

Science Standard 4 Earth in Space

Our Solar System is a collection of gravitationally interacting bodies that include Earth and the Moon. Universal principles of gravitation allow predictions regarding the motions of objects within the Galaxy and beyond. Earth's motion, position, and posture account for a variety of cyclic events observable from Earth. While the composition of planets vary considerably, their components and the applicable laws of science are universal. The motions and interactions of objects within the Solar System are consistent with the hypothesis that it emerged from a large disk of gas and dust. Our Solar System is part of the Milky Way Galaxy, which, in turn, is one of many galaxies in the known Universe.

Strand	Grades K-3	Grades 4-5	Grades 6-8	Grades 9-12
<p><u>The Earth/Moon/Sun System</u></p> <p>Enduring Understanding: There are observable, predictable patterns of movement in the Sun, Earth, and Moon system that account for day/night.</p> <p>Enduring Understanding for Grades 6-12: Observable, predictable patterns of movement in the Sun, Earth, Moon system occur because of gravitational interaction and energy from the Sun.</p> <p>Essential Question: Grades K-3: What predictable, observable patterns occur as a result of the interaction between the Earth, Moon, and Sun?</p> <p>Essential Question: Grades 4-12: What causes these patterns?</p>	<p>A. The shape of the Earth is similar to a sphere. Level: Compact</p> <p>B. From Earth many objects may be seen in the sky including the Sun, the Moon, stars, and man-made objects. Level: Important</p> <p>C. The Sun and Moon appear to move slowly across the sky. Level: Important</p> <p>D. The pattern of day and night repeats every 24 hours. The Sun can only be seen in the daytime. Level: Important</p> <p>E. The Moon can be observed sometimes at night and sometimes during the day. Level: Compact</p> <p>F. The appearance of the Moon changes in a cycle that takes about a month. Level: Compact</p>	<p>A. The apparent path of the Sun, as seen from Earth, is from east to west. Over the course of a day, half of the Earth is always illuminated by the Sun causing day, and the half not illuminated by the Sun experiences nighttime. Level: Essential</p> <p>B. The cycle from day to night is caused by the Earth's rotation. Earth undergoes one complete rotation about every 24 hours. Level: Essential</p> <p>C. The Moon orbits the Earth. The appearance of the Moon changes as it moves through its orbit. These changes are called phases. Level: Essential</p> <p>D. The Sun is much larger than the Moon. Although the Moon is closer to Earth than the Sun, the two appear to be the same size when viewed from Earth. This is because objects appear smaller as the distance from the viewer increases. Level: Important</p>	<p>A. The Sun is a star that gives off radiant energy that drives Earth systems and is essential for life. The amount of radiant energy Earth receives from the Sun throughout the year is nearly constant. Level: Essential</p> <p>B. The tilt of Earth's axis of rotation as it orbits the Sun points in the same direction with respect to the stars. The tilt and the orbital motion of Earth around the Sun cause variation in the amount of solar radiation striking a location on the Earth's surface which results in variation in the length of day/night and seasons. Level: Essential</p> <p>C. Moon phases occur because the relative positions of Earth, Moon, and Sun change, thereby enabling us to see different amounts of the Moon's surface. Level: Important</p> <p>D. The Moon is a natural satellite of Earth and is different than the Earth in size, atmosphere, gravity, and surface features. Level: Compact</p> <p>E. Tides are caused by the gravitational interactions of the Sun, Moon and Earth. The Moon has a greater impact on tides because of its proximity to Earth. Level: Compact</p>	<p>A. The source of the Sun's energy is the fusion of hydrogen atoms into helium, a process common in relatively young stars. Level: Essential</p> <p>B. The Sun's influence on Earth include gravity, (which maintains Earth's orbit), electromagnetic radiation (which provides energy for living things), and energetic particles such as coronal mass ejections that can cause electromagnetic disturbances. Level: Essential</p>

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<p><u>The Solar System</u></p> <p>Enduring Understanding: Grades 4-5: Earth is part of a system that includes other planets.</p> <p>Most objects in the Solar System orbit the Sun and have distinctive physical characteristics and orderly motion (grades 6-8) which are a result of their formation and changes over time (grades 9-11).</p> <p>Essential Question: Grades 4-5: What is Earth's place in the Solar System?</p> <p>Essential Question: Grades 6-8: How does Earth's physical characteristics and motion compare to other bodies in the Solar System?</p> <p>Essential Question: Grades 9-12: How did Earth's crust, atmosphere, and interior form and change over time?</p>		<p>A. Earth is one of the planets in our Solar System that orbits the Sun. The Sun we see during the day is our nearest star. Stars we see at night lie outside our Solar System.</p> <p>Level: Important</p>	<p>A. The Sun is by far the most massive object in the Solar System, therefore gravitationally dominating all other members of the Solar System.</p> <p>Level: Essential</p> <p>B. The Solar System consists of comets, asteroids, planets, and their respective satellites, most of which orbit the Sun on a plane called the ecliptic. The planets in our Solar System revolve in the same direction around the Sun in elliptical orbits that are very close to being in the same plane. Most planets rotate in the same direction with respect to the Sun.</p> <p>Level: Important</p> <p>C. Planets can be categorized as inner or outer planets according to density, diameter and surface features.</p> <p>Level: Compact</p> <p>D. Planets and their moons have been shaped over time by common processes such as cratering, volcanism, erosion, and tectonics. The presence of life on a planet can contribute to its unique development.</p> <p>Level: Compact</p>	<p>A. The motion and the basic elements (periodic table) that comprise our Solar System are consistent with the theory that the Solar System emerged from a large disk of gas and dust.</p> <p>Level: Important</p> <p>B. The Earth's atmosphere, crust, and interior have changed since the formation of the planets. Driven by internal heat (radioactive decay and heat from accretion), the Earth's layers have separated by density into a solid core, molten mantle, and crust of solid rock composed of plates.</p> <p>Level: Important</p>

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<p><u>Stars and Galaxies</u></p> <p>Enduring Understanding: Grades 9-12: The Universe is composed of galaxies that are composed of solar systems, all of which are composed of the same elements and governed by the same laws.</p> <p>Essential Question: Grades 9-12: Is there an order to the Universe? Explain.</p>				<p>A. The Universe consists of billions of galaxies, each of which is a gravitationally bound collection of stars. Level: Important</p> <p>B. As a force, gravity causes tides, pulls matter together to make spherical stars and planets, maintains the orbits of planets, and gathers cosmic gas and dust to form stars and star systems. Level: Essential</p> <p>C. Stars are separated by vast distances. Light which reaches Earth from distant galaxies is millions of years old and is actually a view of the past. Level: Important</p> <p>D. The Sun and our Solar System are part of the Milky Way galaxy consisting of billions of other stars that appear to be made of the same elements found on Earth. Level: Important</p> <p>E. Most elements are formed as a result of natural astronomical processes, either in the Big Bang itself or in the natural evolution of stars. Level: Essential</p>

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<p><u>Stars and Galaxies</u> <i>(Continued from previous page)</i></p>				<p>F. The Big Bang Theory is a core scientific theory that is supported by a large body of evidence and is well accepted by the scientific community. It states that the Universe began in a hot dense state of energy and matter, and the Universe has been expanding ever since. Level: Essential</p>
<p><u>Technology and Applications</u></p> <p>Enduring Understandings: Grades K-5: Technology expands our knowledge of the Earth, Moon, and Sun System. Grades 6-8: Technology expands our knowledge of the Solar System. Grades 9-12: Technology expands our knowledge of the Universe.</p> <p>Essential Questions: Grades K-5: How has technology expanded our knowledge of the Earth, Moon, and Sun System? Grades 6-8: How has technology expanded our knowledge of the Solar System? Grades 9-12: How has technology expanded our knowledge of the Universe?</p>	<p>A. Binoculars allow people to observe objects in the sky from Earth. Level: Compact</p>	<p>A. Humanity’s view of the Solar System has expanded enormously as a result of our exploration of outer space. The Hubble telescope gives us a better view of the many planets than the view we have from the Earth. Robot probes, sent to planets, send back close-up pictures of their surfaces. Level: Compact</p> <p>B. Terrestrial telescopes allow people to observe objects in the sky from Earth. Level: Compact</p>	<p>A. Technology, including humans landing on the Moon, robot landers and other space probes, satellites, and radio telescopes, allow scientists to investigate conditions on Earth and on other objects in the Solar System. Level: Compact</p> <p>B. The technology used in space exploration expands our knowledge of the Universe and has many spin-offs related to everyday applications. Level: Compact</p>	<p>A. Spectroscopes are used to analyze starlight to reveal information about the composition and evolution of stars. Level: Important</p> <p>B. Technology is vital in investigating the Universe. Level: Important</p>