Unit 4: Space Science (Earth and Space Science)

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Belleville Public Schools

Curriculum Guide

EARTH SCIENCE, GRADE 7

SPACE SCIENCE

Belleville Board of Education

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Unit Overview

Patterns in the Solar System

- The Earth-Sun-Moon System
- Seasons

The Solar System and Universe

- Formation of the Solar System
- Earth and the Solar System
- Earth's Place in the Solar System

Enduring Understanding

- Earth not only rotates on its axis, but it also orbits around the sun.
- The moon rotates on its own axis while orbiting around Earth, takes about 27 days.
- Both Earth and Moon revolve around a barycenter, the center of mass between two objects.
- The consequences of the interactions between the objects in this system are significant.
- Earth's rotation, which takes 24 hours to complete, causes day and night as one half of the earth is always facing either toward (day) or away (night) from the sun.
- The orbit around the sun, as well as, earth's tilt causes seasons.
- The most widely accepted explanation of how our solar system was formed is the solar nebula theory.
- Over time, the geocentric (earth is the center of the universe) view of the universe evolved to heliocentric (sun is the center of the solar system).
- Earth and its solar system are part of the Milky Way galaxy, which itself is one of many galaxies in the universe.
- Gravity is a force of attraction that affects all matter in the universe and causes orbiting masses to move along an elliptical path.

Essential Questions

- What causes seasons?
- Why does the mooon's shape and brightness appear to change?
- What causes eclipses?
- What is the relationship between ocean tides and the Moon?
- How does the sun affect weather and climate?
- How does the Earth-Sun-Moon system affect life on earth?
- How is earth similar to and different from other objects in space?
- What makes up the universe?
- How did the solar system form?
- What role does gravity play in Earth's place in the universe?

Exit Skills

By the end of Module H, Lesson 1 students should be able to:

- Recognize patterns in order to better understand the cause and effect relationships within the Earth-Sun-Moon system.
- Describe the patterns of lunar phases, eclipses of the sun and moon.
- Identify the four seasons and their characteristics and formulate ideas as to why they vary.
- Explain why different stars can be observed throughout the year.

By the end of Module H, Lesson 2 students should be able to:

- Explain the arrangement of objects in the solar system.
- Describe how the solar system was formed.
- Distinguish the differences between geocentric and heliocentric models of the solar system.
- Identify where earth fits into the Milky Way galaxy and the entire universe.
- Explain how the attractive force of gravity accounts for the motions of Earth and other objects in the universe.

New Jersey Student Learning Standards (NJSLS-S)

NextGen Science Standards

6-8.MS-ESS1-1.1.1	Patterns can be used to identify cause-and- effect relationships.
6-8.MS-ESS1-1.2.1	Develop and use a model to describe phenomena.
6-8.MS-ESS1-2.2.1	Develop and use a model to describe phenomena.
6-8.MS-ESS1-3.3	Scale, Proportion, and Quantity
6-8.MS-ESS1-4.3.1	students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small. They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and designed systems may change with scale. They use proportional relationships (e.g., speed as the ratio of distance traveled to time taken) to gather information about the magnitude of properties and processes. They represent scientific relationships through the use of algebraic expressions and equations.
6-8.MS-ESS1-3.3.1	students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small. They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and

	designed systems may change with scale. They use proportional relationships (e.g., speed as the ratio of distance traveled to time taken) to gather information about the magnitude of properties and processes. They represent scientific relationships through the use of algebraic expressions and equations.
6-8.MS-ESS1-3.4.1	Analyze and interpret data to determine similarities and differences in findings.
6-8.MS-ESS1-2.4.1	Models can be used to represent systems and their interactions.
6-8.MS-ESS1-4.6.1	Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
6-8.MS-ESS1-2.ESS1.A.1	Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe.
6-8.MS-ESS1-1.ESS1.A.1	Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models.
6-8.MS-ESS1-2.ESS1.B.1	The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.
6-8.MS-ESS1-3.ESS1.B.1	The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.
6-8.MS-ESS1-1.ESS1.B.1	This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.
6-8.MS-ESS1-4.ESS1.C.1	The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale.
SCI.MS-ESS1-2	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
SCI.MS-ESS1-1	Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
SCI.MS-ESS1-3	Analyze and interpret data to determine scale properties of objects in the solar system.
SCI.MS-ESS1-4	Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

Interdisciplinary Connections

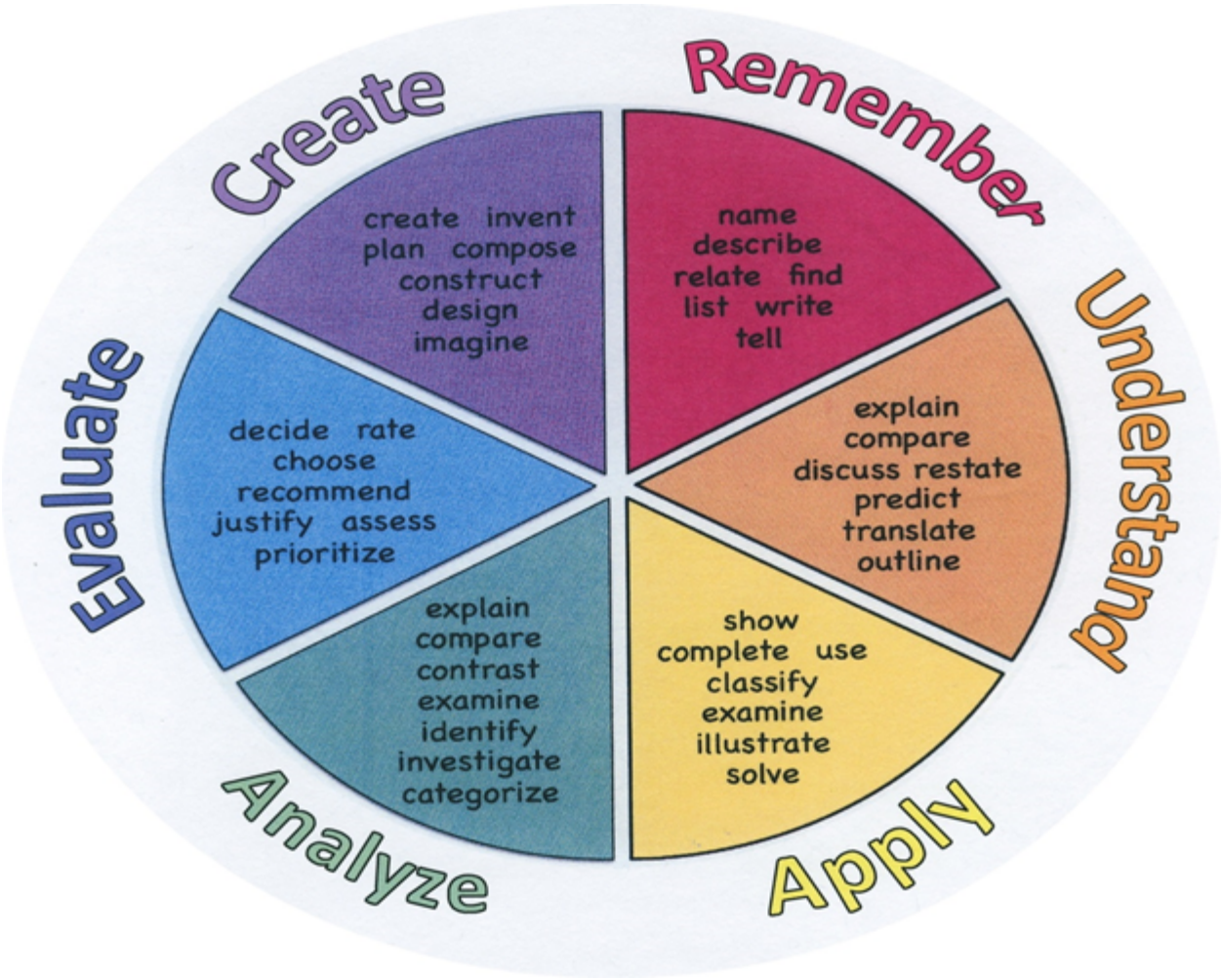
LA.RL.7.1	Cite several pieces of textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.
MA.7.RP.A.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.
LA.RL.7.4	Determine the meaning of words and phrases as they are used in a text, including figurative and connotative meanings; analyze the impact of rhymes and other repetitions of sounds (e.g., alliteration) on a specific verse or stanza of a poem or section of a story or drama.

LA.W.7.1	Write arguments to support claims with clear reasons and relevant evidence.
MA.7.G.A.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
SOC.6.1.8.B	Geography, People, and the Environment

Learning Objectives

- Students will be able to explore patterns in order to better understand the causes and effect relationships within the Earth-sun-moon system.
- Students will be able to develop and use models to describe patterns of the apparent motion of objects in this system and to explain eclipses of the sun and the moon.
- Students will be able to relate the motions of Earth to the apparent motion of the stars in the sky to explain why different stars can be observed throughout the year.
- Students will be able to construct the arrangement of objects in the solar system and understand the vast distances and periods of time related to the solar system.
- Students will be able to compare the geocentric and heliocentric models of the solar system.
- Students will be able to conclude that Earth fits into the Milky Way Galaxy.
- Students will be able to investigate how the attractive forces of gravity accounts for the motions of Earth.

Remember	Understand	Apply	Analyze	Evaluate	Create
Choose	Classify	Choose	Categorize	Appraise	Combine
Describe	Defend	Dramatize	Classify	Judge	Compose
Define	Demonstrate	Explain	Compare	Criticize	Construct
Label	Distinguish	Generalize	Differentiate	Defend	Design
List	Explain	Judge	Distinguish	Compare	Develop
Locate	Express	Organize	Identify	Assess	Formulate
Match	Extend	Paint	Infer	Conclude	Hypothesize
Memorize	Give Examples	Prepare	Point out	Contrast	Invent
Name	Illustrate	Produce	Select	Critique	Make
Omit	Indicate	Select	Subdivide	Determine	Originate
Recite	Interrelate	Show	Survey	Grade	Organize
Select	Interpret	Sketch	Arrange	Justify	Plan
State	Infer	Solve	Breakdown	Measure	Produce
Count	Match	Use	Combine	Rank	Role Play
Draw	Paraphrase	Add	Detect	Rate	Drive
Outline	Represent	Calculate	Diagram	Support	Devise
Point	Restate	Change	Discriminate	Test	Generate
Quote	Rewrite	Classify	Illustrate		Integrate
Recall	Select	Complete	Outline		Prescribe
Recognize	Show	Compute	Point out		Propose
Repeat	Summarize	Discover	Separate		Reconstruct
Reproduce	Tell	Divide			Revise
	Translate	Examine			Rewrite
	Associate	Graph			Transform
	Compute	Interpolate			
	Convert	Manipulate			
	Discuss	Modify			
	Estimate	Operate			
	Extrapolate	Subtract			
	Generalize				
	Predict				



Suggested Activities & Best Practices

Utilization of various **DefinedStem.com** projects which recognizes the different learning styles of the students. DefinedStem is both problem and project-based learning. Content specific project:

- Online Space Weather Business

Utilization of **NEWSELA.com** that can be used for different leveled readers.

- Assign weekly informational text articles directly related to the lesson
- Complete reading comprehension activities on the assigned articles: quiz, power words, write

Problem and project-based learning. Content specific project:

- Diagramming and analyzing Lunar and Solar Eclipses
- Creating a display for Lunar Phases to evaluate how the moon revolves around the earth

Assessment Evidence - Checking for Understanding (CFU)

Summative Module H Chapter Tests given in Google Classroom (Summative)

Periodic Vocabulary Quizzes (Summative)

Lab activities and Accompanying worksheets (Summative)

Defined Stem project (Alternate)

Why It Matters charts (KWL) (Formative)

Graphic Organizer (Formative)

BrainPop quizzes on videos covering Module H (Summative)

Newsela Article/Quiz covering Module H (Summative)

HMH Workbook Highlights & Questions (Formative)

Notebook Entries & Diagrams (Alternate)

Oncourse Assessment Tools (Formative)

"Do Now/Exit Ticket" Activity (Formative)

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster

- DBQ's
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Google Forms
- Illustration
- Journals
- Kahoot
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline
- Outline
- Plickers
- Question Stems
- Quickwrite
- Quizlet
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

- HMH workbook series: F and G and supplementary materials (lab kits)
- Internet resources
- 1:1 Google classroom platform: Docs, Sheet, Forms, Slides, Sites

- Video streaming: YouTube, BrainPOP

Ancillary Resources

- Outdoor area of school
- Chromebook/ 1:1 Google classroom platform

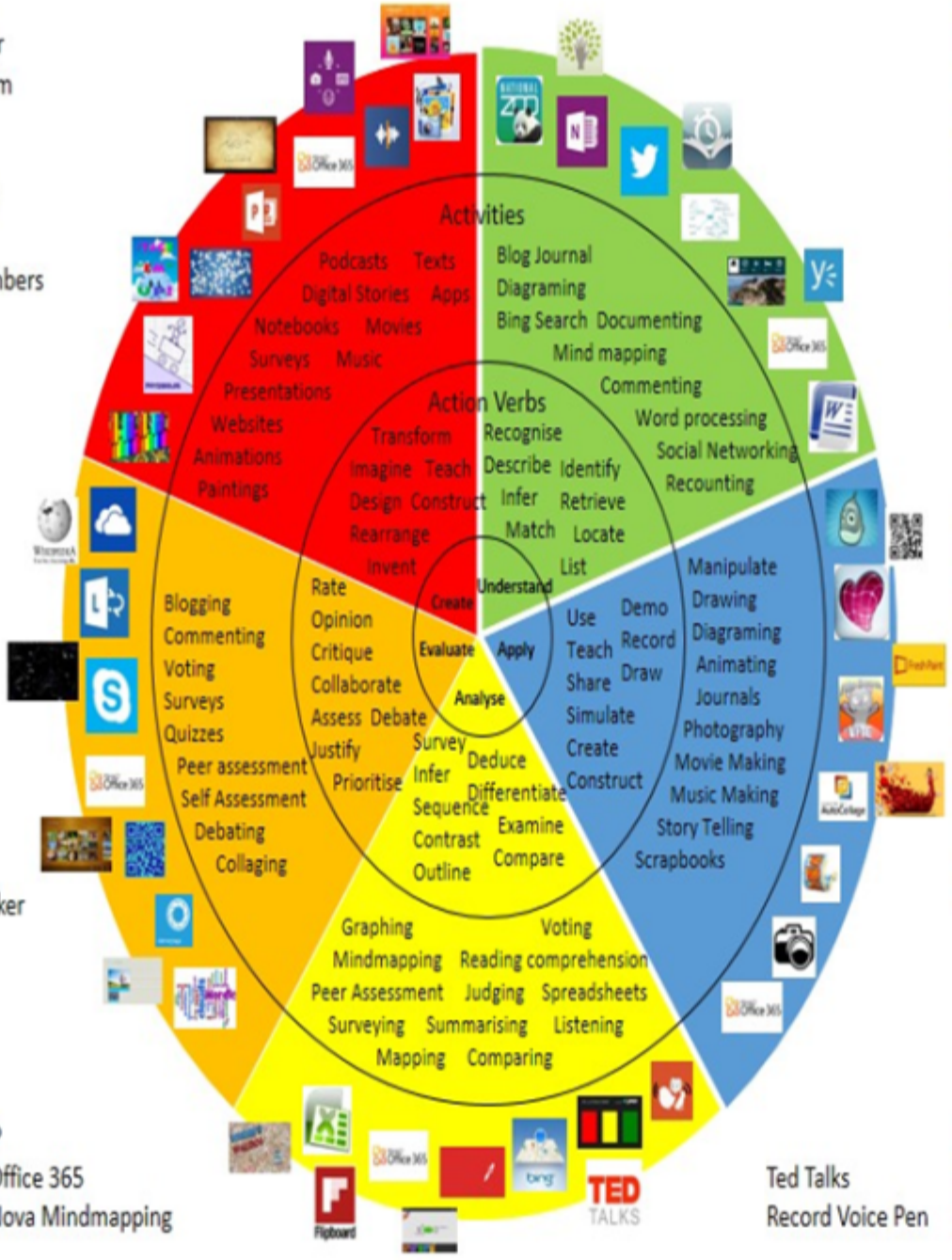
Technology Infusion

- Smart TV
- DefinedStem.com
- Document Camera
- Pod-casts video streams
- Discovery Education video streams
- YouTube video streams
- BrainPOP video streams
- Chromebooks
- Khan Academy
- Power Point presentation
- Flipgrid
- MS Word
- Google Applications: Classroom, Docs, Sheets, Slides, Forms, Sites

Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker



Where's Waldo?
MS Excel Office 365
Flipboard Nova Mindmapping

Ted Talks
Record Voice Pen

Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

Alignment to 21st Century Skills & Technology

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
CAEP.9.2.8.B.4	Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.
CAEP.9.2.8.B.6	Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.
CAEP.9.2.8.B.7	Evaluate the impact of online activities and social media on employer decisions.
TECH.8.1.8.A.2	Create a document (e.g., newsletter, reports, personalized learning plan, business letters or flyers) using one or more digital applications to be critiqued by professionals for usability.
TECH.8.1.8.A.4	Graph and calculate data within a spreadsheet and present a summary of the results.
TECH.8.1.8.B.1	Synthesize and publish information about a local or global issue or event (ex. telecollaborative project, blog, school web).
TECH.8.1.8.C.CS2	Communicate information and ideas to multiple audiences using a variety of media and formats.
TECH.8.1.8.C.CS4	Contribute to project teams to produce original works or solve problems.

21st Century Skills/Interdisciplinary Themes

21st Century/Interdisciplinary Themes that will be incorporated into this unit.

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

21st Century Skills

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

Please list only the **21st Century Skills** that will be incorporated into this unit.

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

Differentiation

- Have students use an online lunar and solar eclipse calculator to determine when in the next century a total lunar eclipse will be visible in their area.
- Have students take pictures of the moon at the same angle at the same time every night outside to observe the moon phases.
- Have students develop an interactive game that allows players to search for and identify objects in the solar system.
- Have students research different technology that is used to study space and present findings via power point presentation.
- Have students create venn diagram to compare and contrast Aristotle's geocentric model with Ptolemy's model.

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts

- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

Special Education Learning (IEP's & 504's)

Special Education Learning adaptations that will be employed in the unit, using the ones identified below.

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning (ELL)

English Language Learning adaptations that will be employed in the unit, using the ones identified below.

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarif
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

At Risk

Intervention Strategies that will be employed in the unit, using the ones identified below.

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests

- using videos, illustrations, pictures, and drawings to explain or clarify

Talented and Gifted Learning (T&G)

Talented and Gifted adaptations that will be employed in the unit, using the ones identified below.

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

Sample Lesson

Unit Name: Formation of the Solar System

NJSLS: See Link

Interdisciplinary Connection: See Link

Statement of Objective: SWDAT analyze the four different theories of how the moon was created.

Anticipatory Set/ Do Now: ANS: d. MARIA

_____ are dark-colored, relatively flat regions of the Moon's surface formed when interior lava filled large basins.

a. Craters b. Eclipses c. Volcanoes d. Maria

Learning Activity:

1- Spend 5 minutes going over ' Do Now' answer

2- Students will watch https://www.youtube.com/watch?v=WGTBJHFNywI and decide which theory makes the most sense to them.

3- Students will make a chart and bullet the important notes about each theory.

4- Students will discuss their opinion and debate with a shoulder partner.

5- For an exit card, students will hand in a short one paragraph written response explaining how they believe the moon to be made.

Student Assessment/CFU's: See Link (which theory can you relate to the most? Why does that make the most sense to you? How do you believe the moon was made?)

Materials: 1. Smart Board with Powerpoint
2. textbook
3. Video
4. Short written response

21st Century Themes and Skills: See Link

Differentiation: See Link (watch visual on the different theories, students can explain via text or drawing/picture how the moon was made)

Integration of Technology: smart TV, youtube.com

SCI.MS-ESS1-4	Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.
SCI.MS-ESS3-4	Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
SCI.MS-ESS1-2	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
SCI.MS-ESS3-2	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
SCI.MS-ESS1-3	Analyze and interpret data to determine scale properties of objects in the solar system.
SCI.MS-ESS1-1	Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
SCI.MS-ESS3-3	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.