Unit 6: Astronomy

Content Area: **Science**
Course(s):
Time Period: **Marking Period 1**
Length: **4 Weeks**
Status: **Published**

Essential Questions/Enduring Understandings

Essential Questions

1. How do orbital geometry, gravitational forces, and Earth's 23.5 axial tilt interact to drive human timekeeping, variations in solar insolation, and seasonal climate cycles?

2. What physical and chemical conditions distinguish Earth from other terrestrial and gas giant planets, allowing it to maintain dynamic habitability within the "Goldilocks zone"?

3. How do astronomers use stellar light spectra and astrophysics models to reconstruct the life cycles of stars, the synthesis of elements, and the architecture of the cosmos?

Enduring Understandings

1. The rhythms of time, seasons, and solar radiation on Earth are governed by predictable orbital mechanics, where Earth's rotation, axial tilt, and revolution around the Sun determine diurnal cycles, seasonal changes, and long-term insolation patterns.

2. Planetary habitability is the result of a delicate balance of chemical differentiation, physical structure, and stellar location, setting Earth apart from other planets due to its liquid water reservoirs, protective magnetosphere, atmospheric composition, and optimal distance from the Sun.

3. The solar system is a minute component of an expanding, vast universe, built from heavy elements forged inside stellar cores through nuclear fusion and distributed across billions of galaxies through cosmic nucleosynthesis and star death over billions of years.

Assessment

Formative:

Do Now Questions

Exit Ticket Questions

Whole Class Discussion Participation

Small Group Discussion Participation

Individual Student Questions/Responses

Independent Tasks

Lab Experiments

Quizzes

Summative:

Lab Report

Unit Test

Benchmark:

Midterm/Final Exam

Alternative Assessments:

Guided Formal Lab Report

Unit Study Guide

Brief Summary of Unit

Students will investigate orbital mechanics, planetary astronomy, and astrophysics to evaluate Earth's spatial and temporal position within the cosmos. This unit analyzes how Earth's axial tilt, rotation, and revolution around the Sun dictate timekeeping systems, solar insolation variations, and the mechanics of seasonal change. Students will examine the physical and chemical properties—such as atmospheric composition, differentiation, magnetospheres, and Goldilocks-zone habitability—that distinguish Earth from terrestrial and gas giant bodies. Expanding outward, students will analyze cosmic scales, stellar evolution, nucleosynthesis, and deep-space observation data to construct an explanation of the universe's structure and the place of our solar system within the Milky Way galaxy.

Revised July 2026

Standards

L.SS.11–12.1	Demonstrate command of the system and structure of the English language when writing or speaking.
2	Reason abstractly and quantitatively
P.4	Demonstrate creativity and innovation.
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L.KL.11–12.2	Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.
4	Model with mathematics
P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
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HS-PS1-8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.
HS-PS2-4	Use mathematical representations of Newton's law of gravitation and Coulomb's law to describe and predict the gravitational and electrostatic forces between objects.
HS-PS4-5	Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.
HS-ESS1-1	Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.
HS-ESS1-2	Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.
HS-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements.
HS-ESS1-4	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
HS-ESS1-6	Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.
HS-ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Objectives: Students will know / Students will be skilled at

- • Calculate time is based on the relative positions and motions of Earth and the Sun.
- • Describe the process of nuclear fusion and the elements involved.
- • Determine the position of Earth in orbit at the start of each season based on the angle of incoming sunlight.
- • Differentiate the galaxies in the universe and how they compare to the Milky Way.

- Explain how stellar evolution forms the elements on the periodic table.
- Explain how the greenhouse effect warms the Earth.
- Explain the Big Bang Theory and how it relates to the observed expansion of the universe.
- How the sun and moon cause tides on Earth.
- Identify parts of the Milky Way galaxy.
- Identify the gases in Earth's atmosphere that regulates the temperature at the surface.
- Identify the phases of the moon.

Learning Plan

- Create a travel brochure for an object/location in the solar system, galaxy etc.
- Create an object that demonstrates the relationship between the relative position of the sun and earth and time. (A sundial.)
- Describe Earth's magnetic field.
- Discuss the effect of gravitational attraction between Earth and the moon on the tides.
- Discuss the electromagnetic spectrum – particularly the fact that heat is a form of light and that most light is not visible.
- Discuss the electromagnetic spectrum: relate spectroscopy to our knowledge of the formation of the elements within stars.
- Discuss the fact that planets are subject to Newton's laws.
- Discuss the greenhouse effect.
- Discuss the origins of the Solar System.
- Discuss the relationship between planetary motion and the measurement of time on Earth.
- Discuss the relationship between planetary position and the seasons.
- Discuss the relationship of the solar system to the Milky Way and the Milky Way to the rest of the universe.
- Discuss why the planets near the sun are relatively small compared to the huge outer planets.
- Events such as eclipses and the differing phases of the moon are due to the motion of Earth and the moon in space.
- Inquire: How does the hypothesized formation of the moon from primitive Earth relate to Newton's Laws of Motion?
- Inquire: Which model of the solar system, Heliocentric or Geocentric, best fits with what you have learned about motion? Why? (Ptolemy, Galileo)
- Inquiry: explain why high tides occur at the same time on opposite sides of Earth? Where are the low tides?
- Lab activity – Analysis of Star Maps
- Lab activity – Properties of Stars
- Lab: observe the spectra of several elements and identify unknowns based on previously recorded spectra. (Have students diagram spectra with colored pencils.)
- Meaningful participation in guided question/answer sessions, individual/group discussions, demonstrating an understanding of the purpose of the unit lesson(s), key terms, and concepts
- Preview the essential questions, provide answers, and connect to learning throughout the unit
- Project: Create a model that demonstrates the relationship between planetary position and

solar/lunar eclipses.

- Report: Compare and contrast the inner planets based on planetary position, size, and atmosphere.
- Research the Big Bang Theory and Stephen Hawking's contribution.
- School trip: Planetarium visit. View movie on astronomy topic.
- Unit quizzes and tests.

Materials

- Earth Science, Glencoe
- Earth Science, Merrill, and ancillary resource materials
- Earth Science, Prentice-Hall, and ancillary resource materials
- quantitative/qualitative lab equipment for activities, experiments
- related astronomy maps, charts
- supplementary interactive multimedia, internet websites, videos
- Textbook, Physical Science with Earth Science, Glencoe, and ancillary resource materials