Unit 3: Earth and Space Science
8th Grade Science

17 Class Meetings

Revised May 2024

Essential Questions

- How are we connected to the patterns we see in the sky and space?

Enduring Understandings with Unit Goals

EU 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.

- Develop a model of the Earth-moon-sun system in which they identify the relevant components, including Earth (tilt and axis rotation included), Sun, Moon, and Solar energy.
- Describe the relationships between the components in their models.
- Indicate the accuracy of size and distance (scale) relationships within the model, including and scale limitations within the model.
- Use patterns observed from their model to provide casual accounts for events including, Moon phases, eclipses, and seasons.
- Use their model to make predicts about patterns and phenomenon observed in the sky

EU 2: Earth and its solar system are part of the Milky Way galaxy, which is one of the many galaxies in the universe. The solar system consists of the sun and a collection of objects that are held in orbit around the sun by its gravitational pull on them. The solar system appears to have formed from a disk of dust and gas drawn together by gravity.

- Develop a model in which they identify the relevant components of the solar system and galaxy. Indicate the relative spatial scales of solar systems and galaxies in the model.
- Describe the relationships and interactions between components of the solar and galaxy systems.
- Use the model to describe that gravity is predominantly an inward-pulling force. Gravity causes a pattern of smaller/less massive objects orbiting around larger/more massive objects at all scales in the universe.
- Use the model to describe that objects too far away from the sun do not orbit it because the sun's gravitational force on those objects is too weak.

EU 3: 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..

- Organize given data to describe that different representations illustrate different characteristics of objects in the solar system.
- Use quantitative analyses to describe similarities and differences among solar system objects by describing patterns of those features.
- Use patterns in data as evidence to describe characteristics of categories of solar system objects.

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Standards

Next Generation Science Standards:

- **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.
- **MS-ESS1-2:** Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
- **MS-PS2-4:** Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
- **MS-ESS1-3:** Analyze and interpret data to determine scale properties of objects in the solar system.
- **MS-PS4-2:** Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

Common Core State Standards:

- **CCSS.ELA-LITERACY.RST.6-8.1:** Cite specific textual evidence to support analysis of science and technical texts.
- **CCSS.ELA-LITERACY.WHST.6-8.8:** Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
- **CCSS.ELA-LITERACY.RST.6-8.7:** Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- **CCSS.MATH.CONTENT.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.

Unit 3: Earth and Space Science
8th Grade Science
17 Class Mee

ISAAC Vision of the Graduate Competencies

Competency 1: Write effectively for a variety of purposes.
Competency 2: Speak to diverse audiences in an accountable manner.
Competency 3: Develop the behaviors needed to interact and contribute with others on a team.
Competency 4: Analyze and solve problems independently and collaboratively.
Competency 5: Be responsible, creative, and empathetic members of the community.

Unit Content Overview

1. **Develop ideas about the Earth-Sun system**
   - Analyze how the sun aligns with the Manhattan skyline one day each year and develop an initial model to explain the phenomenon of Manhattanhenge.
   - Use patterns to begin making connections between the position of the sunset on Earth, connect it to our daily lives, and brainstorm other interesting patterns that link our lives to the sky.

2. **Add the Moon into the system**
   - Develop a logical argument for why lunar eclipses do not go completely dark.
   - Investigate more phenomena related to color and light

3. **Use tools to see better and farther into space, expanding the scale of their models**
   - Identify how the solar system is organized and how it got that way
   - Investigate how gravitational interactions dictate the organization and motion of objects within each system and how this holds true for multiple scales and subsystems.

Interdisciplinary Connection:

- Language Arts- Students gather, read, and synthesize information from multiple sources.
- Math – Students use scale, proportion, and quantity to build out to the vast scale of the universe.
- Art – Students use models and build models to explain patterns in the sky and interacting objects.

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8th Grade Science
17 Class Mee

Daily Learning Objectives with *TWPS*

Students will be able to…

- Ask questions about systems in space that arise from observations of patterns in the sky. Obtain information from images, videos, and podcasts to describe patterns in natural phenomena of objects in the Solar system as seen from Earth. Develop an initial model of systems in space to describe patterns we observe in the sky.
    - *Notice and wonder T-chart for Manhattanhenge. Discuss your observations with a partner.*
- Use a graphical display to determine what patterns are happening in the sky over six months.
    - *What were some of the things you observed in the sky that we were interested in observing to figure out more about some of these patterns? Turn and talk with a partner.*
- Explain the Sun's path change over time.
    - *What are some things that happen as the amount of sunlight changes over time?*
- Develop a model and logical argument for how changes in sunlight impact us here on Earth.
    - *Look at the data of four dates used to measure daylength and solar elevation. How would you describe temperatures around those four dates?*
- Develop and use a model of the Earth-Sun system to explain how Earth's fixed tilt and orbit would cause a cyclical pattern in the location of the Sun at sunset that repeats every year.
    - *Why do places in the Southern Hemisphere experience their seasons at the opposite time of year compared to places in the Northern Hemisphere?*
- Develop and use a model of the Earth-Sun-Moon system to explain and predict patterns we observe in the way the apparent shape of the Moon changes over time.
    - *Does the moon always look the same? What phases of the moon can you remember?*
- Develop and use a model of the Earth-Sun-Moon system to explain why and when we can see a solar eclipse.
    - *Notice and wonder T-chart of a solar eclipse. Discuss your observations with a partner.*
- Evaluate the limitations of our solar system model predicting what we would see during a lunar eclipse.
    - *What do you think a person would see in the sky when watching a lunar eclipse?*
- Revise our Earth-Sun system model to include ideas about how the Earth's atmosphere causes light from the Sun and Moon to change colors.
    - *Notice and wonder T-chart based on photos of sunrises, sunsets, moonrises, and moonsets. Discuss your observations with a partner.*
- Investigate and collect data as evidence of the effect of light interacting with a simulated atmosphere.
    - *Summarize the variables that might be a cause for color (and brightness) changes in sunlight at sunset (and sunrise).*
- Investigate and collect data as evidence to determine how the shape of a water droplet or an ice crystal cause sunlight to form into a rainbow.
    - *What did we see last class when we shined white light on our simulated atmosphere?*
- Develop and use a model of light in the Earth-Sun-Moon system to describe why the Moon changes color during a lunar eclipse.
    - *Using what we have figured out recently, what could help explain why the Moon looks reddish during a lunar eclipse?*

Unit 3: Earth and Space Science
8th Grade Science
17 Class Mee

- Determine what other patterns we see when we look more closely at other objects in the sky.
    - *Look at images of how some planets looked to someone at a different time and location. What new questions do you have about the planets?*
- Develop a logical argument using evidence to determine why some solar system objects orbit planets and others orbit the sun.
    - *How does the path that Earth and other objects moves through space affect the patterns we experience on Earth? How would what we experience be different if Earth and these other objects didn't follow the patterns of motion through space that they do now?*
- Develop and map evidence from written and media sources to support the claim that the solar system formed from a disk of gas and dust, drawn together by gravity that was once chaotic but has become more stable over time.
    - *Do you think all the objects in our solar system will remain in these orbits far into the future?*
- Compare and critique two arguments emphasizing the same evidence (images of galaxies) about the organization of systems in space. Obtain and synthesize information across multiple sources about the organization of space systems in our universe from the human scale to the galactic scale.
    - *Notice and wonder T-chart based on a Hubble Deep Field photo. Discuss your observations with your partner?*
- Develop a model of the universe that shows how gravity forces cause the patterns of motion and organization of objects in space systems at multiple scales.
    - *Why do you think that we find things in space clumped together, with so much emptiness in between, instead of spread out evenly?*

Instructional Strategies/Differentiated Instruction

- Whole group instruction
- Guided notes
- Student-led instruction
- Independent problem-solving
- Collaborative problem-solving
- Graphic Organizer
- Cross-curricular problem solving (independent and collaborative)
- Accountable Talk
- Homework
- Word walls with visuals
- Small group instruction
- Investigations/labs

EL Differentiated Instruction:

- Sentence starters
- Simplified directions
- Prompting and questioning
- Alternate responses when needed
- Explicit modeling
- Key vocabulary
- Visuals

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8th Grade Science
17 Class Mee

- Graphic organizers
- KWL charts
- Venn diagram
- Glossary

Assessments

FORMATIVE ASSESSMENTS:

- Do Now
- Notebook checks
- Mid-class check-ins
- Exit Slips
- Accountable Talk Discussions- TWPS
- Homework
- NGSS Interim Assessment

SUMMATIVE ASSESSMENTS:

- Quiz – EU 1-2 & EU 3
- Performance Task- Model the universe- Are we alone?
- Unit Test

Unit Task

Unit Task Name: Structure of the Universe Model- Are we alone?

Description: Students will develop a complete model on a poster of how all the space systems fit together and help us organize our ideas about where there might be life (EU 1). Students will be encouraged to use "zooming" to represent multiple scales. Students need to include the important parts of each system for considering where we might find life (EU 2). Students should show how these systems are held together through interactions among the parts (EU 3).

Evaluation: Assessment rubric and Teamwork Rubric

Unit Resources

- Open Sci Ed unit resources
- Science notebooks
- Laptops
- NGSS Interim Assessments