

8th Grade Astronomy and Space

Chapter 1: Earth, Moon, and Sun

Lesson 1 (The Sky From Earth)

Satellite – any object or body that orbits a planet

– The moon is Earth's only natural satellite.

Planet – an object that orbits the sun, is large enough to have become rounded by its own gravity, and has cleared the area of its orbit

– Five planets are visible from Earth without a telescope:

1. Mercury
2. Venus
3. Mars
4. Jupiter
5. Saturn

Asteroid – one of the larger rocky objects revolving around the sun that are too small and numerous to be considered planets

Meteoroid – a chunk of rock or dust in space, generally smaller than an asteroid

Meteor – a streak of light produced when a small object burns up entering Earth's atmosphere

- These are sometimes called "shooting stars", but they are not stars.
- They **are meteoroids** that enter Earth's atmosphere at a high speed and burn due to friction with the air.
- Most small ones burn up completely before hitting the ground, but some larger ones do not.

Meteorite – a meteoroid that passes through the atmosphere and hits Earth's surface

Comet – a cold mixture of dust and ice that gives up a long trail of light as it approaches the sun

– They orbit the sun, just like planets.

Star – a giant ball of hot gas, mainly composed of hydrogen and helium

– These gases undergo nuclear fusion that produces huge amounts of energy.

Constellation – a pattern or group of stars that people imagine represent a figure or object

Actual Motion and Apparent Motion:

- Objects that move from one place to another have **actual motion**.
- Objects that seem to move because your perspective (how you view them) changes have **apparent motion**.
- The apparent motion of objects in the sky depends on the motion of Earth.
- Stars generally **appear** to move from east to west through the night because Earth turns from west to east on its axis.
- The sun's **apparent** motion during the day is also caused by Earth's motion around its axis.
- The constellations you can see varies from season to season because as Earth orbits around the sun we see different parts of space at night. (Some stars that we can see in the summer are not visible in the winter.)
- The only constellations that we can see all year long are the ones closest to the North Star.
- The North Star is the only star that does not change location much each night because it is directly above the geographic north pole.

Lesson 2 (Earth in Space)

Axis – an imaginary line that passes through a planet's center and its north and south poles, about which the planet rotates

Rotation – the spinning motion of a planet on its axis

- Earth's rotation causes day and night.
- Earth rotates from west to east, therefore the sun **appears** to move from east to west across the sky.
- One rotation of Earth on its axis is called a day.
- It takes Earth 23 hours and 56 minutes to rotate once around its axis.

Revolution – the movement of an object around another object

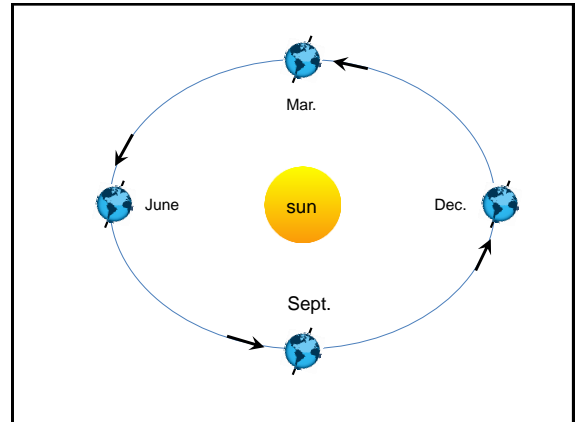
- One revolution of Earth around the sun is called a year.
- It takes Earth 365.25 days to revolve around the sun.

Orbit – the path of an object as it revolves around another object in space

- Earth's orbit is an ellipse (elongated circle)
- This type of orbit puts Earth closest to the sun in **January**.

Why Do We Have Seasons?

1. Near the equator, sunlight is concentrated in a smaller area and does not spread very far.
2. Near the poles, the same amount of sunlight spreads over a greater area.
3. As Earth revolves around the sun, the north end of its axis is tilted away from the sun for part of the year and towards the sun for part of the year.
4. Summer and winter are caused by Earth's tilt as it revolves around the sun.



Solstice – either of the two days of the year on which the sun reaches its greatest distance north or south of the equator

Summer solstice – the day of the year when the sun appears farthest north in the Northern Hemisphere

- This occurs around June 21 each year.

- It is the longest day of the year in the Northern Hemisphere and shortest day in the Southern Hemisphere.

Winter solstice – the day of the year when the sun appears farthest south in the Northern Hemisphere

- This occurs around December 21 each year.
- It is the shortest day of the year in the Northern Hemisphere and the longest day in the Southern Hemisphere.

Equinox – either of the two days of the year on which neither hemisphere is tilted toward or away from the sun

- These occur halfway between solstices.

- During an equinox, day and night are each about 12 hours long everywhere.

Vernal (spring) equinox – occurs around March 21 each year.

Autumnal (fall) equinox – occurs around September 21 each year.

Lesson 3 (Gravity and Motion)

Force – a push or pull on an object

Gravity – the attractive force between objects

- The strength of this force depends on:
 1. The masses of the objects – the more mass, the greater the pull
 2. The distance between the objects
 - The pull decreases as distance increases.
 - If the distance between the objects doubles, the force of gravity decreases to $\frac{1}{4}$ of its original value.

Law of Universal Gravitation – every object in the universe attracts every other object

Mass – the amount of matter in an object

Weight – the measure of the force of gravity on an object

Inertia – the tendency of an object to resist change in motion

- The more mass an object has, the greater its inertia.
- Objects with greater inertia are harder to start or stop their motion.

Newton's First Law of Motion:

- An object at rest will stay at rest and an object in motion will stay in motion with a constant speed and direction (velocity) unless acted on by a force.
- Newton decided that inertia and gravity combine to keep Earth in orbit around the sun and the moon in orbit around Earth.

Lesson 4 (Phases and Eclipses)

Motions of the Moon:

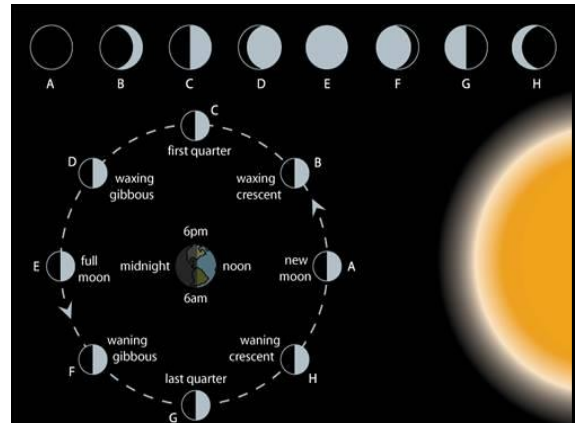
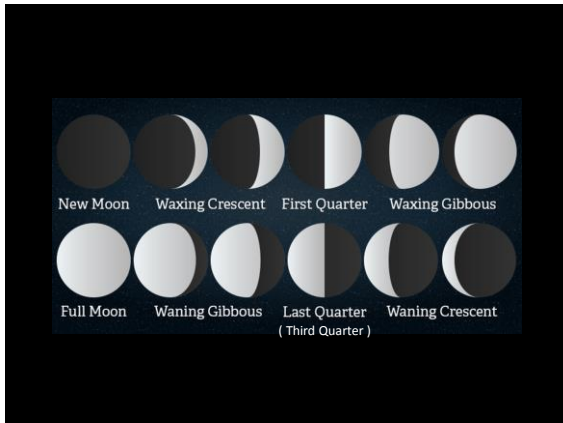
- The same side of the moon always faces Earth.
- Like Earth rotates on its axis and revolves around the sun, the moon rotates on its axis and revolves around Earth.
- The moon rotates once on its axis in the same amount of time that it takes to revolve once around Earth.

Phase – one of the different apparent shapes of the moon as seen from Earth

- caused by the motions of the moon around Earth
- Half the moon is always lit by the sun, but since the moon orbits Earth, you see the moon from different angles.
- The phase of the moon you see depends on how much of the sunlit side of the moon faces Earth.

Waning – a term that describes a gradual decrease in the amount of the lit portion of the moon we can see

Waxing – a term that describes a gradual increase in the amount of the lit portion of the moon we can see



Eclipse – the partial or total blocking of one object in space by another

Solar eclipse – the blocking of sunlight to Earth that occurs when the moon is directly between the sun and Earth

- The moon's shadow is on the earth as the moon blocks the sun from Earth.



Umbra – the darkest part of a shadow

- This will be the center of the shadow where light is completely blocked.
- If you are in this part of the shadow you are experiencing a **total solar eclipse**.

Penumbra – the part of the shadow surrounding the darkest part

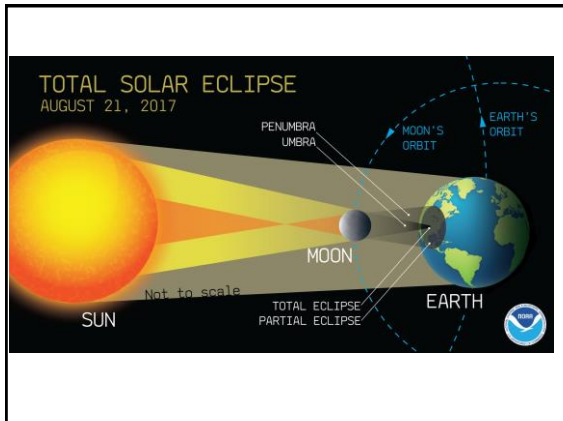
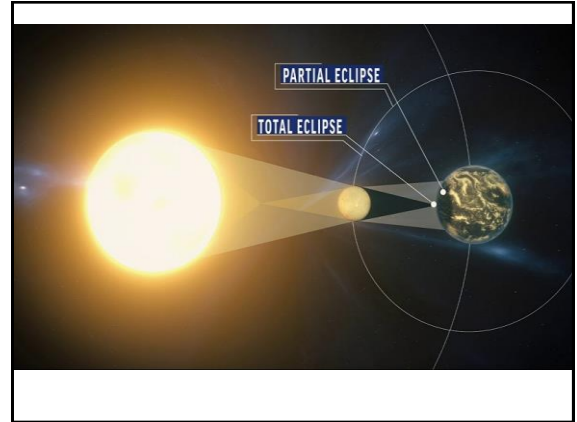
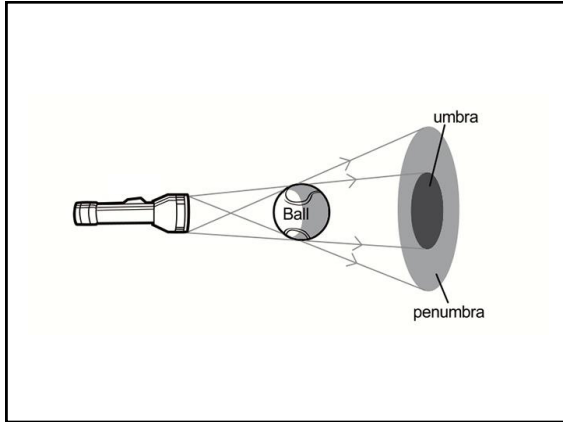
- This part is less dark because some light reaches this area.
- If you are in this part of the shadow you are experiencing a **partial solar eclipse**.

Total solar eclipse – the blocking of sunlight you experience if you are within the moon's umbra

- You would see very little of the sun.

Partial solar eclipse – the blocking of sunlight you experience if you are within the moon's penumbra

- You would see part of the sun.



Lunar eclipse – the blocking of sunlight to the moon that occurs when Earth is directly between the sun and moon

- Earth blocks the sun from the moon.
- Occurs during a full moon.
- When the moon is in Earth's umbra, you see a **total lunar eclipse**.
- When the moon is in Earth's penumbra, you see a **partial lunar eclipse**.

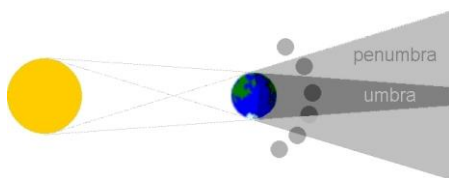


Total lunar eclipse – the blocking of sunlight to the moon when the moon is in Earth's umbra

- You would not see any of the moon.

Partial lunar eclipse – the blocking of sunlight to the moon when the moon is in Earth's penumbra

- You would see some or most of the moon.



Lesson 5 (Tides)

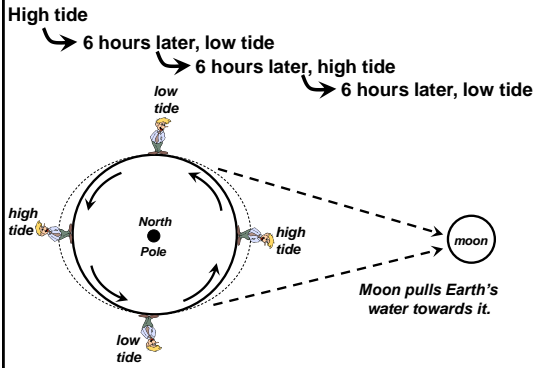
tides – the daily rise and fall of Earth's waters on its coastlines

- Caused by the interaction of Earth, the moon, and the sun.
- high tide
- low tide

gravity – the force that pulls objects towards each other

- Anything with mass has a gravitational pull. (even a speck of dust)
- The more mass an object has, the more gravitational pull it has.
- As the distance between objects increases, the gravity's pull becomes weaker.

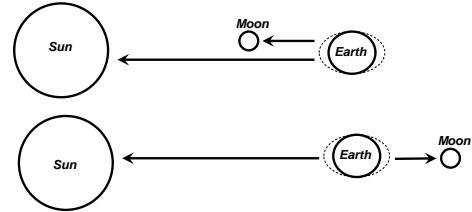
The tide changes at a given location about every 6 hours.



Effect of the Sun on tides:

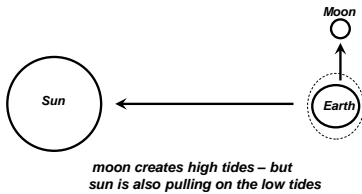
Spring tide – a tide with the greatest difference between high and low tide when the sun, moon, and earth are lined up

– results in higher high tides and lower low tides than normal

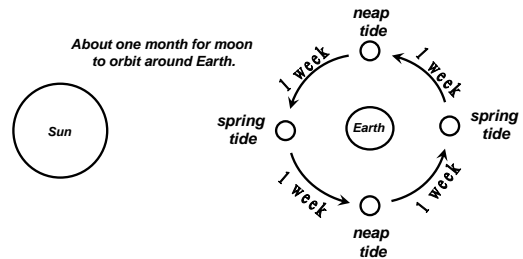


Neap tide – a tide with the least difference between low and high tide when the moon, earth, and sun form a right angle

– results in lower high tides and higher low tides than normal



Spring tides and neap tides occur twice each month, about two weeks apart.



Lesson 6 (Earth's Moon)

Maria – dark, flat areas of the moon

- formed from huge lava flows that have hardened
- have relatively few craters, meaning they are younger features of the moon

Craters – large round pits on the moon

- formed by the impacts of meteoroids

Highlands – light-colored features on the moon's surface

- covers most of the moon's surface
- Some highlands have sharp peaks and can be considered mountains.

Size and Density of the Moon:

- The moon's diameter is about one fourth that of Earth.
- The moon has about one eightieth the mass as Earth.
- The moon's density is similar to the density of Earth's outer layers.
- This all gives the moon gravity that is about one sixth of Earth's.

Temperature of the Moon:

- The moon does not have an atmosphere to block radiation or to retain heat.
- The moon's equator varies from 266°F in direct sunlight to minus-274°F at night.
- The temperatures at the poles are even colder.

Water on the Moon:

- Scientists believe the moon's soil has a thin layer of water.
- The amount is very small, but is found in many places.

Origin of the Moon:

- The most accepted theory is called the **Collision-ring Theory**.
- About 4.5 billion years ago, the solar system was full of rocky debris.
- Scientists believe a planet-sized object collided with Earth, throwing materials from the object and Earth's outer layers into orbit around Earth.
- This material formed a ring of material that gravity clumped together to form the moon.