Earth in the Universe

Date:

6.E.1 Understand the earth/moon/sun system, and the properties, structures, and predictable motions of celestial bodies in the Universe.

6.E.1.1 Explain how the relative motion and relative position of the sun, Earth and moon affect the seasons, tides, phases of the moon, and eclipses.

6.E.1.2 Explain why Earth sustains life while other planets do not based on their properties (including types of surface, atmosphere and gravitational force) and location to the Sun.

6.E.1.3 Summarize space exploration and the understandings gained from them.
Round and Round They Go!

How are Earth, the moon, and the sun related in space?
• Earth _______ on its _______ and ________ around the sun.

• A body that orbits a larger body is called a _______________.

• ________ bodies that travel around planets are natural satellites called ________.

• ____________ is the force that pulls all bodies that have mass toward other objects.

• Earth’s ____________ pull on the moon keeps the moon in orbit, forming the Earth-moon ____________.

• The ____________ between Earth and the moon is roughly ________ km (238,000 mi).

What does the moon look like from Earth?
• The ______ is only _________ from Earth when it __________ sunlight.

• Only ___ side of the moon, often called the _____ side, ________ Earth.

• The moon __________ once on its _____ for every _____ days it takes to __________ around Earth.

It’s Just a Phase!

How does the appearance of the moon change?
• As the moon ___________ around Earth, the portion of the moon that __________ sunlight back to Earth changes.

• The ________________ are changes in the moon’s appearance due to its position in orbit around Earth.

• Lunar phases cycle ____________ and begin with a _____ moon.

• The _____ moon is _______ to see because Earth, the moon, and the sun are ___________ up, making the moon unlit.
• As the moon ________ in its orbit, it _________ more sunlight, and its ___________ shape grows larger.

• The moon ________, or __________, until half of the near side is in sunlight. This is the ________ quarter.

• The _____________ phase is when the near side is more than half-lit but not fully lit.

• When the moon is _________ lit, it is called a ______ moon.

• The _____ portion of the moon ____________, or ___________, during the _____ week of the cycle.

• When the _______ side is only _____-lit in sunlight, it is three-quarters through the cycle. The phase is called the ________ quarter.

• When the moon is seen as ____________ crescent shapes, the cycle is almost complete.

• When the moon is again unlit as a ______ moon, the cycle is ____________.
Exploring Eclipses

How do lunar eclipses occur?

• An ________ is an event during which one object in space casts a shadow on another object.

• A lunar eclipse ________ when the moon moves through Earth’s shadow.

• The ________ is the darkest part of a shadow. Around the umbra is a spreading cone of lighter shadow called the _______________.

• __________ a lunar eclipse, the moon is a ______ moon.

• The moon ________ into the _______________ shadow and ________ less bright.

• When the moon ________ into the ________, the moon is in total ________________.
• A _________ lunar eclipse occurs when the moon moves completely inside the umbra.

• If the moon misses all or part of the umbra and a part stays lit, it is called a ________________ lunar eclipse.

• You do _____ see lunar eclipses each month because the moon’s orbit is tilted by about ___ relative to Earth’s orbit.

**How do solar eclipses occur?**

• When the moon is ___________ between the sun and Earth, the ___________ of the moon falls on a part of Earth and causes a _______ eclipse.

• When the sun’s light is ____________ blocked by the ______, it is a __________ solar eclipse.

• ___________ the umbra, but ___________ the penumbra, people see a ____________ solar eclipse.

• The ____________ umbra makes a shadow that is never more than a few hundred _____________ across.

• A _______ eclipse __________ only a part of Earth and can only be seen in particular areas.

• A _______ solar eclipse happens somewhere on Earth every ____ to ____ years.

• Why is a total solar eclipse visible over only a small portion of Earth?
A Rising Tide of Interest

What causes tides?

• _______ are daily changes in the level of ocean water.

• Tides are _________ by the difference in the gravitational force of the sun and moon across Earth.

• The ____________ in gravitational force is called the _________________.

• Because the moon is _________ to Earth, the moon is mainly responsible for Earth’s tides.

• ______ on the side of Earth __________ to the moon bulges toward the moon.

• A _________ is created on both the near side and the _____ side of Earth.

What are high tides and low tides?

• ______ tide is a water level that is higher than the average sea level.

• ______ tide is a water level that is lower than the average sea level.

• _______ bulges move around Earth following the motion of the moon.

Tide Me Over

What are two kinds of tidal ranges?

• The ________ tidal force is ______________ than the ________ tidal force, which results in different tidal ranges.

• A ________________ is the difference between the levels of ocean water at high tide and low tide.

• _________________ are tides that have the largest daily tidal range.

• _______ tides happen when the sun, moon, and Earth form a ______________ line.
• Spring tides __________ during the new moon and full moon phases every ____ days.

• What causes the large tidal range of a spring tide?

___________ are tides that have the smallest daily tidal range.

_________ tides happen when the sun, moon, and Earth form a ____ angle.

• During a _____ tide, the ___________ effects of the sun and moon on Earth do not add together.

• During which moon phases do neap tides occur?

What causes tidal cycles?

• The moon __________ around Earth much more _______ than Earth rotates.

• A _______ on Earth facing the moon takes ___ h and ___ min to __________ to face the moon again.

• So, the _______ of _____ tides and _____ tides at that place happens ____ min later each day.
• Because the _______ cycle occurs in 24 h and 50 min intervals, it takes about ___h and ____ min for ________ in an area to go from high tide to low tide.

• It takes about ___ h and ___ min to go from ____ high tide to the _____ high tide.

**Earth**

• Earth is a __________ place because it has just the right combination of conditions to support life.

• The presence of ____ and ________ supports the growth and development of plants and animals.

• The ___________ contains an _________ layer that __________ harmful solar radiation and other gases that keep Earth warm enough for life to exist.

**Gravity**

**What is gravity?**

• __________ is a force of attraction between objects that is due to their masses and the distances between them.

• Every object in the universe ________ on every other object.

• Objects with __________ masses have a greater _______ of attraction than objects with ________ masses have.

• Objects that are _______ together have a _________ force of attraction than objects that are far apart have.

• Gravity is the __________ force in nature, yet it is one of the most important forces in the universe.

• Gravity ______________ for the formation of planets, stars, and galaxies.

• Gravity also ________ smaller bodies in _____ around larger bodies.

• An _________ is the path that a body follows as it travels around another
body in space.

What are Kepler’s laws?
• The __th century Polish astronomer Nicolaus _____________ changed our view of the solar system.

• He discovered that the __________ of the planets could best be explained if the planets orbited the sun.

• Like astronomers before him, Copernicus thought that the planets followed __________ paths around the sun.

• Danish astronomer Tycho Brahe used special instruments to accurately measure planetary motions over a period of 20 years.

• Using Tycho’s data, Johannes ________ discovered what we call Kepler’s laws of __________ motion.

• Upon plotting the orbit of ________, Kepler saw that it was a deformed circle.

• After eight years of work, he realized that it was an ____________.

• Kepler then proposed that each of the planets has an elliptical orbit, with the sun at one focus of the ellipse.

• This is Kepler’s _____ law.

• When an object follows an elliptical orbit around the sun, there is one point, called ______________, where the object is farthest from the sun.

• There is also a point, called ______________,
where the object is closest to the sun.

• Today, we know that the _______ of the planets are only ___________ elliptical, but the orbits of objects such as Pluto and _________ are ___________ elliptical.

• Kepler found that a planet moves __________ at aphelion, sweeping out a narrow sector on the ellipse.

• Conversely, a planet moves __________ at perihelion, sweeping out a thick sector on the ellipse.

• As a planet moves around its orbit, it sweeps out equal areas in equal times. This is Kepler’s ___________ law.

• Kepler looked at how long it took for the planets to orbit the sun. He also observed the sizes of their orbits.

• He discovered that the ___________ of the orbital period is ___________ to the _______ of the planet’s distance from the sun.

• This principle is Kepler’s _______ law.

**What is the law of universal gravitation?**

• Using Kepler’s laws, Sir Isaac ___________ became the first scientist to mathematically describe how the _______ of gravity behaves.

• He reasoned that ___________ is the force that accounts for both the fall of an apple from a tree and the movement of the moon around Earth.

• In 1687, Newton formulated the law of _______________ gravitation.

• The law of universal gravitation states that all objects in the universe _______ each other through _________________ force.

• The ___________ of this force ___________ on the product of the _______ of the objects.

• Gravitational force is also ___________ proportional to the square of the distance between the objects.
How does gravity affect planetary motion?
• If a ball is attached to a string and is swung around, it moves in a circular path.

• The inward force that causes an object to move in a circular path is called ________________.

• If the string breaks, the ball will move off in a straight line. When the string is intact, the centripetal force prevents the ball from flying off.

• When planets orbit the sun, a force similar to centripetal force prevents them from moving out of their orbits and into a straight line.

• The ______ gravity is the force that _______ the planets moving in ______ around the sun.

Space: The Final Frontier
How did space exploration begin?
• In October of __________, the Soviet Union launched the first satellite, ____________, into low Earth orbit. It was the start of the “Space Age.”

• In response, the United States launched its first satellite, __________ I, on January 31, __________. This started the Space Race.

• In the same year, the National Aeronautics and Space Administration, or __________, was formed.

From Earth to the Moon
How have people explored space?
• _______ crewed spacecraft do not orbit Earth because they do not reach the required speed and altitude. They spend only a short time in space.

• The first crewed suborbital spaceflight missions were NASA’s Mercury project in ______.

• These _________ included the suborbital flights of Alan B. Shepard, Jr., on May 5, 1961, and Virgil I. Grissom on July 21, 1961.
•crewed spacecraft completely orbit Earth. On April 12, 1961, Soviet air force pilot Yuri A. Gagarin became the first person to orbit Earth.

•On July 21,______, John H.______, Jr., became the first ________ to orbit Earth.

•On June 16,______, Soviet cosmonaut Valentina V. Tereshkova became the first ________ to fly in space and orbit Earth.

•The United States developed the ________ program with two-person crews, partly to see if astronauts could spend longer periods of time in space.

•The Soviet Union extended their existing Vostok program to include multiperson spaceflights.

•On March 18,______, Soviet cosmonaut Alexei A. Leonov performed the first walk in space. On June 3, 1965, Edward H. White II became the first American to do so.

•On September 12,______, President John F. Kennedy committed the United States to land a man on the moon before the decade ended.

•In______, the ________ 11 spacecraft took astronauts Neil__________, Edwin “Buzz”______, and Michael__________ to the ________.

•While Collins orbited the moon in the spacecraft, Armstrong and Aldrin __________ on the moon’s surface in a lunar module on July 20,______.

•The __________ is the ______ nation that has sent astronauts to the moon.

•___moon landings took place during the ________ program of the late 1960s and early 1970s.

•In total, ___astronauts have walked on the moon.

Where have people lived and worked in space?

•Space__________ are crewed space vehicles that lift off with the aid of rocket boosters and land like airplanes.
• Space shuttles _______ Earth while in space. The shuttle and its rocket boosters are reusable.

• Shuttle ___________ have included gathering data, launching satellites, transporting materials, and docking with the International Space Station.

• Space shuttle missions began with the launch of the shuttle ___________ in _______.

• ___ shuttles—Enterprise, Columbia, Challenger, Discovery, Atlantis, and Endeavour—have together completed more than ____ missions.

• Tragic accidents led to the loss of ___________ and its crew in _____ and ___________ and its crew in _____.

• A space ________ is a ______-term, crewed spacecraft that orbits Earth.

• It can be _____ to launch other vehicles and carry out scientific research.

• ___________ live aboard a space station for a period of several weeks or months and ___________ research and experiments.

• The first space station, ___________, was placed in orbit by the Soviet Union in April ______. In ______, the ______ launched its first space station, ________.

• The Soviet/Russian space station _____ was built between 1986 and 1996 and operated in low Earth orbit until 2001.

• The ________________ Space Station, as long as a football field, was built in low Earth orbit over a period of 13 years, starting in _______.

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Just Passing By

How have people used uncrewed vehicles to explore space?

• __________ vehicles, such as space probes and ________, are a safe way to explore distant bodies that could take years or decades to reach.

• Space ________ carry scientific instruments and ___________ data back to Earth.

• Scientists have used space probes to fly by the ______, ________, and ___________, to land on Mars, and to explore the far reaches of the solar system.

How have people used uncrewed vehicles to explore space?

• An ___________ is a spacecraft that travels to a planet and goes into orbit around it.

• Several orbiters have been ___________ the features of Mars by mapping the Martian surface and collecting ______ about its chemical makeup.

• NASA’s Mars ____________________ Orbiter has a powerful camera that could guide future spacecraft to make precise landings on Mars.

• A ___________ is designed to land on the surface of a planet or other body and send data back to Earth.

• A ___________ physically explores the body’s surface by moving about.

• Landers and rovers can ___________ experiments on soil and rocks, and they can _________ surface conditions such as temperature and wind flow.

• An ___________ satellite is any human-made object placed in orbit around a body in space. Hundreds of active satellites currently orbit Earth.
• A satellite may __________ weather data, relay TV and radio signals, assist in navigation, or study Earth’s surface.

• A system of orbiting global navigation satellites has been operated by the U.S. since ______. They are used to determine ________ locations on Earth.