



Grade 8 Science - Unit 2 - Astronomy

Unit Focus

Students will demonstrate their understanding of how the relationship between Earth, Sun, and Moon cause the patterns and phenomena we experience here on Earth as they explore these celestial bodies and their place in the universe. Students will develop an understanding of Earth's position and movement through space, the impact of gravity and inertia, the reasons for the seasons, moon phases, eclipses, and tides. Students will make scientific discoveries through inquiry-based laboratory investigations, virtual labs, and problem-solving challenges. Students will be asked to create models that will serve to correct misconceptions using scientific claims that are justified with evidence and data and ultimately make their learning visible and to close the unit, they will create and deliver a narration to a science video featuring the Earth, Moon and Sun in motion. The unit answers the guiding question, "How are we connected to the patterns we see in the sky and space?"

Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
NGSS/NSTA Science & Engineering Practices NGSS Science & Engineering Practices: 6-8 - Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information. (SE.6-8.1.1) - Ask questions to clarify and/or refine a model, an explanation, or an engineering problem. (SE.6-8.1.4) - Develop and/or use a model to predict and/or describe phenomena. (SE.6-8.2.5) - Analyze and interpret data to determine similarities and differences in findings. (SE. 6-8.4.7) - Construct an explanation using models or representations. (SE.6-8.6.2) - 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. (SE.6-8.6.3) - Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real-world phenomena, examples, or events. (SE.6-8.6.4) Next Generation Science Standards Performance Expectations: Middle School Earth and Space Sciences - 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-ESS1-1) - Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. (MS-ESS1-2)	<i>Students will be able to independently use their learning to...</i> T1 Make observations and ask questions to define a problem based on prior knowledge and curiosity that stimulates further exploration, analysis, and discovery. T2 Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions. T3 Create models to explore complex systems, show mastery of key science concepts, and/or develop solutions through creation of a product open to testing and redesign. T4 Communicate effectively based on purpose, task, and audience to promote collective understanding and/or recommend actions.	
	Meaning	
	Understanding(s)	Essential Question(s)
	<i>Students will understand that...</i> U1 Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted. U2 The orbit of the earth and the moon have observable patterns. U3 The solar system is held in orbit around the sun by its gravitational pull on them. U4 The model of our solar system can explain phenomena such as eclipses and the Earth's seasons. U5 Varying intensities of sunlight across the surface of the earth causes the seasons U6 There is an attractive gravitational force between any two objects that is dependent on their masses and distance between them. U7 All objects, including galaxies in the universe, are shaped by the force of gravity.	<i>Students will keep considering...</i> Q1 How does the relationship between the Earth and the Sun cause the patterns we experience on Earth? Q2 How do scientist develop and use models to explain what holds a solar system together and how our solar system moves through space. Q3 How can we use models to understand systems that are too large or too small to observe directly.

Stage 1: Desired Results - Key Understandings

- Analyze and interpret data to determine scale properties of objects in the solar system. (MS-ESS1-3)

Next Generation Science Standards (DCI)

Science: 8

- Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (ESS1.6.A1)
- Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (ESS1.6.A2)
- 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. (ESS1.6.B1)
- 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. (ESS1.6.B2)
- The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (ESS1.6.B3)

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- Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system. (ESS1.9.B1)
- Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes. (ESS1.9.B2)

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- Analyzing: Examining information/data/ evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)
- Product Creation: Effectively use a medium to communicate important information. (POG.3.2)

Acquisition of Knowledge and Skill

Knowledge

Students will know...

- K1** The sun, moon and stars move in predictable ways and can be explained with models.
- K2** Our solar system consists of the sun, and a collection of objects (including planets, moons, asteroids, etc.) that are held in orbit around the sun by gravity.
- K3** The forces of gravity and inertia is what keeps a celestial object in an elliptical orbit.
- K4** The moon appears to change shape throughout the month because of its changing position in relation to the sun.
- K5** The combined effect of Earth's tilted axis and revolution around the sun is the cause of the seasons.
- K6** The ordering of the sun, moon and earth cause both solar and lunar eclipses to occur.
- K7** Vocabulary Terms: Calendar, axis, rotation, revolution, axial tilt, seasons, orbit, solstice, equinox, gravity, force, inertia, mass, weight, shadow, eclipse, planet, satellite, full moon, new moon, quarter moon, names of planets, terrestrial planet, gas giant, planetary rings, dwarf planet, sun, inner planet, outer planet, comet, solar system, galaxy.

Skill(s)

Students will be skilled at...

- S1** Describing the cyclical movement of Earth (with its tilted axis) as it revolves around the sun and the seasons.
- S2** Applying scientific reasoning to describe the progression of events for a lunar and solar eclipse.
- S3** Constructing a model that can be used to explain how Earth and other objects move through space.
- S4** Applying scientific reasoning to solve problems that include predicting the phases of the moon.
- S5** Demonstrating how the movement of the sun, moon, and Earth affects conditions on the surface of planet relating to tides, eclipses, and seasons.
- S6** Identifying the influence that the force of gravity has on celestial objects.
- S7** Developing and using a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and the seasons.
- S8** Developing and using a model to describe the role of gravity in the motions within galaxies and the solar system.
- S9** Analyzing and interpreting data to determine scale properties of objects in the solar system.
- S10** Students will be able to address the following Crosscutting Concepts:
 - Patterns: Patterns can be used to identify cause-and-effect relationships
 - Systems and System Models: Models can be used to represent systems and their interactions
 - Scale, Proportion and Quantity: Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small