# Unit 5 Exploring our Solar System

Content Area: **Science**
Course(s): **Astronomy 1**
Time Period: **December**
Length: **6 weeks**
Status: **Published**

## Transfer Skills

Students will be able to develop logical connections through physical principles, including Kepler's and Newton's Laws about the relationships and the effects of Earth, Moon, and Sun on each other .They will also be able to analyze the motion of an object in terms of its position, velocity, and acceleration (with respect to a frame of reference) as functions of time. Finally, they will be able to describe how the gravitational force between two objects depends on their masses and the distance between them.

## Enduring Understandings

Identify circumpolar constellation.

Link the folklore and myths surrounding major constellations.

Use and read star charts.

Name the planets and their order from the sun.

State and identify that planets form two main types: Terrestrial (small and rocky) and Jovian (big and gas liquid).

## Essential Questions

Can you diagram the solar system (all objects) outward from the Sun?

What role did density play in the formation of the solar system?

How did ancient cultures interpret the heavens and the motions of various objects?

How were the Sun, Earth, and solar system formed from a nebula of dust and gas in a spiral arm of the Milky Way Galaxy about 4.6 billion years ago?

How have natural processes on Earth changed its surface features and what affect have they had on life?

## Content

Vocab. Terms:

Magnetic field, Van Allen belts, gravitational collapse, protoplanet, nebular hypothesis, seismic waves, hydrostatic equilibrium, paleomagnetism, plate tectonics, stellar occultations, obliquity

## Skills

Discuss how scientists determine the location of constellations, celestial spheres, and sky maps.

Compare and contrast the celestial coordinate system (equatorial system) to the use of latitude and longitude to specify locations on Earth.

Understand that all objects in the solar system are about the same age.

Understand that density plays an important role.

Understand the theory of the formation of the solar system.

Identify the properties of solar nebula and Planetesimals.

Discuss interstellar matter and the idea that a rotating mass flattens.

## Resources

## Standards

**NGSS: Science Performance Expectations(2014)**
**NGSS: MS Earth & Space Science**
**MS.Space Systems**
**Performance Expectations**

- MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
- 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.

**MS.History of Earth**
**Performance ExpectationsShow details**

- 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.
- MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

**MS.Earth's Systems**
**Performance Expectations**

- MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

**NGSS: Science and Engineering Practices**
**NGSS: 9-12**
**Practice 1. Asking questions (for science) and defining problems (for engineering)**
Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations. Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

Ask questions to clarify and refine a model, an explanation, or an engineering problem.

Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a

model or theory.

**Practice 3. Planning and carrying out investigations**
Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.
Select appropriate tools to collect, record, analyze, and evaluate data.

**Practice 6. Constructing explanations (for science) and designing solutions (for engineering)**
Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.
Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

**NGSS: Crosscutting Concepts**
**NGSS: 9-12**
**Crosscutting Statements**
**1. Patterns** – Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.
Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.

Mathematical representations are needed to identify some patterns.

Empirical evidence is needed to identify patterns.

**3. Scale, Proportion, and Quantity** – In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.
Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale.

**4. Systems and System Models** – A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.
Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

**7. Stability and Change** – For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.
Much of science deals with constructing explanations of how things change and how they remain stable.

**NGSS: Disciplinary Core Ideas**
**NGSS: 9-12**
**ESS1: Earth's Place in the Universe**
**ESS1.A: The Universe and Its Stars**
Other than the hydrogen and helium formed at the time of the BigBang, nuclear fusion within stars produces all atomic nuclei lighterthan and including iron, and the process releases electromagneticenergy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode. (HS-ESS1- 2),(HS-ESS1-3)

**ESS1.B: Earth and theSolar System**
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. (HS-ESS1-4)

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 climatechanges. (secondary to HS-ESS2-4)

**PS2: Motion and Stability: Forces and Interactions**
**PS2.A: Forces and Motion**
If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objectsoutside the system. (HS-PS2-2),(HS-PS2-3)

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| SCI.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. |
| SCI.HS-ESS2 | Earth's Systems |
| SCI.HS-ESS1 | Earth's Place in the Universe |
| SCI.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. |
| SCI.HS-ESS1-4 | Use mathematical or computational representations to predict the motion of orbiting objects in the solar system. |