruptions in a production environment.

Representation:

Simulation Tools: Provide access to simulation tools (e.g., virtual machines, penetration testing environments) where students can practice analyzing computer systems safely without impacting real systems.
 Case Studies: Present case studies of ethical hacking, highlighting how attackers can exploit systems and how minimal-impact analysis tools were used to identify vulnerabilities.

Action/Expression:

Hands-On Practice: In a controlled environment (e.g., using virtual labs), have students perform penetration testing and vulnerability scanning with tools like Nmap or Nessus, ensuring minimal disruption.
 Document Findings: Ask students to write a report on their findings from a system analysis, focusing on the security vulnerabilities they identified and how to fix them without causing system downtime.

3. I CAN identify network topology and create a diagram to meet the security needs.

Engagement:

Network Design Scenarios: Start with examples of different network topologies (e.g., star, bus, ring, mesh) and how they impact security. Discuss the benefits and challenges of each topology in securing a network.
Interactive Discussions: Engage students by discussing real-world network setups and how they are designed with security in mind (e.g., a corporate LAN vs. a home network).

Representation:

Network Diagrams: Provide students with pre-made network topology diagrams and explain how each component (routers, firewalls, switches) contributes to security.

Diagramming Tools: Introduce network diagramming software (e.g., Lucidchart, Microsoft Visio) and show how students can create and analyze security-focused network diagrams.

Action/Expression:

Create a Network Diagram: Have students design a network topology diagram that reflects security best practices (e.g., segmented networks, firewalls, DMZ) to meet specific needs (e.g., securing a financial institution).

Peer Review: Students can present their network diagrams to peers, explaining how their design addresses potential security vulnerabilities.

4. I CAN analyze a notorious malware attack called Stuxnet.

Engagement:

Real-World Case Study: Introduce the Stuxnet malware attack, a sophisticated cyberattack that targeted Iran's nuclear facilities, and discuss its impact on global cybersecurity.

Group Discussion: Facilitate a class discussion about the Stuxnet attack: how it was carried out, what vulnerabilities were exploited, and its implications for the future of cybersecurity.

Representation:

Documentaries/Case Studies: Show a video or documentary on Stuxnet to give students a deeper understanding of how the attack unfolded and how it was detected.

Timeline of Events: Provide a detailed timeline of the Stuxnet attack, breaking it down into phases (e.g., initial infection, spread, targeting, and discovery).

Action/Expression:

Research Assignment: Assign students to research the Stuxnet attack and write a report analyzing how it worked, the vulnerabilities it exploited, and the lessons learned.

Class Presentation: Students can present their findings on Stuxnet, proposing ways that similar attacks could be prevented in future systems.

5. I CAN exploit a website by uploading files to its root directory using anonymous FTP.

Engagement:

Ethical Hacking Discussion: Introduce the concept of anonymous FTP and its vulnerabilities. Discuss ethical considerations and the legal implications of exploiting website vulnerabilities.

Interactive Activity: Start with a demo or simulation that shows how FTP can be used to upload files and exploit websites.

Representation:

Step-by-Step Guide: Provide a detailed guide on how an attacker might exploit anonymous FTP access, and then explain how to protect against it (e.g., disabling anonymous FTP access).

Diagrams: Show diagrams of FTP file transfers and root directory structures to help students visualize how file uploads can lead to vulnerabilities.

Action/Expression:

Simulated Attack: In a controlled environment (e.g., virtual labs), allow students to perform an exploit by uploading files to a test server's root directory and then ask them to demonstrate how to mitigate this risk.

Report on Mitigation: After completing the task, students should create a report explaining how they exploited the vulnerability and the steps necessary to prevent such an attack.

6. I CAN disable directory browsing from a client's web browser.

Engagement:

Security Scenarios: Begin with examples of how directory browsing can expose sensitive information on a website. Discuss how attackers can exploit this feature to gather files from a web server.

Discussion: Lead a class discussion on why disabling directory browsing is important and how it helps prevent unauthorized access to server files.

Representation:

Step-by-Step Tutorial: Provide a step-by-step guide on how to disable directory browsing in different web servers (e.g., Apache, Nginx).

Visual Examples: Show examples of a website's file structure with and without directory browsing enabled to help students understand the impact of this security setting.

Action/Expression:

Hands-On Configuration: Have students practice disabling directory browsing on a local or virtual web server.
Write a Report: After disabling directory browsing, students should document the process, explaining the importance of this setting in securing web applications.

7. I CAN manage and protect data from client-initiated attacks.

Engagement:

Real-World Attacks: Start with examples of client-initiated attacks such as SQL injection, cross-site scripting (XSS), or clickjacking, and explain how attackers target vulnerabilities in client systems.
Interactive Quiz: Use a quiz or game to test students' knowledge of common client-initiated attack techniques and the impact they can have on data protection.

Representation:

Visual Diagrams: Provide diagrams that show how client-initiated attacks work, including attack vectors and defense mechanisms.
Video Tutorials: Use videos to demonstrate how these attacks can be prevented, focusing on secure coding practices, input validation, and using firewalls to block malicious requests.

Action/Expression:

Simulate an Attack: Have students simulate a client-initiated attack on a test website and then work on implementing protections such as input validation or using prepared statements to prevent SQL injection.
Create a Data Protection Plan: Students can create a plan for protecting client data in an application, specifying security measures like encryption, secure sockets layer (SSL), and regular updates.

8. I CAN use Wireshark to identify attack data related to a common network tool.

Engagement:

Introduction to Wireshark: Introduce Wireshark as a tool for network analysis and packet sniffing. Start with a demonstration of how to use Wireshark to monitor network traffic.
Attack Scenarios: Present scenarios in which Wireshark can help detect common attacks (e.g., DDoS, MITM attacks, DNS poisoning).

Representation:

Wireshark Walkthrough: Provide a walkthrough of Wireshark's interface, explaining how to capture, filter, and analyze network packets. Show examples of attack data in the packet logs.
Attack Case Studies: Use case studies to demonstrate how Wireshark was used to identify and mitigate network attacks in real-world situations.

Action/Expression:

Hands-On Lab: Have students capture network traffic using Wireshark and analyze it for signs of attack (e.g., unusual traffic patterns or suspicious protocols).
Reporting Findings: Students should write a report detailing the attack data they identified, explaining the type of attack and how Wireshark helped detect it.

Supporting Multilingual/English Learners

Related [CELP standards:](#)

Learning Targets:

Learning Target 1: I can use the CIA triad to design a network security plan.

- **Level 1:** Can recognize the basic concepts of the CIA triad (Confidentiality, Integrity, Availability) with support. May be able to identify simple examples of network security.
- **Level 2:** Can describe the three components of the CIA triad and their role in network security (e.g., keeping data private, ensuring it's not altered, and accessible when needed).
- **Level 3:** Can explain how the CIA triad informs decisions in network security, including how to balance the three principles when designing a network security plan.
- **Level 4:** Can apply the CIA triad to design a basic network security plan, ensuring that confidentiality, integrity, and availability are addressed through access controls, encryption, and redundancy.
- **Level 5:** Can design a comprehensive network security plan incorporating the CIA triad principles, including advanced techniques like encryption protocols, secure access policies, and disaster recovery planning. Can analyze and adjust security measures based on real-world threats and business requirements.

Learning Target 2: I can analyze computer systems while causing minimal impact.

- **Level 1:** Can recognize that computer systems should be analyzed in a way that does not cause harm. May need support in understanding how to perform safe analysis.

- **Level 2:** Can describe basic methods for analyzing computer systems, such as using diagnostic tools or checking system performance, while minimizing impact (e.g., avoiding system crashes).
- **Level 3:** Can explain and apply techniques for analyzing computer systems without disrupting normal operations (e.g., using non-intrusive scanning tools or running tests in controlled environments).
- **Level 4:** Can perform detailed system analysis while minimizing risk and system downtime. Can use advanced tools (e.g., virtual machines or sandbox environments) to perform tests without impacting the production environment.
- **Level 5:** Can perform comprehensive system analysis with minimal impact on system functionality. Can identify and mitigate potential risks during analysis and use advanced methodologies (e.g., penetration testing, forensic analysis) to ensure systems remain secure during review.

Learning Target 3: I can identify network topology and create a diagram to meet the security needs.

- **Level 1:** Can recognize basic network components (e.g., routers, switches, devices). May need assistance in understanding network topology and security requirements.
- **Level 2:** Can describe simple network topologies (e.g., star, bus, mesh) and their basic components. Can identify some security needs in a basic network.
- **Level 3:** Can explain the concept of network topology and how different types of topologies influence security measures. Can create a simple network diagram that meets basic security requirements (e.g., firewalls, VPNs).
- **Level 4:** Can analyze the security needs of a network and create a detailed network diagram that incorporates security features such as access control lists (ACLs), firewalls, and intrusion detection/prevention systems (IDPS).
- **Level 5:** Can design and document advanced network topologies that address complex security needs, including multi-layer security, redundancy, and segmentation. Can create diagrams that balance both performance and security, ensuring scalability and fault tolerance.

Learning Target 4: I can analyze a notorious malware attack called Stuxnet.

- **Level 1:** Can recognize the term "Stuxnet" and understand it as a type of malware. May need assistance in grasping its impact.
- **Level 2:** Can describe the basics of the Stuxnet malware attack, such as it being a virus that targeted industrial systems. Can identify the affected systems (e.g., SCADA systems).
- **Level 3:** Can explain how Stuxnet was able to exploit vulnerabilities and spread across networks. Can describe the basic mechanism of how it caused damage to industrial control systems.
- **Level 4:** Can analyze the detailed functioning of Stuxnet, identifying specific vulnerabilities it exploited, such as zero-day exploits, and its impact on critical infrastructure. Can discuss its historical significance in the context of cyber warfare.
- **Level 5:** Can critically evaluate Stuxnet as a case study in cyber threats, discussing its implications on international cybersecurity policy, advanced malware tactics, and the future of industrial security. Can recommend security strategies to defend against similar attacks.

Learning Target 5: I can exploit a website by uploading files to its root directory using anonymous FTP.

- **Level 1:** Can recognize the concept of FTP (File Transfer Protocol) and understand the potential risks of improper configuration. May need support in understanding how anonymous FTP works.
- **Level 2:** Can describe what FTP is and how it can be used to upload files to a website. Can explain the potential vulnerabilities of anonymous FTP access.
- **Level 3:** Can demonstrate how improper FTP configuration can allow unauthorized file uploads to a website. Can describe the risks associated with anonymous FTP access.
- **Level 4:** Can exploit a website by uploading files to its root directory through anonymous FTP in a controlled, ethical hacking environment. Can identify vulnerabilities in FTP configuration that could allow this type of attack.
- **Level 5:** Can assess and exploit FTP misconfigurations to identify potential security flaws, while understanding the ethical implications. Can recommend corrective measures, such as disabling anonymous FTP, enforcing authentication, and securing FTP access to prevent such attacks.

Learning Target 6: I can disable directory browsing from a client's web browser.

- **Level 1:** Can recognize that directory browsing is a potential security risk. May need assistance in understanding how to disable it.
- **Level 2:** Can describe what directory browsing is and why it might be a security concern. Can explain the basic concept of restricting web server access to directories.
- **Level 3:** Can explain how to disable directory browsing in a web server configuration (e.g., through .htaccess

file or server settings). Can identify the risks of allowing directory browsing.

- **Level 4:** Can configure a web server to prevent directory browsing, enhancing security by limiting the visibility of directory contents. Can apply these settings across various types of web servers (e.g., Apache, Nginx).
- **Level 5:** Can implement and test directory browsing restrictions across a range of web applications, ensuring that server configurations are secure and robust against unauthorized access. Can educate clients on the risks of directory browsing and recommend security best practices.

Learning Target 7: I can manage and protect data from client-initiated attacks.

- **Level 1:** Can recognize that data protection is important when interacting with clients. May need assistance in understanding how client-initiated attacks work.
- **Level 2:** Can describe basic methods to protect data from attacks, such as using passwords or encrypting sensitive information. Can identify some types of client-initiated attacks (e.g., phishing, SQL injection).
- **Level 3:** Can explain how to protect data from client-initiated attacks by using techniques like encryption, input validation, and secure authentication. Can describe common attack vectors and how they target data.
- **Level 4:** Can implement strategies to protect data from client-initiated attacks, including secure communication protocols (e.g., HTTPS), data validation, and access control. Can monitor and respond to potential security incidents.
- **Level 5:** Can develop comprehensive security policies and procedures to safeguard data from client-initiated attacks. Can use advanced techniques like threat modeling, penetration testing, and security audits to identify and mitigate vulnerabilities before attacks occur.

Learning Target 8: I can use Wireshark to identify attack data related to a common network tool.

- **Level 1:** Can recognize the basic purpose of Wireshark (e.g., capturing network traffic). May need guidance in understanding how to use it to detect attacks.
- **Level 2:** Can describe how Wireshark captures network data and how it can be used to monitor network traffic. Can identify simple network traffic patterns.
- **Level 3:** Can use Wireshark to capture and analyze network traffic, identifying basic indicators of network attacks (e.g., unusual traffic spikes, unauthorized requests).
- **Level 4:** Can analyze network traffic in detail using Wireshark, identifying attack patterns (e.g., denial-of-service, man-in-the-middle). Can use filters to isolate relevant data related to a suspected attack.
- **Level 5:** Can use Wireshark to conduct in-depth network analysis, identifying complex attack data, such as advanced persistent threats or malware communication. Can apply expert-level knowledge to interpret traffic and identify sophisticated attack vectors.

Lesson Sequence	Learning Target	Success Criteria/Assessment/Resources
1	I CAN use the CIA triad to design a network security plan	<ul style="list-style-type: none"> ● I can discuss data confidentiality, integrity, and availability ● I can define the internet of things ● I can protect against website tracking
2	I CAN analyze computer systems while causing minimal impact	<ul style="list-style-type: none"> ● I can identify web ownership ● I can observe website traffic ● I can learn about domain names and IP addresses ● I can identify ports and their services
3	I CAN identify network topology and create a diagram to meet the security needs.	<ul style="list-style-type: none"> ● I can apply CIA levels of security to the e-commerce architecture of the Bikes, Boards, and Beyond network ● I can identify hardware necessary to create the network
4	I CAN analyze a notorious malware attack called Stuxnet	<ul style="list-style-type: none"> ● I can define malware ● I can discuss motivations of malicious users ● I can identify malware types and levels of sophistication
5	I CAN exploit a website by uploading files to its root directory using anonymous FTP.	<ul style="list-style-type: none"> ● I can understand how web servers organize files ● I can investigate a web server for directory browsing and log file location vulnerabilities

		<ul style="list-style-type: none"> • I can use anonymous FTP to update a web server.
6	I CAN disable directory browsing from a client's web browser	<ul style="list-style-type: none"> • I can mitigate web server vulnerabilities including directory browsing, default log file location, and anonymous FTP
7	I CAN manage and protect data from client-initiated attacks.	<ul style="list-style-type: none"> • I can identify client-server architecture. • I can explore JavaScript programs. • I can recognize and mitigated cross-site scripting exploits and SQL injection exploits
8	I CAN use Wireshark to identify attack data related to a common network tool	<ul style="list-style-type: none"> • I can learn basic network topology • I can monitor and analyze data packets • I can witness and mitigate a ping flood attack

Unit Title:

Unit 3: Network Security

Relevant Standards: Bold indicates priority

COM.B Recognize documentation as an indispensable part of the security process.

COM.B.1 Maintain a detailed record of the process and the steps used to solve a problem.

ERM.C Access safely, manage safely, and attribute information using effective and secure strategies.

ERM.C.1 Use advance search tools, Boolean logic, and key words to refine the search focus and/or limit search results based on a variety of factors (e.g., limiting by domain or site).

CCP.B Create a computational artifact for creative expression.

CCP.B.1 Identify a computational artifact as something created by a human using a computer and differentiate between a program, an image, audio, a video, a presentation, or a web page file.

CCP.C Deconstruct a complex problem into simpler parts.

CCP.C.1 Identify and apply solutions to subcomponents to achieve a system-wide solution.

CCP.E Engage stakeholder in a problem and use their perspectives to shape the course of your development.

CCP.E.1 Apply cybersecurity and privacy principles to organizational requirements (relevant to confidentiality, integrity, availability, authentication, nonrepudiation). (NICE A0123)

CCP.E.3 Share meaningful insights about the context of an organization's threat environment that improve its risk management posture. (NICE A0120)

CCP.F Apply and describe the process based on user-centered research to solve a problem.

CCP.F.1 Apply and describe the process used during the development of a solution

CCP.F.2 Acknowledge that stages of failure and technical hurdles are typical in processes that produce positive outcomes.

IARP.B Analyze the evidence of an attack.

IARP.B.1 Identify common types of malware.

IARP.B.2 Use knowledge of historical malware attacks to evaluate modern threats.

IARPC Design the correct level of protection by implementing the appropriate safeguards.

IARPC.3 Protect against future information threats.

IARP.D Detect and analyze the occurrence of a cybersecurity event.

IARP.D.1 Use pattern finding techniques to determine trends in attack data.

IARP.D.2 Identify malicious network traffic.

IARP.D.3 Analyze attack data to determine the source of the attack and the harmful effects it may have on the system.

IARPE Respond to a detected cybersecurity event.

IARPE.1 Communicate the event.

IARPE.2 Discuss recovery methods for data, capabilities, or services that were impaired due to a cybersecurity event.

IARPE.3 Remove threats and update protections.

DAT.A Find patterns and test hypotheses about digitally processed information to gain insight and knowledge.

DAT.A.1 Identify systemic security issues based on the analysis of vulnerability and configuration data. (NICE A0001)

DAT.A.2 Apply front-end collection systems, including traffic collection, filtering, and selection, to identify security threats. (NICE K0143)

DAT.A.3 Use Boolean operators to construct simple and complex queries. (NICE S0285)

DAT.A.4 Identify hidden patterns or relationships. (NICE S0109)

DAT.C Describe the variety of abstractions used to represent data.

DAT.C.1 Digital data is represented by abstractions at different levels.

DAT.C.2 Data is represented using different number bases such as decimal and hexadecimal.

IOC.B Analyze the impact of cybersecurity on our national security, infrastructure, economy, and public health.

IOC.B.1 Identify the sectors of society that are at risk to cybersecurity breaches.

IOC.B.2 Weigh the outcomes of various types of computer "hacking", including black, white, and gray.

IOC.B.3 Compare the motivations of different types of cybercrimes.

CTT.A Select and apply appropriate computational tools and techniques to solve a problem or create value for others.

CTT.A.1 Select collaboration tools for data collection, writing, or protecting data.

CTT.A.2 Navigate and use unfamiliar documentation and public information to extend the student's own

knowledge and to achieve a computational approach to solve a problem.

CTT.B Apply tools with varying levels of abstraction within software, a computer, a network, and the internet.

CTT.B.1 Recognize and discern between different levels of abstraction while working with computational tools.

CTT.B.2 Recognize the commonalities of command line tools and their automated, scripted versions.

SA.B Express an algorithm in a language.

SA.B.1 Analyze software algorithms and configuration files, including comments or pseudocode.

SA.C Use encryption algorithms to secure information.

SA.C.3 Apply encryption algorithms to encode or decode data digitally.

CSN.A Describe the modular components of a computer's hardware and software.

CSN.A.1 Identify the hardware components of a computer.

CSN.A.2 Identify the broad tasks that operating systems manage, such as process management and file management.

CSN.B Identify user actions that strengthen the security of information stored on a computer.

CSN.B.1 Navigate system files to locate files that are used to manage computer resources.

CSN.B.2 Manage system processes and user processes.

CSN.B.3 Create strong passphrases.

CSN.B.4 Install and manage protective software, including updates and removal.

CSN.B.5 Manage software using configuration tools and/or parameters.

CSN.C Monitor, analyze, and manage active processes on a computer or network of computers.

CSN.C.1 Differentiate between user and system processes.

CSN.C.2 Identify and analyze potentially malicious/foreign processes.

CSN.C.3 Install, analyze and remove processes.

CSN.D Gain understanding of how an operating system is structured and works by navigating the file system and modifying files, extensions, rights, and visibility to better protect data.

CSN.D.1 Traverse a file system using command lines.

CSN.D.2 Use ownership and permissions to analyze digital assets.

CSN.D.3 Change file extensions and predict the effects of the change.

CSN.D.4 Manage file types, access rights, and visibility of files.

CSN.D.5 Organize a file system.

CSN.D.6 Search a file system.

CSN.F Identify the components (software, hardware, protocols) that allow computers to network and communicate.

CSN.F.1 Define the boundary of a network (the network edge)

CSN.F.2 Diagram a network of computers.

CSN.F.3 Describe networking hardware.

CSN.F.4 Determine the security configurations of a wireless network.

CSN.F.6 Identify network system sub-components responsible for security.

CSN.F.7 Locate and solve security problem(s) within a network system's subcomponents.

CSN.G Analyze the evidence of web exploitations, both from front-end application and backend services perspective.

CSN.G.2 Analyze security weaknesses in client-side (front-end) applications.

CSN.G.3 Analyze security weaknesses in server-side (back-end) web services.

CSN.G.4 Protect against web-based weaknesses.

CSN.H Perform ethical hacking to discover systems strengths and weaknesses.

CSN.H.1 Identify the risks and needs of ethical hacking.

CSN.H.2 Identify the various stages of ethical hacking.

CSN.H.3 Analyze system security to discover vulnerabilities and exploits.

CSN.I Identify user actions that strengthen the security of a networked system.

CSN.I.1 Recognize that the security of a network depends on the security of its individual components.

CSN.I.2 Manage settings and configuration files of software and/or drivers to maintain the security of the network.

CSN.J Use abstractions to manage and analyze information.

CSN.J.1 Use high- and/or low-level data analysis techniques to analyze network traffic.

CSN.J.2 Use a variety of data representations to help analyze large or complex data.

CSN.J.3 Identify the abstracted nature of network communication

Essential Question(s):

Enduring Understanding(s):

- 1.2: Is hacking ever appropriate?
Hacking can be ethical when used to identify and fix security vulnerabilities. This practice, known as ethical hacking, helps protect systems and data while promoting responsible and lawful behavior in cyberspace.
- 2.2: How do computers safely store information?
Computers use encryption, secure storage practices, and access controls to protect data, ensuring it is kept private, accurate, and safe from unauthorized access or alteration.
- 3.1: How does past knowledge help with data analysis?
Using historical data helps identify patterns, predict outcomes, and make informed decisions. In cybersecurity, understanding past events aids in recognizing potential threats and improving defenses.
- 4.1: How can information be safely exchanged?
Safe information exchange relies on encryption, secure communication protocols, and authentication to prevent unauthorized access and protect data integrity during transmission.
- 4.2: What makes a network vulnerable?
Networks are vulnerable due to weak security measures, outdated software, misconfigurations, and human error. Identifying and addressing these weaknesses is crucial to maintaining secure systems.
- 5.1: How can malware be stopped?
Malware can be prevented and stopped through a combination of proactive measures like antivirus software, firewalls, education, regular updates, and swift responses to threats.
- 6.1: Where and how are cybersecurity skills used?
Cybersecurity skills are essential across industries like healthcare, finance, government, and technology, where they protect sensitive information, maintain system integrity, and defend against cyberattacks.
- 7.1: What makes a good cyber team?
A good cyber team is built on collaboration, diverse skills, effective communication, and professionalism. Team members must work together to solve problems, adapt to new challenges, and uphold ethical standards in cybersecurity.

Demonstration of Learning:

<p>A comprehensive penetration testing and malware detection exercise on a Linux-based system. In this scenario, students will be tasked with detecting, analyzing, and responding to a series of simulated security incidents on a Linux system. Here's how you could break it down:</p> <p>Students submit the following documentation as part of their final demonstration:</p> <ul style="list-style-type: none"> Malware Detection and Removal Report: Including a list of detected malware, processes, files, and steps taken to remove them. Pen Test Report: Detailing reconnaissance, vulnerabilities discovered, exploitation attempts, and remediation actions. Security Incident Response Report: Documenting the breach, response, and recovery efforts. Packet Analysis Report: Highlighting the differences between normal and malicious traffic and suggesting how such traffic can be detected. Log and Traffic Analysis Report: Explaining where the security breach occurred, how it was identified through log and traffic analysis, and recommendations for future monitoring. 	<p>Students will demonstrate their learning by:</p> <ul style="list-style-type: none"> Detecting malware on a Linux®-based operating system. Identifying malicious files, processes, and users on the system. Securing a system by removing the detected malware. Using reconnaissance, scanning, compromise, and remediation to identify and remove system vulnerabilities. Creating a Pen Test report. Using packet analysis to compare safe, normal traffic to suspicious, malicious traffic. Creating a Security Incident Response Report. Analyzing network logs and traffic patterns to pinpoint where security breaches occur
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Family Overview	Pacing for Unit
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PLTW Cybersecurity Family Overview (2024)	46 Days (Traditional) 23 Days (Block)
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Unit-specific Vocabulary:	Integration of Technology & Aligned Unit Materials, Resources, and Technology
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<p>3.1 Files and Processes: File system, Argument, Concatenate, Access control, AASCII, GNU, Open source, Shell, Pipe, Spawn, Background process, Root directory,</p> <p>3.2 Attacks from the Net: Abstraction, Security baseline, Subnet, Ethical hacking, Reconnaissance, Scanning, Compromise, Remediation, Service, TCP handshake, Banner grabbing, Security framework, NIC</p> <p>3.3 Analyzing the Net: Packet-switched, Address Resolution Protocol (ARP), ARP poisoning, Internet Control Messaging Protocol (ICMP), DoS, Maximum Transition Unit (MTU), Ethernet, Encryption, Spectrum analyzer, IEEE, Channels, WAP, WEP, Authentication protocol</p>	
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Opportunities for Interdisciplinary Connections:	Anticipated misconceptions:
<p>Potential interdisciplinary connection may integrate ethical considerations in cybersecurity with principles of civic responsibility and democratic values. Students will explore how advancements in technology intersect with civil liberties, rights, and governance, fostering critical thinking and ethical reasoning</p>	<ul style="list-style-type: none"> • All operating systems are the same, they just have different names • Cybersecurity careers are all technical. • Cybersecurity educational paths always require a four-year college degree. • Cybersecurity career opportunities are limited. • Network traffic is always different so patterns of normal traffic cannot be determined. • There is no way to detect unusual activity on a network • Firewall rules are only configured on the physical pfSense firewall (the edge of the network). • Hacking is always harmful to a network and only done by cyber attackers. • It is completely acceptable to use scanning and compromise tools to investigate public hosts on the internet, as long as we don't intend to do major harm. • Packets are too detailed to be used to analyze larger issues like exploits and malware. • Malicious network traffic does not look anything like legitimate, healthy network traffic. • Network traffic changes drastically between network configurations, and it is difficult to apply previous knowledge to new traffic. • A slow network is always due to heavy traffic or low bandwidth.

Differentiation through *Universal Design for Learning*

UDL Indicator	Teacher Actions:
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<p>1. I CAN use the command line to navigate the file system and to manage files and directories.</p> <p><i>Engagement:</i> Start with an interactive demonstration of common command-line commands (e.g., <code>cd</code>, <code>ls</code>, <code>mkdir</code>, <code>rm</code>) in a terminal, allowing students to follow along. Present practical scenarios, such as organizing a project directory or cleaning up files, to show the relevance of mastering command-line navigation.</p> <p><i>Representation:</i> Provide students with visual command-line cheat sheets or slides with syntax examples and common commands for file management. Show the command structure (e.g., <code>command [options] [arguments]</code>) with explanations of what each part does.</p> <p><i>Action/Expression:</i> Have students practice by navigating the file system, creating directories, moving files, and deleting files using</p>

the command line. Assign a project where students must organize files in a directory structure and then manage or back up their files using specific commands.

2. I CAN utilize ownership and permission setting to analyze files.

Engagement:

Begin with an example of a company where sensitive files need restricted access. Ask students why setting ownership and permissions is important in such environments. Facilitate a class discussion on how misconfigured permissions can lead to security breaches or unauthorized access.

Representation:

Provide diagrams or charts showing how ownership and permissions work in Linux, including user, group, and other categories. Use a detailed step-by-step guide to show how to check and modify file permissions using commands like `chmod`, `chown`, and `chgrp`.

Action/Expression:

Have students practice changing file ownership and permissions using the `chown` and `chmod` commands to allow or deny access. Ask students to review a set of files with incorrectly set permissions and identify the problems, then fix the permissions according to best practices.

3. I CAN manage processes and services in a Linux®-based system.

Engagement:

Start with a scenario where managing services (e.g., a web server) is critical for system performance or security. Ask students how they think processes and services are managed on a server and why it's important to be able to start, stop, or monitor them.

Representation:

Use flowcharts to illustrate how processes are managed in Linux, showing parent-child relationships and process IDs (PIDs). Provide a list of useful commands like `ps`, `top`, `kill`, `systemctl`, and `service`, explaining their purpose and syntax.

Action/Expression:

Have students list running processes using `ps` and `top`, and stop or restart services using `systemctl` or `service`. Ask students to configure a service (e.g., Apache or SSH) to start at boot and then manually start and stop the service.

4. I CAN create an education/career plan.

Engagement:

Begin with a discussion on various careers in cybersecurity, networking, and IT, and how creating a plan can help students achieve their career goals. Invite professionals from the industry to discuss their career paths and provide advice on how to get started in the field.

Representation:

Provide students with a framework for setting long-term goals, such as SMART goals (Specific, Measurable, Achievable, Relevant, Time-bound). Provide examples of common career paths (e.g., cybersecurity analyst, network engineer) and certifications or degrees that help students advance.

Action/Expression:

Have students create a career plan that outlines their current skills, desired career, and the steps they will take (e.g., certifications, degrees, experience) to reach their goal. Have students share and provide feedback on each other's career plans, offering suggestions and advice.

5. I CAN create a security baseline of network traffic.

Engagement:

Present a scenario where students need to establish a baseline of normal network traffic for a company. Discuss why this baseline is important for identifying malicious activity. Provide a simulated network environment where students can observe normal traffic patterns and discuss what constitutes "normal" vs. "abnormal."

Representation:

Use network diagrams to show what typical traffic should look like under normal conditions and how anomalies might be detected. Introduce traffic analysis tools like Wireshark and NetFlow, showing how they can be used to establish and monitor a baseline.

Action/Expression:

Have students use network monitoring tools to capture traffic data and establish a baseline of what normal traffic looks like for a test network. Ask students to document their findings, outlining what types of traffic are normal and what constitutes suspicious activity.

6. I CAN configure firewall rules to improve security.

Engagement:

Begin by discussing the role of firewalls in protecting a network and why configuring them properly is critical. Use case studies of real network attacks where poorly configured firewalls were a contributing factor to a security breach.

Representation:

Provide examples of firewall configuration rules (e.g., blocking certain ports, allowing specific IP addresses). Show firewall rule diagrams illustrating how traffic flows through different ports and how rules are applied to allow or deny traffic.

Action/Expression:

Have students configure firewall rules using `iptables` or `ufw` on a Linux system to control incoming and outgoing traffic based on specified criteria. Assign a lab where students must configure a firewall to allow necessary traffic (e.g., web traffic) while blocking unwanted traffic (e.g., HTTP on non-standard ports).

7. I CAN apply ethical hacking techniques to test and identify system vulnerabilities.

Engagement:

Introduce students to ethical hacking, highlighting the difference between ethical hacking (legal) and black-hat hacking (illegal). Present a scenario where students need to conduct a penetration test to identify system vulnerabilities in a controlled, ethical manner.

Representation:

Demonstrate the use of penetration testing tools like Kali Linux, Metasploit, and Nmap, and explain how each tool is used to find vulnerabilities. Show diagrams of common vulnerabilities (e.g., SQL injection, cross-site scripting) and explain how they are tested for in ethical hacking.

Action/Expression:

Have students perform a penetration test on a simulated vulnerable system, identifying and exploiting weaknesses in a controlled lab environment. After completing the test, ask students to write a detailed report on the vulnerabilities they discovered and how to mitigate them.

8. I CAN use Wireshark to perform an in-depth packet analysis on Address Resolution Protocol (ARP) data.

Engagement:

Start with an explanation of ARP (Address Resolution Protocol) and its role in mapping IP addresses to MAC addresses in a network. Show how ARP traffic can be captured in Wireshark and explain its role in network monitoring.

Representation:

Teach students how to use filters in Wireshark to isolate ARP packets for detailed analysis. Provide examples of ARP packets and explain the details of the captured data, such as ARP requests and responses.

Action/Expression:

Have students capture ARP packets in a controlled network environment using Wireshark and analyze the data to identify ARP requests and responses. Ask students to write a report on their analysis, identifying potential issues like ARP spoofing or unauthorized devices on the network.

9. I CAN analyze normal and malicious network traffic related to IP fragmentation.

Engagement:

Introduce the concept of IP fragmentation, explaining how large packets are broken into smaller fragments for transmission and why this can be exploited by attackers. Present examples of how IP fragmentation can be used for network attacks, such as fragment overlap attacks or DDoS amplification.

Representation:

Use diagrams to show how IP fragmentation works and how malicious traffic might exploit fragmented packets. Show how tools like Wireshark can be used to capture and analyze fragmented packets, with a focus on detecting unusual fragment patterns.

Action/Expression:

Have students capture and analyze fragmented packets in a network environment using Wireshark, distinguishing between normal and malicious fragmented traffic. Ask students to document their findings, identifying potential attacks using IP fragmentation and ways to mitigate them.

10. I CAN analyze normal and malicious network traffic related to user access and authentication to a wireless device.

Engagement:

Start with a discussion of how wireless networks use authentication protocols (e.g., WPA2) to secure access, and why analyzing authentication traffic is critical for network security. Present examples of common wireless attacks like WPA handshake cracking or rogue access points.

Representation:

Provide students with packet capture examples of normal vs. malicious wireless traffic, showing key elements like SSIDs, BSSIDs, and authentication frames. Explain the role of encryption and authentication in protecting wireless networks.

Action/Expression:

Have students capture wireless network traffic using tools like Wireshark or Aircrack-ng, analyzing authentication packets to identify potential vulnerabilities or attacks. Ask students to document their analysis, identifying legitimate and suspicious access attempts, and recommend security improvements.

Supporting Multilingual/English Learners

Related CELP standards:

Learning Targets:

Learning Target 1: I can use the command line to navigate the file system and to manage files and directories.

- **Level 1:** Can recognize basic command line concepts (e.g., "file," "folder") with support. May need help using simple commands.
- **Level 2:** Can use basic command line commands to navigate the file system (e.g., `cd`, `ls`) and perform simple file management tasks (e.g., creating, renaming files or directories).
- **Level 3:** Can effectively navigate directories, create and delete files and directories, and use more advanced commands (e.g., `cp`, `mv`, `rm`). Can explain the basic structure of a file system.
- **Level 4:** Can manage files and directories using advanced command line tools (e.g., `find`, `grep`, `chmod`) for searching, filtering, and modifying files. Can perform batch file management tasks with scripts.
- **Level 5:** Can navigate and manage complex file systems and automate file and directory management tasks using advanced command line techniques. Can troubleshoot file system issues and optimize system file structures.

Learning Target 2: I can utilize ownership and permission setting to analyze files.

- **Level 1:** Can recognize that files have owners and permissions. May need assistance understanding the concept of file ownership.
- **Level 2:** Can identify basic file permissions (e.g., read, write, execute) and understand file ownership. Can view file permissions using commands like `ls -l`.
- **Level 3:** Can explain how file ownership and permissions control access to files and directories. Can change file ownership and modify permissions using commands like `chown` and `chmod`.
- **Level 4:** Can analyze file ownership and permissions to determine potential security risks (e.g., files with weak permissions). Can configure access control lists (ACLs) for advanced permission management.
- **Level 5:** Can assess and manage file ownership and permissions at a system level to ensure secure and effective access control. Can automate permission auditing and troubleshoot complex permission issues in multi-user systems.

Learning Target 3: I can manage processes and services in a Linux®-based system.

- **Level 1:** Can recognize that a system runs processes and services. May need assistance in identifying running processes.
- **Level 2:** Can view basic system processes using commands like `ps` or `top`. Can start and stop simple services (e.g., using `systemctl` or `service` commands).
- **Level 3:** Can manage processes and services, including starting, stopping, and restarting services. Can monitor system performance and resource usage using commands like `htop` or `top`.
- **Level 4:** Can manage background processes (e.g., using `nohup`, `screen`, or `tmux`). Can troubleshoot and optimize service performance, ensuring services are running correctly and efficiently.
- **Level 5:** Can configure and automate processes and services for system optimization, security, and performance. Can analyze process dependencies, manage service failures, and automate service monitoring using scripts or tools like `systemd`.

Learning Target 4: I can create an education/career plan.

- **Level 1:** Can recognize the importance of planning for education and career development. May need guidance in creating specific goals.
- **Level 2:** Can describe their interests and career aspirations. Can set simple education or career goals (e.g., "I want to be a network administrator").
- **Level 3:** Can create a basic plan for education and career development, including short- and long-term goals. Can research potential career paths and the necessary education or certifications.
- **Level 4:** Can design a detailed education and career plan that includes specific courses, certifications, and

- professional experience needed to achieve career goals. Can outline a timeline for achieving milestones.
- **Level 5:** Can develop a comprehensive and adaptable education/career plan, including backup strategies, ongoing professional development, and networking strategies. Can evaluate and adjust the plan as opportunities and challenges arise in the field.

Learning Target 5: I can create a security baseline of network traffic.

- **Level 1:** Can recognize that network traffic can be monitored for security purposes. May need guidance in identifying what constitutes normal vs. suspicious traffic.
- **Level 2:** Can describe the concept of network traffic baselines (e.g., expected volume, types of communication). Can use basic tools to capture network traffic.
- **Level 3:** Can establish a security baseline by capturing and analyzing network traffic. Can identify normal traffic patterns and baseline expectations for network activity.
- **Level 4:** Can create a comprehensive network traffic baseline using advanced tools (e.g., Wireshark, NetFlow). Can compare baseline data to identify potential anomalies or security threats.
- **Level 5:** Can continuously monitor and adjust network traffic baselines to detect emerging threats. Can recommend and implement changes to network configurations or security protocols based on baseline analysis.

Learning Target 6: I can configure firewall rules to improve security.

- **Level 1:** Can recognize the basic purpose of a firewall. May need assistance in understanding how to configure rules.
- **Level 2:** Can describe basic firewall concepts, such as allowing or blocking specific traffic. Can configure simple firewall rules for inbound and outbound traffic.
- **Level 3:** Can configure advanced firewall rules to secure a network, including rules for different ports and protocols. Can test firewall configurations and troubleshoot issues.
- **Level 4:** Can create and manage firewall policies for complex network environments. Can optimize firewall settings to prevent unauthorized access and ensure secure traffic flow.
- **Level 5:** Can design, implement, and audit firewall configurations for large-scale or multi-network environments. Can integrate firewalls with other security technologies (e.g., IDS/IPS) and monitor for security incidents.

Learning Target 7: I can apply ethical hacking techniques to test and identify system vulnerabilities.

- **Level 1:** Can recognize ethical hacking as a method for identifying vulnerabilities. May need support in understanding hacking techniques.
- **Level 2:** Can describe basic ethical hacking concepts, such as penetration testing or vulnerability scanning. Can identify simple vulnerabilities using basic tools.
- **Level 3:** Can apply ethical hacking techniques, such as penetration testing or network scanning, to identify vulnerabilities in systems. Can report findings to improve system security.
- **Level 4:** Can conduct detailed penetration tests on systems or networks, identifying vulnerabilities and recommending remediation strategies. Can use advanced tools (e.g., Metasploit, Nmap) to test for weaknesses.
- **Level 5:** Can design and execute comprehensive ethical hacking assessments, including social engineering, web application testing, and post-exploitation analysis. Can create and present detailed vulnerability reports and assist in remediation efforts.

Learning Target 8: I can use Wireshark to perform an in-depth packet analysis on Address Resolution Protocol (ARP) data.

- **Level 1:** Can recognize ARP as a protocol used in networking. May need assistance in using Wireshark for packet analysis.
- **Level 2:** Can describe the purpose of ARP in a network and the basic concepts of packet analysis. Can use Wireshark to capture basic ARP packets.
- **Level 3:** Can analyze ARP packets using Wireshark, identifying key fields such as MAC addresses and IP addresses. Can describe how ARP is used in network communication.
- **Level 4:** Can perform detailed ARP analysis with Wireshark, identifying ARP poisoning attacks or other network anomalies. Can use Wireshark filters to isolate ARP traffic.
- **Level 5:** Can conduct advanced packet analysis of ARP traffic using Wireshark, identifying malicious activities (e.g., ARP spoofing). Can recommend and implement countermeasures to secure ARP traffic on a network.

Learning Target 9: I can analyze normal and malicious network traffic related to IP fragmentation.

- **Level 1:** Can recognize that network traffic can be fragmented. May need guidance in understanding what

constitutes normal vs. malicious fragmentation.

- **Level 2:** Can describe the concept of IP fragmentation and how it is used in network communication. Can identify basic examples of fragmented packets.
- **Level 3:** Can analyze fragmented network traffic to identify typical fragmentation patterns. Can explain how malicious actors might exploit fragmentation to bypass security filters.
- **Level 4:** Can identify and analyze fragmented packets that could indicate malicious activity, such as fragmented denial-of-service (DoS) attacks. Can use tools like Wireshark to capture and inspect fragmented traffic.
- **Level 5:** Can conduct in-depth analysis of fragmented IP traffic, identifying complex attack patterns and mitigating potential risks. Can implement measures to detect and block fragmented traffic designed for exploitation.

Learning Target 10: I can analyze normal and malicious network traffic related to user access and authentication to a wireless device.

- **Level 1:** Can recognize the importance of network security for wireless devices. May need help in identifying normal vs. malicious network traffic.
- **Level 2:** Can describe the basic concepts of user access and authentication in wireless networks (e.g., WPA, WPA2). Can identify basic network traffic related to user authentication.
- **Level 3:** Can analyze network traffic related to wireless authentication and user access. Can differentiate between legitimate and suspicious access attempts.
- **Level 4:** Can identify and analyze malicious wireless access attempts (e.g., brute-force, rogue AP) and recommend security measures to prevent unauthorized access.
- **Level 5:** Can conduct comprehensive analysis of wireless network traffic, identifying complex threats such as man-in-the-middle attacks, and implementing strategies to secure wireless networks.

Lesson Sequence	Learning Target	Success Criteria/Assessment/Resources
1	I CAN use the command line to navigate the file system and to manage files and directories.	<ul style="list-style-type: none"> ● I can describe the Linux operating system ● I can document a variety of Linux commands
2	I CAN utilize ownership and permission setting to analyze files	<ul style="list-style-type: none"> ● I can identify various file types ● I can utilize file hiding and encryption techniques
3	I CAN manage processes and services in a Linux®-based system.	<ul style="list-style-type: none"> ● I can examine a process tree to identify parent/child processes ● I can use search techniques for identifying suspicious processes ● I can terminate processes
4	I CAN create an education/career plan	<ul style="list-style-type: none"> ● I can discover the many ways to begin a career in cybersecurity
5	I CAN create a security baseline of network traffic.	<ul style="list-style-type: none"> ● I can identify the layered nature of network architecture.
6	I CAN configure firewall rules to improve security	<ul style="list-style-type: none"> ● I can mimic suspicious activity on the water treatment plant network ● I can capture suspicious network traffic for comparison to baseline traffic ● I can analyze suspicious network traffic using network topology documents and baseline traffic
7	I CAN apply ethical hacking techniques to test and identify system vulnerabilities	<ul style="list-style-type: none"> ● I can learn the four phases of ethical hacking to identify system vulnerabilities ● I can use tools such as nmap, Nessus, Metasploit, and iptables
8	I CAN use Wireshark to perform an in-depth packet analysis on Address Resolution Protocol (ARP) data	<ul style="list-style-type: none"> ● I can understand how packets and network communication should behave ● I can observe what network traffic looks like during an exploit

		<ul style="list-style-type: none"> • I can analyze normal packet activity and distinguish it from the abnormal/suspicious packet activity
9	I CAN analyze normal and malicious network traffic related to IP fragmentation	<ul style="list-style-type: none"> • I can understand how data moves through a network • I can use Wireshark graphs to help see data trends in very large capture files • I can apply IP fragmentation attack prevention methods
10	I CAN analyze normal and malicious network traffic related to user access and authentication to a wireless device	<ul style="list-style-type: none"> • I can discuss the dangers of using public Wi-Fi • I can understand the normal and abnormal network traffic related to wireless networks. • I can used a capture file that contains Wi-Fi traffic from a Cisco wireless router (or WAP) to crack an encrypted password

Unit Title:

Unit 4: Applied Cybersecurity

Relevant Standards: Bold indicates priority**CCP.B Create a computational artifact for creative expression.**

CCP.B.1 Identify a computational artifact as something created by a human using a computer and differentiate between a program, an image, audio, a video, a presentation, or a web page file.

CCP.C Deconstruct a complex problem into simpler parts.

CCP.C.1 Identify and apply solutions to subcomponents to achieve a system-wide solution.

CCP.F Apply and describe the process based on user-centered research to solve a problem.

CCP.F.1 Apply and describe the process used during the development of a solution

CCP.F.2 Acknowledge that stages of failure and technical hurdles are typical in processes that produce positive outcomes.

IARP.A Use digital forensics investigative techniques to solve a cybercrime

IARP.A.1 Define what constitutes a cybercrime.

IARP.A.2 Acquire and maintain data in compliance with the digital forensics process.

IARP.A.3 Analyze data associated with a digital forensics investigation.

IARP.A.4 Describe the potential legal ramifications of cybercrimes.

IARP.B Analyze the evidence of an attack.

IARP.B.1 Identify common types of malware.

IARPC Design the correct level of protection by implementing the appropriate safeguards.

IARPC.1 Describe the positive and negative outcomes of different solutions related to data confidentiality, integrity, and availability.

IARP.D Detect and analyze the occurrence of a cybersecurity event.

IARP.D.1 Use pattern finding techniques to determine trends in attack data.

IARPE Respond to a detected cybersecurity event.

IARPE.1 Communicate the event.

DAT.A Find patterns and test hypotheses about digitally processed information to gain insight and knowledge.

DAT.A.1 Identify systemic security issues based on the analysis of vulnerability and configuration data. (NICE A0001)

DAT.A.4 Identify hidden patterns or relationships. (NICE S0109)

DAT.B Identify personal data sharing that places people at risk and evaluate risky personal data-sharing practices.

DAT.B.1 Understand that security and privacy concerns arise with data containing personal information.

DAT.B.2 Understand data mining techniques used to perform social engineering.

DAT.B.4 Evaluate attacks that occur via email.

DAT.C Describe the variety of abstractions used to represent data.

DAT.C.1 Digital data is represented by abstractions at different levels

DAT.C.2 Data is represented using different number bases such as decimal and hexadecimal.

CTT.A Select and apply appropriate computational tools and techniques to solve a problem or create value for others.

CTT.A.1 Select collaboration tools for data collection, writing, or protecting data.

CTT.B Apply tools with varying levels of abstraction within software, a computer, a network, and the internet.

CTT.B.1 Recognize and discern between different levels of abstraction while working with computational tools.

CTT.B.2 Recognize the commonalities of command line tools and their automated, scripted versions.

SA.A Analyze an algorithm used to encrypt or decrypt data.

SA.A.1 Understand that in cryptography, ciphers are used to encrypt and decrypt data

SA.A.2 Evaluate the effectiveness of historical ciphers used to encrypt and decrypt data

SA.A.3 Describe how public key/private key encryption uses algorithms to secure data

SA.C Use encryption algorithms to secure information.

SA.C.1 Create historical algorithmic cyphers to encrypt and decrypt data.

SA.C.2 Apply encryption algorithms to encode or decode data manually or unplugged.

SA.C.3 Apply encryption algorithms to encode or decode data digitally

CSN.A Describe the modular components of a computer's hardware and software.

CSN.A.1 Identify the hardware components of a computer.

CSN.A.2 Identify the broad tasks that operating systems manage, such as process management and file management.

CSN.B Identify user actions that strengthen the security of information stored on a computer.

CSN.B.1 Navigate system files to locate files that are used to manage computer resources.

CSN.B.4 Install and manage protective software, including updates and removal.

CSN.B.5 Manage software using configuration tools and/or parameters.

CSN.D Gain understanding of how an operating system is structured and works by navigating the file system and modifying files, extensions, rights, and visibility to better protect data.

CSN.D.6 Search a file system.

CSN.F Identify the components (software, hardware, protocols) that allow computers to network and communicate.

CSN.F.5 Define network addressing including sub-netting.

CSN.F.6 Identify network system sub-components responsible for security.

CSN.I Identify user actions that strengthen the security of a networked system.

CSN.I.1 Recognize that the security of a network depends on the security of its individual components.

CSN.J Use abstractions to manage and analyze information.

CSN.J.2 Use a variety of data representations to help analyze large or complex data.

Essential Question(s):	Enduring Understanding(s):
1.1 Why do people engage in risky behavior in cyberspace? People engage in risky behavior in cyberspace due to factors such as lack of awareness, peer pressure, convenience, or the illusion of anonymity. Understanding these motivations helps in designing strategies to reduce harmful online actions and increase digital responsibility. 1.2 Is hacking ever appropriate? Hacking can be appropriate when done ethically, such as in the case of ethical hacking or penetration testing. These practices help identify and fix vulnerabilities in systems, preventing malicious attacks and improving overall security. 1.3 What are the consequences of inappropriate behavior in cyberspace? Inappropriate behavior in cyberspace, such as cyberbullying, hacking, or data theft, can lead to legal penalties, loss of trust, damage to reputations, and emotional harm. It is important to understand the lasting effects of online actions on individuals, organizations, and communities. 2.1 Why does information need protection? Information needs protection to ensure its privacy, accuracy, and availability. Without proper protection, sensitive data can be stolen, misused, or corrupted, leading to personal, financial, and societal harm. Secure information is critical to maintaining trust in digital systems. 2.2 How do computers safely store information? Computers safely store information through encryption, secure access controls, and physical security measures. These techniques protect data from unauthorized access and ensure its integrity and confidentiality over time. 3.1 How does past knowledge help with data analysis? Past knowledge, including historical data and previous incidents, provides context for analyzing current data trends. It helps in identifying patterns, predicting future outcomes, and making informed decisions, especially when assessing risks and vulnerabilities in cybersecurity. 4.1 How can information be safely exchanged? Information can be safely exchanged by using secure protocols, encryption, and authentication measures. These tools ensure that data is transmitted privately and accurately, protecting it from interception and unauthorized access during exchange. 4.2 What makes a network vulnerable? A network becomes vulnerable due to weak passwords, outdated software, misconfigurations, poor access controls, and lack of monitoring. Identifying and addressing these vulnerabilities is key to preventing unauthorized access and maintaining a secure network. 5.1 How can malware be stopped? Malware can be stopped through a combination of proactive defenses, such as antivirus software, firewalls, regular software updates, and educating users about recognizing malicious threats. A multi-layered approach minimizes the risk and impact of malware. 6.1 Where and how are cybersecurity skills used?	

Cybersecurity skills are used in various industries, including healthcare, finance, government, and technology. These skills protect sensitive data, defend against cyberattacks, and ensure the integrity of systems across diverse fields, making them crucial for safeguarding digital infrastructure.

7.1 What makes a good cyber team?

A good cyber team is characterized by diverse skills, strong collaboration, clear communication, and professionalism. Team members must work together, adapt to new challenges, and adhere to ethical practices to effectively address cybersecurity issues and protect systems.

Demonstration of Learning:	
<p>A forensic investigation simulation where students are tasked with solving a complex cybercrime scenario. They would need to recover files, analyze encrypted data, trace stolen information, and apply forensic and cybersecurity protocols to uncover the full story.</p> <p>Students submit the following as part of their final demonstration:</p> <ul style="list-style-type: none"> • File Recovery Report: Detailing the evidence recovered from the suspect’s USB drive, including any hidden or deleted files. • Forensic Analysis Report: A comprehensive analysis of encrypted file systems, steganographic images, encrypted emails, and malware source files, including findings and decryption or extraction methods used. • Suspect Involvement Report: A report identifying the primary suspect and any accomplices, with supporting evidence linking them to the crime. • Exfiltration Report: A report tracing the exfiltration of the confidential spreadsheet, detailing how the data was accessed, moved, or shared. • Stolen Data Tracking Report: Documentation of how the stolen data was traced across networks, emails, or other communication channels. • Executive Innocence Verification Report: An analysis confirming or disproving the executive’s claim of innocence based on forensic evidence. • Security Breach Analysis and Remediation Report: A final report outlining how the breach occurred, identifying weaknesses, and recommending improvements to security protocols to prevent future incidents. 	<p>Students will demonstrate their learning by:</p> <ul style="list-style-type: none"> • Recovering files and evidence from a suspect’s USB flash drive. • Analyzing encrypted file systems, steganographic images, encrypted emails, and malware source files. • Determining a suspect’s involvement, uncover accomplices, and locate the missing diamond. • Investigating the exfiltration of a confidential spreadsheet • Tracing stolen data • Verifying the executive’s claim of innocence and identifying potential security breaches. • Applying forensic techniques and cybersecurity protocols to solve the data breach.
Family Overview	Pacing for Unit
PLTW Cybersecurity Family Overview (2024)	42 Days (Traditional) 21 Days (Block)
Unit-specific Vocabulary:	Integration of Technology Aligned Unit Materials, Resources, and Technology
<p>Section 4.1 Cipher, cryptography, plaintext, ciphertext, substitution cipher, encryption key, private key encryption, symmetric key encryption, public key encryption, asymmetric key encryption, one-way functions, Encrypted Drive, Recovery Key, Container, Encrypted Container, Mount, Dismount, Hash, Cryptocurrency, Steganography, Least Significant Bit, ASCII, Insertion Steganography,</p>	

<p>Generation Steganography, Digital Watermarking, Steganalysis, Digital Forensic Team, Consent Form, Chain of Custody</p> <p>Section 4.2 Hash Function, Hashing, Message, Digest, Brute-force, Algorithm, Disk Image, Identity, Subnet, Subpoena, open source,</p>	
<p>Opportunities for Interdisciplinary Connections:</p> <p>Potential interdisciplinary connection may integrate ethical considerations in cybersecurity with principles of civic responsibility and democratic values. Students will explore how advancements in technology intersect with civil liberties, rights, and governance, fostering critical thinking and ethical reasoning</p>	<p>Anticipated misconceptions:</p> <ul style="list-style-type: none"> • Cryptography is something that developed around advances in computing, and has not been around that long. • Cryptography only relies on knowledge of computing systems. • Information exchanged in public is very difficult to keep private. • There is only one secure method to encrypt data stored on a computer. • It is possible to decrypt data without knowing the recovery key or the password. • Changing the data, the bits and bytes, that make up an image results in obvious changes to the way we see the image. • In performing an investigation, you know or can predict most of the steps you will take ahead of time. • Digital evidence (and computer data) isn't fragile. • Browsing around a computer is the best way to go about an investigation. • Just collecting and examining a computer is enough to prove where the evidence on it came from. • Only police officers gather digital evidence. • Minor changes are hard to detect on a file system. • Files you get from another source (like the internet) are always safe and untampered with. • Just copying data is good enough to perform an investigation. • Looking around a drive doesn't modify its contents. • People are easy to find or to discover "who" they are on the internet. • Emails are anonymous. • Digital evidence is always easy to find. • Digital forensic tools do all the work for me; I don't have to understand or interpret the data.
<p>Differentiation through <i>Universal Design for Learning</i></p>	
<p>UDL Indicator</p>	<p>Teacher Actions:</p>
<p>1. I CAN create encrypted messages using various strategies.</p> <p><i>Engagement:</i> Start by discussing the importance of encryption in protecting sensitive data and why it's essential for securing communication. Present real-world examples of encryption, such as secure messaging apps or email encryption, to make the concept relatable.</p> <p><i>Representation:</i> Provide examples of various encryption techniques, such as symmetric encryption (AES) and asymmetric encryption (RSA). Visualize encryption processes through diagrams, showing how data is transformed into ciphertext.</p>	

Action/Expression:

Have students practice creating encrypted messages using different strategies. Set up lab exercises where students encrypt and decrypt messages using tools like OpenSSL or GPG, reinforcing their understanding of the different encryption methods.

2. I CAN utilize public encryption while keeping information secret and private on the internet.

Engagement:

Begin by discussing how public encryption (e.g., RSA) is used to protect information on the internet, such as in secure email or website communication (HTTPS). Pose a question about how we can ensure our data stays private while communicating over untrusted networks.

Representation:

Provide a clear explanation of public-key cryptography and demonstrate how public and private keys work together to protect data. Use diagrams to show the encryption and decryption process, focusing on how private information remains confidential.

Action/Expression:

Have students generate public and private keys using encryption tools like OpenSSL, and then use them to send encrypted messages. Ask them to demonstrate how public-key encryption ensures privacy by encrypting messages with the recipient's public key and decrypting with their private key.

3. I CAN apply three strategies for data storage encryption.

Engagement:

Introduce the topic by explaining the importance of encrypting data at rest, such as protecting stored files on a hard drive or cloud storage. Discuss scenarios where data loss or theft can have serious consequences (e.g., financial data, medical records).

Representation:

Provide an overview of three common encryption strategies for data storage: full disk encryption (e.g., BitLocker), file-level encryption (e.g., EFS), and cloud storage encryption. Use diagrams or videos to show how each method protects data.

Action/Expression:

Have students implement each encryption method in a lab environment, such as enabling BitLocker on a Windows system or using VeraCrypt for file-level encryption. Have them compare the benefits and challenges of each method and write a report on their findings.

4. I CAN crack and extract hidden data.

Engagement:

Begin by discussing the concept of hidden or encrypted data, such as steganography or password-protected files. Pose a question about how attackers might extract data from seemingly secure environments.

Representation:

Explain common techniques used for hiding and cracking data, such as password cracking, steganography, and file decryption. Provide examples of tools like John the Ripper or Steghide that can help with cracking and extracting hidden data.

Action/Expression:

Have students practice cracking passwords or extracting hidden data using tools like John the Ripper for password cracking and Steghide for steganography. Assign a lab where students demonstrate how to uncover hidden data in a file or image and document the steps involved.

5. I CAN play the role of a digital forensics investigator, weighing the importance of evidence, considering the legality of gathering evidence, and documenting their work.

Engagement:

Start by discussing the role of digital forensics in criminal investigations and the importance of maintaining the integrity of evidence. Present real-world cases where digital evidence was key in solving crimes.

Representation:

Explain the principles of digital forensics, such as chain of custody, legal considerations (e.g., warrants), and documentation practices. Use case studies to illustrate the steps involved in collecting, preserving, and analyzing digital evidence.

Action/Expression:

Have students participate in a simulated digital forensics investigation, where they must identify, preserve, and document evidence from a compromised system. Students should follow proper legal procedures and document their findings as a professional forensics investigator would.

6. I CAN use hashing techniques to validate and authenticate data.

Engagement:

Introduce hashing by discussing its role in data integrity and authentication, such as how websites use hashing to store passwords securely. Present a scenario where data integrity is critical, such as verifying downloaded files or securing communications.

Representation:

Explain hashing algorithms (e.g., MD5, SHA-256) and their uses in validating data integrity and authenticating information. Provide examples of how hash values are used to ensure data has not been tampered with.

Action/Expression:

Have students use hashing tools like `sha256sum` or `hashdeep` to generate hashes for files and verify their integrity. Set up a lab where students compare the hash values of original and modified files to see how hashing can detect tampering.

7. I CAN image files and devices.

Engagement:

Begin with a discussion on the importance of creating an image of a device or storage medium, such as preserving a copy of data for forensics or backup purposes. Pose a question on why we might need to create an exact replica of a device or file system.

Representation:

Demonstrate the process of imaging a device or file system using tools like `dd`, FTK Imager, or Clonezilla. Use diagrams to show how imaging works, emphasizing how it ensures that no data is altered during the process.

Action/Expression:

Have students create a disk image of a virtual machine or a physical device using imaging software. Ask them to analyze the image to verify that it is an exact replica of the original device, documenting their process and any potential issues encountered.

8. I CAN establish identity in cyberspace.

Engagement:

Discuss the challenges and importance of establishing secure identities online, such as in online banking or social media. Present examples of identity theft and how attackers impersonate legitimate users.

Representation:

Explain methods of establishing identity in cyberspace, such as two-factor authentication (2FA), digital signatures, and biometrics. Use visual examples of each method, showing how they protect online identities.

Action/Expression:

Have students set up two-factor authentication for their accounts and generate digital signatures using encryption tools like PGP or GPG. Ask them to describe how these methods help establish and verify identities securely.

9. I CAN utilize forensic tools to create and analyze forensic images.

Engagement:

Start by discussing the role of forensic tools in digital investigations and how they help preserve and analyze evidence. Provide examples of famous forensic investigations that relied on forensic images.

Representation:

Introduce common forensic tools like FTK Imager, EnCase, or Autopsy, and explain how they can be used to create and analyze forensic images. Demonstrate the tools through a walkthrough video or guide.

Action/Expression:

Have students use forensic tools to create a forensic image of a device or storage medium. Then, have them analyze the image for potential evidence, identifying key artifacts such as deleted files or system logs. Students should document their analysis and discuss their findings in a written report.

Supporting Multilingual/English Learners

Related CELP standards:

Learning Targets:

Learning Target 1: I CAN create encrypted messages using various strategies

- **Level 1:** Can recognize basic encryption concepts and understand the purpose of encryption. Needs guidance to create simple encrypted messages.
- **Level 2:** Can apply basic encryption techniques (e.g., Caesar cipher, substitution cipher) to encrypt simple messages. Can explain the importance of encryption in protecting data.
- **Level 3:** Can use standard encryption methods (e.g., symmetric encryption) to encrypt messages securely. Can explain how different encryption techniques protect data from unauthorized access.
- **Level 4:** Can apply advanced encryption strategies (e.g., asymmetric encryption, public/private key pairs) to

encrypt messages securely. Can explain the strengths and weaknesses of different encryption algorithms.

- **Level 5:** Can create and implement complex encryption protocols and algorithms to secure messages in real-world scenarios. Can troubleshoot and analyze encryption issues in digital communication systems.

Learning Target 2: I CAN utilize public encryption while keeping information secret and private on the internet

- **Level 1:** Can recognize the concept of public encryption but may need help understanding its practical use in securing online communication.
- **Level 2:** Can describe how public encryption works and why it is important for securing data on the internet. Can apply basic public key encryption methods (e.g., RSA) for sending secret messages.
- **Level 3:** Can use public key encryption to secure information exchanged online, ensuring privacy and confidentiality. Can explain how the public/private key pair works in securing internet communications.
- **Level 4:** Can implement and manage secure online communication channels using advanced public encryption techniques (e.g., TLS/SSL). Can troubleshoot issues with encrypted communications and apply appropriate fixes.
- **Level 5:** Can design and implement secure online communication strategies using state-of-the-art encryption protocols. Can conduct security audits and risk assessments to ensure that encryption practices are effective in protecting privacy and data integrity.

Learning Target 3: I CAN apply three strategies for data storage encryption

- **Level 1:** Can identify the need for data storage encryption but may require help understanding different strategies.
- **Level 2:** Can describe basic encryption strategies for protecting data at rest, such as file-level encryption or folder encryption.
- **Level 3:** Can apply at least three different strategies for data storage encryption, such as full disk encryption, file-based encryption, and database encryption.
- **Level 4:** Can evaluate the strengths and weaknesses of different data storage encryption strategies and select the most appropriate strategy for a given use case.
- **Level 5:** Can design and implement robust encryption solutions for securing data across multiple storage platforms. Can integrate encryption with other security measures to create a comprehensive data protection system.

Learning Target 4: I CAN crack and extract hidden data

- **Level 1:** Can recognize that hidden data exists but may need assistance identifying methods for cracking or extracting it.
- **Level 2:** Can describe basic techniques for cracking encrypted data or extracting hidden information from files (e.g., steganography).
- **Level 3:** Can apply basic methods for cracking passwords or extracting hidden data from encrypted files using tools like hash crackers or steganography software.
- **Level 4:** Can employ advanced data recovery and decryption techniques to extract hidden information from encrypted or obfuscated data. Can explain the ethical considerations in cracking or recovering data.
- **Level 5:** Can conduct thorough forensic investigations to uncover hidden data in complex encrypted systems. Can design and implement methods to recover and extract data from a variety of digital storage formats.

Learning Target 5: I CAN play the role of a digital forensics investigator, weighing the importance of evidence, considering the legality of gathering evidence, and documenting their work

- **Level 1:** Can recognize the role of a digital forensics investigator but may need guidance in applying the legal and ethical aspects of the profession.
- **Level 2:** Can describe the role of a digital forensics investigator and the importance of evidence in an investigation. Can understand basic legal and ethical guidelines for gathering evidence.
- **Level 3:** Can perform basic digital forensics tasks, such as collecting and preserving evidence, while considering the legality and ethical implications. Can document findings clearly and systematically.
- **Level 4:** Can conduct full forensic investigations, evaluating evidence for its importance and legal admissibility. Can ensure that evidence is collected and documented according to legal standards.
- **Level 5:** Can lead complex forensic investigations, applying advanced techniques for data recovery and evidence analysis. Can ensure the integrity of evidence and provide expert testimony or reports that meet legal and ethical standards.

Learning Target 6: I CAN use hashing techniques to validate and authenticate data

- **Level 1:** Can recognize what a hash function is but may need help understanding its role in validating and authenticating data.

- **Level 2:** Can describe basic hashing techniques (e.g., MD5, SHA) and how they are used for data integrity checking.
- **Level 3:** Can use hashing techniques to validate data by comparing hashes, ensuring that data has not been altered. Can authenticate data by generating and comparing hash values.
- **Level 4:** Can apply advanced hashing techniques to secure data, ensuring that the data has not been tampered with during transmission or storage. Can use hash functions as part of an authentication system.
- **Level 5:** Can design and implement secure data validation and authentication systems using complex cryptographic hashing algorithms. Can integrate hashing with digital signatures and other security measures to protect data integrity.

Learning Target 7: I CAN image files and devices

- **Level 1:** Can recognize that imaging involves copying data but may need assistance with the process of creating and working with disk images.
- **Level 2:** Can describe the purpose of creating disk images and understand the concept of data duplication. Can create basic disk images of simple files or devices using imaging software.
- **Level 3:** Can create and manage disk images for forensic investigations, ensuring the integrity of the original data. Can use imaging tools to create and work with images of files or devices.
- **Level 4:** Can create disk images of complex systems (e.g., entire hard drives) and use specialized imaging software. Can ensure the image is an exact replica and document the imaging process for legal compliance.
- **Level 5:** Can create and analyze advanced disk images from various devices and file systems. Can troubleshoot and manage complex disk imaging tasks, ensuring data recovery, integrity, and compliance with legal standards.

Learning Target 8: I CAN establish identity in cyberspace

- **Level 1:** Can recognize the concept of identity in cyberspace but may need assistance understanding the various ways to establish and protect it.
- **Level 2:** Can describe methods for establishing identity online, such as using usernames and passwords. Can identify basic strategies for protecting online identity.
- **Level 3:** Can establish and verify identity in cyberspace using secure methods, such as multi-factor authentication (MFA) or biometric authentication.
- **Level 4:** Can implement and manage advanced identity protection strategies, such as digital certificates or identity management systems, to ensure secure online presence.
- **Level 5:** Can design and manage identity systems in cyberspace, ensuring secure, authenticated access to digital services. Can evaluate identity management systems for vulnerabilities and improve security protocols.

Learning Target 9: I CAN utilize forensic tools to create and analyze forensic images

- **Level 1:** Can recognize forensic tools but may need assistance understanding their role in creating and analyzing forensic images.
- **Level 2:** Can describe the basic purpose of forensic tools and understand how they can be used to create forensic images.
- **Level 3:** Can use basic forensic tools (e.g., FTK Imager, EnCase) to create and analyze forensic images of files and devices. Can ensure the image is a faithful copy of the original data.
- **Level 4:** Can use advanced forensic tools to create, analyze, and document forensic images, ensuring data integrity and legal admissibility. Can analyze images for hidden or deleted data.
- **Level 5:** Can design and execute complex forensic imaging tasks, using a wide range of forensic tools to handle sophisticated cases. Can ensure forensic imaging is performed according to legal and professional standards, documenting the entire process for evidence presentation.

Lesson Sequence	Learning Target	Success Criteria/Assessment/Resources
1	I CAN create encrypted messages using various strategies	<ul style="list-style-type: none"> ● I can explore the history of cryptography ● I can identify types of encryption
2	I CAN utilize public encryption while keeping information secret and private on the internet	<ul style="list-style-type: none"> ● I can understand how data can be shared publicly and remain confidential. ● I can validate who owns specific information. ● I can exchange a message with paired key encryption

3	I CAN apply three strategies for data storage encryption	<ul style="list-style-type: none"> • I can explore uses of cryptography. • I can identify different levels of cryptography in cybersecurity • I can test the security of various cryptography methods (such as password cracking).
4	I CAN crack and extract hidden data	<ul style="list-style-type: none"> • I can explore the history of steganography. • I can exercise the use and detection of steganography.
5	I CAN play the role of a digital forensics investigator, weighing the importance of evidence, considering the legality of gathering evidence, and documenting their work.	<ul style="list-style-type: none"> • I can understand the value of digital evidence. • I can understand authority to search • I can recognize different storage containers of digital evidence. • I can practice proper collection techniques of digital evidence. • I can use a chain of custody.
6	I CAN use hashing techniques to validate and authenticate data	<ul style="list-style-type: none"> • I can understand data authentication and validation • I can practice hashing techniques • I can validate and authenticate data using hashing
7	I CAN image files and devices.	<ul style="list-style-type: none"> • Understand the properties of a forensic image. • Explore applicable scientific standards of forensic images. • Practice creating a forensic image.
8	I CAN establish identity in cyberspace	<ul style="list-style-type: none"> • Understand identifying artifacts in digital forensics • Explore methods to identify someone on the internet. • Practice tracing email sources
9	I CAN utilize forensic tools to create and analyze forensic images.	<ul style="list-style-type: none"> • Understand the capabilities of a forensic tool suite • Process a forensic image with a forensic tool suite • Explore a forensic tool suite

Course Title:	Content Area:	Grade Level:	Credit (if applicable)
Three Dimensional Modeling	Career and Technical Education (CTE): Engineering and Technical Sciences	9-12	0.5 (45 - 75 minute classes)
Course Description:			
This course provides an introduction to creating, editing, and analyzing 3D models. Develops foundational skills to work with, and navigate the digital 3D modeling workspace to create 3D objects. Examines basic elements of the 3D development of modeling, texturing, lighting, animating, and rendering. Along with building foundational skills in 3D modeling, students work toward the advanced skills of creating 3D models with moveable parts.			
Aligned Core Resources:		Connection to the <i>BPS Vision of the Graduate</i>	
Autodesk Fusion 360 Autodesk Inventor Ultimaker Cura Parametric Modeling with Autodesk Fusion Spring 2024 Edition. Shih, Randy H. Oregon Institute of Technology. SDC Publications. ©2024 ISBN-13: 978-1-63057-686-8 ISBN-10: 1-63057-686-7 SDC Publications, P.O. Box 1334, Mission, KS 66222 913-262-2664, www.SDCpublications.com		Critical Thinking and Problem Solving <ul style="list-style-type: none"> • Collect, assess and analyze relevant information • Reason effectively. Use systems thinking • Make sound judgments and decisions. Identify, define and solve authentic problems and essential questions. • Reflect critically on learning experience, processes and solutions • Transfer knowledge to other situations 	
Additional Course Information: <i>Knowledge/Skill Dependent courses/prerequisites</i>		Link to <i>Completed Equity Audit</i>	
As an introductory course, no prior knowledge of 3D modeling or CAD software is required. Students do need to be experienced with the Windows operating system and have an introductory background in drafting 3D parts which can be developed with TinkerCAD and/or SketchUp.		3D Modeling Equity Curriculum Review Fall 2024	
Standard Matrix			
Advance CTE Standard	Unit 1 CAD Fundamentals	Unit 2 Part & Assembly Modeling	Unit 3 3D Solid Modeling
ESS01.02: Demonstrate language arts knowledge and skills required to pursue the full range of post-secondary education and career opportunities. <ul style="list-style-type: none"> • Comprehend key elements of written information such as cause/effect, comparisons/contrasts, conclusions, context, purpose, charts /tables/graphs, evaluation/critiques, sequence, 	✓	✓	✓

<p>summaries, and technical subject matter.</p> <ul style="list-style-type: none"> • Evaluate oral and written information for accuracy, adequacy/sufficiency, appropriateness, clarity, conclusions/solutions, fact/opinion, propaganda, relevancy, validity, and relationship of ideas. 			
<p>ESS01.03: Demonstrate mathematics knowledge and skills required to pursue the full range of post-secondary education and career Opportunities.</p> <ul style="list-style-type: none"> • Demonstrate knowledge of basic arithmetic operations such as addition, subtraction, multiplication, and division. • Apply data and measurements to solve a problem. • Analyze data when interpreting operational documents. 	✓	✓	✓
<p>ESS02.01: Select and employ appropriate reading and communication strategies to learn and use technical concepts and vocabulary in practice.</p> <ul style="list-style-type: none"> • Demonstrate use of content, technical concepts and vocabulary when analyzing information and following directions. • Interpret information, data, and observations to apply information learned from reading to actual practice. • Communicate information, data, and observations to apply information learned from reading to actual practice 		✓	✓
<p>ESS02.05 Use correct grammar, punctuation and terminology to write and edit documents.</p>	✓	✓	✓
<p>ESS03.01 Employ critical thinking skills independently and in teams to solve problems and make decisions (e.g., analyze, synthesize and evaluate).</p> <ul style="list-style-type: none"> • Analyze elements of a problem to develop creative solutions. • Use structured problem-solving methods when developing proposals and solutions. • Identify alternatives using a variety of problem-solving and critical thinking skills. 	✓	✓	✓
<p>ESS 04.10 Employ computer operations applications to manage work tasks.</p> <ul style="list-style-type: none"> • Manage computer operations. • Manage file storage. • Compress or alter files. 	✓	✓	✓
<p>ESS06.01 Implement personal and jobsite safety rules and regulations to maintain safe and healthful working conditions and environments.</p> <ul style="list-style-type: none"> • Assess workplace conditions for safety and health. • Align safety issues with appropriate safety standards to ensure a safe workplace/jobsite. • Identify safety hazards common to workplaces. • Identify safety precautions to maintain a safe worksite. • Select appropriate personal protective equipment as needed for a safe workplace/jobsite. 		✓	✓

<p>ESS07.03 Employ teamwork skills to achieve collective goals and use team members' talents effectively.</p> <ul style="list-style-type: none"> • Work with others to achieve objectives in a timely manner. • Demonstrate teamwork processes that provide team building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution. • Take responsibility for shared group and individual work tasks. • Assist team members in completing their work. • Adapt effectively to changes in projects and work activities. 	✓	✓	✓
<p>MNPA01.01.04 Monitor fabrication of the product using process control data.</p> <ul style="list-style-type: none"> • Use process control data to ensure that the manufacturing process complies with standards. • Identify possible consequences resulting from failure to perform operations safely. • Verify that the product meets customer specifications. • Complete, maintain, and forward to proper parties product and process documentation. • Verify that production operations comply with all health, safety, and environmental policies and procedures. 		✓	✓
<p>MNPA01.01.05 Inspect the product to verify that it meets specifications.</p> <ul style="list-style-type: none"> • Verify the calibration of the testing equipment. • Follow the established sampling plan and inspection policies/procedures. • Predict consequences of failure to identify promptly any product and production process that do not meet specifications. • Complete inspection documents accurately and forward them to proper parties. • Following appropriate testing/production tools and procedures. • Make adjustments needed to keep the production process within specifications. 		✓	✓
<p>ACC01.01 Perform math operations such as estimating and distributing materials and supplies to complete jobsite/workplace tasks.</p> <ul style="list-style-type: none"> • Use basic math functions to complete jobsite/workplace tasks. • Use geometric formulas to determine areas and volumes of various structures. • Use appropriate formulas to determine ratios, fractions, and proportion measures. • Use appropriate formulas to determine measurements of dimensions, spaces and structures. • Conceptualize a three-dimensional form from a two-dimensional drawing to visualize proposed work. 	✓	✓	✓
<p>ACPA06.01 Develop technical drawings drafted by hand and computer generated plans to design structures.</p>	✓	✓	✓

<ul style="list-style-type: none"> • Draw and sketch by hand to communicate ideas effectively • Learn to read and produce technical drawings, understanding the significance of each line in a drawing. 			
<p>ACPA06.02 Employ appropriate representational media to communicate concepts and design.</p> <ul style="list-style-type: none"> • Convey graphic information using multi-dimensional drawings. • Build models using referenced drawings and sketches. • Utilize computer technology when communicating concepts and designs. 	✓	✓	✓

Unit Links

Unit 1: CAD Fundamentals	4
Unit 2: Part & Assembly Modeling	6
Unit 3: 3D Solid Modeling	9

Unit Title:

Unit 1 CAD Fundamentals

In this unit, students will learn the foundational principles of creating 3D parts using CAD software. Topics covered include sketching, extrusion, revolve, fillets, chamfers, patterns, and feature-based modeling. Through guided exercises and projects, students will develop proficiency in generating precise and complex part models, applying geometric constraints, and understanding parametric modeling techniques.

Relevant Standards: Bold indicates priority

ESS01.02: Comprehend key elements of written information such as cause/effect, comparisons/contrasts, charts /tables/graphs, evaluation/critiques, sequence, summaries, and technical subject matter.

ESS01.03: Demonstrate knowledge of basic arithmetic operations such as addition, subtraction, multiplication, and division. Apply data and measurements to solve a problem.

ESS 02.05 Use correct grammar, punctuation and terminology to write and edit documents.

ESS03.01 Employ critical thinking skills independently and in teams to solve problems and make decisions (e.g., analyze, synthesize and evaluate): Use structured problem-solving methods when developing proposals and solutions.

ESS 04.10 Manage file storage and compress or alter files.

ESS07.03 Demonstrate teamwork processes that provide team building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution. Assist team members in completing their work. Adapt effectively to changes in projects and work activities.

ACC01.01 Use appropriate formulas to determine ratios, fractions, and proportion measures.
Use appropriate formulas to determine measurements of dimensions, spaces and structures.
Conceptualize a three-dimensional form from a two-dimensional drawing to visualize proposed work.

ACPA06.01 Learn to read and produce technical drawings, understanding the significance of each line in a drawing.

ACPA06.02 Convey graphic information using multi-dimensional drawings.

Essential Question(s):

Enduring Understanding(s):

Lesson 1: Intro to Fusion 360

- How do I create an Autodesk education account and get a Fusion 360 license or are assigned a Fusion 360 license?
- What is the purpose and benefits of a Folder-Level Project?
- How can I invite and manage members to a Folder-Level Project Folder?
- How can I remove and/or deactivate members from a Folder-Level Project?
- What is the purpose of archiving a Project on Fusion Team?

Lesson 2: Sketching

- What is applied to help define a profile in a sketch?
- What type of dimensions can be created with the sketch Dimension tool?
- While in a sketch, what do blue, and black lines represent?

A Fusion Team Is where you access your Fusion 360 and project data. Data is stored in the cloud. Control roles/permissions, files, versions, markups, add comments, and recover deleted files are controlled in the cloud. You can invite members to your Fusion Team and control their access and you can be invited into others' Fusion Team. You can administer more than one Fusion Team.

Projects are used to manage data and control access. A project can be setup for a class or for a specific design You can invite members to the project and set how the project can be found by members called project security types.

Folders are used to manage data. In a Folder-Level Project, you can set a role for each member per folder. When you set a role, it will be the default for subfolders. Each folder can have members with different roles.

- While in a sketch, how can you apply a horizontal/vertical constraints to a midpoint?
- How do you know when a profile is fully constrained?
- How do you edit a sketch?
- How can we copy geometry onto an active sketch?

Lesson 3: Part Modeling

- How do you know when a profile is closed?
- When creating features, what are the three main operation types you use to define a component?
- Can you use the extrude command on the solid tab to extrude an open profile?
- When creating a profile that will be revolved, why would you change a line to a centerline?
- When placing threaded hole, what option do you use to create true modeled threads?
- When editing a fillet or chamfer feature, how do you add or remove edges to the selection set?
- When creating a circular pattern, what can be used as the axis of rotation?
- What construction plane method would you use to create a construction plane an equal distance from two existing faces or planes.
- What construction plane method is used to create a construction plane that touches a circular face on one location and at a specified angle?
- What is the difference between changing the Physical Material and the Appearance of a component?
- How do you find the area and mass information about a component?
- When using the measure command, what information can you obtain?
- After creating a Section Analysis, how do you control its visibility?

Lesson 4: Assembly Modeling

- How do you know if you are working on a component or an assembly?
- How do you turn a component file into an assembly file which only has local components?
- What are the differences and benefits of bottom-up and top-down assemblies?
- How many assemblies can a component be inserted (referenced) into?
- After converting a body into a component, what happens to the features that were used to create the body?
- When would you apply an As-Built Joint?
- When applying an assembly joint, how do you filter for points on a specific face?
- When would you create a Rigid Group?
- Are Contact Sets or Joint Limits the preferred

A component can be created in its own file or within the context of an assembly design file. Components can be placed together to create an assembly or subassembly.

When modeling a component, the 2D outline will be used to create the base feature (first feature). It is the feature other features will add material to or remove material from. Extruded or revolved the profile which will be known as the base feature. Continue modeling by creating additional features. Features can add or remove material.

A sketch is used to locate where profile geometry will be placed. A sketch can consist of 2D or 3D geometry, constraints and dimensions, and is usually turned into 3D geometry.

Dimensions are added to sketch geometry to define the size and location of the geometry. The geometry changes size to match the value of the dimension. This is referred to as parametric dimensions.

Sketch constraints help define the shape of the profile and create relationships. To add sketch constraints, a sketch must be active.

Features are used to define the shape of a design. The first feature created for a component is referred to as a base feature. If the feature is created after another feature was created, the features can add and remove material. When using tools like; extrude, revolve, sweep, loft you have five operation options: join, cut, intersect, body, and new component.

The Modeling Hierarchy includes (from basic to complex): A body which is a continuous 3D object; it is a solid or surface that is used to model a component. Bodies are stationary. Then there is a component which is an envelope that contains bodies, sketches, a coordinate system, & reference geometry. A component can contain multiple features and must have at least one body. Components can move. Finally there is an assembly that is a grouping of 1 or more components and has its own coordinate system. Assemblies allow the assignment of position and motion of components using joints.

Assembly creation methods can be either top-down where single design file for assembly and its components create components inside a single design file or bottom-up where separate design files for components and assemblies Insert component files into assembly files.

Components are required to apply assembly joints. When a component is created from a body, and when the component is active, the features that were used to create the body are not shown in the Timeline. The features remain at the top-level assembly.

<p>method for modeling?</p> <ul style="list-style-type: none"> Why would you set a joint's limits? <p><u>Lesson 5: Drawings</u></p> <ul style="list-style-type: none"> What command do you use to create orthographic views that are projected relative to a parent view? When creating a drawing of a component, when do you first define the sheet size? When placing a drawing view, what are the four Appearance and Edge Styles? When creating a projected drawing view, how many orientations can you create? When would you create a Detail View? When a parent view moves, what happens to the child orthographic views? When you change the scale of a Base View, what happens to the child views? When annotating a drawing view, how do you add centerlines and center marks? When annotating a drawing, how do you add text to a dimension? When annotating a drawing with the general dimension tool and you select the outside circle of a counterbore hole, what information will be displayed? When adding a Parts List to a drawing, where do you change a components Part Number, Part Name and Description? When exporting a drawing, what file formats can be created? 	<p>When designing, you may have multiple components that should be locked together in their current location. Instead of applying multiple Rigid - As-Built Joints, you can create one Rigid Group. Components in a Rigid Group are treated as a single object when you move them in the canvas or apply joints to the Rigid group. To prevent the Rigid Group from moving in the parent assembly, include the parent assembly in the Rigid Group.</p> <p>When designing an assembly that has motion, you can simulate real-world conditions by using Contact Sets and Joint Limits. Contact Sets apply to components so they only move or stop when they touch each other. Contact sets use physical contact between components to limit movement. This method requires more computer computation than Joint Limits. Joint Limits are values that define the range of motion allowed for components to move or rotate. Use joint limits to evaluate a design by limiting motion to a minimum and maximum values. Joint Limits are preferred over contact set because they require less computer computation.</p> <p>To document a design (component, assembly or animation) you can create a new drawing file that will document the design for manufacturing or customer use. Fusion 360 generates a 2D projection of the component(s) you select. The first drawing view is referred to as a base view. Once you place the base view in the drawing, you can generate orthogonal and isometric projected views from it. Fusion 360 calculates the most appropriate scale for the base view at the time you create the drawing.</p>
<p>Demonstration of Learning:</p>	<p>Pacing for Unit</p>
<p>Completion of lesson activities and exercises in Fusion 360 (models showing work in timeline).</p>	<p>18 - 75 minute classes</p>
<p>Family Overview (link below)</p>	<p>Integration of Technology:</p>
<p>Three Dimensional Modeling Family Overview (2024)</p>	<p>Use of the Autodesk Fusion 360 cloud-based program on desktop or laptop computers. Models may be created through additive manufacturing techniques (3D Printing) or subtractive manufacturing techniques (laser engraving, CNC machining).</p>
<p>Opportunities for Interdisciplinary Connections:</p>	<p>Aligned Unit Materials, Resources, and Technology (beyond core resources):</p>
<p>This unit teaches the foundational knowledge and skills required to create 2D and 3D models in Fusion 360.</p> <p><i>Mechanical Engineering:</i> Fusion 360 is primarily used in mechanical engineering for designing parts, assemblies, and creating technical drawings. Students can explore concepts of material properties, forces, and stress analysis through</p>	<ul style="list-style-type: none"> https://www.autodesk.com/education/support Students create an Autodesk education account and acquire a Fusion 360 license Educator assigns students' a Fusion 360 license Getting Started with Fusion Team for Education Fusion 360 Educators Forum https://www.autodesk.com/learn/ Autodesk Learning Catalog

<p>simulations and design testing. <i>Architecture:</i> Fusion 360 can help architecture students model building structures and interior designs. <i>Art and Design:</i> Fusion 360 can be used in the creation of sculptures, installations, and interactive art.</p>	
<p>Unit-specific Vocabulary:</p>	<p>Anticipated misconceptions:</p>
<p>Lesson 1 Fusion Team (file cabinet), Project (drawer), Folders (organize data); Canvas, Fusion Team Roles: Team Administrator, Team Member, Project Contributor; Folder Member Roles: Viewer, Reader, Editor, Manager, Administrator; Sketch; Dimensions, Constrained geometry, X, y, z axis orientation Lesson 2 Component, Assembly, Extrude, Revolve, Plane, Planar face, Base feature, Horizontal/Vertical, Coincident, Tangent, Equal, Parallel, Perpendicular, Fix/UnFix, Midpoint, Concentric, Collinear, Symmetry, Curvature, Timeline, Browser, Visibility, Driving dimension, Driven dimension, Project geometry Lesson 3 Extrude, Thin-extrude, Profile, Symmetric, Half-length, Whole-length, Taper angle, Join, Cut, Intersect, New Body, New Component, Revolve, Centerline, Hole, Counterbore, Countersink, Threads, Fillet, Chamfer, Pattern features, Mirror features, Shell feature, Construction geometry, Tangent, Perpendicular, Torus, Inspection, Section analysis Lesson 4 Assemblies, Subassemblies, Components, Bodies, Joints, As-built joints, Assembly Joints, Rigid, Revolute, Slider, Cylindrical, Pin-Slot, Planar, Ball, Faces, Parent Assembly, Rigid groups, Contact sets, Joint limits Lesson 5 Drawing Views, Base, Projected, Section, Detail, Annotations, ASME, ISO, Sheet, Title Block, Center Marks, Centerlines, Slice, Parent View, Text Notes, Hole Notes, Thread Notes, Parts List, Balloons, Export, PDF, DWG, DXF, CSV</p>	<p>Misconception 1: Failure is a sign of incompetence Failure is a natural and necessary part of learning and innovation. Every CAD project involves trial and error, experimentation and feedback, and iteration and improvement. Failure is not something to be ashamed of, but to be embraced as an opportunity to grow and refine your ideas.</p> <p>Misconception 2: Failure is a waste of time and resources Failure is not a waste, but an investment in your future success. Failure helps you to discover new possibilities, identify problems and solutions, and gain valuable insights and knowledge. Failure also helps you to develop resilience, adaptability, and creativity, which are essential skills for any CAD professional.</p> <p>Misconception 3: Failure is final and irreversible. Failure is not final, but temporary and reversible. CAD software allows you to save, edit, undo, and redo your work at any stage of the design process. You can always recover from a failure, learn from your mistakes, and make changes or adjustments to your model. Failure is not the end, but the beginning of a new challenge.</p> <p>Misconception 4: Failure is a solo experience Failure is not a solo experience, but a shared one. You are not the only one who fails in CAD, and you can benefit from the support and feedback of others who have faced similar challenges. You can also share your failures with others, and learn from their experiences and perspectives. Failure is a source of collaboration and inspiration.</p>
<p>Connections to Prior Units:</p>	<p>Connections to Future Units:</p>
<p>This is the first unit in this course.</p>	<p>This unit provides the foundational knowledge and skills for the applications of solid modeling in the remaining units in this course.</p>
<p>Differentiation through <i>Universal Design for Learning</i></p>	
<p>UDL Indicator and Teacher Actions</p>	

- Expression and Communication:** Build fluencies with graduated levels of support for practice and performance
- Provide Computer-Aided-Design (CAD), notation (writing) software, or mathematical notation software support documentation
 - Use web applications (e.g., animations, presentations)
 - Provide differentiated models to emulate (i.e. models use differing approaches, strategies, skills, etc.)
 - Provide scaffolds that can be gradually released with increasing independence and skills
 - Provide differentiated feedback (e.g., feedback customized to individual learners)
 - Provide multiple examples of novel solutions to authentic problems

Supporting Multilingual/English Learners

Related [CELP standards:](#)

Learning Targets:

An EL can participate in grade appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments and questions.

I can create a manufacturing file using Fusion360.

Level 1: With prompting and support, use a very limited set of strategies to:

- Follow basic instructions to create a manufacturing file using Fusion360
- Use simple vocabulary to describe the steps involved in creating a manufacturing file
- Respond to yes/no questions and some basic questions about creating a manufacturing file

Level 2: With prompting and support, use an emerging set of strategies to:

- Follow instructions to create a manufacturing file using Fusion360
- Participate in short exchanges about creating manufacturing files using academic and domain-specific vocabulary
- Respond to simple questions about the process of creating a manufacturing file

Level 3: With guidance and support, use a developing set of strategies to:

- Discuss and ask questions about creating manufacturing files using Fusion360
- Use academic and domain-specific vocabulary to describe the steps involved in creating a manufacturing file
- Add relevant information and evidence to discussions about creating manufacturing files
- Restate key ideas about creating manufacturing files expressed by others

Level 4: Use an increasing range of strategies to:

- Engage in discussions and written exchanges about creating manufacturing files on various topics and issues using academic and domain-specific vocabulary
- Build on the ideas of others regarding creating manufacturing files
- Clearly express own ideas about creating manufacturing files with specific evidence
- Ask and answer questions to clarify steps and concepts related to creating manufacturing files
- Summarize key points discussed about creating manufacturing files

Level 5: Use a wide range of strategies to:

- Participate in extended discussions and written exchanges about creating manufacturing files on substantive topics and issues using academic and domain-specific vocabulary
- Build on the ideas of others to deepen discussions about creating manufacturing files
- Clearly and persuasively express own ideas about creating manufacturing files with specific and relevant evidence
- Refer to specific evidence from texts or research to support ideas about creating manufacturing files
- Ask and answer questions that probe reasoning and claims related to creating manufacturing files
- Summarize key points and evidence discussed about creating manufacturing files

General Teacher Resources for Fusion 360

[Learn about the Fusion Interface Video](#)

[Setting Preferences in Fusion](#)

[Display Settings](#)

[Use the Marking Menu](#) (most common commands - different for each workspace)
[Use the Toolbox](#)
[Using Fusion Team](#)
[Difference Between TinkerCAD and Fusion 360](#)
[Product Documentation](#)
[CAD Projects Fusion Library and Learning Catalog](#)
[New to Fusion Videos \(Autodesk\)](#)

Lesson Sequence	Learning Target/Success Criteria	Task/ Assessment	Resources
<p>1 Intro to Fusion 360</p>	<p>I can describe Fusion 360 as a cloud-enabled platform for design, understand the structure of a Fusion Team, access and manage project data, set up folder-level projects, assign roles and permissions, deactivate users, archive projects, and identify resources for support.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> ● Describe Fusion 360 as a Cloud Enabled Platform for Design ● Understand the structure of a Fusion Team ● Access their data ● Set up a Folder-Level Project ● Add folders with roles ● Remove and deactivate students ● Archive a project ● Know where to get help 	<p><u>Getting Started</u> Step 1: Create an Autodesk Account & Acquire a Fusion 360 License Step 2: In Fusion 360, Create a Folder-Level Project Step 3: In Fusion 360, Create Folders Step 4: Invite New Members to a Folder Step 5: Set Members' Role for Folders Step 6: Change Members' Role for the Fusion Team</p> <p><u>Archive a Project:</u> Step 1: Remove Students from a Folder-Level Project Step 2: Deactivate Members from Your Fusion Team Step 3: Archive a Project on Fusion Team</p>	<p>Fusion 360 Program</p> <p>01 Introduction to Fusion 360. Fusion Team and Folder-Level Projects Presentation</p> <p>Fusion 360 Fundamentals Course - Import Script</p> <p>Project Data Importer Files</p>
<p>2 Sketching</p>	<p>I can understand the modeling process in Fusion 360, create and edit sketches, navigate the sketching plane using the mouse, add dimensions and constraints to sketches, sketch on the face of a part, and project geometry from a 2D sketch.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> ● Understand the modeling process ● Create sketches ● Utilize the Fusion 360 Interface ● Utilize the mouse to navigate on the sketching plane ● Add dimensions to a sketch ● Add constraints to a sketch ● Edit sketches ● Sketch on the face of a part ● Project geometry from a 2D 	<p>Setup a project, axis, and units. Exercise 1: Sketching (no dimensions) Exercise 2: Sketching (with dimensions) Exercise 3: Sketching on a Part's Face Exercise 4: Dimensioning Exercise 5: Sketch Constraints Exercise 6: Edit Sketch Exercise 7: Project Geometry</p>	<p>Fusion 360 Program</p> <p>02 Fusion 360 Fundamentals Course - Sketching Presentation</p>

	sketch		
3 Part Modeling	<p>I can create and modify features in Fusion 360, including extrude, revolve, hole, fillet, chamfer, pattern, mirror, and shell features, use construction geometry, change materials, and inspect my design.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> ● Create extrude features ● Create revolve features ● Create hole features ● Create fillet and chamfer features ● Pattern and mirror features ● Create a shell feature ● Create construction geometry ● Change material and inspect the design 	<p>Exercise 1: Extrude Features Exercise 2: Thin Extrude Feature Exercise 3: Revolve Feature Exercise 4: Hole Features Exercise 5: Fillets and Chamfer Features Exercise 6: Rectangular and Circular Patterns Exercise 7: Mirror Exercise 8: Shell Feature Exercise 9: Construction Geometry Exercise 10: Inspect – Change Material, Properties, Measure, Section Analysis</p>	<p>Fusion 360 Program</p> <p>03 Fusion 360 Fundamentals Course - Part Modeling</p>
4 Assembly Modeling	<p>I can manage assemblies in Fusion 360, create components from bodies, use the move/copy, align, and assembly joint tools, create rigid groups, and apply contact sets and joint limits.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> ● Manage assemblies ● Create components from bodies ● Utilize the move/copy, align, and assembly joint tools ● Create rigid groups ● Utilize contact sets and joint limits 	<p>Exercise 1: Managing Assemblies Exercise 2: Create Components From Bodies Exercise 3: Move Align Joints Exercise 4: Rigid Groups Exercise 5: Contact Sets and Joint Limits</p>	<p>Fusion 360 Program</p> <p>04 Fusion 360 Fundamentals Course - Assembly Modeling Presentation</p>
5 Drawings	<p>I can create and edit drawing views (base, projected, section, detail), adjust their scale, appearance, and edge visibility, control section and detail view areas, add annotations, centerlines, center marks, dimensions, notes (text, hole, and thread), parts lists, and balloons, and manage sheets and title blocks. I can also export a drawing and edit document settings, including text in the title block.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> ● Create drawing views; base, projected, section, detail ● Edit drawing views <ul style="list-style-type: none"> ○ Move drawing views. ○ Delete drawing views. ○ Change the scale, appearance, and edge visibility of drawing views. ○ Control what is displayed in a section view. ○ Change the area displayed in 	<p>Exercise 1: Create Drawing Views Exercise 2: Edit Drawing Views Exercise 3: Annotating a Drawing Exercise 4: Sheets, Borders and Title Blocks Exercise 5: Export a Drawing</p>	<p>Fusion 360 Program</p> <p>05 Fusion 360 Fundamentals Course - Drawings Presentation</p>

	<ul style="list-style-type: none">○ a detail view● Add annotations<ul style="list-style-type: none">○ Centerlines and Center Marks○ Dimensions○ Text, Hole, and Thread Notes○ Parts List and Balloons● Edit a sheet and title block<ul style="list-style-type: none">○ Change the sheet size.○ Add, rename, and delete a sheet.○ Edit a document's settings.○ Edit text in a title block.○● Export a drawing		
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Unit Title:

Unit 2: Part & Assembly Modeling

In this unit, students will explore the assembly modeling process, focusing on the integration and interaction of multiple parts to create complex assemblies. Topics covered include component hierarchy, constraints, mates, fasteners, interference detection, exploded views, and bill of materials (BOM). Through hands-on projects, students will develop skills in assembling, simulating motion, and documenting assemblies for manufacturing and visualization purposes. Students will further develop their skills with technical drawing and annotation within the CAD environment.

Relevant Standards: **Bold indicates priority**

ESS01.02: Comprehend key elements of written information such as cause/effect, comparisons/contrasts, charts /tables/graphs, evaluation/critiques, sequence, summaries, and technical subject matter. Evaluate written information for accuracy, adequacy/sufficiency, clarity, solutions, and relationship of ideas.

ESS01.03: Apply data and measurements to solve a problem. Analyze data when interpreting operational documents.

ESS02.01: Demonstrate use of content, technical concepts and vocabulary when analyzing information and following directions. Interpret and communicate information, data, and observations to apply information learned from reading to actual practice.

ESS 02.05 Use correct grammar, punctuation and terminology to write and edit documents.

ESS03.01 Analyze elements of a problem to develop creative solutions. Use structured problem-solving methods when developing proposals and solutions. Identify a variety of problem-solving and critical thinking skills.

ESS 04.10 Manage computer operations, manage file storage, and compress or alter files.

ESS06.01 Identify safety hazards common to workplaces. Identify safety precautions to maintain a safe worksite. Select appropriate personal protective equipment as needed for a safe workplace/jobsite.

ESS 07.03 Work with others to achieve objectives in a timely manner. Demonstrate teamwork processes that provide consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution. Take responsibility for shared group and individual work tasks. Assist team members in completing their work. Adapt effectively to changes in projects and work activities.

MNPA01.01.04 Use process control data to ensure that the manufacturing process complies with standards. Identify possible consequences resulting from failure to perform operations safely. Verify that the product meets customer specifications.

MNPA01.01.05 Inspect the product to verify that it meets specifications. Verify the calibration of the testing equipment. Follow the established sampling plan and inspection policies/procedures. Predict consequences of failure to identify promptly any product and production process that do not meet specifications. Make adjustments needed to keep the production process within specifications.

ACC01.01 Use geometric formulas to determine areas and volumes of various structures. Use appropriate formulas to determine ratios, fractions, and proportion measures. Use appropriate formulas to determine measurements of dimensions, spaces and structures. Conceptualize a three-dimensional form from a two-dimensional drawing to visualize proposed work.

ACPA06.01 Learn to read and produce technical drawings, understanding the significance of each line in a drawing.

ACPA06.02 Convey graphic information using multi-dimensional drawings. Build models using referenced drawings and sketches. Utilize computer technology when communicating concepts and designs.

Essential Question(s):

- How do I use CAD assembly tools to combine multiple part files into a common assembly file?
- How do you make part updates within an assembly?
- How do I apply constraints to parts within an assembly?
- How are assembly files used in industry?
- How do presentation files help show a working assembly (optional)?
- What are the components of a technical drawing?
- What are the dimensioning/annotation standards for technical drawings?
- How do you create a technical drawing using CAD software?
- How are drawing sheets used in industry?

Enduring Understanding(s):

- **Part modeling:** Before assembling components, students should be proficient in creating individual parts using CAD modeling tools. This includes creating sketches, extruding, revolving, sweeping, and applying features to generate complex shapes.
- **Component hierarchy:** Students need to understand the concept of component hierarchy within an assembly. This includes defining relationships between parts, such as mates, constraints, and alignments, to accurately position and connect components.
- **Constraints and mates:** Learning how to apply constraints and mates is essential for assembling components in CAD. Constraints define how parts relate to each other geometrically, while mates specify how parts are positioned and oriented relative to one another.
- **Assembly structure:** Students should grasp the structure of an assembly, including the organization of components within a hierarchical tree or list. This involves understanding how to create subassemblies, insert parts into assemblies, and manage assembly components efficiently.
- **Interference detection:** Understanding how to detect and resolve interference between components is crucial for ensuring that the assembled product functions correctly. CAD software often provides tools for detecting and visualizing interferences, allowing students to identify and address potential issues.
- **Assembly motion and animation:** Students may need to learn how to simulate assembly motion and create animations to visualize how components interact and move within the assembly. This involves defining motion constraints and creating motion paths to animate the assembly.
- **Fasteners and joints:** Students should understand how to incorporate fasteners, such as screws, bolts, nuts, and joints, such as hinges and bearings, into assemblies. This includes selecting appropriate standard components from libraries or modeling custom fasteners as needed.
- **Exploded views:** Learning how to create exploded views helps students communicate the assembly process visually by showing how components fit together and how they are assembled or disassembled step by step.
- **Bill of Materials (BOM):** Understanding how to generate a bill of materials from an assembly is essential for documenting the components required to build the product. CAD software typically provides tools for automatically generating BOMs based on the components in the assembly.
- **Collaboration and sharing:** Students should learn how to share and collaborate on assemblies with others, including methods for exchanging CAD files, managing revisions, and incorporating feedback from team members or stakeholders.
- **Drawing setup:** Understanding how to set up drawing templates, including title blocks, units, scales, and layers, is essential for creating standardized technical drawings.
- **Geometry creation:** Proficiency in creating and modifying basic geometric shapes such as lines, circles, arcs, polygons, and ellipses is fundamental to creating technical drawings.
- **Dimensioning:** Students need to learn how to add dimensions accurately to their drawings, including linear dimensions, angular dimensions, radial dimensions, and ordinate dimensions.
- **Text and annotations:** Students should understand how to add text, labels, symbols, and other annotations to convey important information on their technical drawings.
- **Orthographic projection:** Understanding orthographic projection principles, including creating and aligning multiple views (e.g., front, top, side views), is crucial for accurately representing three-dimensional objects in two dimensions.
- **Section views and detail views:** Students should learn how to create section views to show internal features of objects and detail views to magnify specific areas of interest within a drawing.
- **Symbols and standards:** Familiarity with industry-standard symbols, abbreviations, and drawing conventions (such as ANSI, ISO, or ASME standards) is essential for creating professional-quality technical drawings.
- **Plotting and printing:** Knowing how to set up plot configurations, scale drawings for printing, and create PDF or physical prints is necessary for sharing technical drawings with others.
- **File management:** Understanding how to organize and manage CAD files, including naming conventions, file

<p>formats, and version control, helps students maintain an efficient workflow and collaborate effectively.</p> <ul style="list-style-type: none"> ● Practice and application: Regular practice and application of CAD skills through exercises, projects, and real-world applications are essential for students to develop proficiency in creating technical drawings using CAD software. 	
Demonstration of Learning:	Pacing for Unit
Completion of lesson activities and exercises in Fusion 360 Design.	14 class periods (75 minute classes)
Family Overview (link below)	Integration of Technology:
Three Dimensional Modeling Family Overview (2024)	Use of the Autodesk Fusion 360 cloud-based program on desktop or laptop computers. Models may be created through additive manufacturing techniques (3D Printing) or subtractive manufacturing techniques (laser engraving, CNC machining).
Opportunities for Interdisciplinary Connections:	Aligned Unit Materials, Resources, and Technology (beyond core resources):
<p><i>Mechanical Engineering:</i> Fusion 360 is primarily used in mechanical engineering for designing parts, assemblies, and creating technical drawings. Students can explore concepts of material properties, forces, and stress analysis through simulations and design testing.</p> <p><i>Architecture:</i> Fusion 360 can help architecture students model building structures and interior designs.</p> <p><i>Art and Design:</i> Fusion 360 can be used in the creation of sculptures, installations, and interactive art.</p>	<p>Autodesk Fusion in 90 Minutes Course Files 3D Content Central – Large variety of free CAD models</p>
Unit-specific Vocabulary:	Anticipated misconceptions:
Mates, constraints, assembly tools, presentation, exploded view, balloon notes, technical drawing, drawing sheets, dimensions, annotation, multiview, isometric, orthographic, sectional, auxiliary, extension lines, leader lines, hidden lines, center lines, object lines, construction lines, cutting plane, hidden features	<ul style="list-style-type: none"> ● Under constraining or over constraining assemblies ● Use design intent and parametric modeling to prevent or reduce CAD assembly errors ● BOM Mistakes Every CAD Designer Makes ● Starting a model with the primary planes on a corner instead of center. ● Not setting up a good file naming system. ● Not setting up Toolbox, templates, libraries, favorites. ● Becoming too reliant on configurations. ● Becoming too reliant on multi-body techniques. ● Making sketch fillets/chamfers instead of feature fillets. ● Using sketch patterns and not Mirroring sketch entities. ● Deleting things and recreating instead of editing. ● Not assigning a CAD Administrator. ● Failing to keep sketches simple. ● Not having a real plan for model dimensions. ● Dimensioning everything in a sketch instead of minimizing dimensions by using construction lines and relations.
Connections to Prior Units:	Connections to Future Units:
This unit utilizes and expands upon on	Students will apply the information for modeling parts and

knowledge and skills learned in Unit 1: Intro to Fusion 360	assemblies in the next unit for learning how CAD-CAM integration shapes modern manufacturing practices and can impact future design and engineering practices.
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Differentiation through *Universal Design for Learning*

UDL Indicator & Teacher Actions:

Expression and Communication: Build fluencies with graduated levels of support for practice and performance

- Provide Computer-Aided-Design (CAD), notation (writing) software, or mathematical notation software support documentation
- Use web applications (e.g., animations, presentations)
- Provide differentiated models to emulate (i.e. models use differing approaches, strategies, skills, etc.)
- Provide scaffolds that can be gradually released with increasing independence and skills
- Provide differentiated feedback (e.g., feedback customized to individual learners)
- Provide multiple examples of novel solutions to authentic problems

Supporting Multilingual/English Learners

Related *CELP standards* and Learning Targets:

An EL can participate in grade appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments and questions. **I can create a manufacturing file using Fusion360.**

Level 1: With prompting and support, use a very limited set of strategies to:

- Follow basic instructions to create a manufacturing file using Fusion360
- Use simple vocabulary to describe the steps involved in creating a manufacturing file
- Respond to yes/no questions and some basic questions about creating a manufacturing file

Level 2: With prompting and support, use an emerging set of strategies to:

- Follow instructions to create a manufacturing file using Fusion360
- Participate in short exchanges about creating manufacturing files using academic and domain-specific vocabulary
- Respond to simple questions about the process of creating a manufacturing file

Level 3: With guidance and support, use a developing set of strategies to:

- Discuss and ask questions about creating manufacturing files using Fusion360
- Use academic and domain-specific vocabulary to describe the steps involved in creating a manufacturing file
- Add relevant information and evidence to discussions about creating manufacturing files
- Restate key ideas about creating manufacturing files expressed by others

Level 4: Use an increasing range of strategies to:

- Engage in discussions and written exchanges about creating manufacturing files on various topics and issues using academic and domain-specific vocabulary
- Build on the ideas of others regarding creating manufacturing files
- Clearly express own ideas about creating manufacturing files with specific evidence
- Ask and answer questions to clarify steps and concepts related to creating manufacturing files
- Summarize key points discussed about creating manufacturing files

Level 5: Use a wide range of strategies to:

- Participate in extended discussions and written exchanges about creating manufacturing files on substantive topics and issues using academic and domain-specific vocabulary
- Build on the ideas of others to deepen discussions about creating manufacturing files
- Clearly and persuasively express own ideas about creating manufacturing files with specific and relevant evidence
- Refer to specific evidence from texts or research to support ideas about creating manufacturing files
- Ask and answer questions that probe reasoning and claims related to creating manufacturing files

Lesson	Learning Target/Success	Task/Assessment	Resources
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Sequence	Criteria		
1	<p>I can download dataset files and open them in Fusion 360, describe the different sections of the user interface, access projects and designs through the Data Panel, create new projects, upload and open files, change views using zoom, pan, and orbit functions, and make edits to features or components using the Browser and Timeline.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Download dataset files and open in Fusion 360. Describe the different sections of the user interface. Access projects and designs using the Data Panel. Create a new project. Upload a file and open it. Change the view for an object and use the zoom, pan, and orbit functions. Make edits to a feature or component and use the Browser and Timeline. 	<ul style="list-style-type: none"> Demonstrate navigation of the Fusion 360 user interface. Distinguish between the design, render, animation, simulation, and manufacture workspaces. Upload the Tumbler file into the student's Fusion account (2 separate assembly files in the design). Demonstrate use of different views with Tumbler files. Access edit features of the Tumbler by clicking on the timeline. 	<ul style="list-style-type: none"> Lecture Slides Discover the UI Step by Step Slides Discover the User Interface Step by Step Guide Use Navigation & Viewing Tools Step by Step Slides Use Navigation & Viewing Tools Step by Step Guide Dataset: Autodesk_Tumbler.f3z
2	<p>I can create a 2-dimensional sketch, apply dimensions and constraints, add geometric constraints, and ensure sketches are fully constrained in Fusion 360.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> Create a 2-dimensional sketch. Apply dimensions and constraints. Add geometric constraints to a sketch. Create fully constrained sketches. 	<ul style="list-style-type: none"> Create the design file and save as MyTumbler. Utilize imperial units for the project. Create a sketch in the xy plane. Draw lines with exact dimensions. Confirm if the Tumbler sketch is constrained using line colors AND the lock symbol. Create a new design file named Tumbler_Coaster. 	<ul style="list-style-type: none"> Lecture Slides Create a Fully Constrained Sketch Step by Step Slides Create a Fully Constrained Sketch Step by Step Guide Practice Solution: Create a Sketch Step by Step Slides Practice Exercise: Create a Sketch Step by Step Guide Dataset::Tumbler Coaster
3	<p>I can create 3D bodies from 2D sketches, extrude and revolve profiles, hollow solid bodies using the Shell command, and create round and smooth edges with the</p>	<ul style="list-style-type: none"> Make an extrusion on the Tumbler and remove it. Hollow out the inside of the Tumbler. Smooth the edges of the Tumbler. 	<ul style="list-style-type: none"> Lecture Slides Create Features from 2D Sketches Step by Step Slides Create Features from 2D Sketches Step by Step

	<p>Fillet and Chamfer tools in Fusion 360.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> ● Create 3D bodies from 2D sketches. ● Extrude and revolve a profile. ● Hollow a solid body by using the Shell command. ● Create round and smooth edges using the Fillet and Chamfer tools. 		<ul style="list-style-type: none"> ● Guide ● Practice Solution: Extrude a Sketch Profile Step by Step Slides ● Practice Exercise: Extrude a Sketch Profile Step by Step Guide ● Students use their saved Tumbler file and Tumbler Coaster file from prior lesson.
4	<p>I can start a new component in a top-down assembly, use existing geometry to create new components, consider tolerance for different manufacturing processes, add threads to components, toggle between components, apply the correct joints to model motion, and evaluate the differences between various types of joints in Fusion 360.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> ● Start a new component in a top-down assembly. ● Use existing geometry to create new components. ● Consider tolerance when designing for different manufacturing processes. ● Add threads to a component. ● Toggle between components. ● Apply the correct joints to model motion. ● Evaluate the difference between many types of joints. 	<ul style="list-style-type: none"> ● Distinguish between bodies and components. ● Define top-down and bottom-up assemblies. ● Make the top level of the Tumbler assembly active. ● Create a new component named Gasket in an assembly file. ● Create an extrusion on the top of the Tumbler so the Gasket has a feature in its timeline. ● Create a sketch for the Tumbler Lid using the shell and hole tools. ● Distinguish between different joint types. ● Apply the correct joints to control the motion. ● Apply rigid joint types, rigid groups, and as-built joints. ● Create a simple/basic Table for the Tumbler to sit on using as-built joints. 	<ul style="list-style-type: none"> ● Lecture Slides ● Create new components in an assembly Step by Step Slides ● Create new components in an assembly Step by Step Guide ● Use existing geometry to create a design Step by Step Slides ● Use existing geometry to create a design Step by Step Guide ● Position components using joints Step by Step Slides ● Position components using joints Step by Step Guide ● Practice Solution: Create New Components Step by Step Slides Video ● Practice Exercise: Create Components and As Built Joints Step by Step Guide ● Table Drawings and Datasets ● Students use their saved Tumbler file from prior lesson.
5	<p>I can create a sweep, use the Measure tool to determine the sizes of previously modeled parts, insert a separate design file into an assembly using the bottom-up approach, create the base view in a new detailed drawing, apply appropriate dimensioning techniques, and insert notes into a detailed drawing in Fusion 360.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> ● Create a sweep. ● Use the Measure tool to determine sizes of previously 	<ul style="list-style-type: none"> ● Create a customized straw for your tumbler cup that should fit within the opening of the lid and reach the bottom of the tumbler. ● Add the tumbler cup to a table and apply a planar joint to allow a sliding motion on the table top only. ● Create dimensioned drawings to be used in manufacturing processes. ● Use basic fundamentals of dimensioning to create professional-looking 	<ul style="list-style-type: none"> ● Lecture Slides ● Create a Sweep Feature Step by Step Slides ● Create a Sweep Feature Step by Step Guide ● Practice Exercise: Create a Bottom Up Assembly Step by Step Guide ● Practice Solution Create a Bottom Up Assembly Video ● Create Dimensional Drawings Step by Step Slides ● Create Dimensional Drawings Step by Step

	<p>modeled parts.</p> <ul style="list-style-type: none"> ● Insert a separate design file into an assembly using the bottom-up approach. ● Create the base view in a new detailed drawing. ● Apply appropriate dimensioning techniques. ● Insert notes to a detailed drawing. 	<p>drawings for the Tumbler, Coaster, Straw, and Table.</p>	<ul style="list-style-type: none"> ● Guide ● Practice Exercise: Create a Drawing with Multiple Views and Dimensions Step by Step Guide ● Practice Exercise: Create a Drawing with Multiple Views and Dimensions Step by Step Slides Video ● Use saved Tumbler, Tumbler Coaster, Straw, and Table files from prior lessons.
6	<p>I can apply visual settings, modify Render workspace settings, submit a render to the cloud, share a link to the design, and prepare and export files for 3D printing in Fusion 360.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> ● Apply visual settings. ● Modify Render workspace settings. ● Submit a render to the cloud. ● Share a link to the design. ● Prepare and export files for 3D printing. 	<ul style="list-style-type: none"> ● Change the model appearance to create a realistic rendering of the objects and their environment that include the Tumbler, coaster, Lid, Straw, and Table. ● Share a link to the design. ● Prepare and export files for 3D printing. 	<ul style="list-style-type: none"> ● Lecture Slides ● Render a Project Environment Step by Step Slides ● Render a Project Environment Step by Step Guide ● Practice Exercise: Create a Render Step by Step Guide ● Practice Exercise: Create a Render Step by Step Slides ● Export Share Print Step by Step Slides ● Export Share Print Step by Step Guide ● Practice Exercise: Prepare a Design for 3D Printing Step by Step Guide ● Practice Exercise: Prepare a Design for 3D Printing Step by Step Slides ● Use saved Tumbler, Tumbler Coaster, Straw, and Table files from prior lessons.

Unit Title:

Unit 3: 3D Solid Modeling

In this unit, students will utilize the different design setups to virtually examine the manufacturing of their parts, to help make corrections and informed decisions on the manufacturing process being utilized. Students will learn how to implement the steps of the design process for transforming ideas into a production part. For existing parts which may need to be created or modified, the use of reverse engineering will give students the opportunity to recreate or improve on existing designs. Students will use additive or subtractive manufacturing processes to create a part or parts needed for an assembly.

Relevant Standards: **Bold indicates priority**

ESS01.02: Comprehend key elements of written information such as cause/effect, comparisons/contrasts, charts /tables/graphs, evaluation/critiques, sequence, summaries, and technical subject matter. Evaluate written information for accuracy, adequacy/sufficiency, clarity, solutions, and relationship of ideas.

ESS01.03: Apply data and measurements to solve a problem. Analyze data when interpreting operational documents.

ESS02.01: Demonstrate use of content, technical concepts and vocabulary when analyzing information and following directions. Interpret and communicate information, data, and observations to apply information learned from reading to actual practice.

ESS 02.05 Use correct grammar, punctuation and terminology to write and edit documents.

ESS03.01 Analyze elements of a problem to develop creative solutions. Use structured problem-solving methods when developing proposals and solutions. Identify alternatives using a variety of problem-solving and critical thinking skills.

ESS 04.10 Manage computer operations, manage file storage, and compress or alter files.

ESS06.01 Identify safety hazards common to workplaces. Identify safety precautions to maintain a safe worksite. Select appropriate personal protective equipment as needed for a safe workplace/jobsite.

ESS 07.03 Work with others to achieve objectives in a timely manner. Demonstrate teamwork processes that provide consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution. Take responsibility for shared group and individual work tasks. Assist team members in completing their work. Adapt effectively to changes in projects and work activities.

MNPA01.01.04 Use process control data to ensure that the manufacturing process complies with standards. Identify possible consequences resulting from failure to perform operations safely. Verify that the product meets customer specifications.

MNPA01.01.05 Inspect the product to verify that it meets specifications. Verify the calibration of the testing equipment. Follow the established sampling plan and inspection policies/procedures. Predict consequences of failure to identify promptly any product and production process that do not meet specifications. Make adjustments needed to keep the production process within specifications.

ACC01.01 Use geometric formulas to determine areas and volumes of various structures. Use appropriate formulas to determine ratios, fractions, and proportion measures. Use appropriate formulas to determine measurements of dimensions, spaces and structures. Conceptualize a three-dimensional form from a two-dimensional drawing to visualize proposed work.

ACPA06.01 Learn to read and produce technical drawings, understanding the significance of each line in a drawing.

ACPA06.02 Convey graphic information using multi-dimensional drawings. Build models using referenced drawings and sketches. Utilize computer technology when communicating concepts and designs.

Essential Question(s):

- What are the core differences between CAD and CAM, and how do they complement each other in the design and manufacturing process?
- How do you create and manipulate a design using Fusion360, from initial sketch to finalized part?
- What steps are involved in creating a manufacturing file using Fusion360, and how do you ensure the proper setup and settings for the chosen manufacturing process?
- How does the design process facilitate the transformation of an idea into a solution, and what are the key steps involved?
- What are the differences between additive and subtractive manufacturing, and how do they influence the design and production of parts?
- How can Fusion 360 be utilized to create files for different manufacturing processes, such as 3D printing, laser cutting, and CNC machining?

Enduring Understanding(s):

Overview

- Computer-aided manufacturing (CAM) uses computer systems to automate manufacturing processes to make products with very high accuracy and precision. These manufacturing processes are performed by computer numeric control (CNC) machines. The manufacturing processes that these machines perform are milling, turning, cutting (laser, waterjet and plasma), CNC routing, electrical discharge machining (EDM), welding, 3D printing, etc..

Understanding the Design-to-Manufacturing Process:

- Students will understand the sequential process from conceptualizing a design to manufacturing a physical part, involving both CAD and CAM.
- They will comprehend how CAD is used for designing digital models, while CAM is utilized for generating instructions for manufacturing machines.
- Students will grasp the relationship between CAD and CAM, recognizing how they work together to streamline the production process.
- The CAM process starts with CAD where the geometry for the part to be manufactured is generated. The CAD geometry file is then converted to a suitable format that a CNC machine can convert into machine language. The machine language contains all the instructions needed for the CNC machine to make the part. A CAM file is a set of G codes and M codes giving instructions to machines for the manufacturing process.

Applying Manufacturing Principles:

- Students will understand the principles behind manufacturing setups and processes.
- They will know how to create manufacturing setups in Fusion360 and select appropriate processes for a given part.
- They will be able to adjust manufacturing settings based on the chosen process to optimize production.

Integration of Design and Manufacturing:

- Students will understand the importance of integrating design and manufacturing considerations throughout the process.
- They will recognize how design decisions impact manufacturability and vice versa.
- They will be able to make informed design choices that take into account manufacturing constraints and requirements.

Problem-Solving and Adaptability:

- Students will develop problem-solving skills and adaptability in using CAD/CAM software.
- They will be able to troubleshoot issues that arise during the design or manufacturing process.
- They will understand the importance of flexibility in adjusting designs or manufacturing setups based on feedback or changing requirements.

Manufacturing Methods and Their Implications:

- Students will understand the differences between additive and subtractive manufacturing.
- They will recognize that additive manufacturing builds parts layer by layer, while subtractive manufacturing removes material from a solid block.
- They will be able to evaluate the benefits and drawbacks of each manufacturing method in terms of cost, speed, complexity, and material usage.

Application of CAD/CAM Tools:

- Students will understand how to use Fusion 360 to create files for different manufacturing processes.
- They will be able to create .stl files for 3D printing, PDF files for laser cutting, and G-code for CNC machining.
- They will recognize the importance of selecting the appropriate file format and settings based on the requirements of the manufacturing process.

<ul style="list-style-type: none"> ● Design Constraints and Evaluation: ● Students will understand the importance of evaluating design solutions to ensure they meet design constraints. ● They will be able to identify and prioritize design constraints such as size, material, functionality, and cost. ● They will critically evaluate design solutions and make revisions as needed to meet desired criteria. <p>Interdisciplinary Skills and Collaboration:</p> <ul style="list-style-type: none"> ● Students will recognize the interdisciplinary nature of the design and manufacturing process. ● They will understand the importance of collaboration between designers, engineers, and manufacturers to develop and produce successful products. ● They will develop communication skills necessary for effective collaboration and the ability to integrate feedback into the design process. 	
Demonstration of Learning:	Pacing for Unit
Completion of lesson activities and exercises in Fusion 360 (Manufacturing). Fabrication of designs.	13 - 75 minute classes
Family Overview (link below)	Integration of Technology:
Three Dimensional Modeling Family Overview (2024)	Use of the Autodesk Fusion 360 cloud-based program on desktop or laptop computers. Models may be created through additive manufacturing techniques (3D Printing) or subtractive manufacturing techniques (laser engraving, CNC machining).
Opportunities for Interdisciplinary Connections:	Aligned Unit Materials, Resources, and Technology (beyond core resources):
<p><i>Mechanical Engineering:</i> Fusion 360 is primarily used in mechanical engineering for designing parts, assemblies, and creating technical drawings. Students can explore concepts of material properties, forces, and stress analysis through simulations and design testing.</p> <p><i>Architecture:</i> Fusion 360 can help architecture students model building structures and interior designs.</p> <p><i>Art and Design:</i> Fusion 360 can be used in the creation of sculptures, installations, and interactive art.</p>	<ul style="list-style-type: none"> ● The Embedded Design Process: CAD/CAM and Prototyping ● 3D printer(s) and Laser printer(s) ● Machines - milling/ router/ lathe ● 3D Content Central – Host an enormous variety of free CAD models
Unit-specific Vocabulary:	Anticipated misconceptions:
2d Contour, 3d Modeling Tool, Adaptive Clearing, Additive Manufacturing, Assembly, Baseline, CAD (Computer-Aided Design), CAM (Computer-Aided Manufacturing), Constraints, CNC (Computer Numerical Control), CNC Machining, Design Process, Evaluation, Collet, Caliper, Chamfer, Cutting, Design File, Clearance Height, Extrude, Feeds And Speeds, Fillet, Filament, Fusion 360, G-Code, Interdisciplinary, Iterative, Laser Cutting, Lead In/Out, Manufacturing File, Manufacturing Process, Manufacturing Setup, Navigation Bar, Orientation, PDF (Portable Document Format), Projection, Prototyping, Ramping, Rapid Movement, Revolve, Shell, Sketch, Sketch Plane, STL File, Sepover, Stock, Subtractive Manufacturing, Technical Drawing, Toolpath, 3d Printing, View Cube, X Axis, Y Axis, Z Axis, Z Slice	<ul style="list-style-type: none"> ● There are tools and commands for parts, others for assemblies, and others for drawings. ● Know the difference between the Design and Manufacturing locations and capabilities in Fusion. ● The "toggle" contexts: while editing a sketch, when editing a component in assembly context, when making an exploded view, or when editing the sheet format, you are unable to do unrelated things until you close the active toggle context. ● Randomly placing the first part in an assembly because you don't know to hit the green checkmark and fix it at the origin. ● Using assembly mates as a way to validate modeling precision rather than a tool for restricting degrees of freedom of components. ● Using the wrong tool for the desired manufacturing process. ● Ensuring all values are reviewed and simulated prior

to fabrication.

Connections to Prior Units:

In the prior two units in this course students developed their skills for computer aided design in Autodesk Fusion along with creating industry standard drawings of their designs. These skills provide the foundation for computer aided manufacturing where students learn to fabricate their designs in additive and subtractive manufacturing.

Connections to Future Units:

This is the final unit in this course. After successfully completing this course, students will have solid foundational knowledge, understanding, and skills of three dimensional design and manufacturing which can be used in advanced coursework for CAD and CAM.

Differentiation through [Universal Design for Learning](#) UDL Indicator and Teacher Actions:

Expression and Communication: Build fluencies with graduated levels of support for practice and performance

- Provide CAD, notation (writing) software, or mathematical notation software support documentation
- Use web applications (e.g., animations, presentations)
- Provide differentiated models to emulate (i.e. models use differing approaches, strategies, skills, etc.)
- Provide scaffolds that can be gradually released with increasing independence and skills
- Provide differentiated feedback (e.g., feedback customized to individual learners)
- Provide multiple examples of novel solutions to authentic problems

Supporting Multilingual/English Learners

Related [CELP standards](#) and Learning Targets:

An EL can participate in grade appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments and questions.

I can create a manufacturing file using Fusion360.

Level 1: With prompting and support, use a very limited set of strategies to:

- Follow basic instructions to create a manufacturing file using Fusion360
- Use simple vocabulary to describe the steps involved in creating a manufacturing file
- Respond to yes/no questions and some basic questions about creating a manufacturing file

Level 2: With prompting and support, use an emerging set of strategies to:

- Follow instructions to create a manufacturing file using Fusion360
- Participate in short exchanges about creating manufacturing files using academic and domain-specific vocabulary
- Respond to simple questions about the process of creating a manufacturing file

Level 3: With guidance and support, use a developing set of strategies to:

- Discuss and ask questions about creating manufacturing files using Fusion360
- Use academic and domain-specific vocabulary to describe the steps involved in creating a manufacturing file
- Add relevant information and evidence to discussions about creating manufacturing files
- Restate key ideas about creating manufacturing files expressed by others

Level 4: Use an increasing range of strategies to:

- Engage in discussions and written exchanges about creating manufacturing files on various topics and issues using academic and domain-specific vocabulary
- Build on the ideas of others regarding creating manufacturing files
- Clearly express own ideas about creating manufacturing files with specific evidence
- Ask and answer questions to clarify steps and concepts related to creating manufacturing files
- Summarize key points discussed about creating manufacturing files

Level 5: Use a wide range of strategies to:

- Participate in extended discussions and written exchanges about creating manufacturing files on substantive topics and issues using academic and domain-specific vocabulary
- Build on the ideas of others to deepen discussions about creating manufacturing files
- Clearly and persuasively express own ideas about creating manufacturing files with specific and relevant evidence
- Refer to specific evidence from texts or research to support ideas about creating manufacturing files
- Ask and answer questions that probe reasoning and claims related to creating manufacturing files

- Summarize key points and evidence discussed about creating manufacturing files

Lesson Sequence	Learning Target	Success Criteria/ Assessment	Resources
1	<p>I can explain the difference between and characteristics of Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM).</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Explain the difference between Computer Aided Design (CAD) and Computer Manufacturing Design (CAM). • Describe what CAD is and how it is used. • Describe what CAM is and how it is used. 	<p>Computer generated diagram comparing and contrasting CAD and CAM.</p>	<ul style="list-style-type: none"> • CAD/CAM Presentation • Video demonstrations illustrating differences between CAD/CAM and final products. • Manufacture overview
2	<p>I can create a manufacturing file in Fusion 360, set up a new manufacturing process, select the appropriate process, and adjust manufacturing settings accordingly.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Create a manufacturing file in Fusion360. • Create a new manufacturing setup. • Select the proper manufacturing process • Change and adjust manufacturing settings based on the chosen manufacturing process. 	<p>1-Caliper Front FirstOp With NoSetUp 2-Caliper Front FirstOp With SetUp 3-Caliper Front FirstOp Complete</p>	<p>01 Fusion 360 CAM Fundamentals, 2.5 Axis Toolpath operations Presentation Milling Basics</p>
3	<p>I can describe and explain each step of the design process, apply the steps to transform an idea into a solution, and evaluate the solution to ensure it meets design constraints.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Describe the use of the design process. • Explain each step in the design process. • Apply each of the steps of the design process to take an idea and turn it into a solution. • Evaluate the design solution to ensure it effectively meets design constraints. 	<p>4-Caliper Front Setup With Toolpaths 5 - 3D Milling - Overview of Toolpaths 6-3D Milling - Overview of toolpaths StarterFile</p>	<p>02 Fusion 360 CAM Fundamentals, 3 Axis Toolpath operations Presentation 2D adaptive milling tutorial</p>
4	<p>I can explain the difference between additive and subtractive manufacturing, identify three additive and three subtractive manufacturing processes along with their benefits and drawbacks, and demonstrate the use of Fusion 360 to create files for exporting to a device to produce a part.</p> <p>Students will be able to:</p>	<p>Computer generated diagram comparing and contrasting additive and subtractive manufacturing..</p> <p>Additive FFF CAM Files Additive SLA CAM Files</p>	<p>Additive & Subtractive Manufacturing Presentation</p> <p>Manufacturing Product Samples</p> <p>Additive FFF tutorial Additive SLA tutorial</p>

	<ul style="list-style-type: none"> • Explain the difference between additive and subtractive manufacturing? • Name 3 additive manufacturing processes with the benefits and drawbacks of each. • Name 3 subtractive manufacturing processes with the benefits and drawbacks of each • Demonstrate the use of Fusion 360 to create the necessary file(s) needed to export to a device to create a part. 		
5	<p>I can create a physical part by using Fusion 360 to generate an .stl file for 3D printing in MakerPrint, export a design as a PDF for laser printing in CorelDRAW, and create G-code for CNC machining to process a material.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Create a physical part utilizing Fusion 360 to create a .stl file and export it into MakerPrint for setup for a 3D printer. • Create a physical part utilizing Fusion 360 for export as a pdf file into CorelDRAW for setup of a laser printer. • Create G-code utilizing Fusion 360 to export into a CNC machine for subtractive processing of a material. 	<p>CAM Files for Selected Projects</p> <p>Fabricated Projects</p>	<p>3D Printing from Autodesk Fusion Presentation</p> <p>Laser Engraving from Autodesk Fusion Presentation</p>