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NEW JERSEY CENTER
FOR TEACHING & LEARNING

6th Grade

Earth and the Solar System

2016-11-02

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Table of Contents: Earth and the Solar System

Click on the topic to go to that section

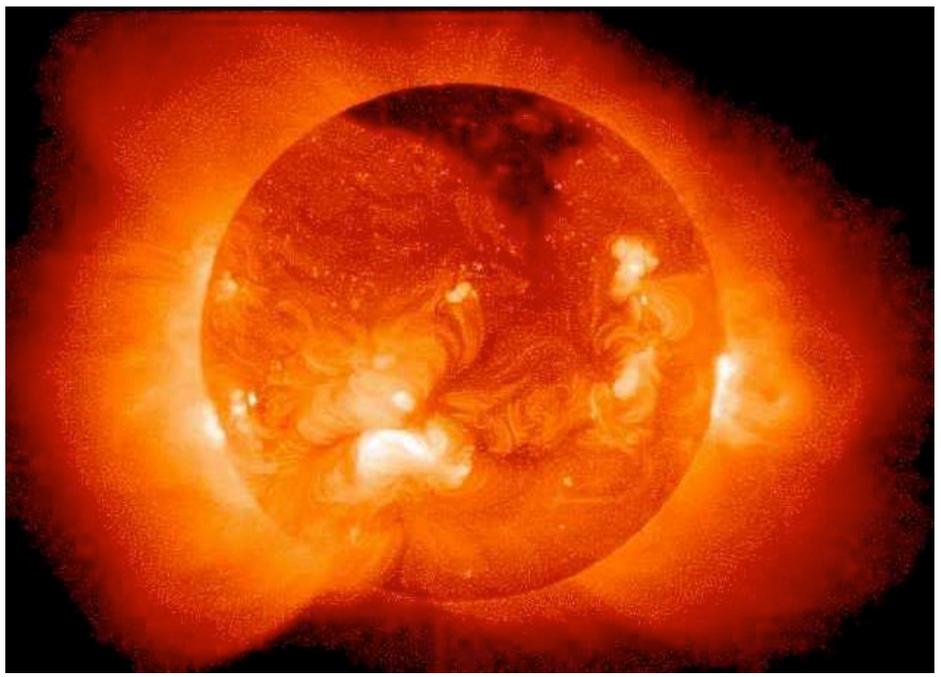
Part A: Our Solar System

Return to Table of Contents

The Birth of Our Sun and Our Solar System

Return to Table of Contents

Review of the Sun



At your table, make a list of facts about the sun you remember from our last unit.

Review of the Sun

Move the box below for some facts you may have come up with:

Move for some facts!

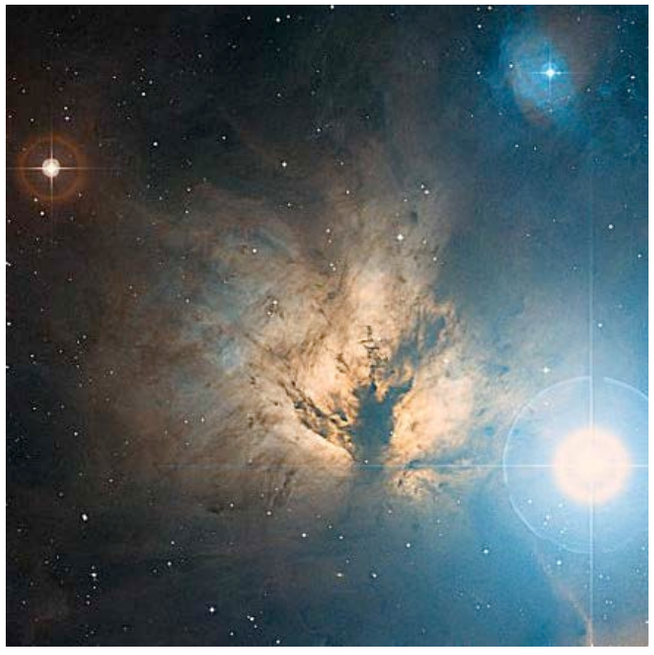
Birth of the Sun

As you probably came up with in your list of facts, the Sun's "life" began about 4.5 billion years ago.

It probably formed from a "nebula" which is a spinning cloud of dust and gas floating out in space.

Some nebulae form as a result of a supernova.

We talked about supernovas in the last chapter. What happens in a supernova?



Birth of the Sun

The nebula then collapsed under its own weight because of its gravity and compressed into a ball of gas.

When this happened, the cloud started to _____ (spin about its axis) faster and the center began to heat up, forming the Sun.

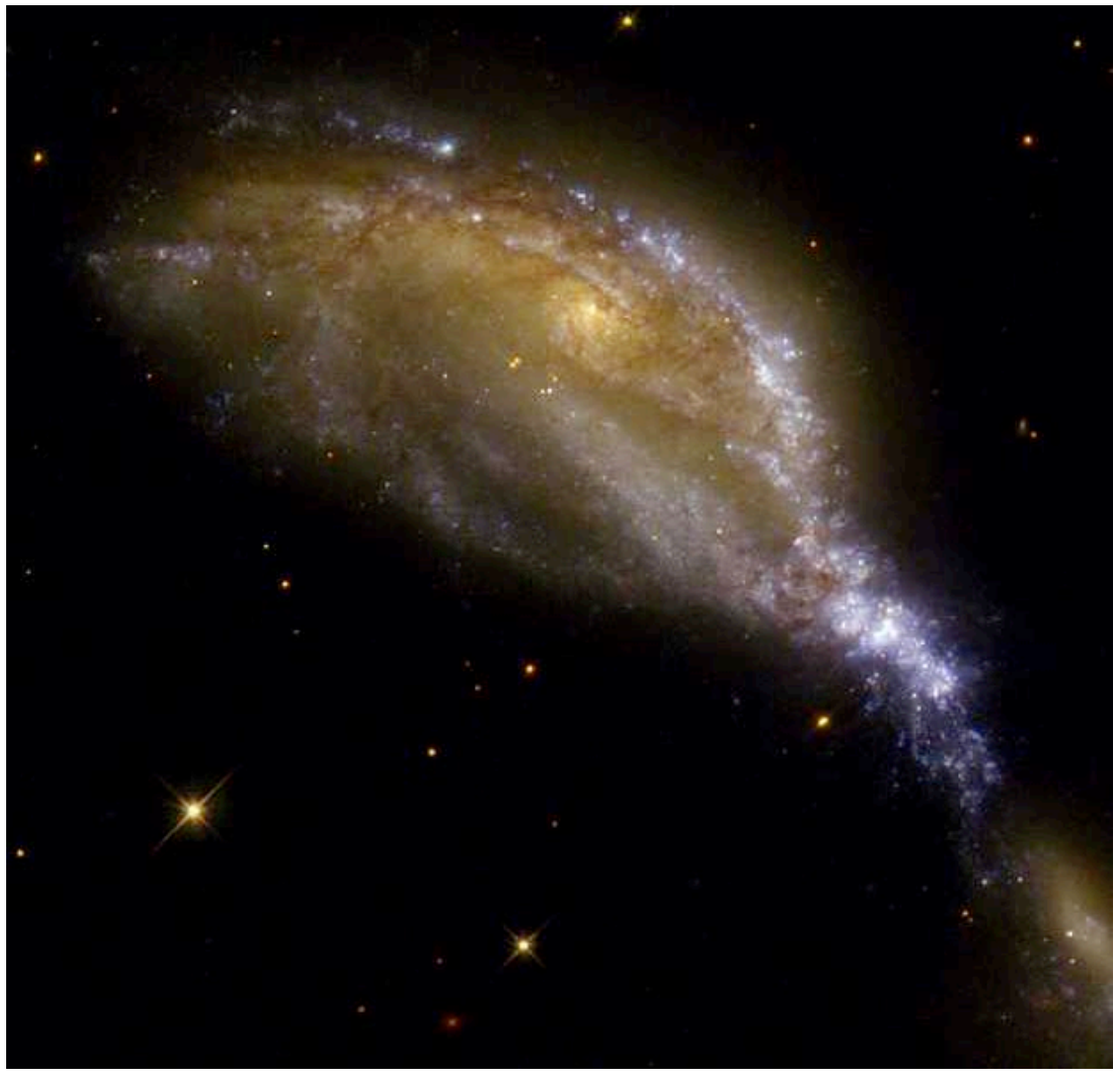


Image: NASA

1 Which of these statements regarding our Sun is correct?

A The Sun is the largest object in our solar system

B The Sun is one of many stars in our solar system

C The Sun is solid like Earth

D The Sun revolves around Earth

Answer

2 Which best describes a supernova?

A An exploding star that has reached the end of its lifespan

B A star that is being born

C A massive ball of gas held together by gravity

D The object with the largest amount of mass in the universe (not even light can escape!)

Answer

3 A spinning cloud of dust and gas is known as a

A supernova.

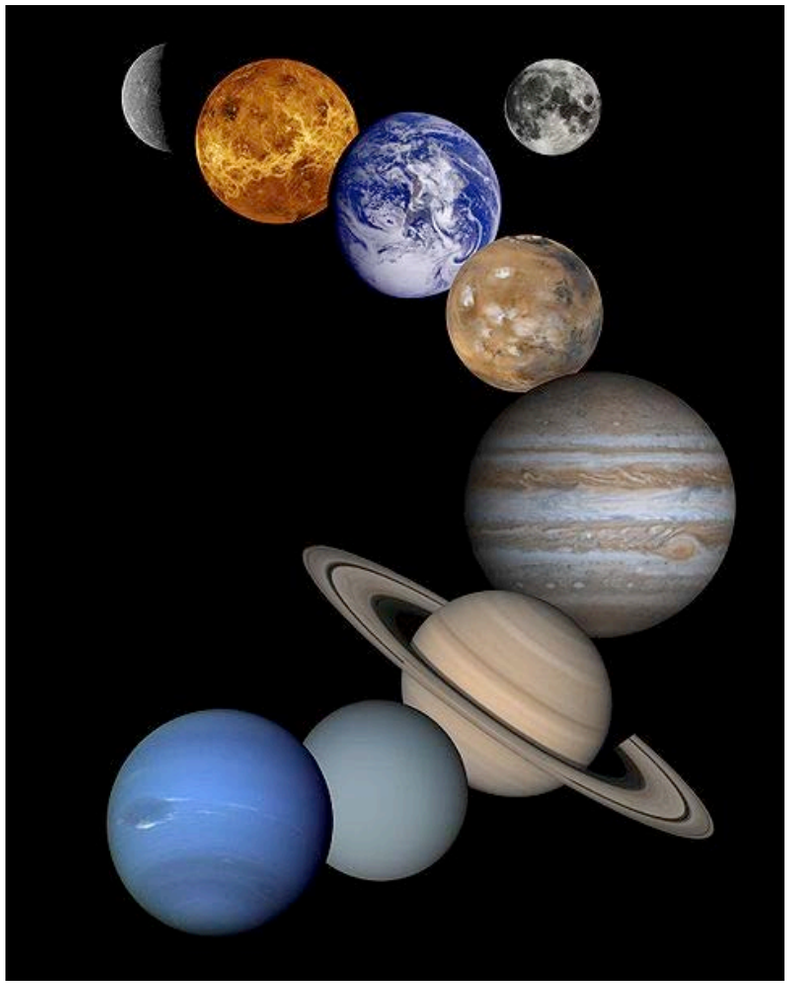
B spectrum.

C yellow dwarf.

D nebula.

Answer

The Beginning of our Solar System



The formation of our solar system - our home - was not a simple process.

Click here to learn more about the violent explosions that started our solar system

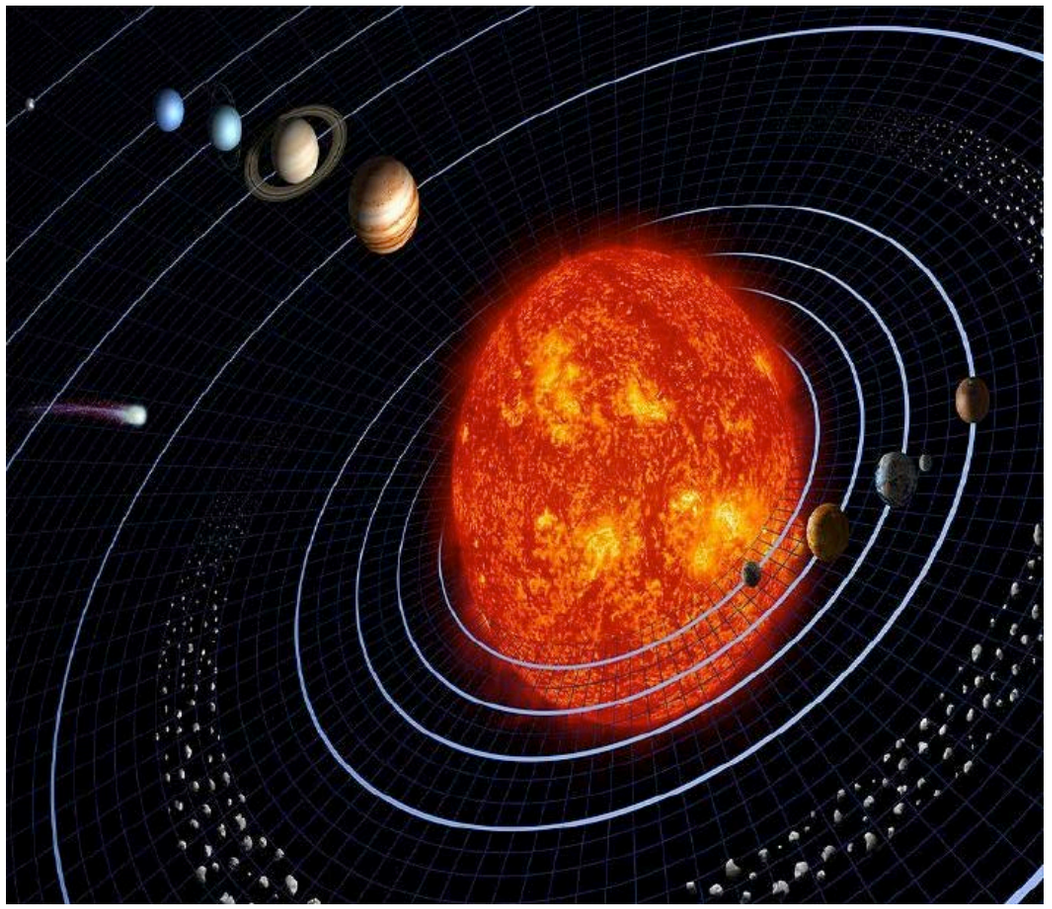
The Beginning of our Solar System

As the cloud of dust was pulled together by gravity, those particles got larger and larger.

At the same time, the cloud of dust was still rotating around the sun.

Formation of the Planets

Because of its size, the Sun has a tremendous gravitational pull -- the strongest in our solar system!



Over time, small bits of ice and rock began orbiting the Sun. These pieces eventually clumped together and the planets started to form.

Think about what you know about the types of planets. We will come back to this in a few slides.

The Importance of our Sun

If our Sun were to stop existing, what would happen to all life on Earth?

What would happen to all the other planets in our Solar System?

The Importance of our Sun

Earth, and every other planet in our Solar System, relies on the Sun for both heat and light.

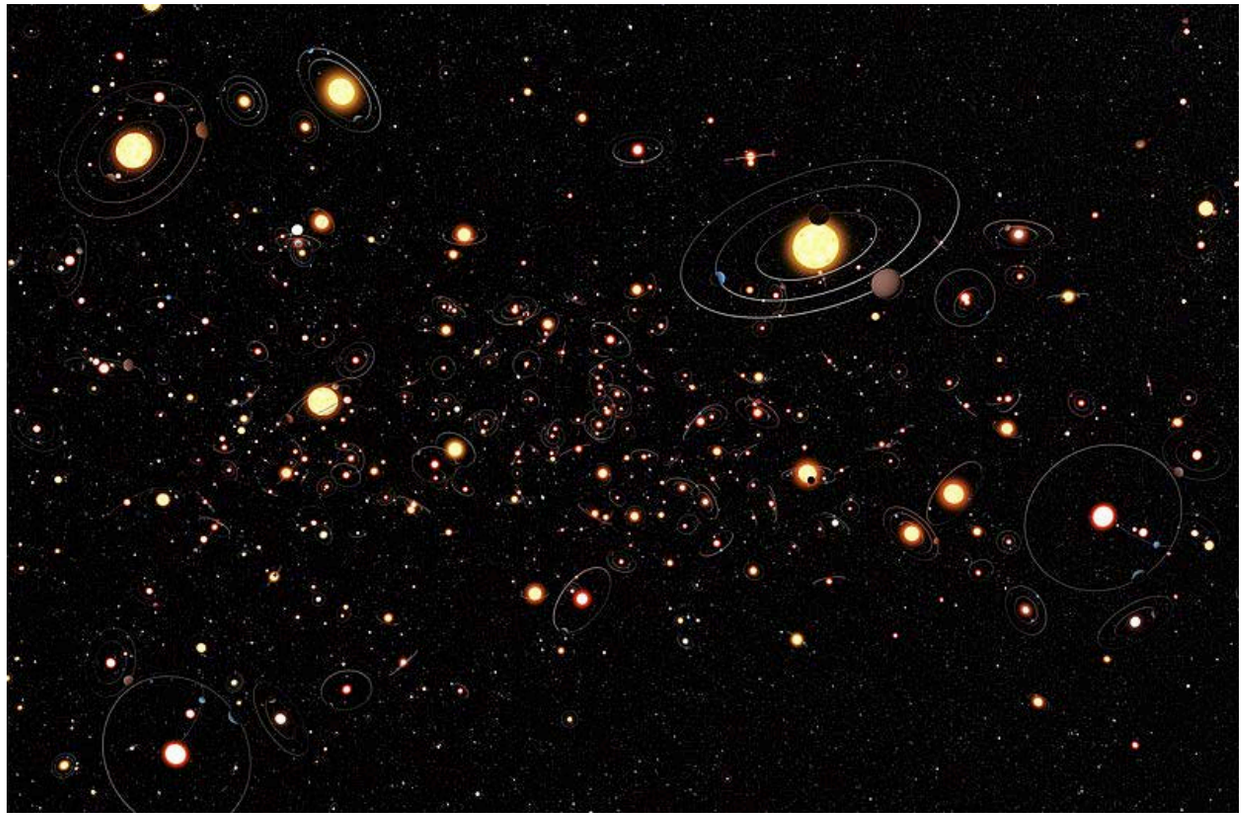
The Sun is the center of our Solar System and all objects revolve around it.

Types of Celestial Bodies

Return to Table of Contents

Celestial Bodies

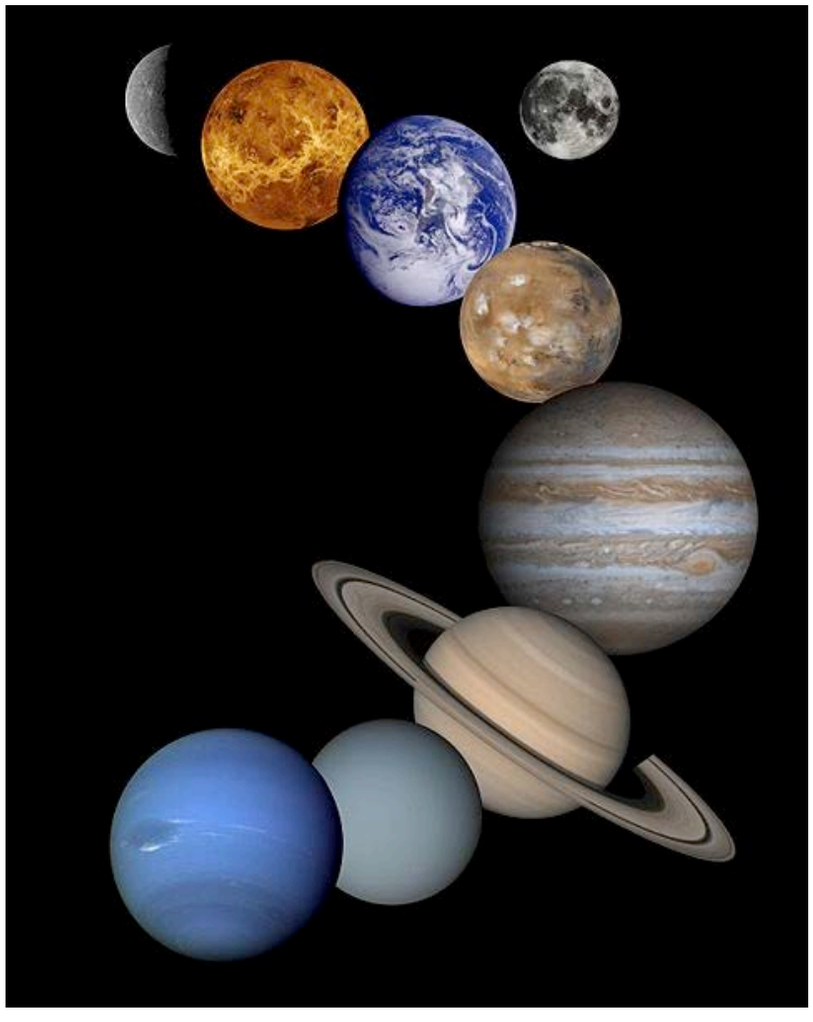
By definition, a celestial body is any natural body outside of Earth's atmosphere.



Celestial Bodies

Can you list 3 examples of celestial bodies you see in the sky on a regular basis?

Move for Answer



There are MANY more celestial bodies than these in our Solar System!

Types of Celestial Bodies

This section will focus on a number of different objects that can be found in our solar system:

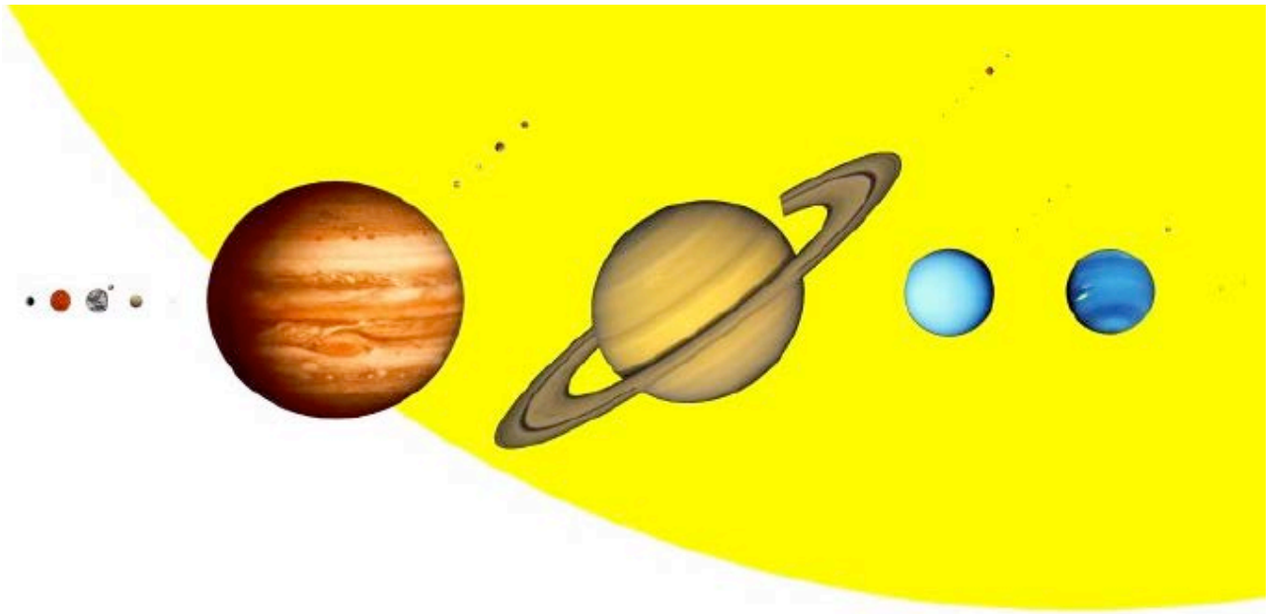
Planets

Moons

Asteroids

Comets

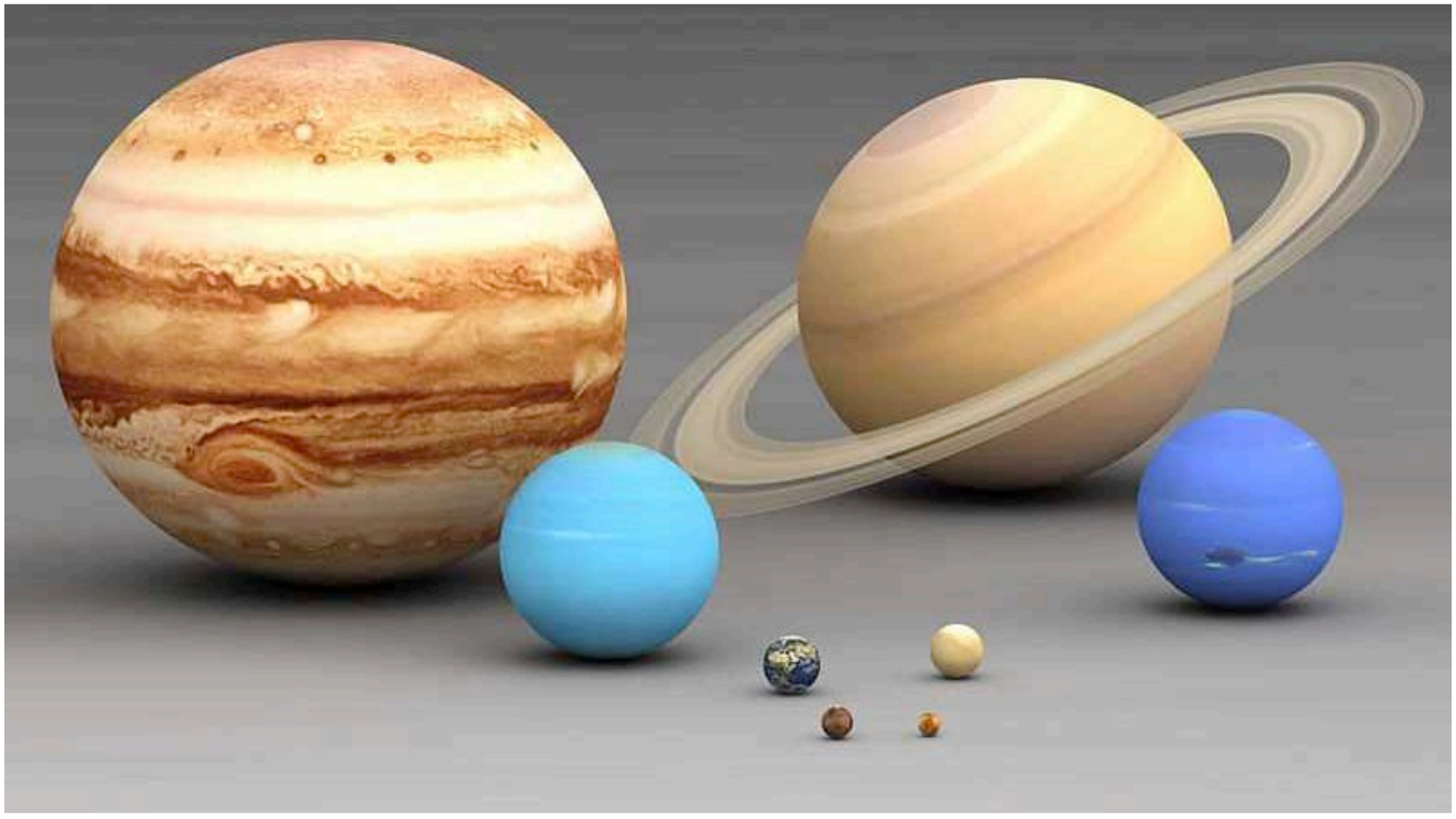
Meteoroids



Click on the topic to go to that section

What is a Planet?

Click here to learn more about what makes something a planet



What is a Planet?

An object must meet three criteria in order to be considered a planet.

Think about the planets in our solar system and come up with a list of what they have in common.

3 Criteria to be considered a planet:

- The object needs to orbit a star
- The object needs to have enough gravity to pull it into a spherical, ball-like shape
- It must be the dominant gravitational body in its orbit (it must be able to clear other objects out of the way and not crash into them as it orbits)

"Clearing the Orbit"

That third requirement can be tricky to understand so let's imagine a crowded school hallway.

A big football player would move easily through the hall because everyone would move out of their way.

A smaller person would have to push their way through the crowd, bumping off people as they go through.

Planets are like the football player.

They move other celestial bodies out of their way.

4 Which of the following is not part of the criteria for being declared a planet?

A Must be able to clear objects out of its orbit.

B Must be a spherical shape.

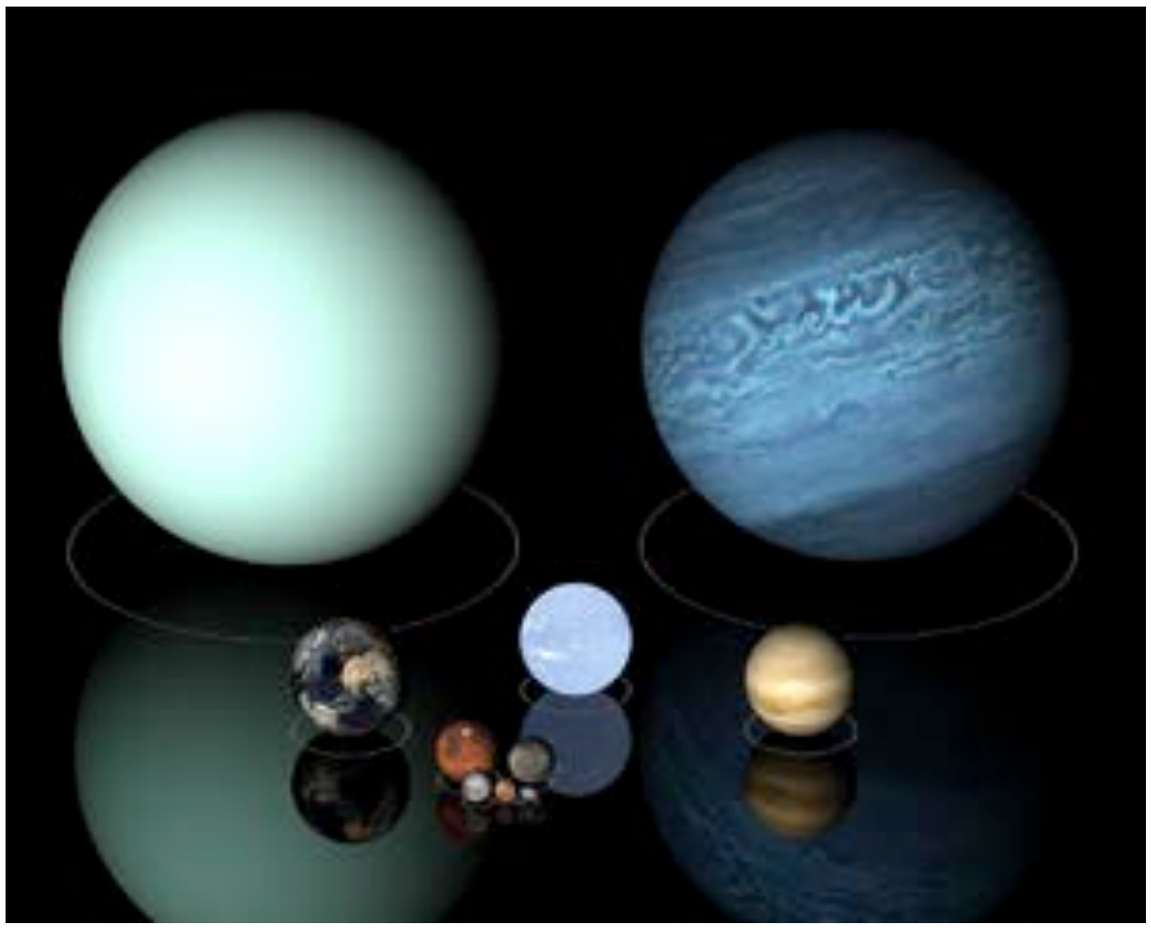
C Must be made of rock and water.

D Must orbit a star.

Answer

The Planets of Our Solar System

There are 8 objects in our Solar System that meet the criteria on the previous slide:



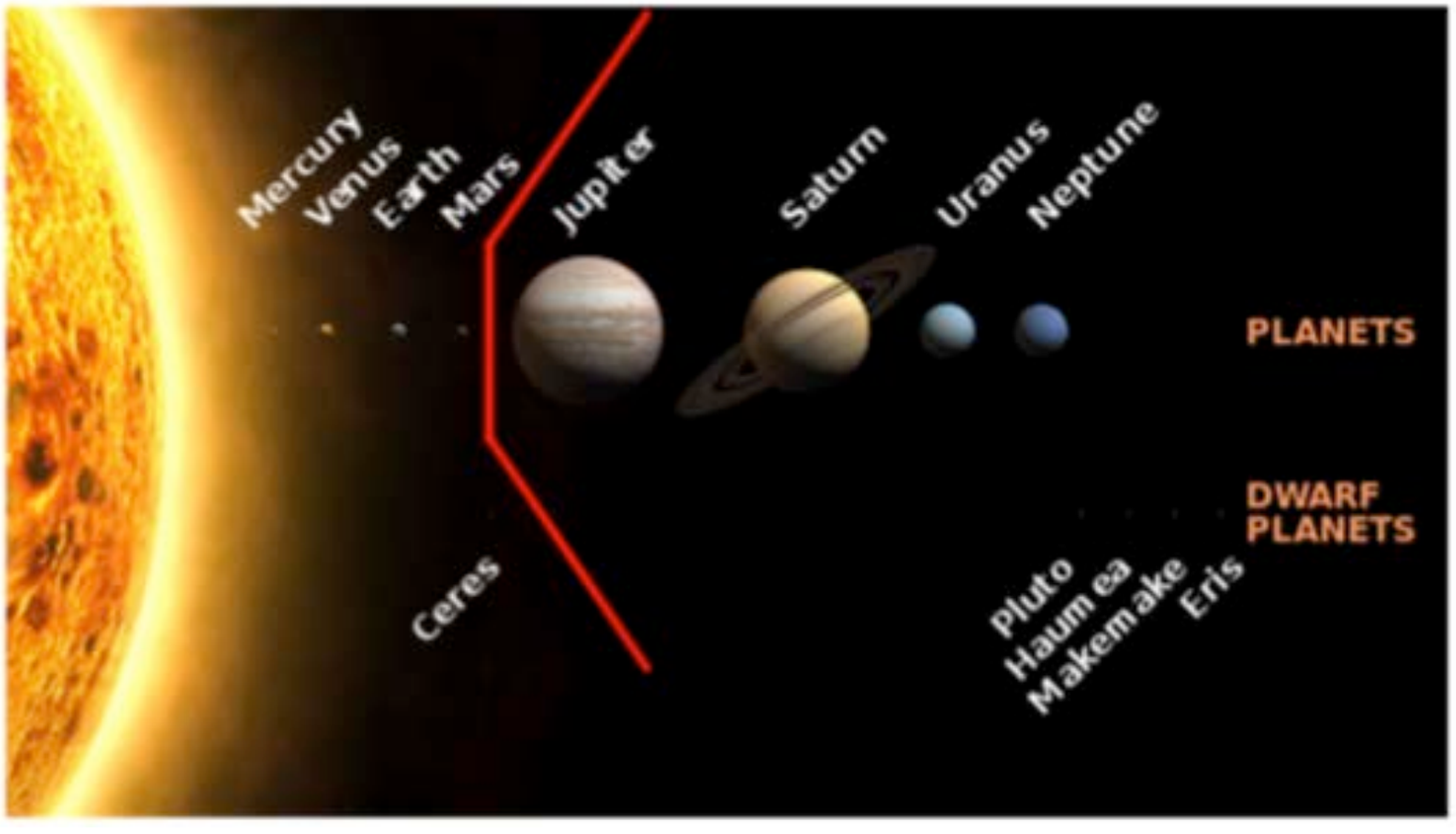
Mercury
Venus
Earth
Mars
Jupiter
Saturn
Uranus
Neptune

Two Types of Planets

The planets are broken up into two categories:

Terrestrials

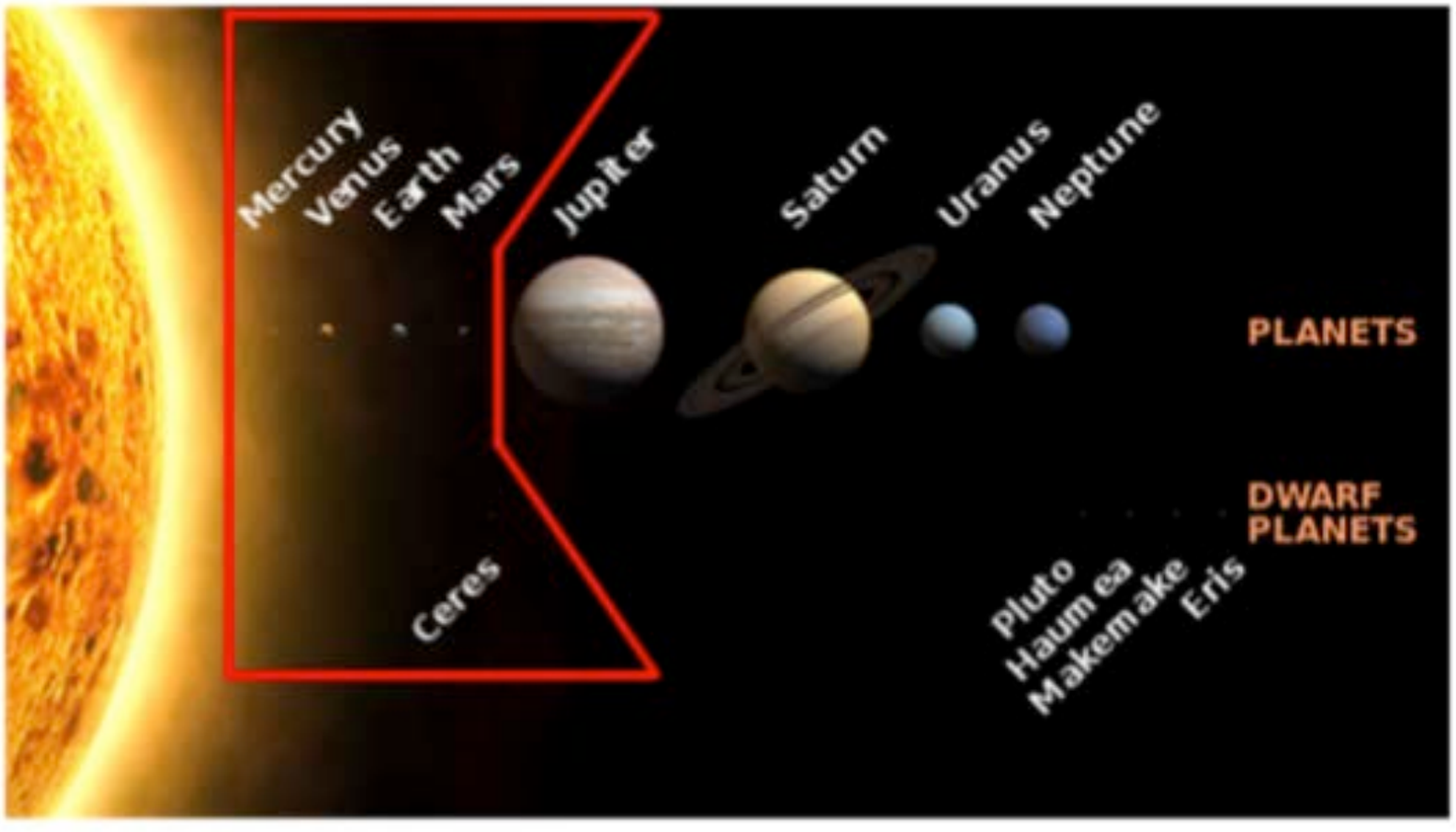
Gas Giants



Terrestrials

The first four planets (Mercury, Venus, Earth, and Mars) are terrestrial planets.

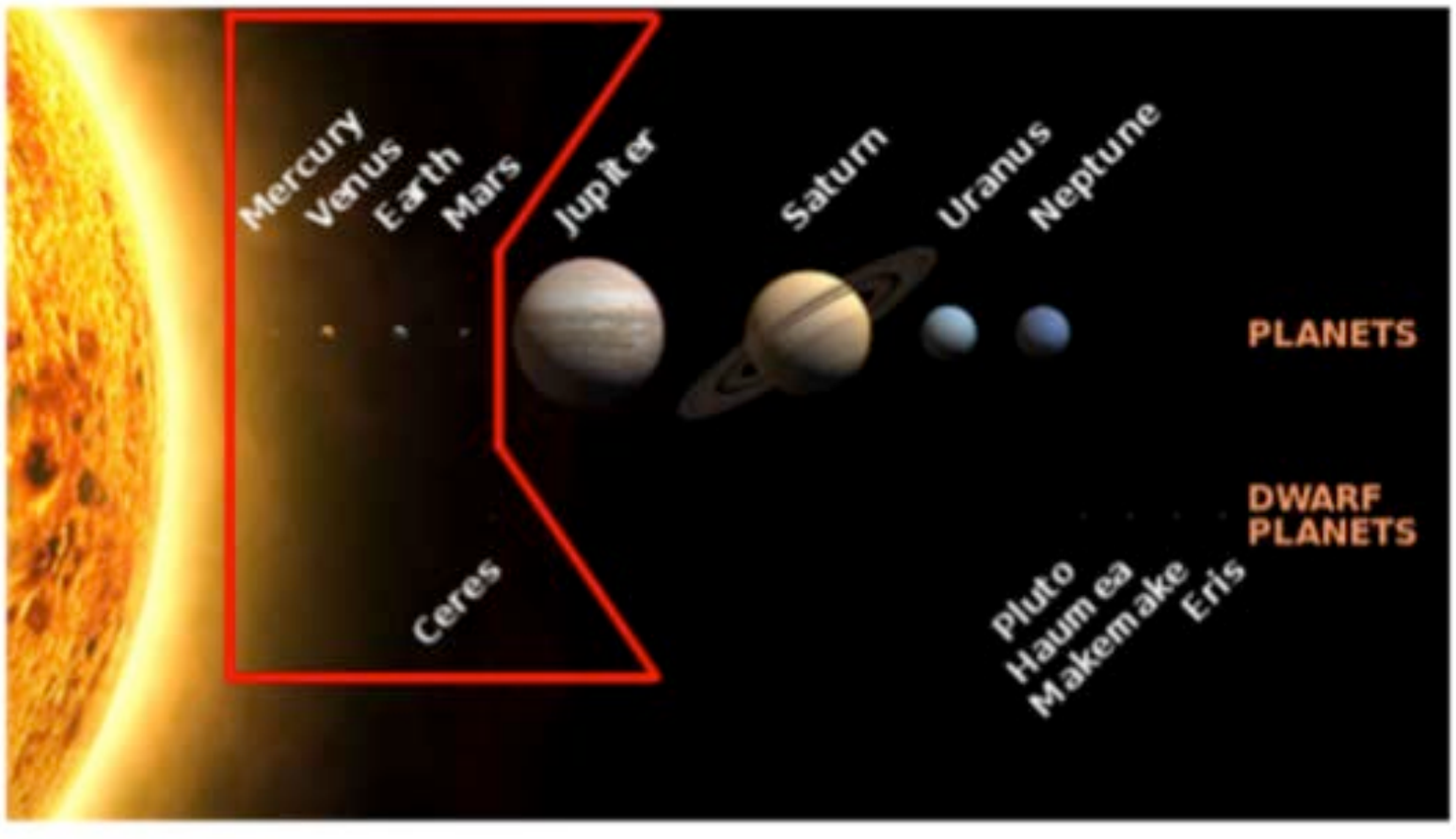
What do these planets have in common that separate them from the outer gas planets?



Terrestrials

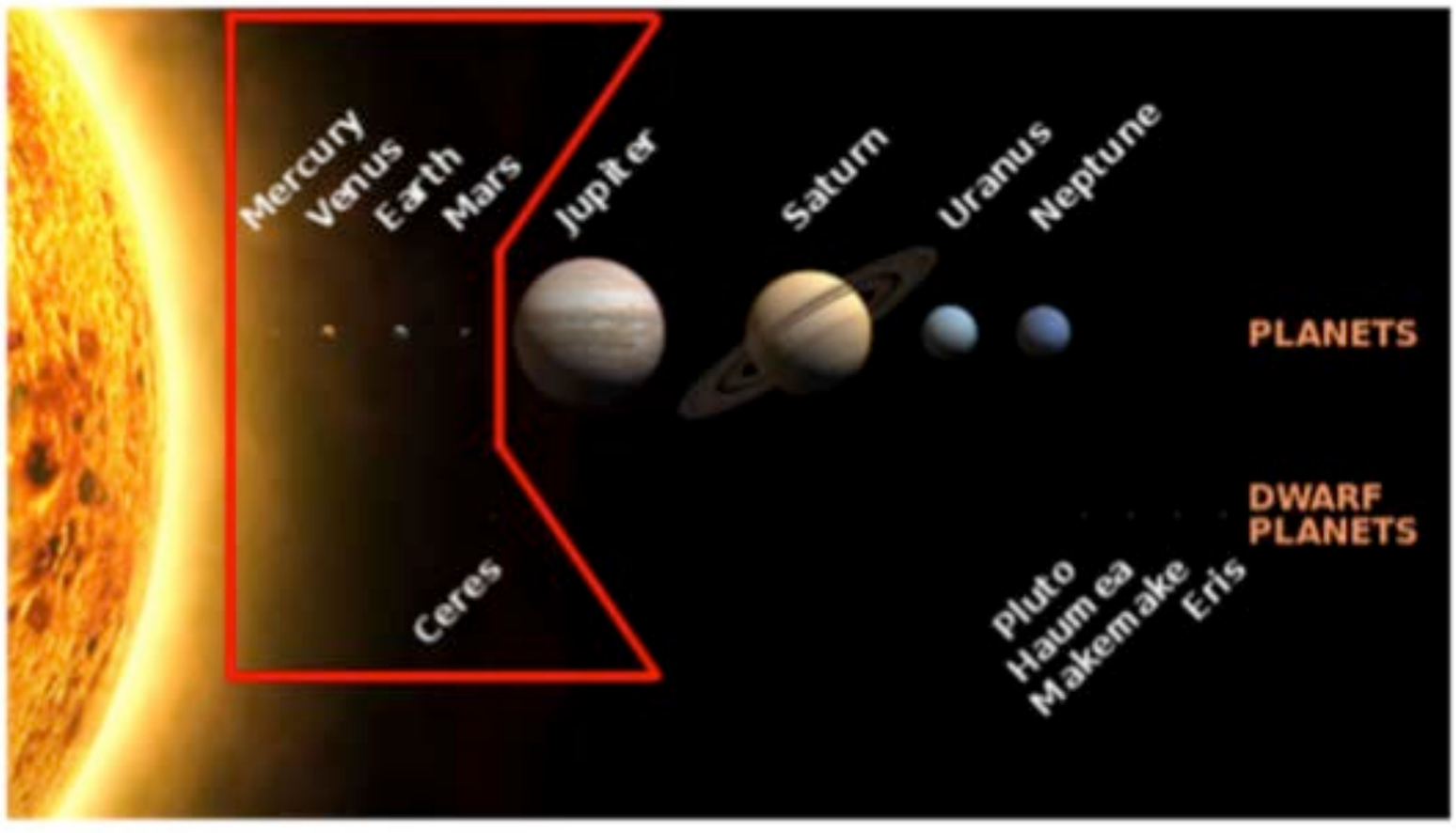
Mercury, Venus, Earth, and Mars are much smaller than the outer planets. They also are rocky planets with surfaces unlike the gas giants.

The word terrestrial contains the Latin root word "terra," which means "land."



Terrestrials

Think about what you know about the effect of gravity. Why do you think the smaller terrestrial planets are closer to the sun than the gas giants? For a hint, look at the size of the planets in the picture below.



5 Which of the following separates the terrestrial planets from the gas giants?

A Terrestrial planets are made primarily of rock.

B Terrestrial planets are significantly larger than the gas planets.

C All terrestrial planets are able to maintain life, but the gas giants cannot.

D The terrestrial planets contain water in liquid form while the gas giants contain water in gas form.

Answer

6 Which of the following explains why the terrestrial planets are closer to the sun than the gas giants?

A gravity

B mass

C air pressure

D random luck

Answer

7 Put the terrestrial planets in order from closest to the sun to most distant.

A Mars, Earth, Venus, Mercury

B Venus, Mercury, Earth, Mars

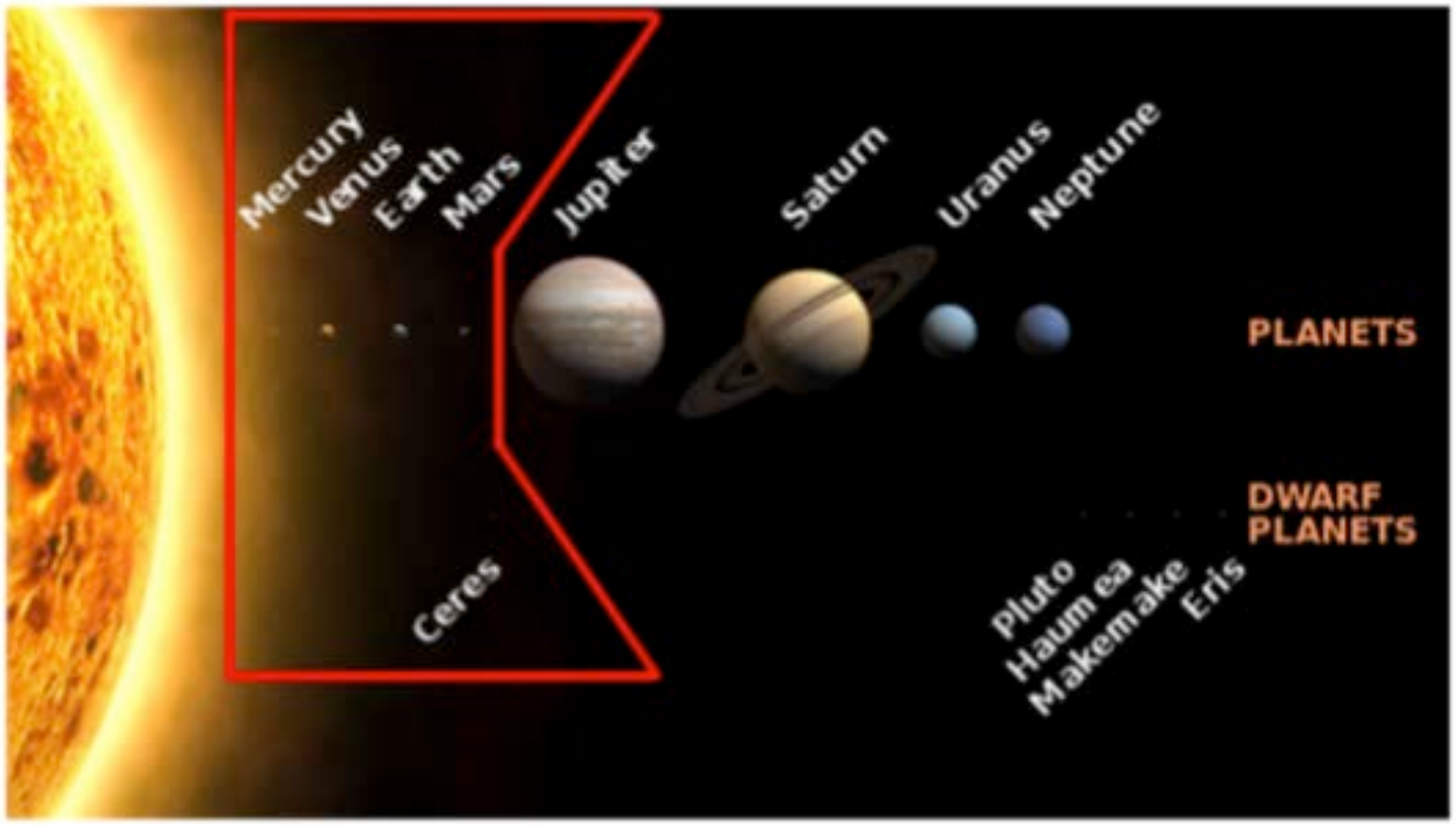
C Mercury, Venus, Earth, Mars

D Mercury, Mars, Earth, Venus

Answer

Temperature of the Planets

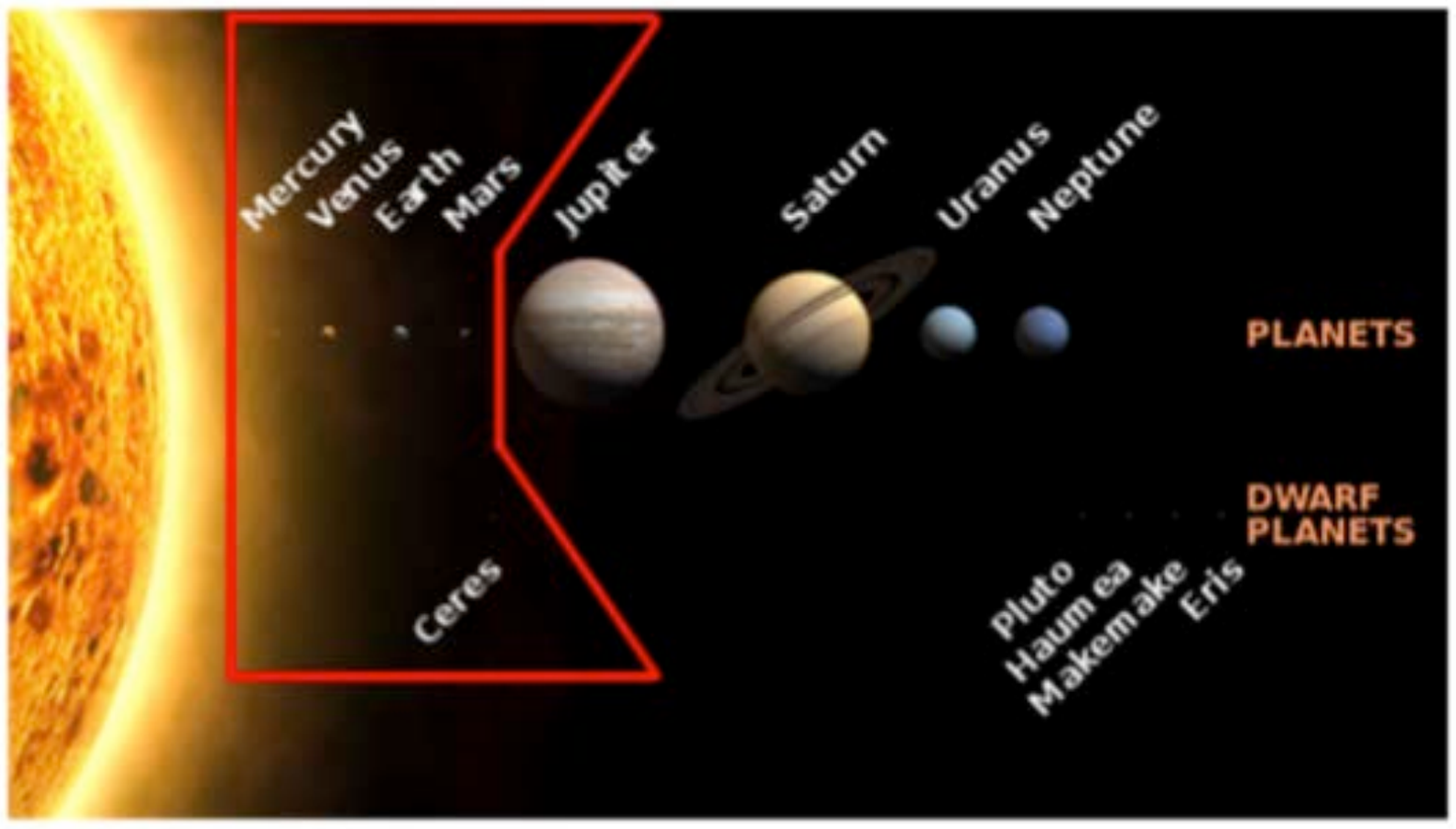
Which of the terrestrial planets do you think is the warmest? why?



Temperature of the Planets

Most people guess Mercury is the warmest due to its proximity to the Sun.

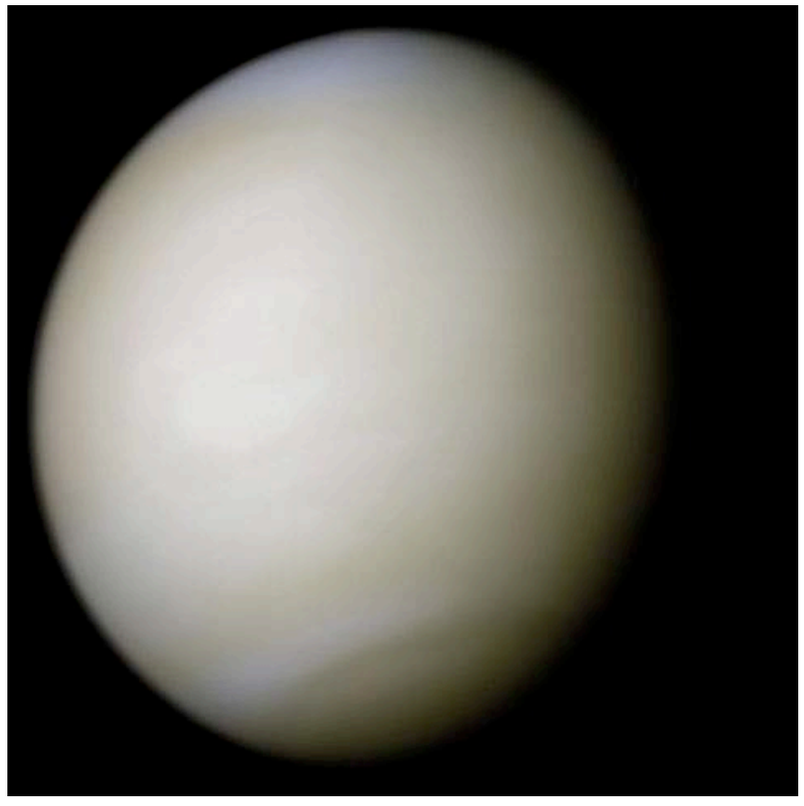
While this is a very good scientific guess, Venus is actually the hottest, with a surface temperature over 800 degrees F!



Venus

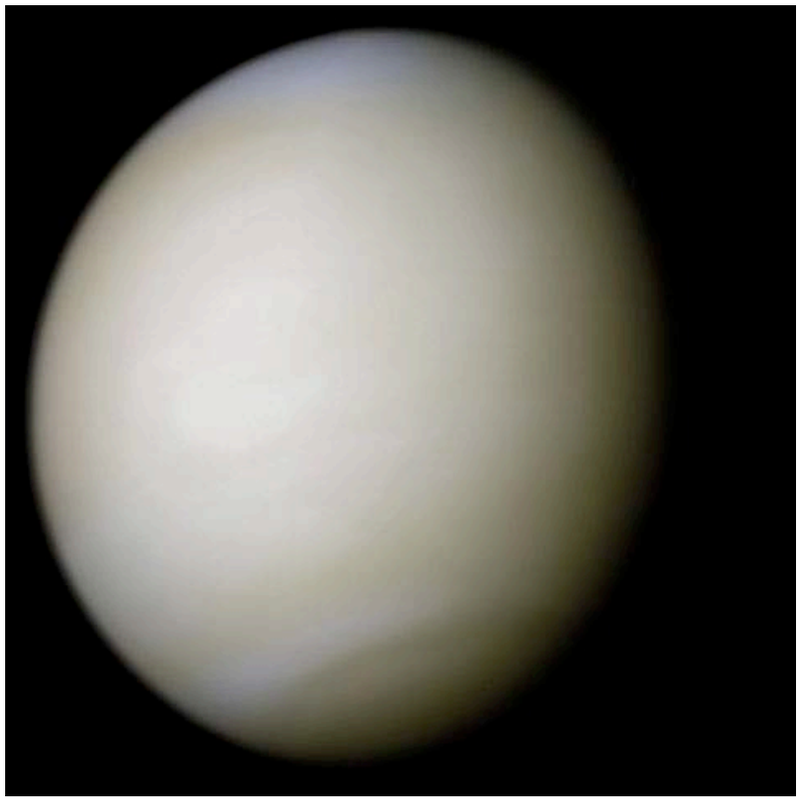
Recall what we learned last year about the greenhouse effect.

Can your group summarize what it is?



Venus

The atmosphere on Venus also creates a greenhouse effect, trapping CO_2, which in turn raises the temperature on Venus.



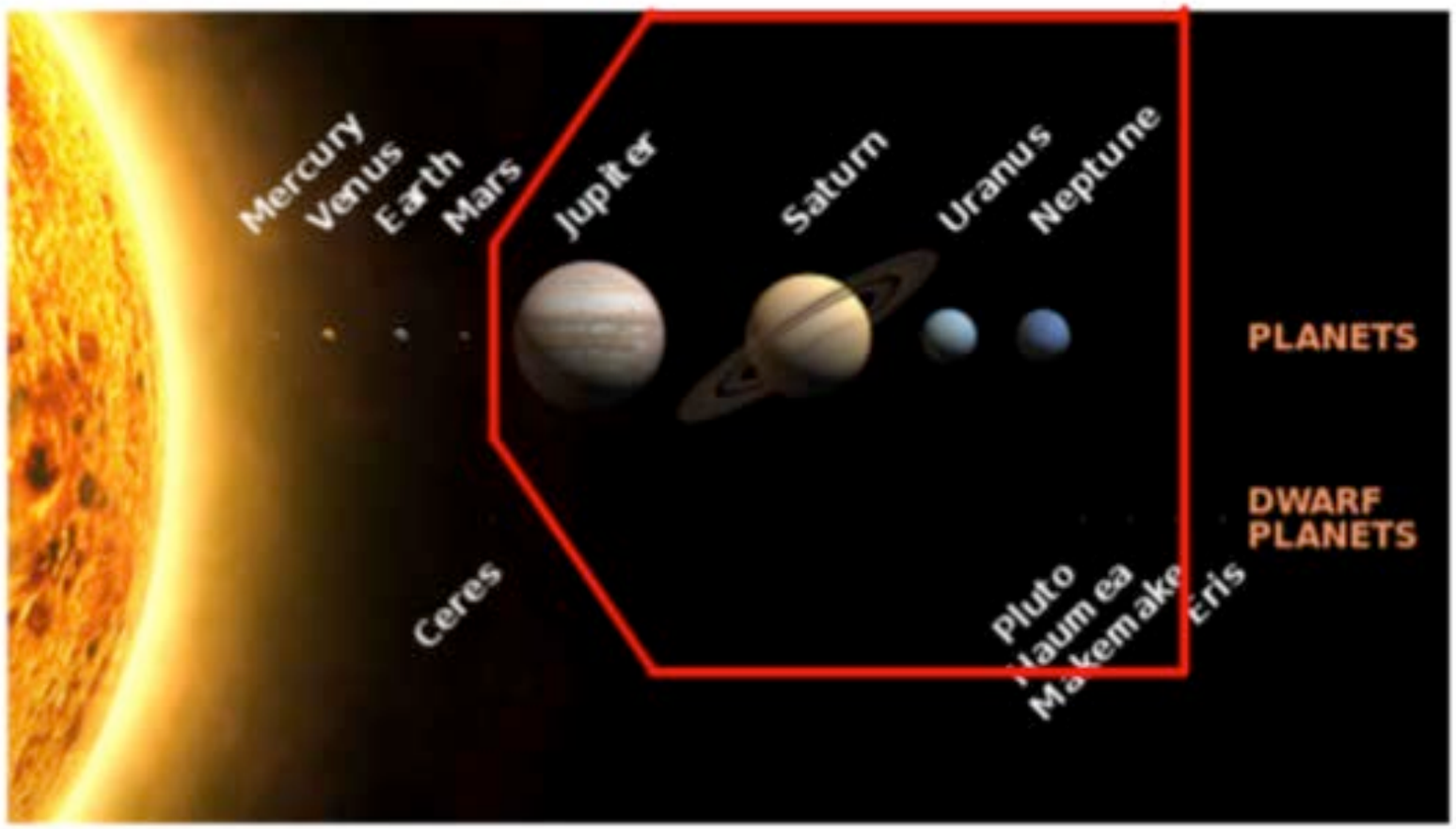
In fact, the atmosphere on Venus contains 96% CO_2!
(The CO_2 in Earth's atmosphere is only about 0.04%)

Even though Mercury is the closest planet to the Sun, Venus is the hottest planet in our solar system.

Gas Giants

Jupiter, Saturn, Uranus, and Neptune are called the "gas giants."

These planets are largely composed of gaseous material and are significantly larger than the terrestrials.



8 Which of the following do you consider celestial bodies?

A stars

B planets

C asteroids

D all of the above

Answer

9 Which of the following planets qualifies as a gas giant?

A Mercury

B Earth

C Mars

D Neptune

Answer

10 _____ is the largest planet in our solar system.

A Jupiter

B Neptune

C Earth

D Saturn

Answer

Pluto: Dwarf Planet

Many people used to believe there were 9 "planets" in the Solar System, including Pluto.

Pluto was downgraded from planet to dwarf planet in 2006 when new information came to light about it.

Image: NASA

What were the 3 criteria for being a planet?

Which one do you think Pluto doesn't fill?

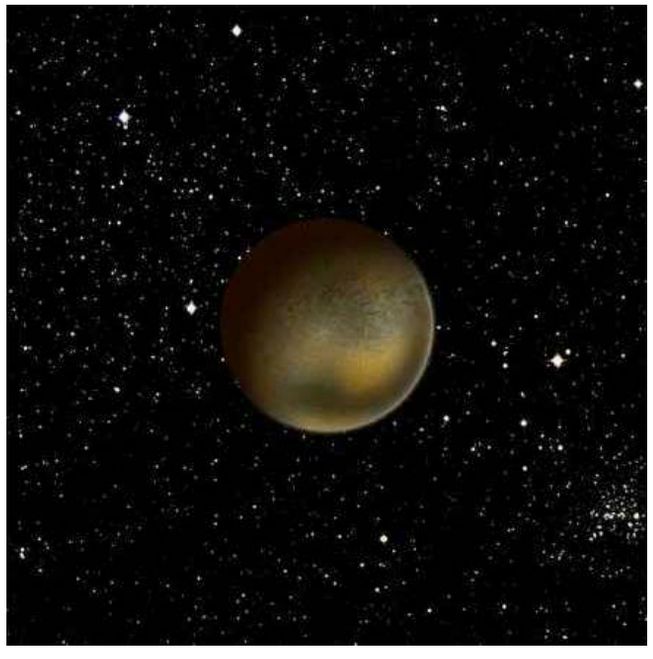
What Makes an Object a Dwarf Planet?

An object is considered a "dwarf planet" if it can only meet two of the three criteria for being a planet:

1. It orbits a star

2. Its gravity holds it in a spherical shape

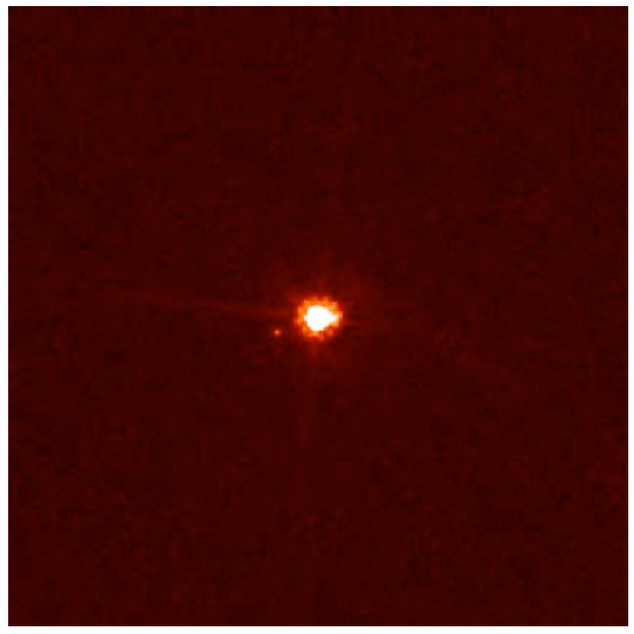
3. ~~It can not clear the neighborhood of its orbit~~



Pluto and Eris

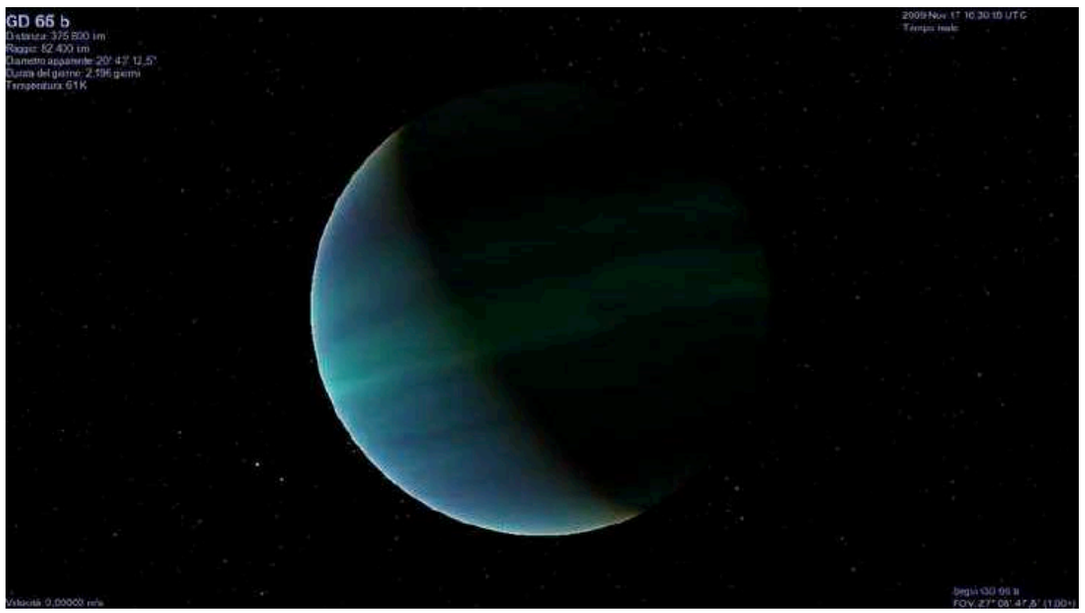
Pluto was down-graded to a "dwarf planet" because itdoes not meet the 3rd criteria (Pluto is not the dominant bodyin its orbit). Pluto is the small kid in the crowded hallway at school.

In 2005, an object that was larger than Pluto was found. The discovery of this body, named Eris (pictured to the right), aided in the demotion of Pluto.



Dwarf Planets in our Solar System

There are five known dwarf planets in our solar system listed below, along with the year in which they were discovered:



Ceres (1801)

Pluto (1930)

Haumea (2004)

Makemake (2005)

Eris (2005)

Ceres

Besides Pluto, the most significant dwarf planet in our solar system is Ceres.

Ceres resides in the main asteroid belt between Mars and Jupiter.

It was discovered in 1801 and was labeled as a planet. It kept this title for nearly half a century before being deemed a large asteroid, and now a dwarf planet. (We will figure out the difference between an asteroid and a dwarf planet later in this unit.)

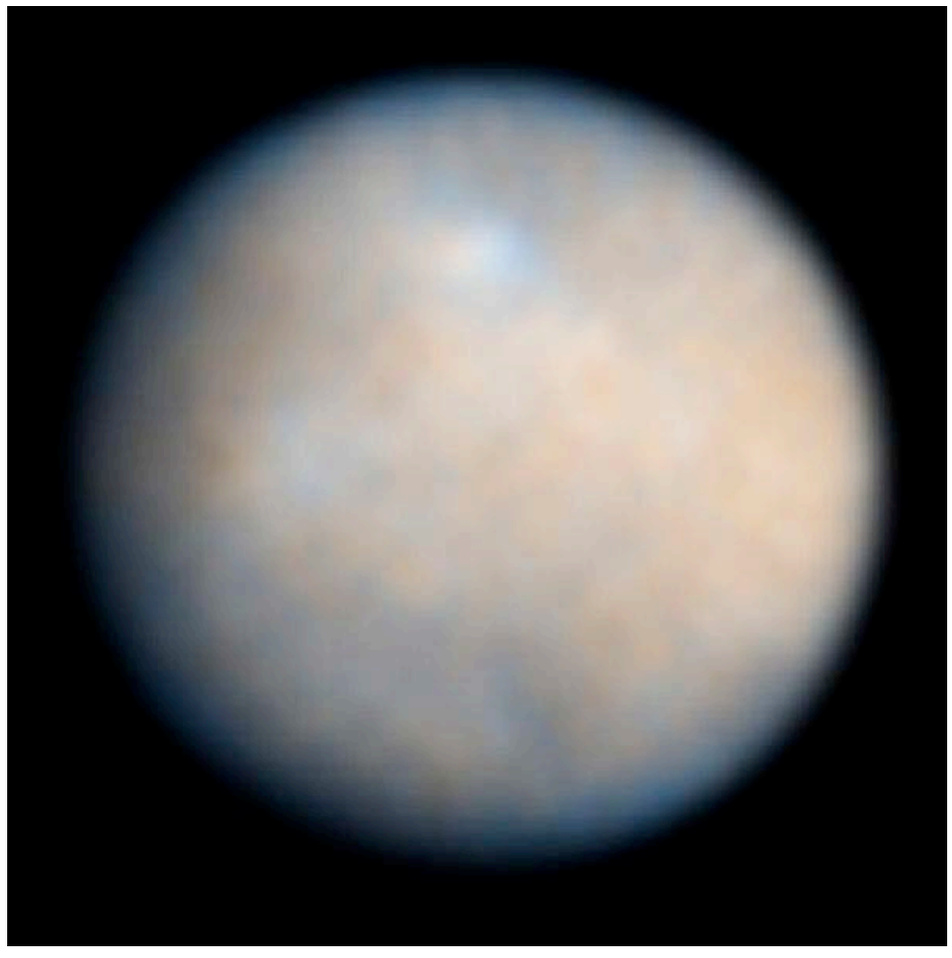


Image: NASA

11 Why was Pluto demoted to a "dwarf planet"?

A Pluto turned out to be a moon rather than a planet.

B Pluto did not revolve around the sun.

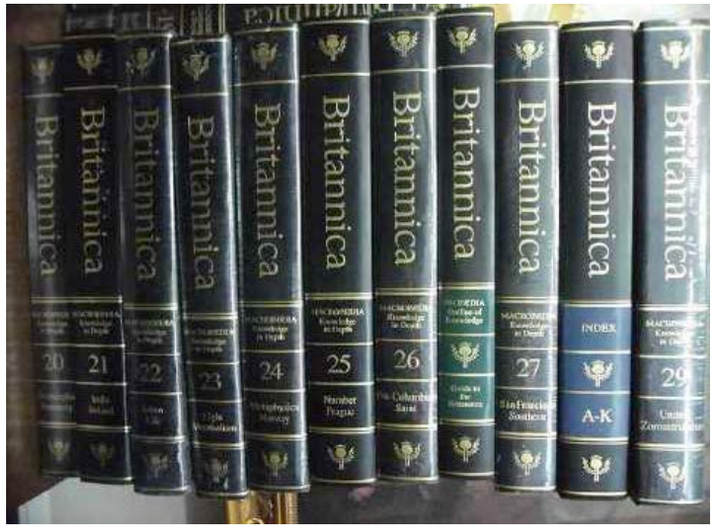
C Pluto was unale to clear out the path of its orbit because of its size.

D Pluto is shaped more like an asteroid than a planet.

Answer

The Planets: In-class Research Activity

On the following slides, you will be asked to fill in information on the planets.



To complete this, you will need access to a laptop, a tablet, or informational texts from your school library.

Mercury

Image: NASA

Distance from Sun:

Time for 1 rotation (1 day):

Time for 1 revolution (1 year):

Diameter:

Number of Moons:

Venus

Image processing by R. Nunes

Distance from Sun:

Time for 1 rotation (1 day):

Time for 1 revolution (1 year):

Diameter:

Number of Moons:

Earth

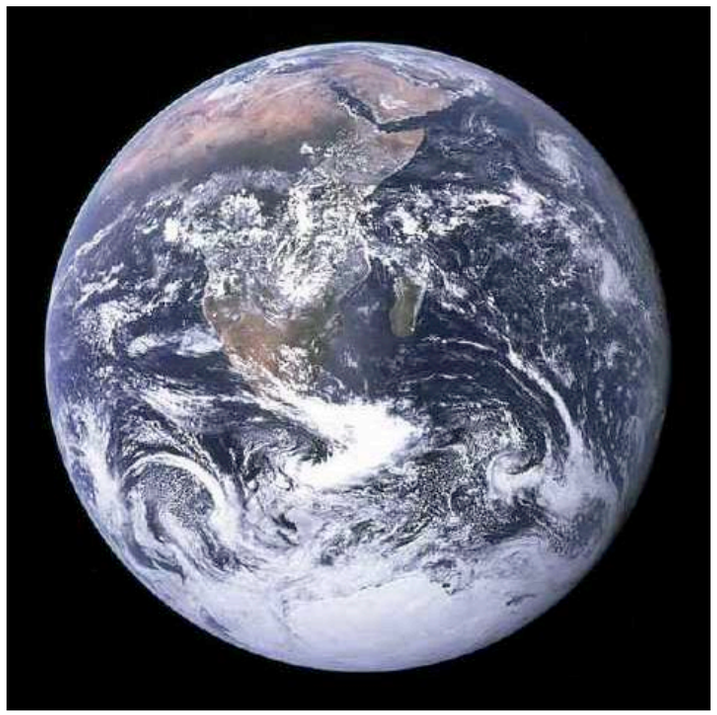


Image: NASA

Distance from Sun:

Time for 1 rotation (1 day):

Time for 1 revolution (1 year):

Diameter:

Number of Moons:

Mars

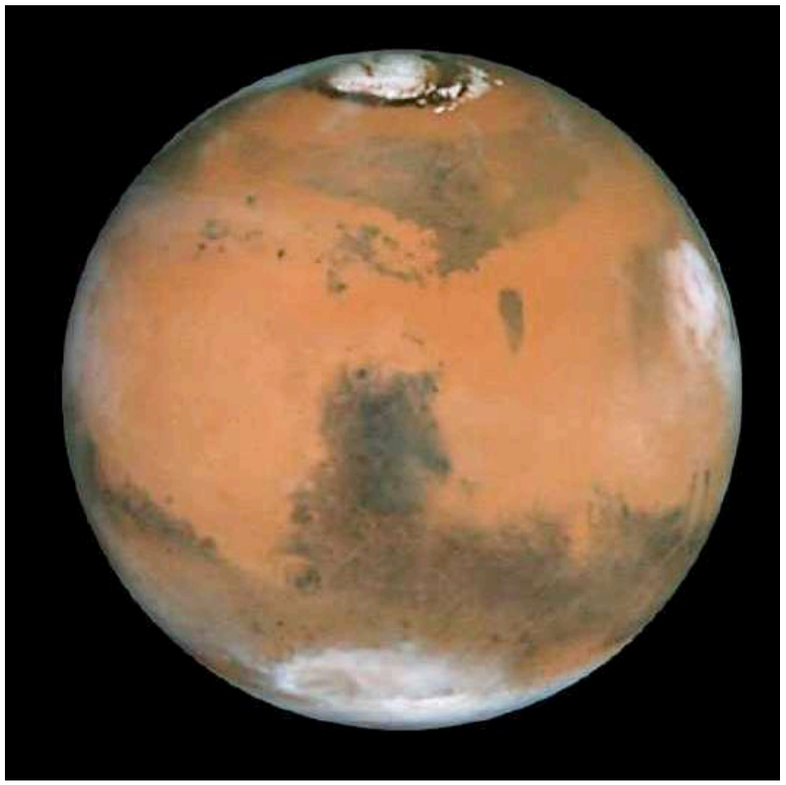


Image: NASA

Distance from Sun:

Time for 1 rotation (1 day):

Time for 1 revolution (1 year):

Diameter:

Number of Moons:

Jupiter

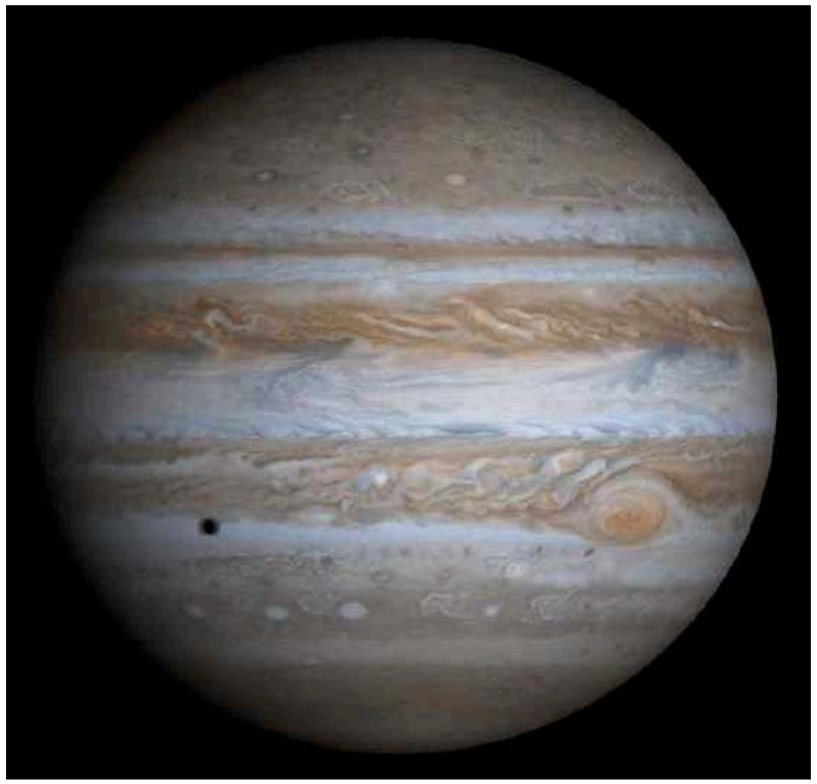


Image: NASA

Distance from Sun:

Time for 1 rotation (1 day):

Time for 1 revolution (1 year):

Diameter:

Number of Moons:

Saturn

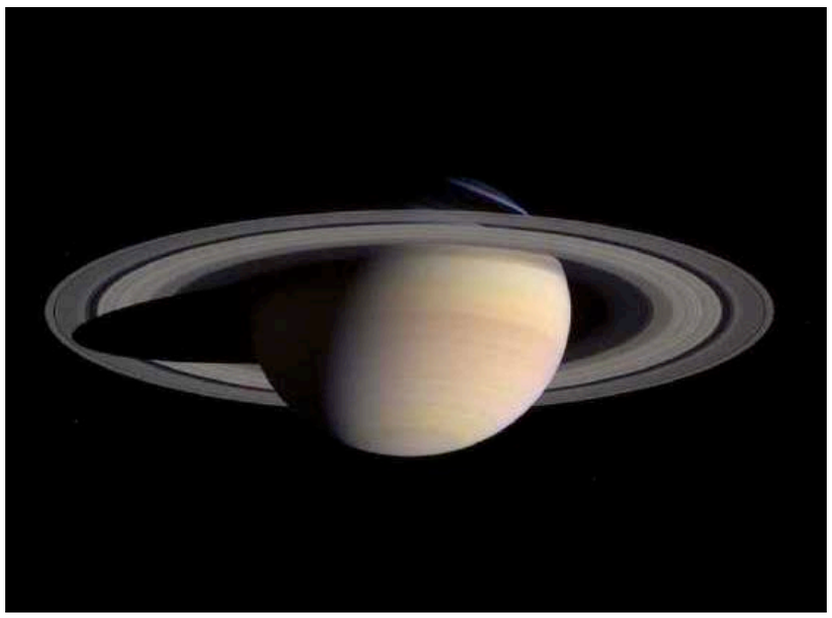


Image: NASA

Distance from Sun:

Time for 1 rotation (1 day):

Time for 1 revolution (1 year):

Diameter:

Number of Moons:

Uranus

Image: NASA

Distance from Sun:

Time for 1 rotation (1 day):

Time for 1 revolution (1 year):

Diameter:

Number of Moons:

Neptune

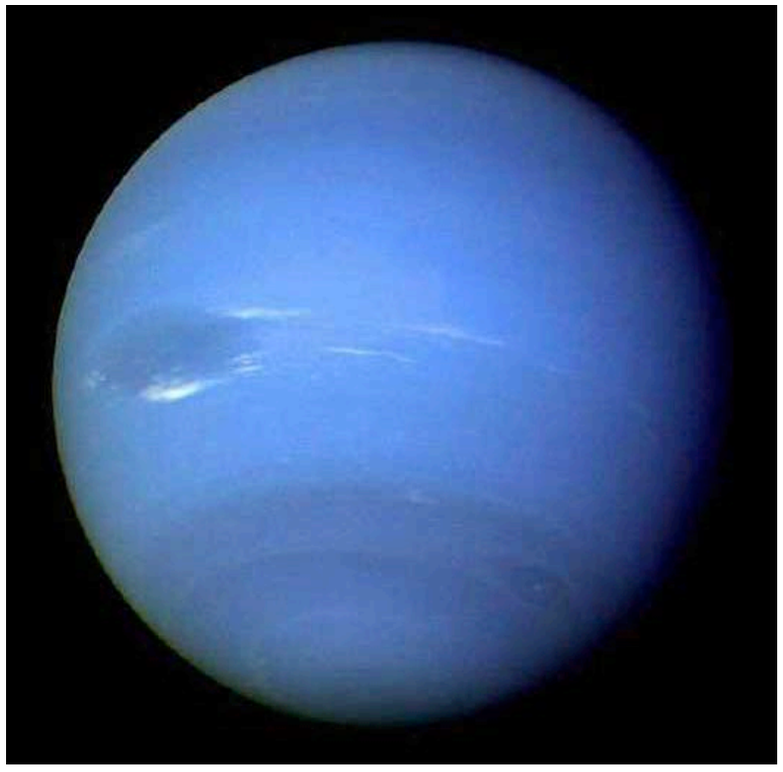


Image: NASA

Distance from Sun:

Time for 1 rotation (1 day):

Time for 1 revolution (1 year):

Diameter:

Number of Moons:

12 Which planet has the longest revolution?

A Mercury

B Venus

C Earth

D Mars

E Jupiter

F Saturn

G Uranus

H Neptune

Answer

13 Which planet has the shortest revolution?

A Mercury

B Venus

C Earth

D Mars

E Jupiter

F Saturn

G Uranus

H Neptune

Answer

14 Which planet has the shortest day?

A Mercury

B Venus

C Earth

D Mars

E Jupiter

F Saturn

G Uranus

H Neptune

Answer

15 Which planet has the longest day?

A Mercury

B Venus

C Earth

D Mars

E Jupiter

F Saturn

G Uranus

H Neptune

Answer

16 Which planet is the largest?

A Mercury

B Venus

C Earth

D Mars

E Jupiter

F Saturn

G Uranus

H Neptune

Answer

17 Which planet is the smallest?

A Mercury

B Venus

C Earth

D Mars

E Jupiter

F Saturn

G Uranus

H Neptune

Answer

18 Which planet has the most moons?

A Mercury

B Venus

C Earth

D Mars

E Jupiter

F Saturn

G Uranus

H Neptune

Answer

19 Which planet has the least moons?

A Mercury

B Venus

C Earth

D Mars

E Jupiter

F Saturn

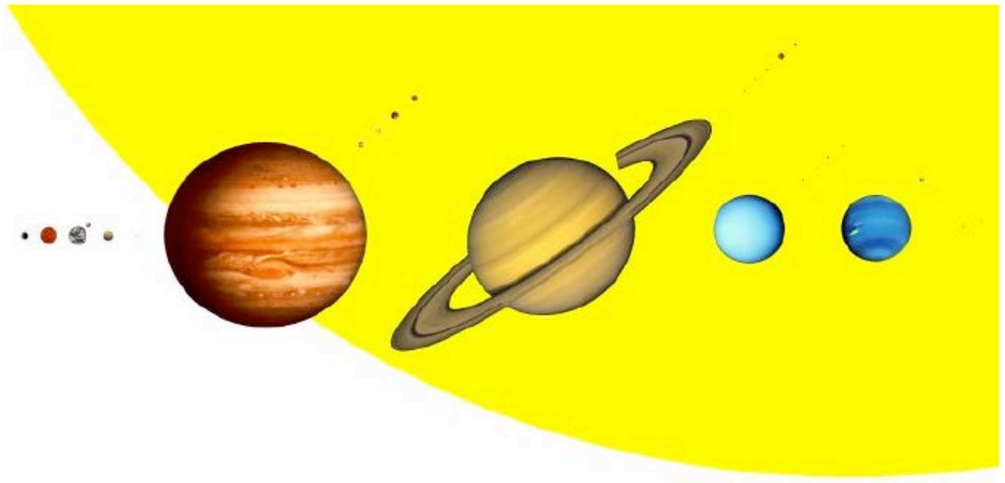
G Uranus

H Neptune

Answer

Distances Between the Planets

Now that we are familiar with the planets, we have to try and imagine just how far apart they all are.



You will be suprised at how great the distances are between planets!

Click here to watch Bill Nye demonstrate the distances between the planets using his bike

Early Stargazers

Before the invention of the telescope, early star-gazers knew of the only two main objects they saw in the sky.

What were those2 objects (or more specifically known as "celestial bodies")?

What is a Moon?

On each of your research slides, there was a question about how many moons each planet had.

Which brings us to our next question... what exactly is a moon?
At your table work on a definition for a moon.

Image: NASA

The Moon

Over time, astronomers realized that the Moon is not something unique for us here on Earth. Other planets have their own moons.

What is a Moon?

You probably included in your definition that a moon is a celestial body that makes an orbit around a planet, including the eight major planets and the dwarf planets.

Images: NASA

Click here to take a tour of Saturn's moons. This amazing video was created using actual photographs taken by the Cassini-Huygens unmanned spacecraft

What is a Moon?

A moon is also referred to as a natural satellite.

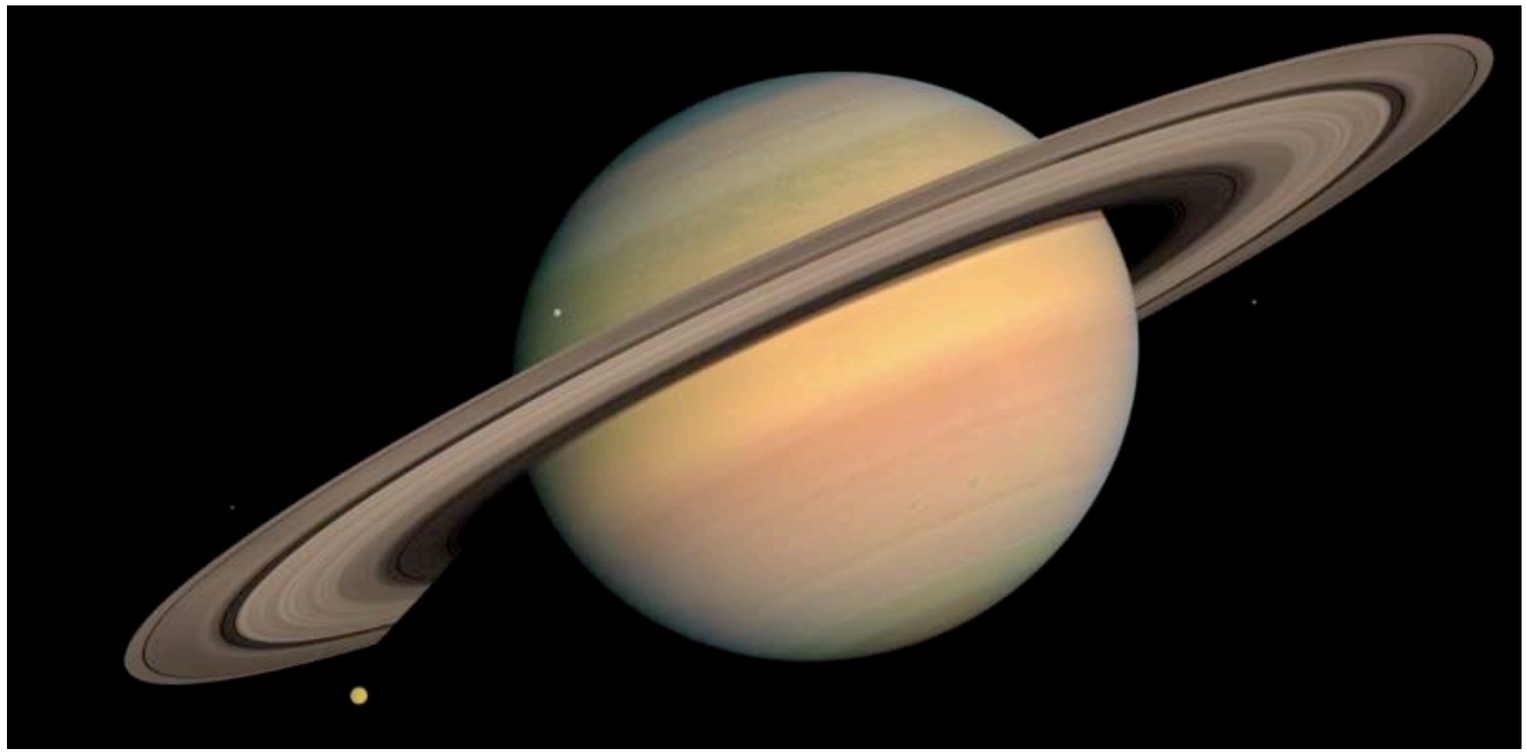
This is different from a man-made satellite which is put in outer space by humans for various purposes.

Hubble Space Telescope

What do moons and man-made satellites have in common?

The Moons of Our Solar System

Astronomers have determined that there are at least 146 moons in our solar system.



Knowing what you know about how planets formed, how do you think moons formed?

Move this box for the answer.

The Moons of Our Solar System

As you saw in your research:

The small terrestrial planets have few moons (or no moons at all)...

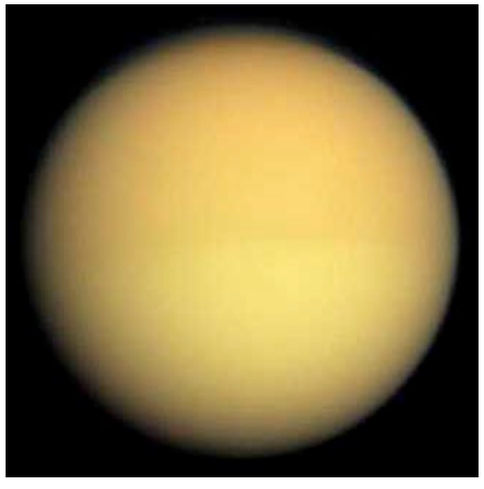
...and the large gas giant planets have many moons caught in their gravity.

Why do you think this is?

Fun Fact!

There are two moons in our Solar System that are even larger than Mercury. Jupiter's satellite named "Ganymede" and Saturn's satellite "Titan" are the 9th and 10th largest objects in the solar system, respectively.

Ganymede



Titan

Images: NASA

There are also 7 moons (including our own) that are larger than Pluto!

20 Some of these moons are, in fact, able to clear out their orbits because of their size. Why then are these objects not considered planets?

A They are not big enough.

B They are not made of gas.

C They do not have a gravity of their own.

D They do not orbit the sun.

Answer

Our Moon

Astronomers have been studying Earth's moon for a long time.

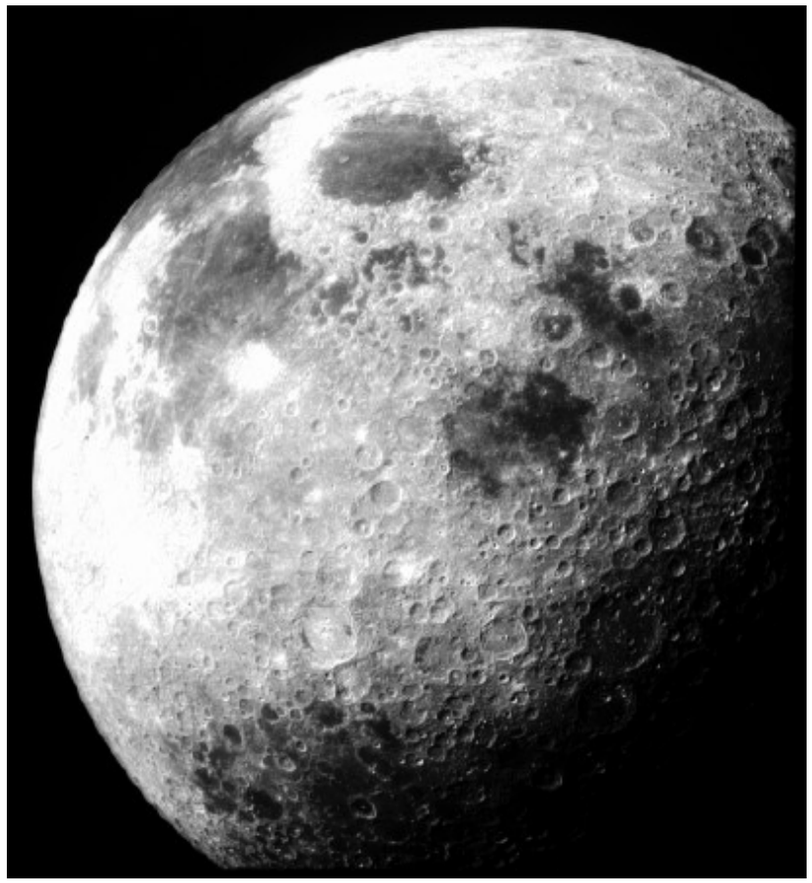


Image: NASA

We will be focusing much more on our moon later in this unit.

What is an Asteroid?

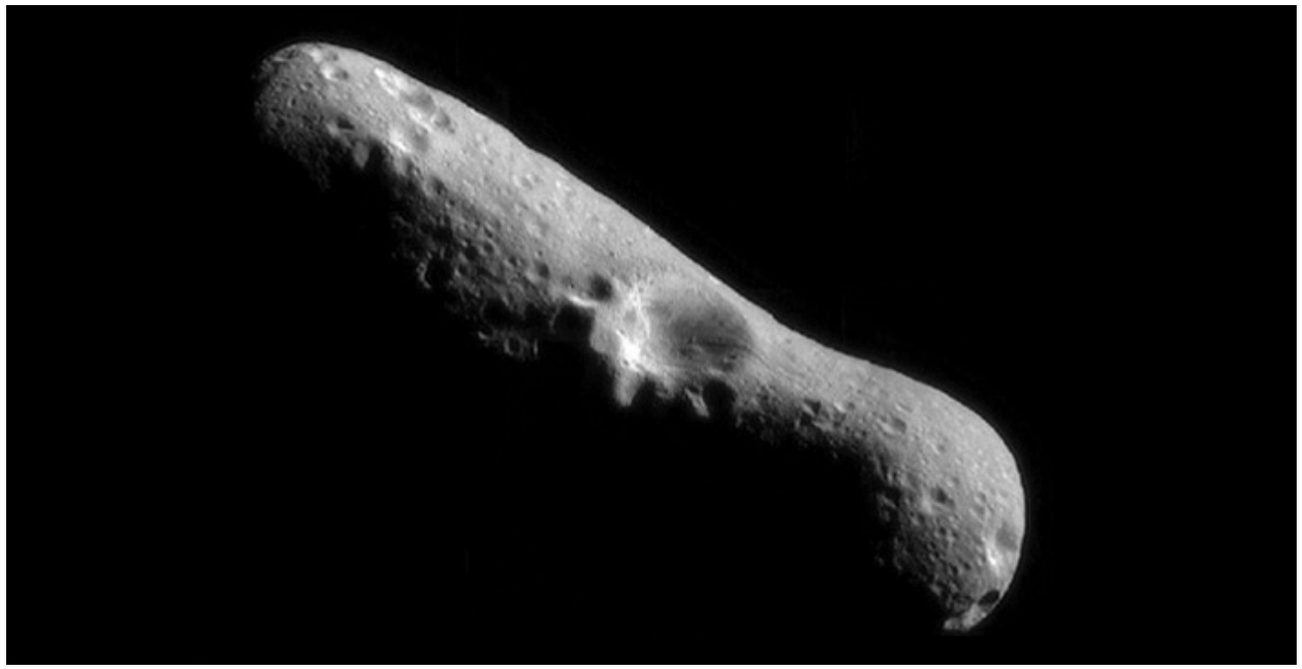


Image: NASA

Our solar system is filled with tens of thousands of airless, rocky worlds that orbit our Sun.

These celestial bodies are too small to be considered planets, and are instead given the nameasteroids .

Where are Asteroids found?

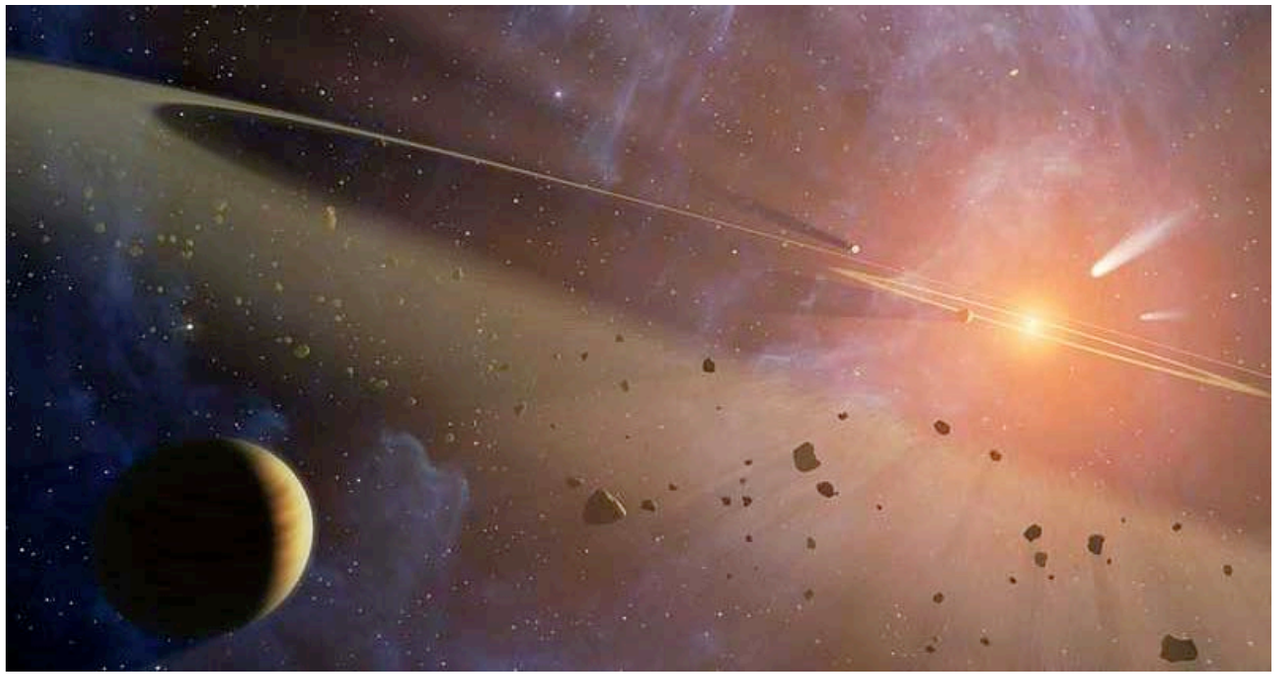


Image: NASA

Many asteroids in our galaxy can be found in the main asteroid belt.

This ring of asteroids is found between the orbit of Mars and Jupiter.

What implications can be drawn about this belt and its potential effect on space travel?

Vesta

Scientists have spent much time studying an asteroid named "Vesta."

This is the 2nd most massive asteroid in our solar system. It is also the brightest asteroid visible from Earth.

Click here to get a close look at the surface of Vesta

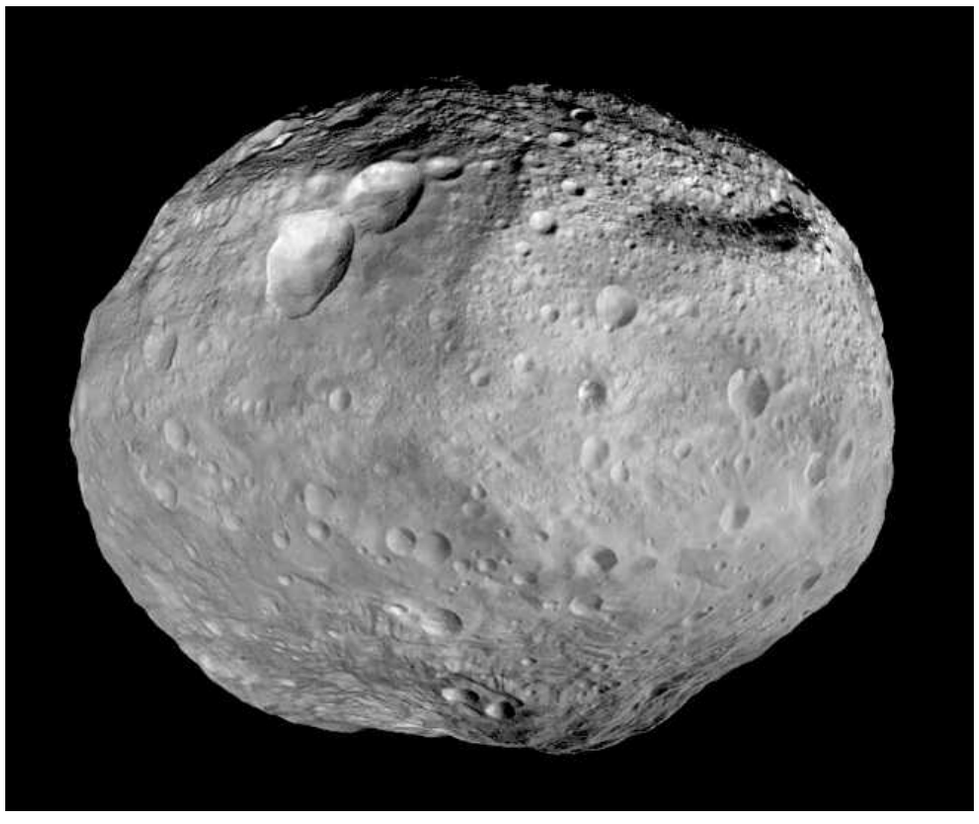


Image: NASA

Asteroid, Moon, or Planet?

Asteroids have much in common with planets and moons when it comes to what they're made of and how they look.

Why is an asteroid not considered a planet?
Why is an asteroid not considered a moon?

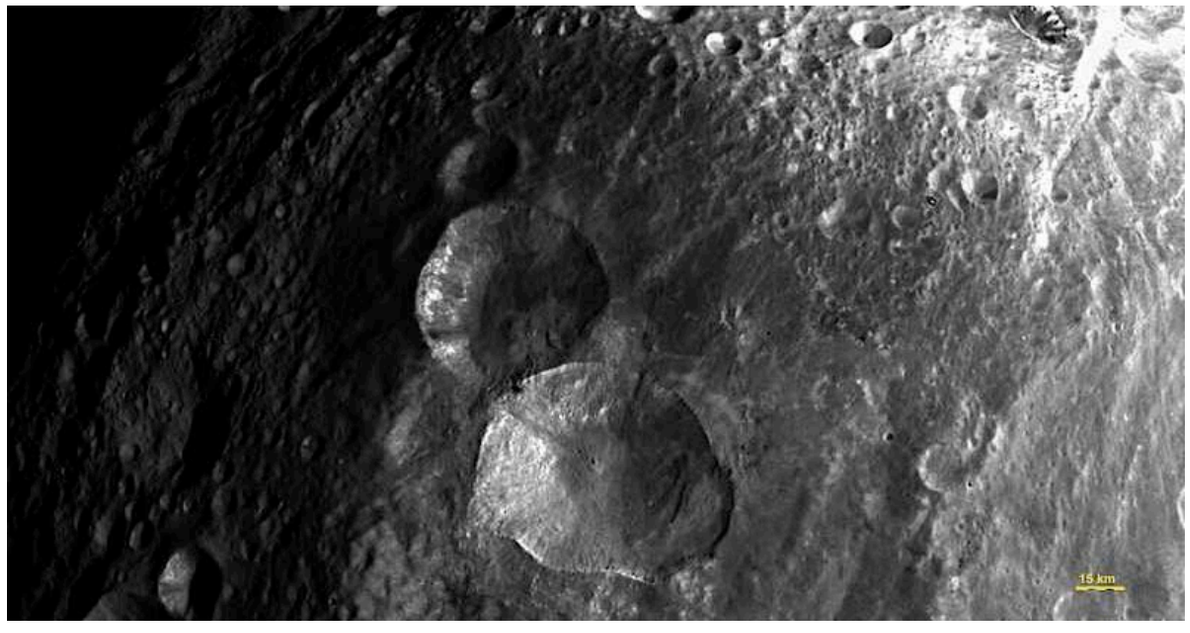


Image: NASA

21 Between which two planets can you find the main asteroid belt?

A Venus

B Earth

C Mars

D Jupiter

E Saturn

Answer

22 Asteroids are most similar to which planet listed below?

A Venus

B Jupiter

C Neptune

D Uranus

Answer

What is a Comet?

Image: NASA

Comets are cosmic snowballs of frozen gases, rock and dust. These aren't just snowballs though, they are much more.

Looking at the photo above, what do you notice is very different from a snowball?

What is a Comet?

Image: NASA

When comets orbit near the sun, the rock and dust create a giant glowing head as well as a tail behind the comet.

Comets: Physical Characteristics

Nucleus -

Click for definition

Comets: Physical Characteristics

Coma -

Click for definition

Comets: Physical Characteristics

Tail -

Click for definition

Comets in History

Throughout history, comets have been noted repeatedly. Ancient civilizations felt these objects in the night sky predicted bad events or disasters to come.

Image: NASA

The word disaster can be traced back to late 16th century, from the Italian word *disastro* which means "ill-starred event."

Halley's Comet

Write down on your calendars to remember the following date:

July 28, 2061 ... that's the next time Halley's Comet is expected to be in our view here on Earth.

Image: NASA

How old will you be when this comet comes back around?

23 A comet is most like which of the objects below?

A An asteroid

B A planet

C A star

D A snowball

Answer

24 As a comet soars overhead, you can most easily see the remains behind it. What part of the comet are you most likely seeing stretched across the sky at this time?

A Coma

B Nucleus

C Tail

Answer

What is a Meteoroid?

Image: NASA

Meteoroids are small chunks of rock and space junk that can be as small as a grain of sand or as large as a boulder which have not entered Earth's atmosphere.

Meteors

There is a good chance you have seen a meteor in your own life. Meteors are related to meteoids.

Using the picture to the left can you come up with the relationship?

Pull for meteor definition

Meteorites

Pull for meteorite definition

Meteorites are also related to meteoids and meteors.

These two photos should give you a hint about what a meteorite is.

The Differences Between Meteoroids, Meteors, and Meteorites

Click here to have NASA Sci Files further explain the differences between these terms.

25 Paul found a piece of space junk in his backyard that fell from the sky following Halley's Comet. What is the correct term for this object?

A Meteroroid

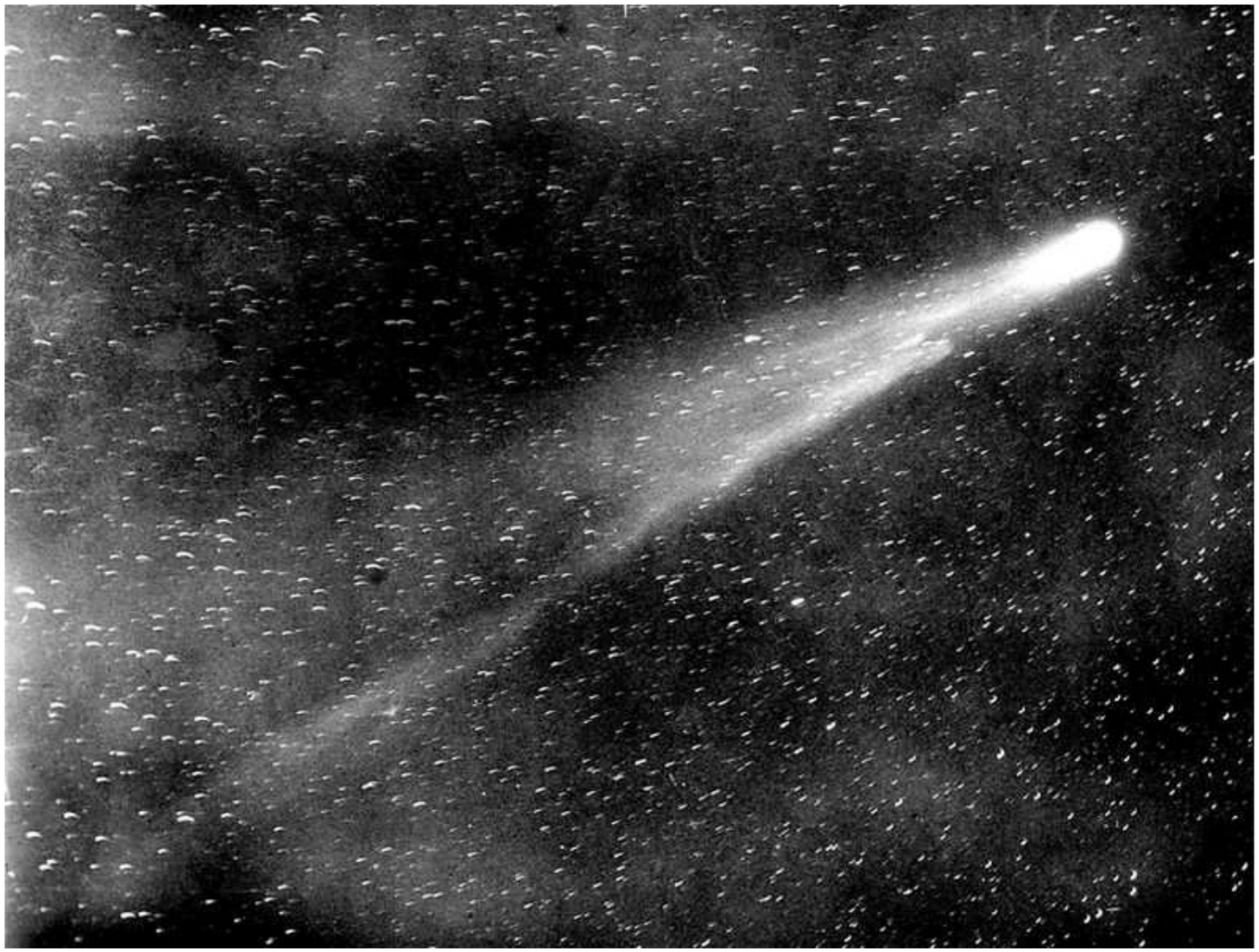
B Meteorite

C Meteor

Answer

Meteors from Halley's Comet

Click here to learn more about the Meteors visible as a result of Halley's Comet.



Click on the boxes below to reveal some review questions!

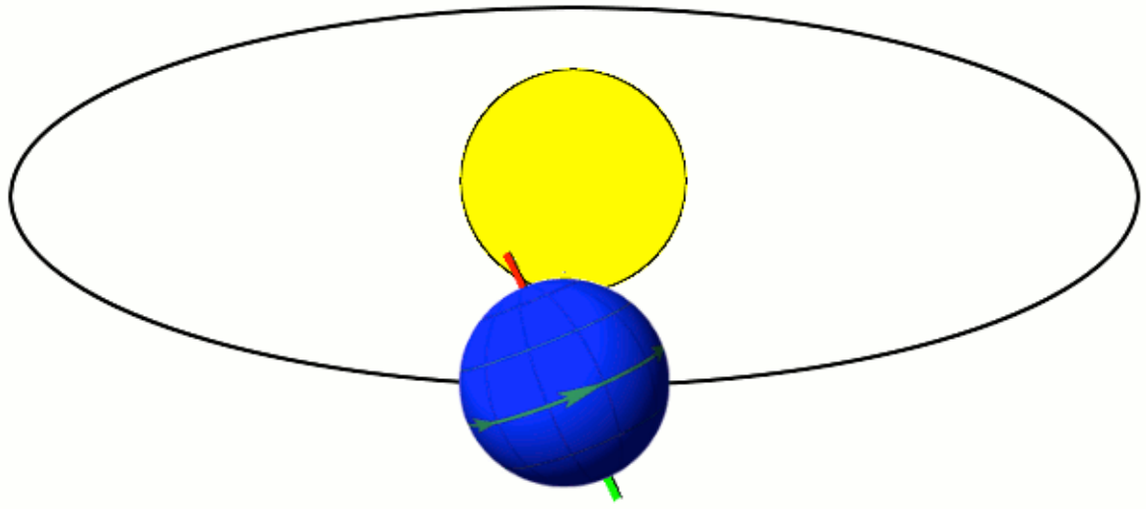
1	2
3	4
5	6
7	8

The Motion of Objects around the Sun

Return to Table of Contents

Review:

In our first unit, we observed Earth's revolution around the Sun.



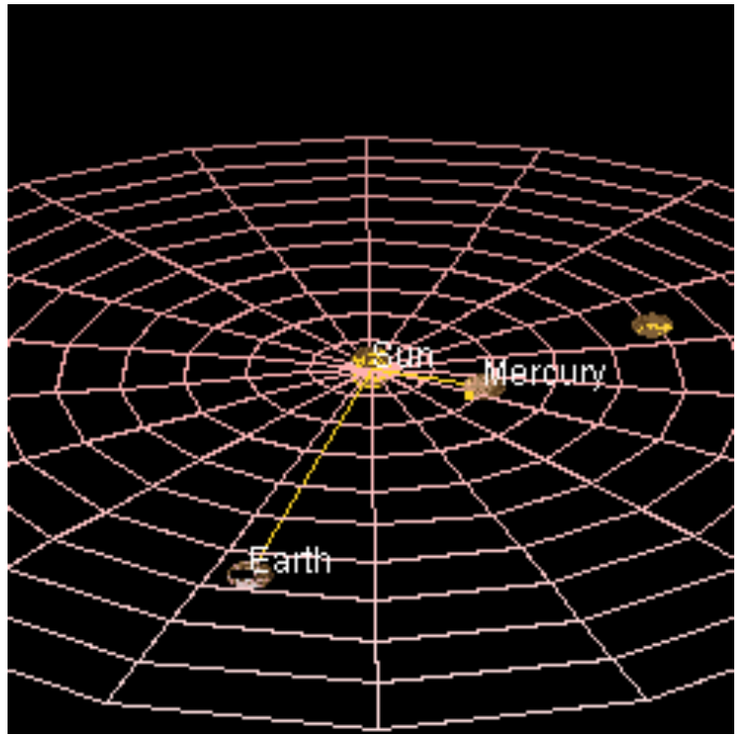
We stated that one trip around the Sun was equivalent to how long here on Earth?

Review

A few sections ago, we researched the other planets in our solar system and saw that the length of their revolutions all varied.

Why are their revolutions all different?

One year on Earth isn't equal to one year on Mars, Jupiter, or any other planet!



26 The planets _____ around the sun.

A revolve

B rotate

Answer

27 Which one of these planets has the longest length of revolution?

A Mercury

B Earth

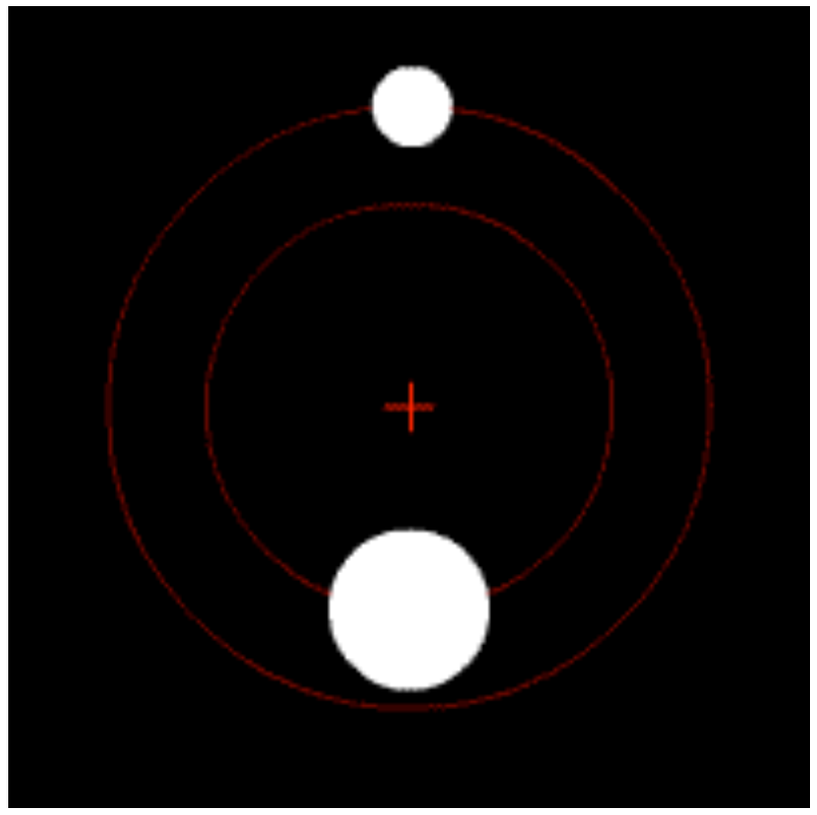
C Saturn

D Neptune

Answer

Orbit

Each of the planets, as well as all of the other Celestial Bodies in the last section, orbit the Sun.



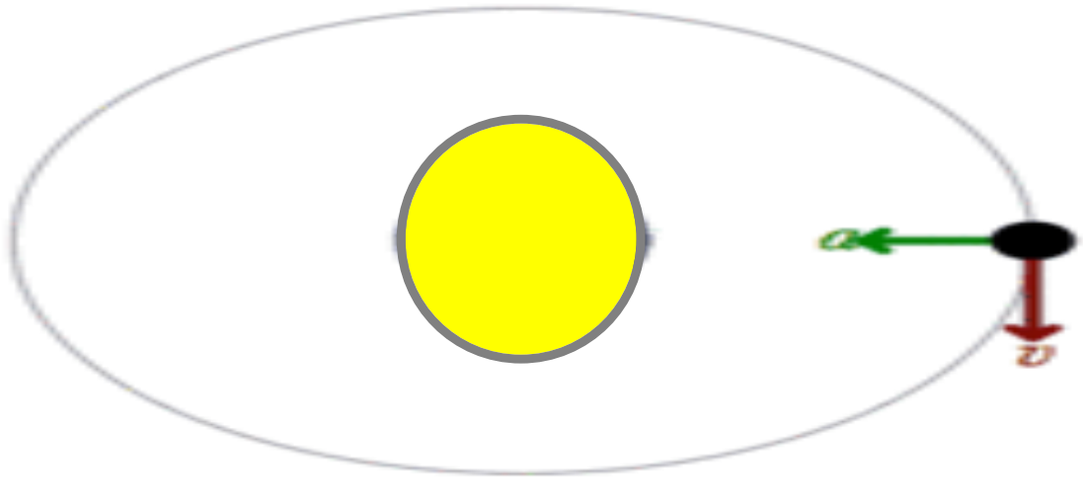
Orbit means to move in a curved path around a star, planet, or moon.

(Hint: When you see the term orbit, you can read it as "goes around")

Earth orbits the Sun --> Earth goes around the Sun

What Causes the Planets to Orbit the Sun?

Planets are held in their orbit by gravity



We have already defined gravity as the force of attraction between any two bodies, based on their mass and the distance between them.

28 Which relationship below is correct?

A The sun orbits each planet.

B Asteroids orbit each planet.

C A moon orbits a planet.

D A comit orbits a moon.

Answer

Gravity

Gravity depends on 2 things:

Mass of the objects

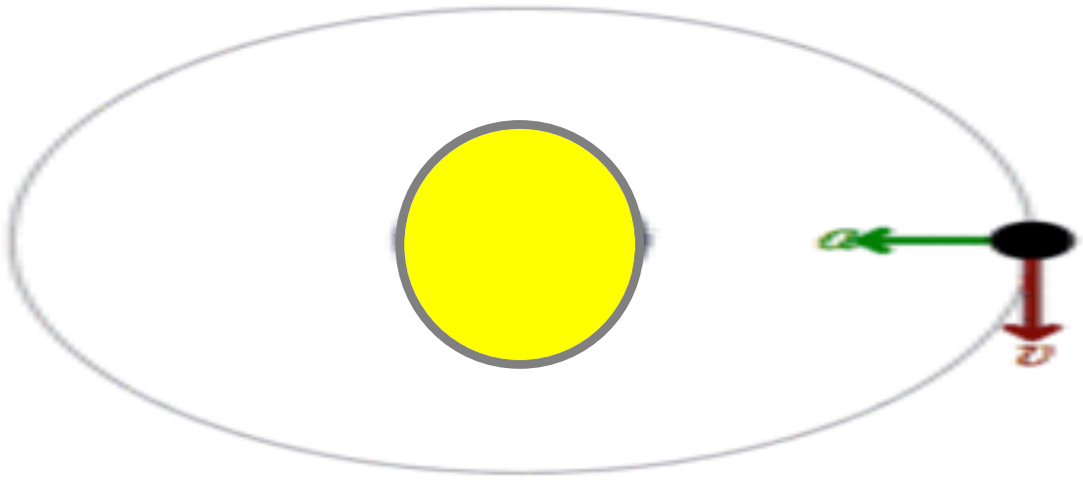
Distance between them

As seen above, the smaller object will feel more of this gravitational pull.

Also, as the objects get closer, their gravitational attraction increases.

Planetary Orbit

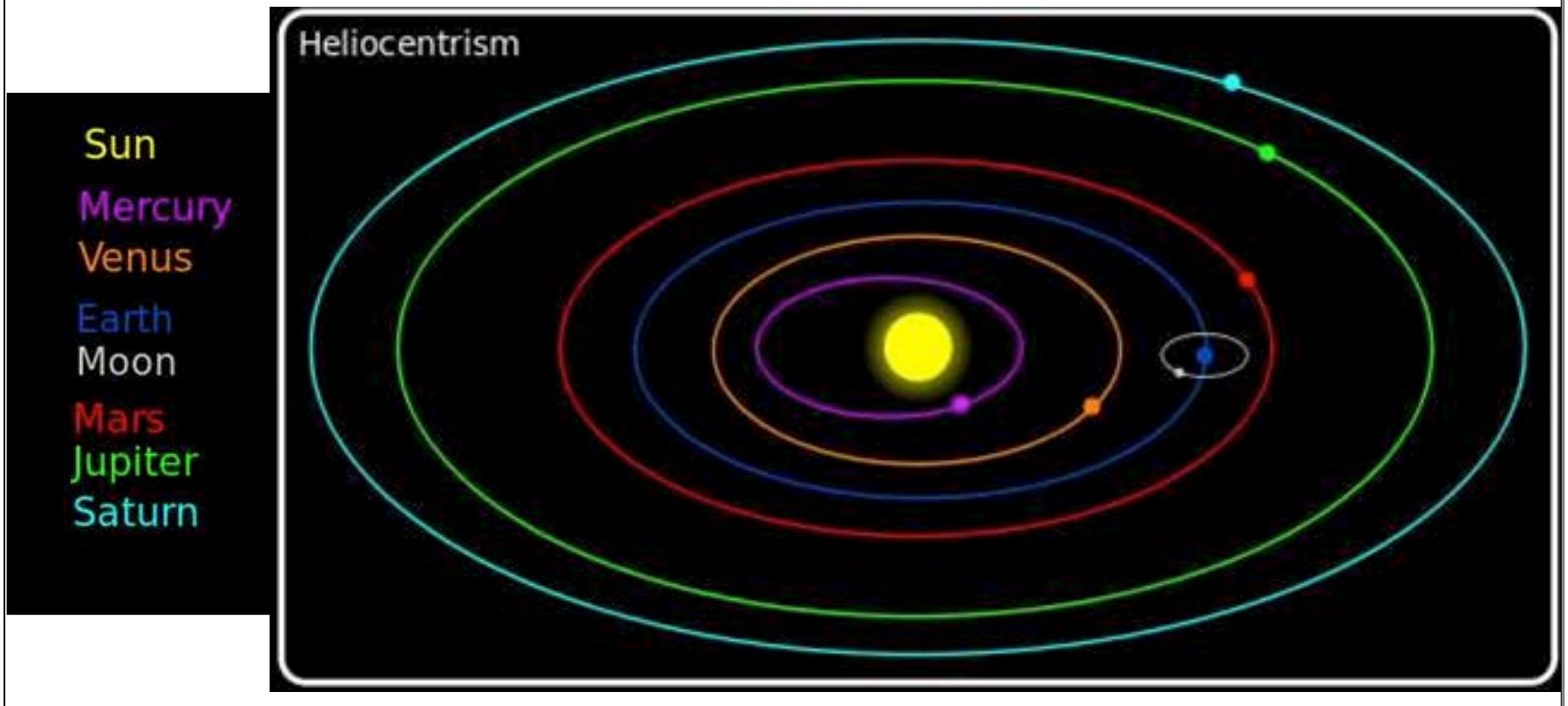
As seen in the image below, the planets don't travel around the Sun in a perfect circle.



Instead, each planet travels in an oval-shaped orbit, known as an ellipse .

Planetary Orbit

Below is an illustration of the orbits of each planet from Mercury to Saturn.



Earth is shown in dark blue, surrounded by the white ellipse.

29 In the image on the previous slide, what celestial body has the white orbit that surrounds Earth?

A Sun

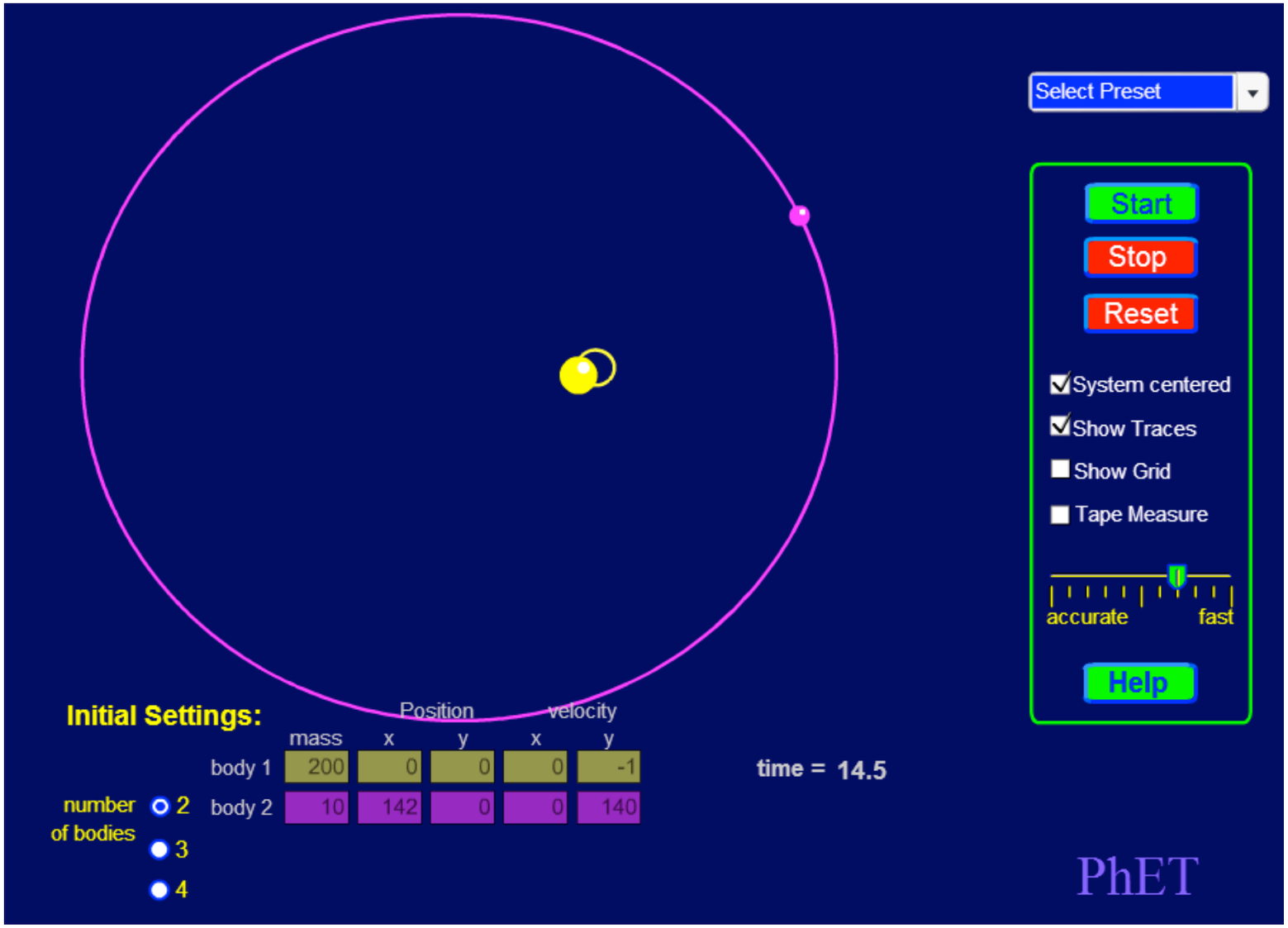
B Moon

C Star

D Mars

Answer

Click for link to webquest.
Complete Webquest worksheet.



Earth's Moon

Return to Table of Contents

Our Moon

Nearly every night, when you look in the sky, you will see our Moon shining down on you.

Depending on when you look, you may see more or less of the moon. You also may notice that sometimes the moon may be higher or lower in the sky.

This section will answer all of your questions about our Moon!

Our Moon

For as long as our Earth has been around, our Moon has been right there beside it.

The Moon is estimated to be about 4.5 billion years old, and scientists believed it formed soon after Earth did.

Image: NASA

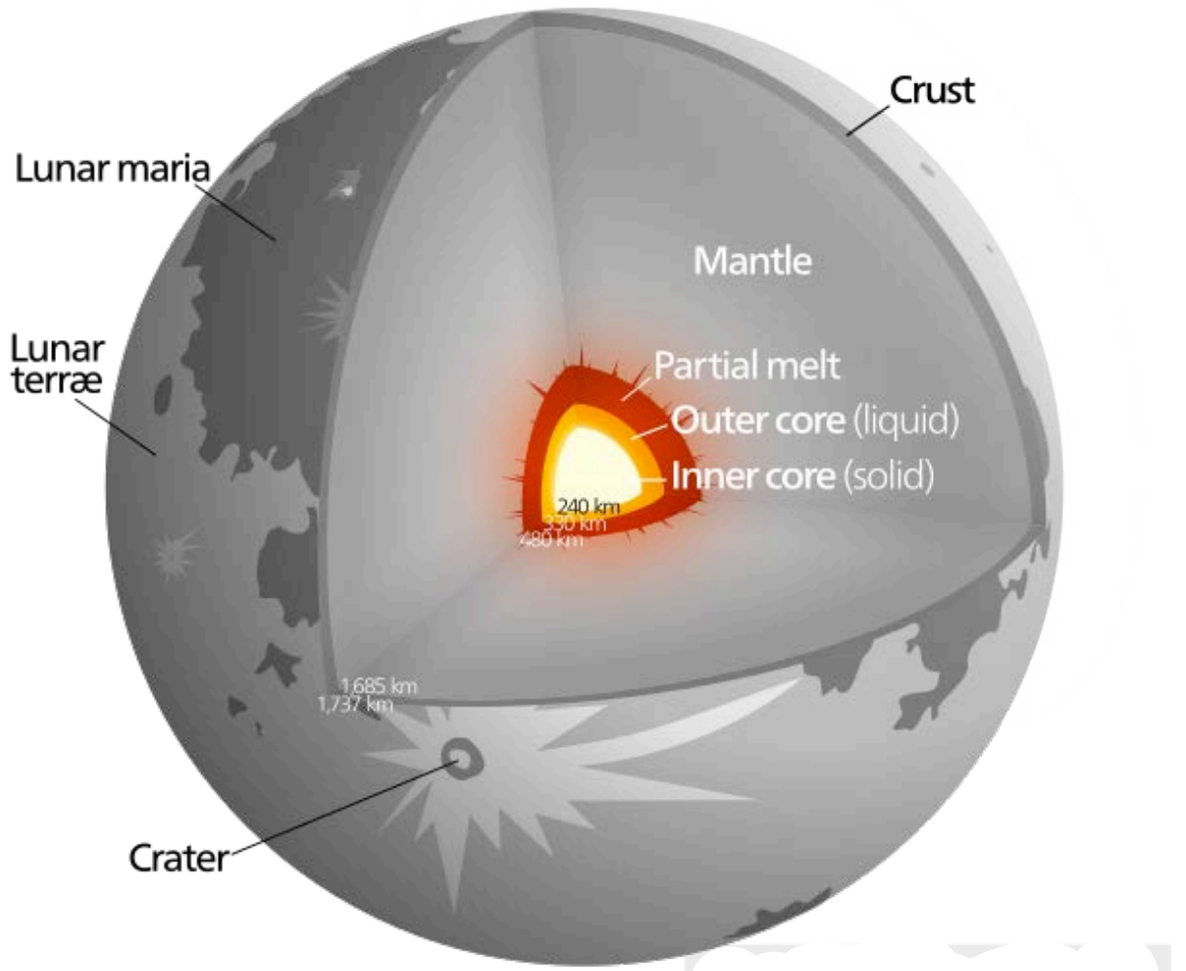
Scientists hypothesize that the Moon formed from debris left over from a giant impact between Earth and another celestial body.

What is our Moon made of?

The Moon is similar to Earth in that it is made of layers.

The inner-most layer is believed to be iron.

Scientists think the other layers of the Moon are made of minerals, rocks, metals, and various elements (like Oxygen and Silicon).



30 Which of the following is true of the moon?

A It is made of gas, like the gas giants.

B It is made of rock, like Earth.

C it is much younger than Earth.

D It was a planet that got trapped in Earth's gravity.

Answer

The Moon's Atmosphere

The title of this slide should probably read "The Moon's *Nonexistent* Atmosphere!"

There is a very thin layer of gases known as the exosphere , but there is no air to breathe on the moon. It is considered a vacuum.

A vacuum is a space that is entirely empty of matter.

Because of this, it is possible for us to see the surface of the Moon clearly from here on Earth.

Image: NASA

The Moon's Craters

When you look at the surface of the Moon, you can see quite a few craters.

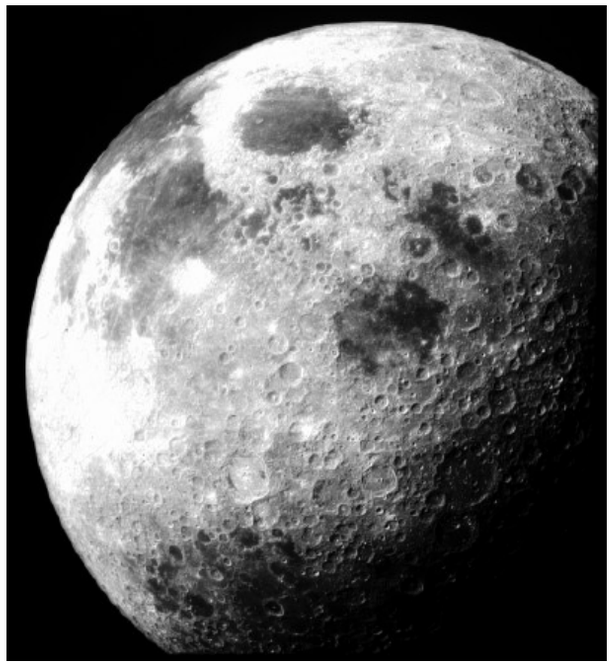
A crater is a depression in the surface of a celestial body that is caused by an impact of another object.

Image: NASA

Some of these craters are believed to be nearly 2 billion years old!

The Moon's Gravity

We know that gravity depends on two things:_____ of the objects and the _____ between the objects.



?

Images: NASA

How would the gravity on the Moon compare to the gravity here on Earth?

31 Earth has _____ mass than the moon.

A more

B less

Answer

The Moon's Gravity

Since the Moon's mass is significantly less than that of Earth, the pull of gravity will be less.

The Moon's gravity is 1/6 as strong as that of Earth. This means that on the Moon, you would weigh 1/6 of what you weigh here on Earth.

Earth		Moon
100 lbs		~ 17 lbs

32 A person would weigh more if they were standing on the moon.

True

False

Answer

33 On the moon, a person's mass would:

A increase

B decrease

C stay the same

Answer

34 Based on what you know about the size of the planets, which of the following would have the largest force of gravity?

A Mercury

B Venus

C Earth

D Mars

E Jupiter

F Saturn

Answer

The Moon's Gravity - In-Class Worksheet

Use the "Moon's Gravity" Worksheet to help you understand how weight will vary when you're on the Moon.

Remember. Even though the *weight* of the object may change based on where you are in the universe, the *mass* of the object will always stay the same

35 What does the moon revolve around?

A The Sun

B Earth

C It doesn't revolve at all.

Answer

The Moon's Revolution

It takes the Moon 27.3 days in order to complete one full revolution of the Earth.

This is referred to as the sidereal month

The Moon's Revolution

The lunar month is slightly different than the sidereal month.

The lunar month is the amount of time between full moons. This period of time is affected by the motion of Earth, so one of these months takes about 29.5 days.

36 Which of these is longest?

A A sidereal month

B A lunar month

C A calendar month

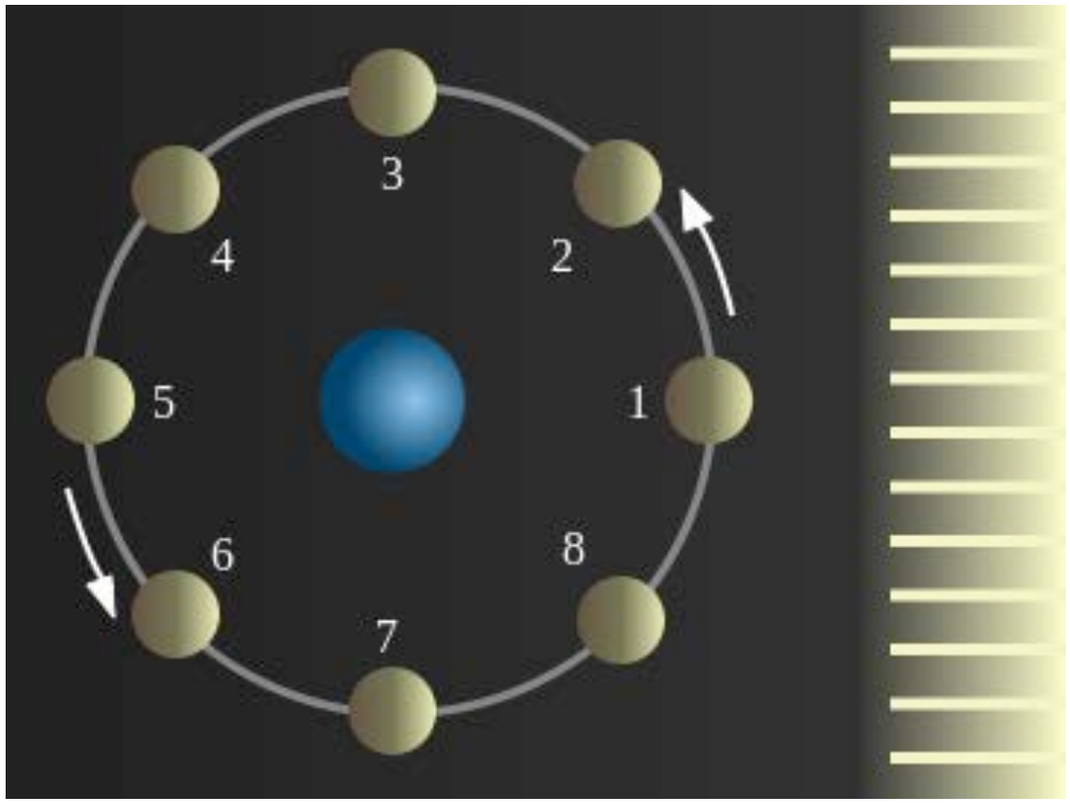
Answer

The Moon's Phases

During a month, the moon looks different depending on when you look at it.

Use the space below to draw the different ways the moon can look.

The Moon's Phases



The phases of the Moon depend on the motion of the Moon as well as the light from the Sun.

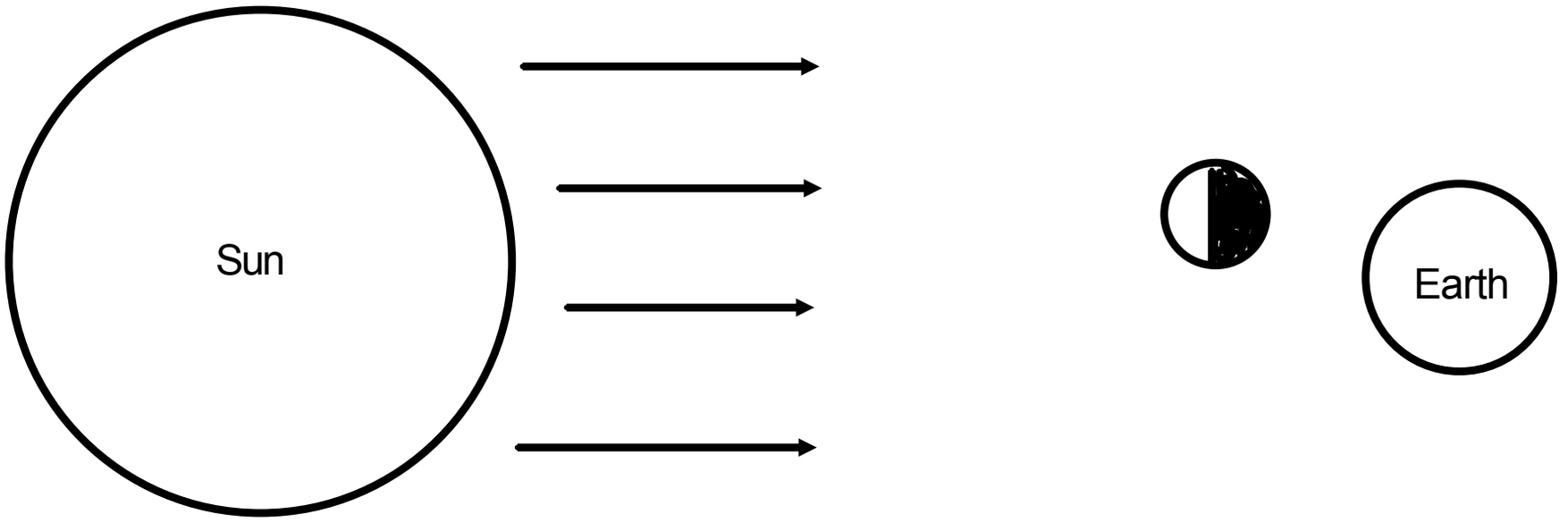
Remember : The Moon does not produce its own light at night.
so where does it get its light from?

New Moon

Depending on where you are in the world, the new moon could be considered the beginning of the lunar month.

Look at the picture below. What do you see?

New Moon



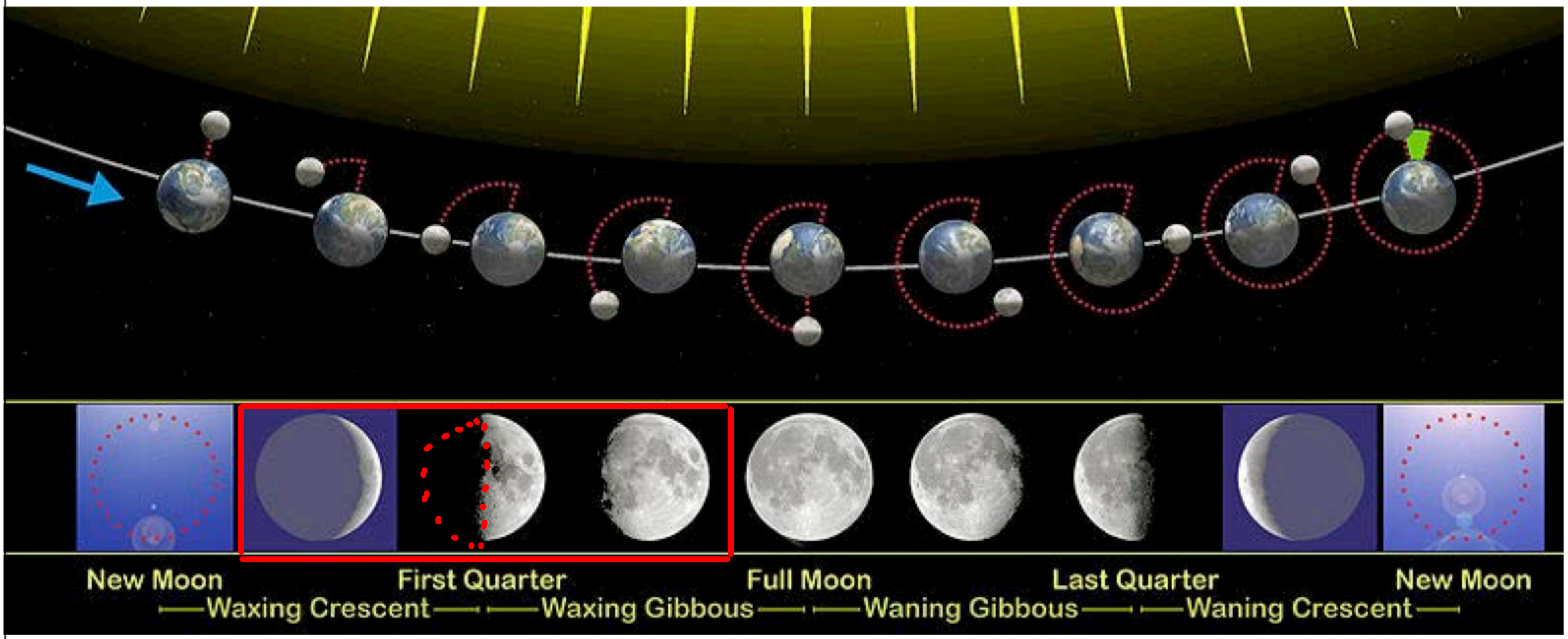
A New Moon occurs when the Moon is between the Earth and the Sun.

When this happens, we are "seeing" the part of the Moon that is in the shadow of the Sun's light. The other side (the side we can't see) is being lit up at that time.

When looking in the sky on these nights, you won't see the Moon at all.

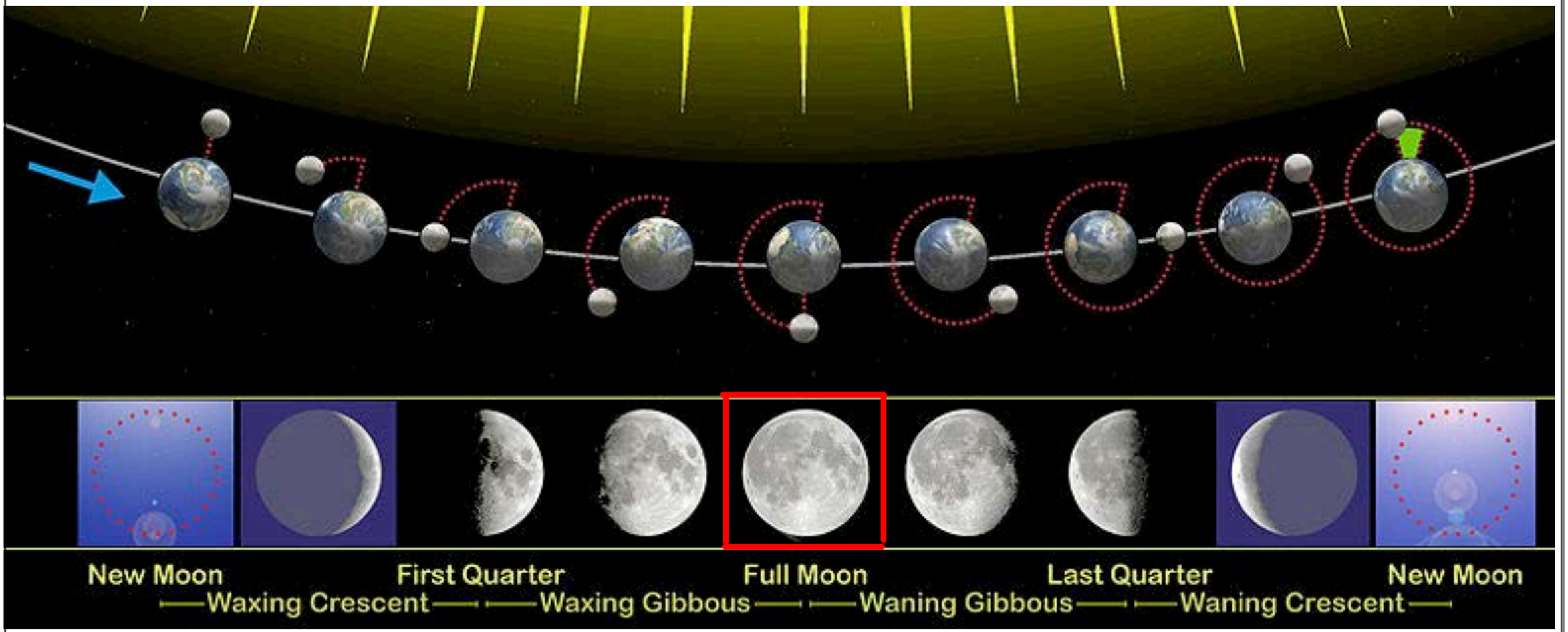
Waxing Moon

When the Moon is going from its New phase to the Full Moon phase, it is said to be waxing . Look at the red box below.



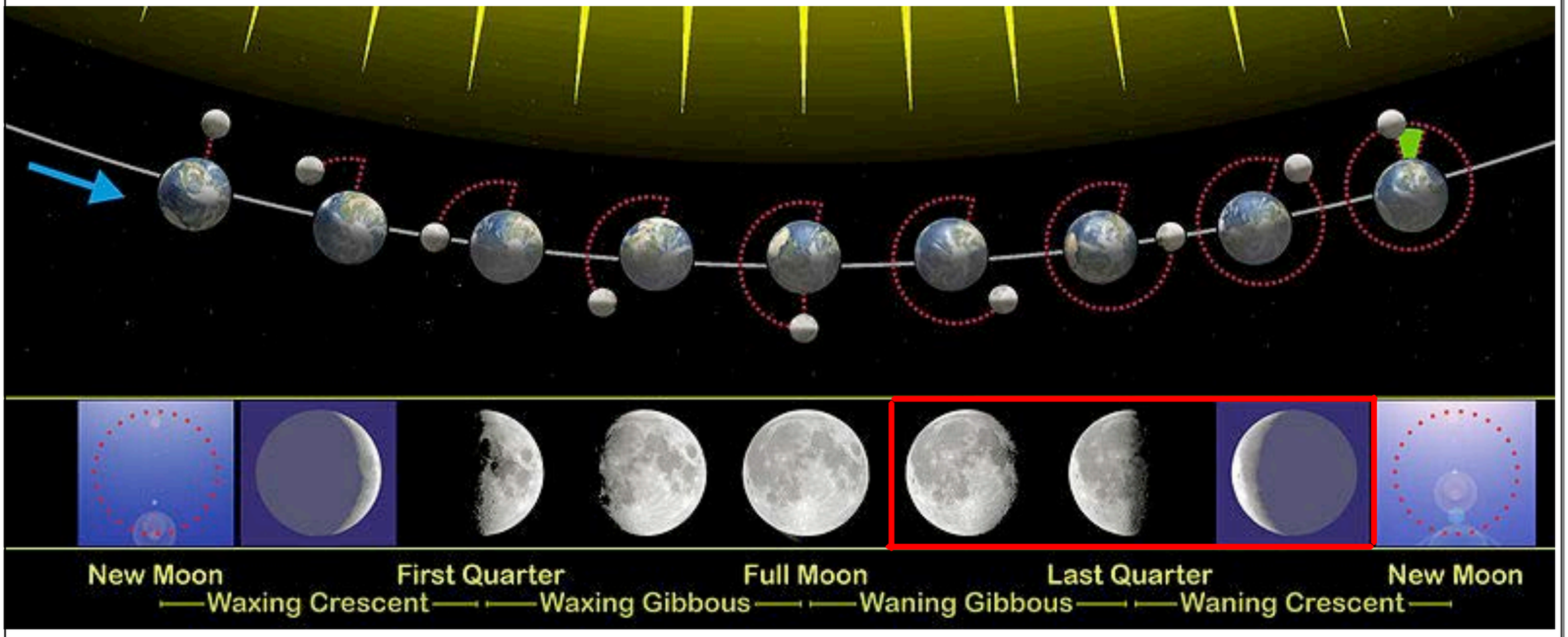
Full Moon

When 100% of the Moon is visible in the night sky, it is called afull moon.



Waning Moon

When the Moon is going from its Full phase back to a New Phase, it is said to be waning .



Phases of the Moon

Practice placing the phases of the moon in the correct order.

Blue Moon

One phrase that is often used is "Once in a Blue Moon."

A "blue moon" is the term for the second full moon in a calendar month. Since a full moon occurs once every 29-30 days, a blue moon is very rare. It comes around about once every 2.5 years.

The image to the right is of the blue moon from August 31, 2012.

The Moon's Rotation

Have you ever seen the "Man in the Moon?"

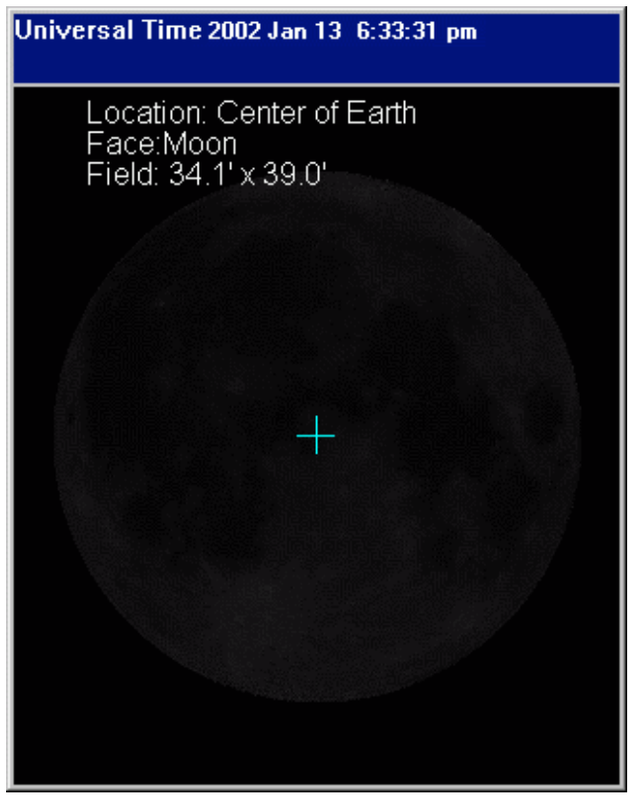
This image on the Moon is <u>always</u> visible here on Earth.

Why do you think this is?

The Moon's Rotation

We said earlier in this section that one revolution of the Moon takes 27.3 days. Coincidentally, the Moon's rotation also takes 27.3 days.

This means that the same side of the Moon is always facing Earth.



In the image to the left, you can see the Moon moving and the phases changing. Despite this motion, you always can see the same side of the Moon. We never see the "Dark side" of the Moon.

37 As the moon revolves around Earth, different portions of the moon's sunlit side become visible from Earth. These are called the _____ of the moon.

A stages

B phases

C steps

D images

Answer

Part B: Earth's Relationship to Its Moon and Sun

Return to Table of Contents

Tides

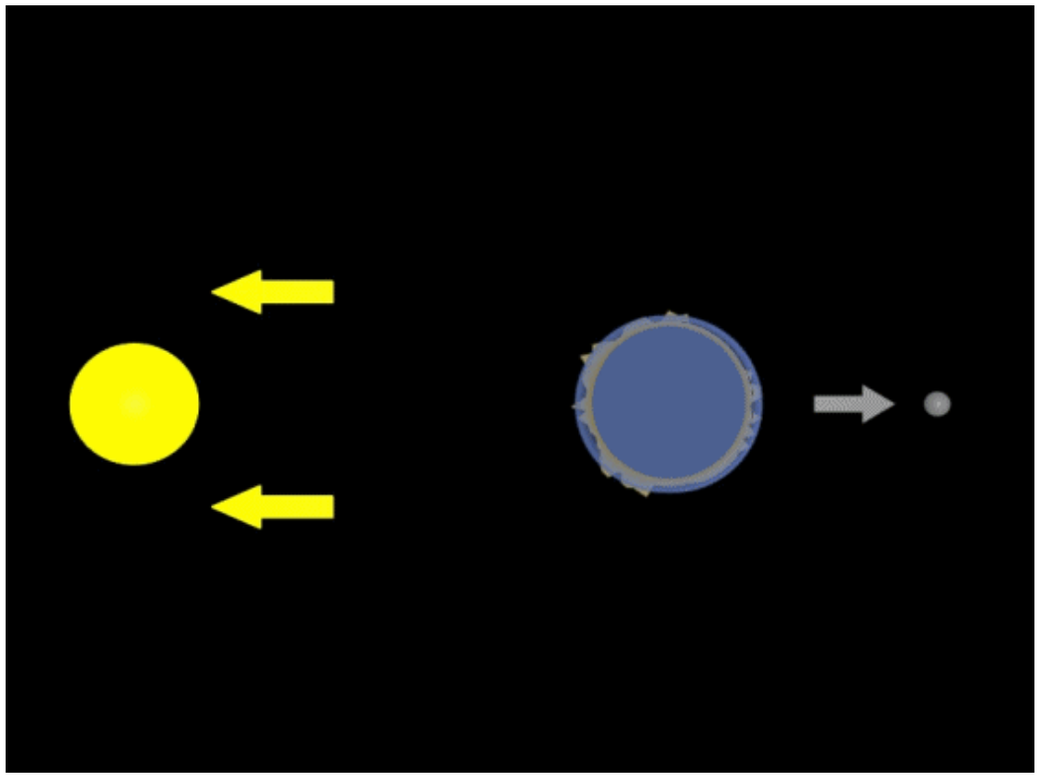
Return to Table of Contents

Tides

The location of the moon also controls the ocean tides here on Earth.

The moon's gravity pulls Earth and its water towards the moon.

Tides are the rise and fall of Earth's surface water due to this force of gravity. They are most noticeable around the shore.



The grey arrow in the image to the left represents the moon's gravitational pull.

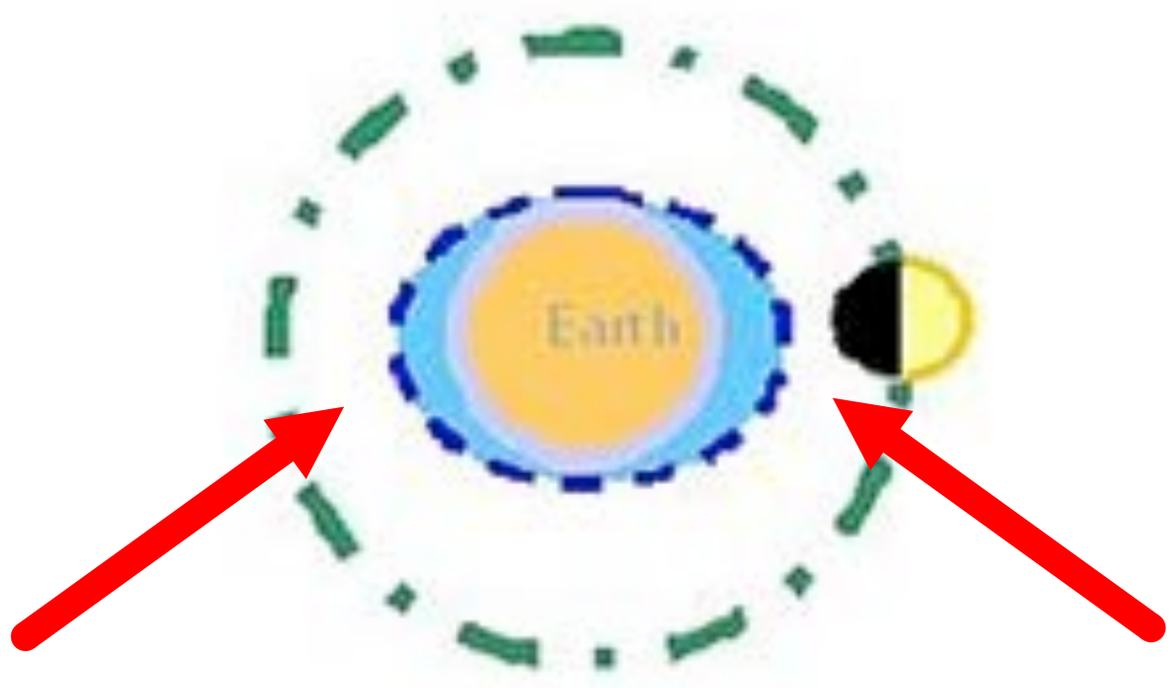
Notice the yellow arrows as well. They represent the Sun's gravity. This will play a role later!

High Tides

As the moon's gravity pulls on Earth's water, the ocean swells on the side closest to the moon.

At the same time, Earth is being pulled slightly towards the moon as well. This creates a high tide on the opposite side of the planet as well.

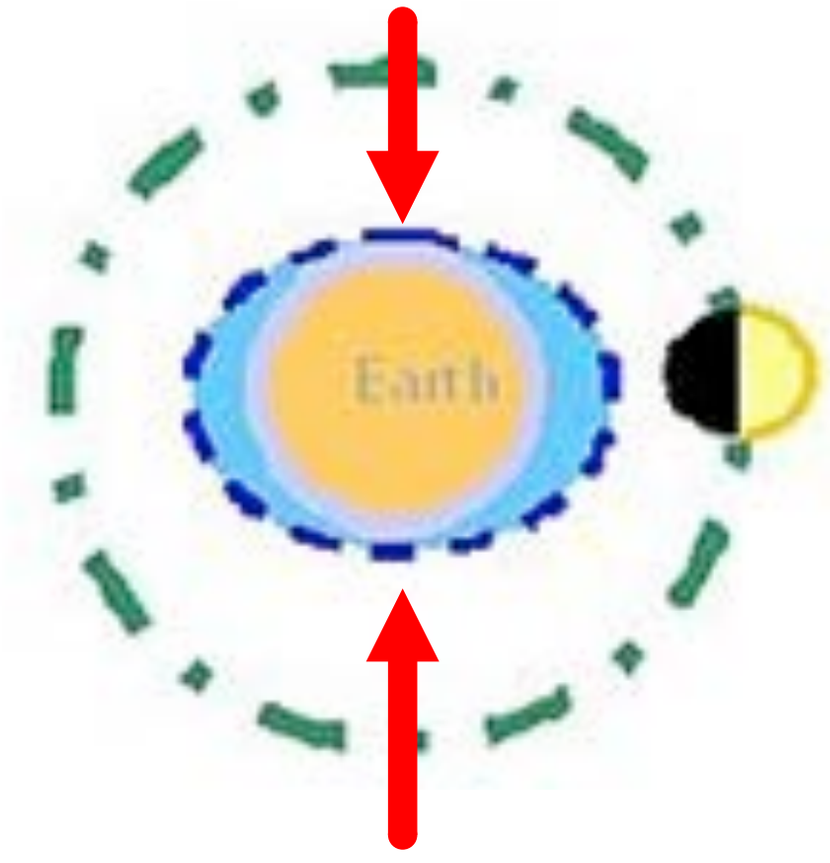
A high tide is when the water is at its highest level.



Low Tides

The areas that are perpendicular to the Earth-moon line experience low tide, as less water will be in these areas.

As Earth rotates, each coastline experiences high and low tides twice a day.



38 What is the primary cause of the tides?

A Magnetism

B Gravity of the moon

C The sun

D Earth's revolution

Answer

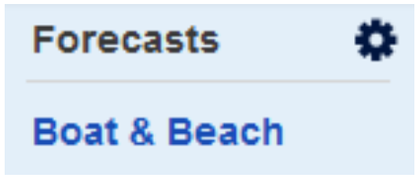
39 How many high tides would a coastal area experience in a 24 hour period?

Answer

Local Tides

If your school is within 60 miles of a coastline, research when high and low tide will occur. If not pick a location of interest on the coast to research.

1) Go to www.weather.com and search for your city.
2) Click on "Boat & Beach" on the left side of the screen.



Low Tide 1: _____

High Tide 1: _____

Low Tide 2: _____

High Tide 2: _____

40 What do you notice about the amount of time between each high/low tide?

(Answer with your group)

Answer

41 How much time is between each high tide?

A 6 hours

B 12 hours

C 24 hours

D 48 hours

Answer

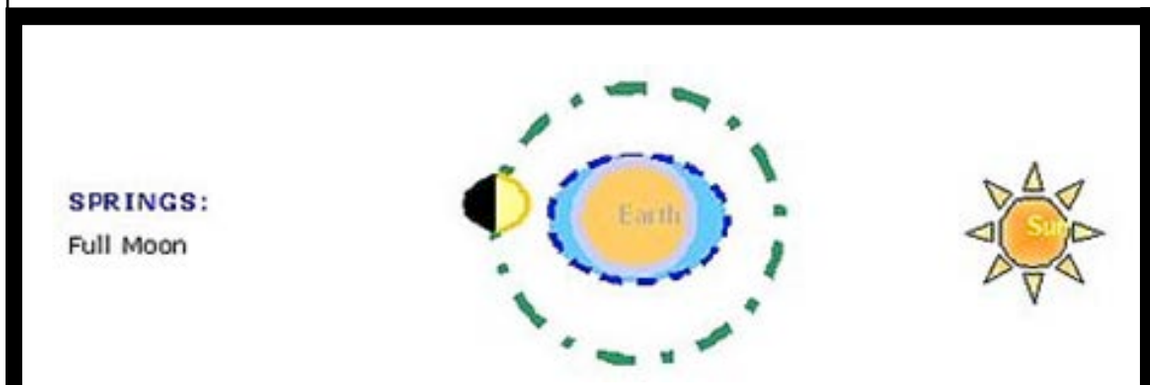
Fun Fact!

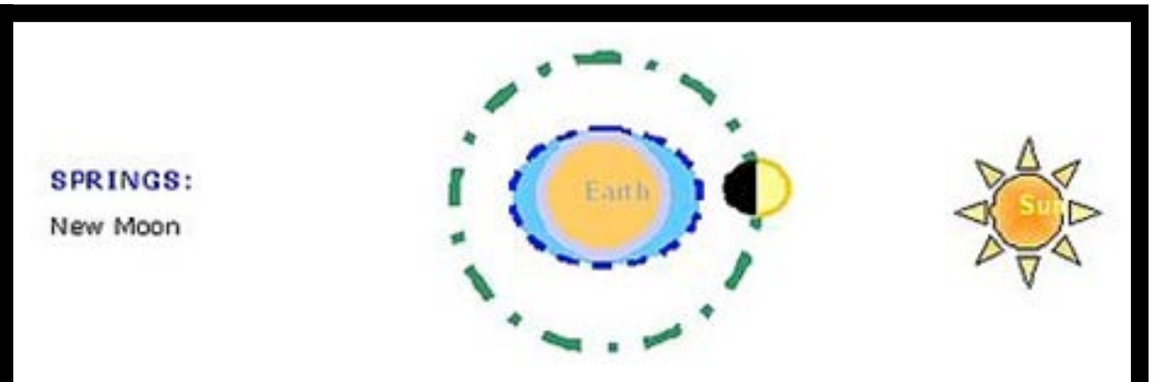
Did you know that the moon's gravitational pull actually has an affect on small ponds and puddles, too?

Because these bodies of water are so small, we don't even notice the moon's affect on them!

Spring Tides

The position of the Sun also plays a role in the tides because of its gravity. When the Earth, Moon, and Sun are aligned, it produces a Spring Tide This happens during full and new moons.

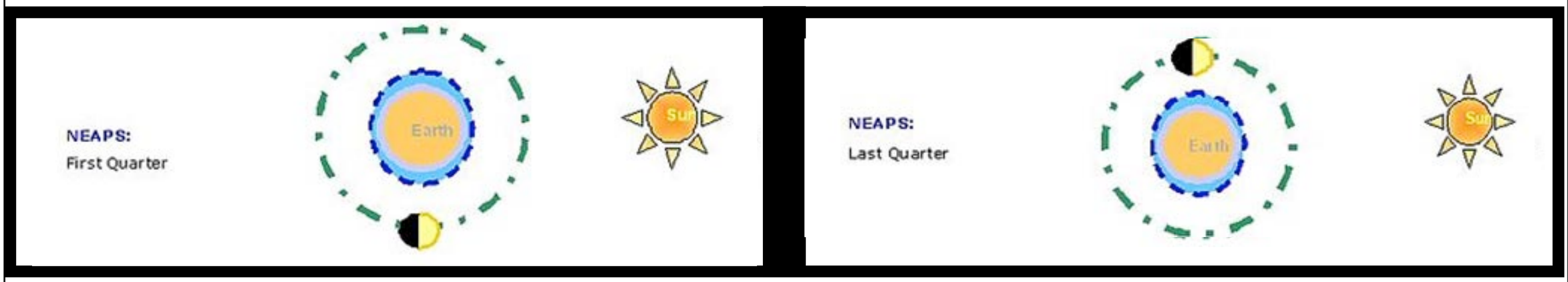




During a Spring Tide, the combined gravity of the Sun and the Moon form the highest high tides and the lowest low tides.

Neap Tides

When the Earth, Moon, and Sun form a 90 degree angle (during the First and Third Quarters), the result is a Neap Tide .



If Spring tides produce the greatest differences between tides, what fluctuations do you think Neap tides produce?

42 A Spring Tide would have the highest high tides and the lowest low tides.

True

False

Answer

43 A neap tide would occur during which of the following phases of the moon?

A full moon

B new moon

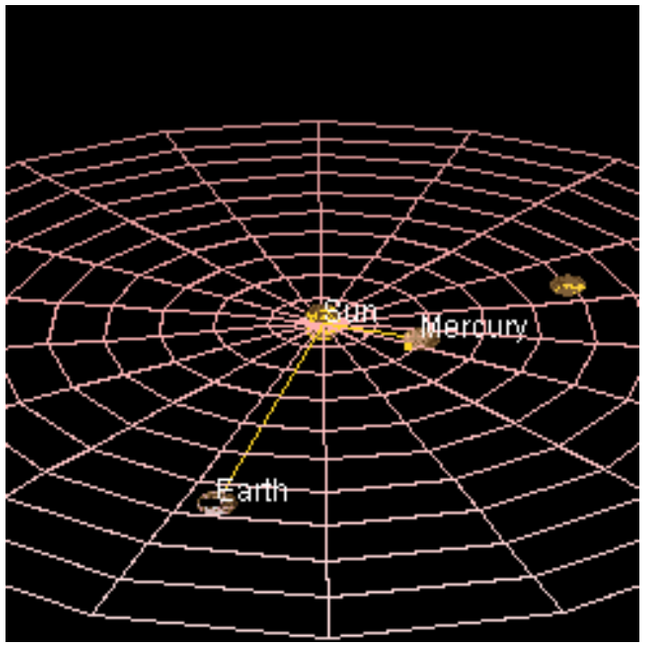
C first quarter

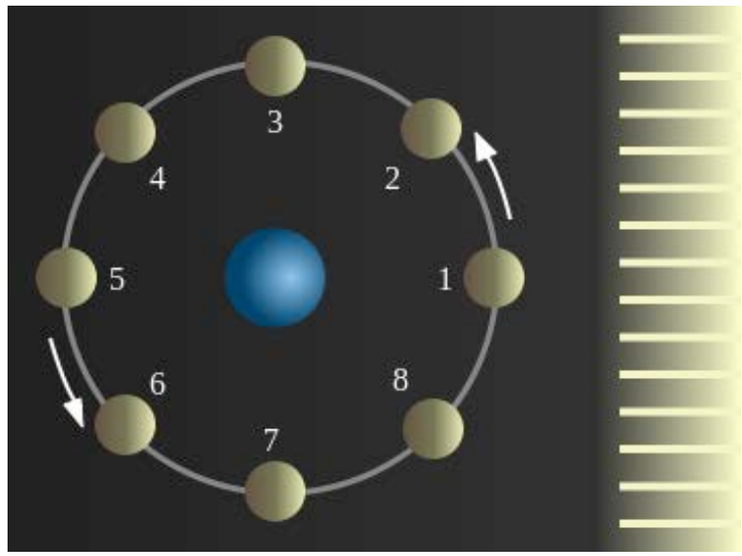
Answer

Eclipses

Return to Table of Contents

Review:





We have learned about the motion of the Earth and the Moon already:

1) Earth revolves around _____

2) The Moon revolves around_____

Sometimes, the positions of Earth and the Moon result in aneclipse .

Eclipses

Sometimes, we are able to see the moon pass in front of the Sun. Other times, we can see Earth cast a shadow over the moon.

These events are calledeclipses . An eclipse is the hiding of one object in space by another, or the passing of an object in space into a shadow cast by another object.

Types of Eclipses

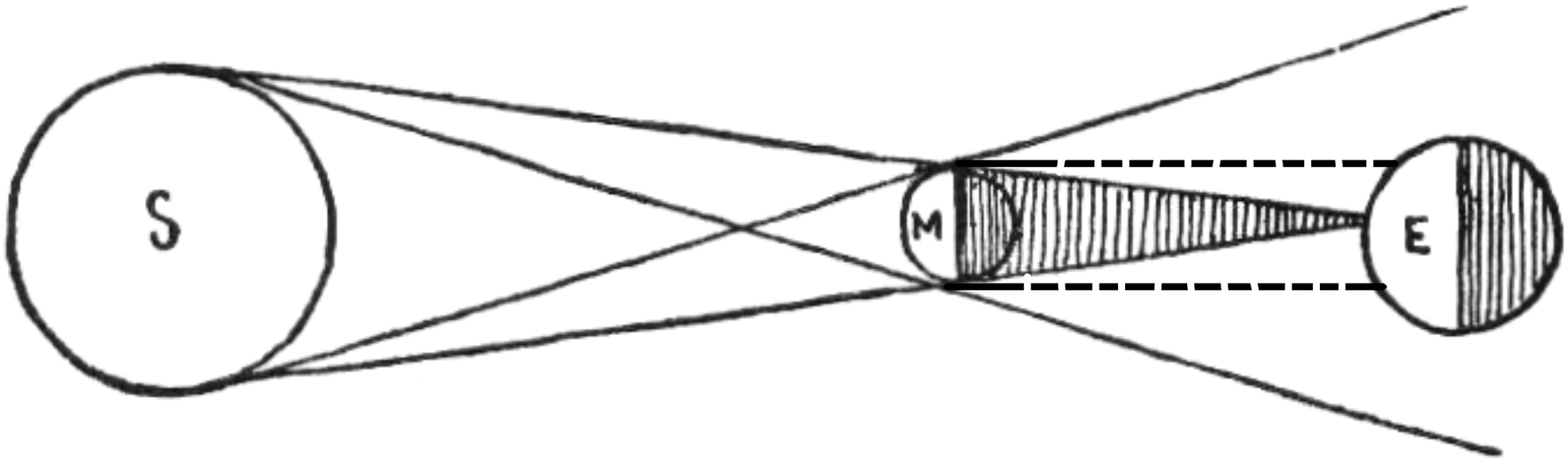
There are two different types of eclipses that involve Earth, Sun, and Moon.

These two eclipses are called a solar eclipse and a lunar eclipse

Which one involves the sun?

Which one involves the Moon?

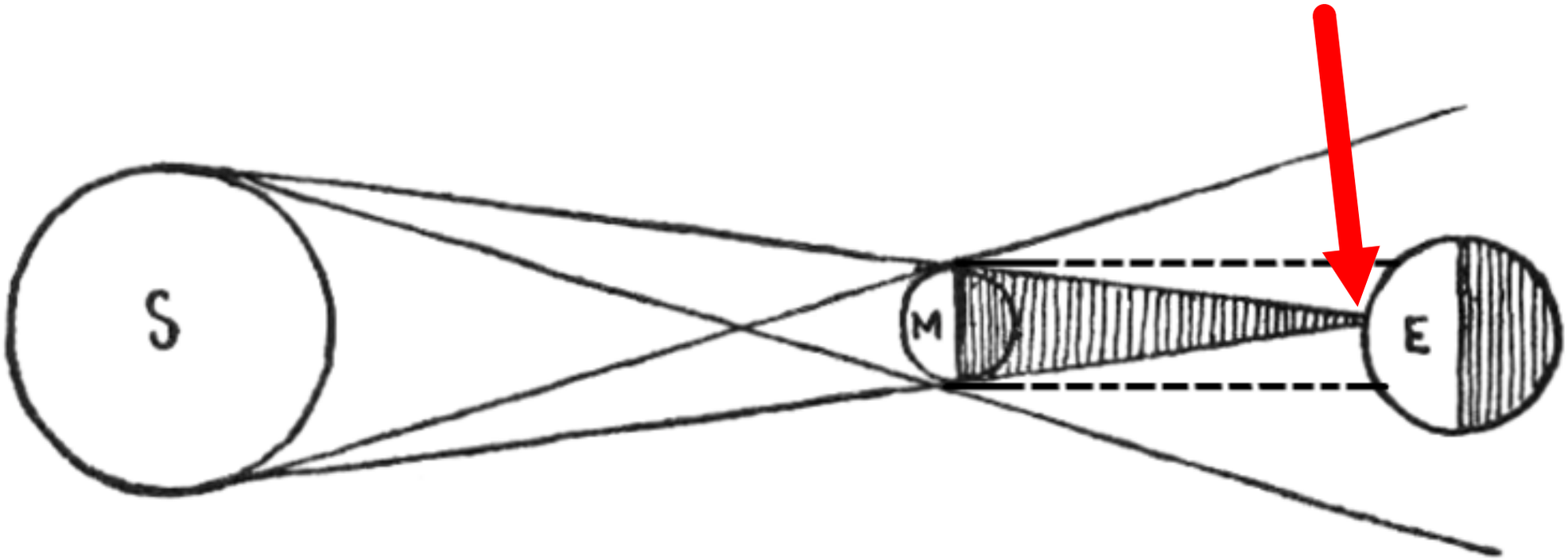
Solar Eclipse



When the moon blocks the Sun's light and casts a shadow on the Earth, this is called a solar eclipse .

As you can see above, the Moon is directly between the Earth and the Sun.

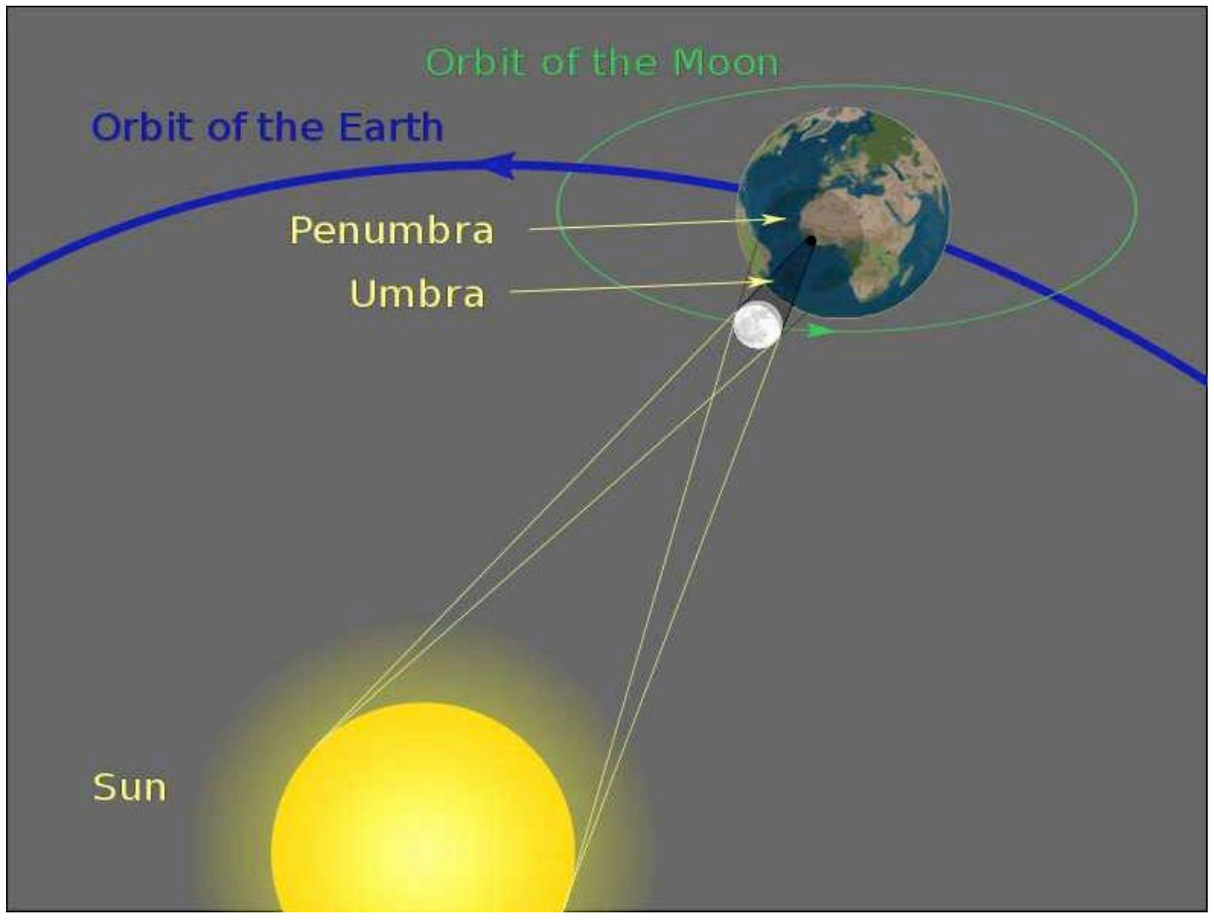
Solar Eclipse



Depending on where you are on Earth, you could see a*partial* solar eclipse or a *total* solar eclipse.

The spot above where the Moon's shadow comes to a point (pointed out with the arrow) would witness a *total* solar eclipse, which means that the Sun would be totally blocked.

Solar Eclipse



During a solar eclipse, the daytime sky grows completely dark .. so dark in fact that the stars in the sky become visible!

Even though the Sun is blocked by the Moon, it is still very dangerous to look directly at the eclipse!

44 During which time of day would a solar eclipse occur?

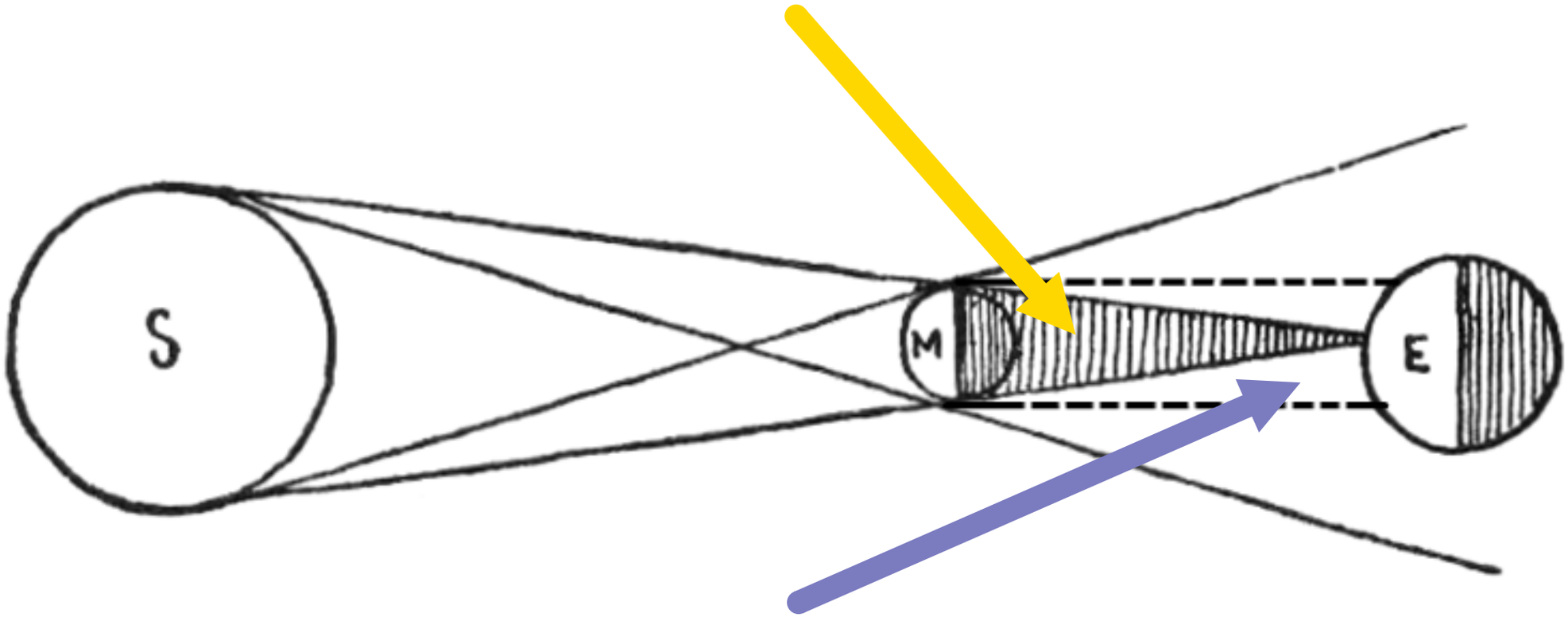
A Day

B Night

Answer

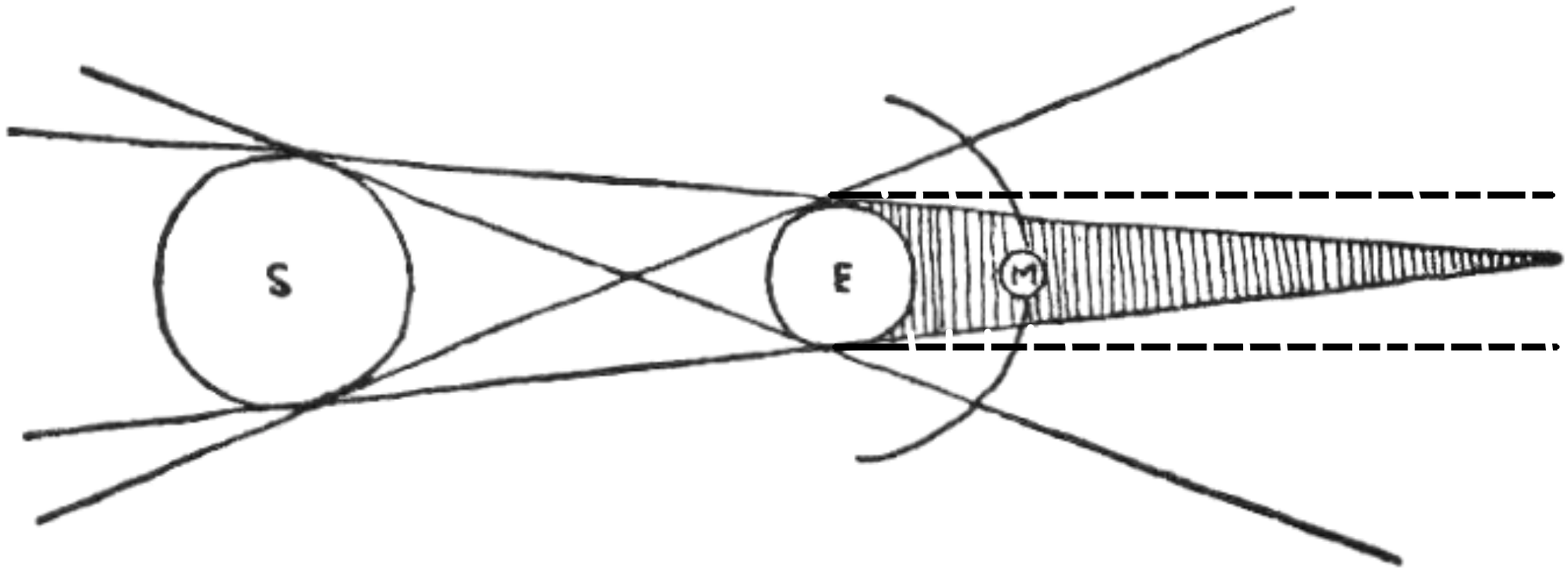
Solar Eclipse - Terms

Umbra - the darkest inner part of the Moon's shadow; at the point where the Umbra reaches the Earth you would see a total solar eclipse



Penumbra - the large outer part of the Moon's shadow; only a partial solar eclipse is visible in this area

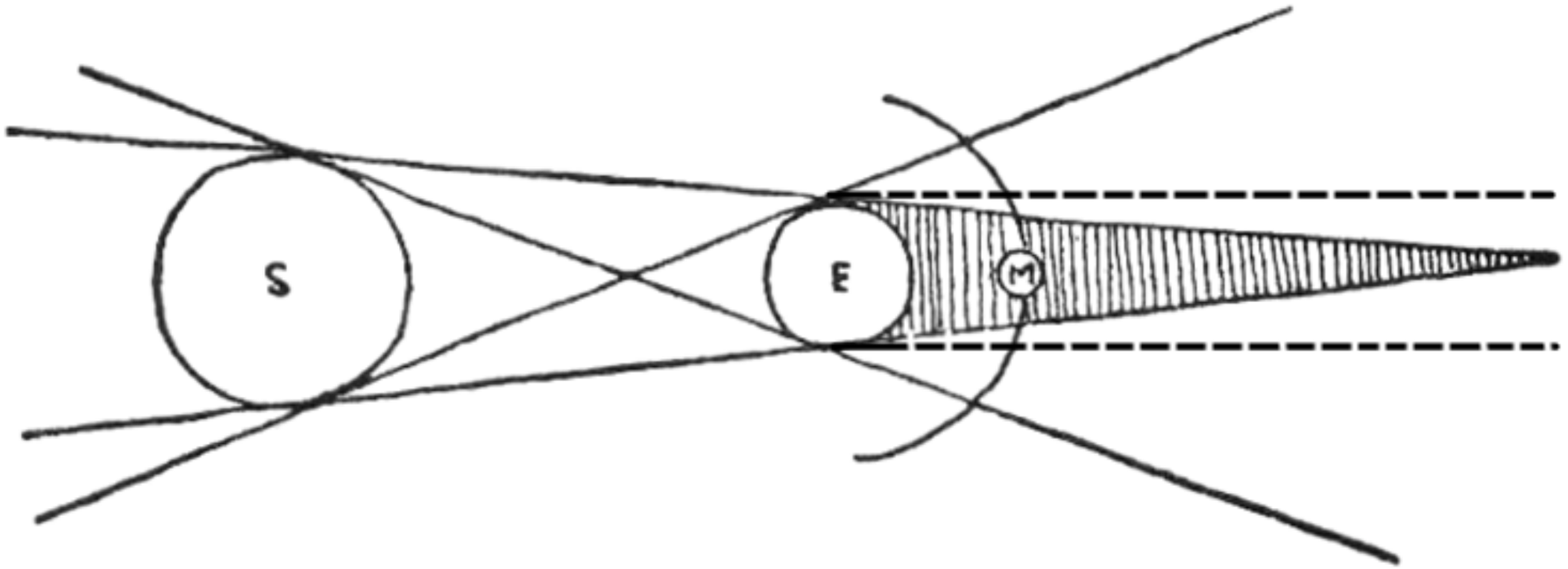
Lunar Eclipse



During a lunar eclipse, the moon passes into Earth's shadow.

As you can see above, the Earth is directly between the Moon and the Sun.

Lunar Eclipse

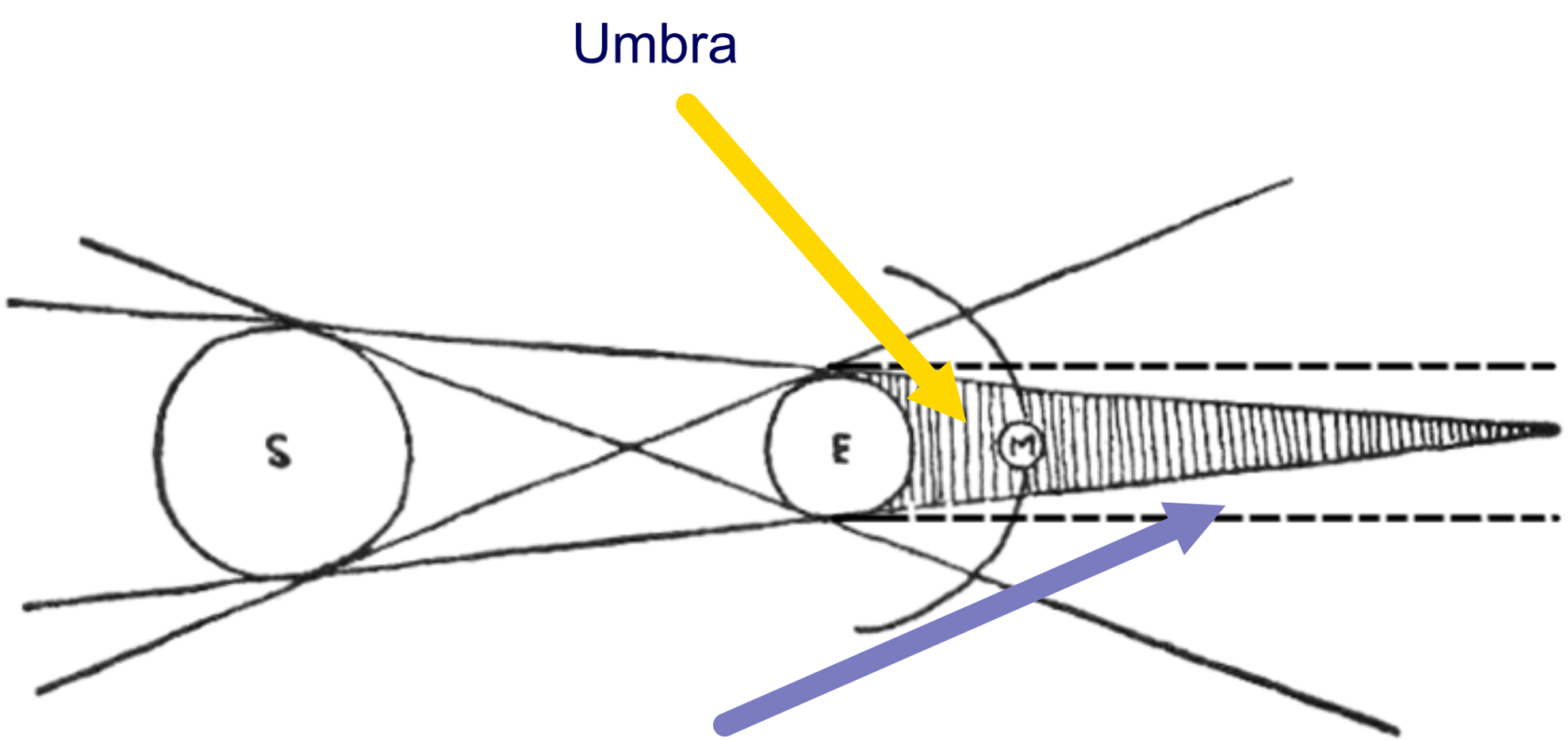


A lunar eclipse can only occur during the Full Moon. This is the phase in which the lit side of the Moon is entirely visible.

When the lunar eclipse begins, you are able to see the curved shape of the Earth slowly blocking out the light of the Moon.

Lunar Eclipse

Just like the Solar Eclipse, there is anumbra and a penumbra .



45 The penumbra is the point that is in the darkest part of the shadow during an eclipse.

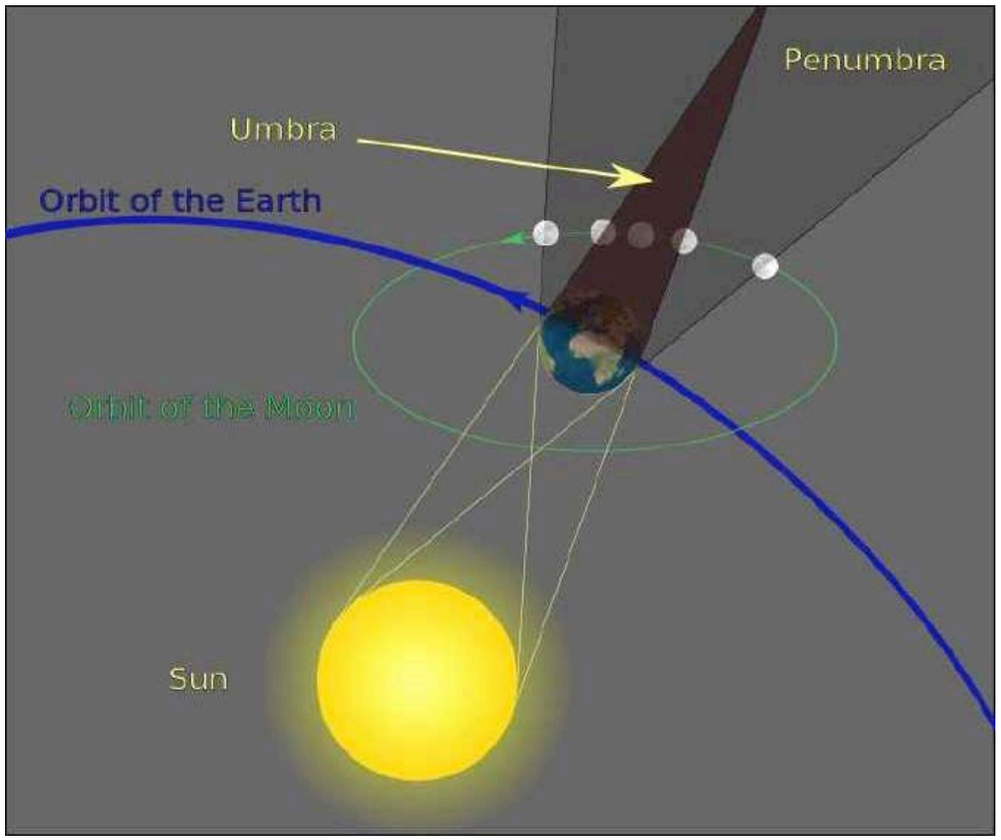
True

False

Answer

Lunar Eclipse

Unlike a solar eclipse, everyone on the half of the Earth that is experiencing nighttime will be able to see a *total* lunar eclipse.



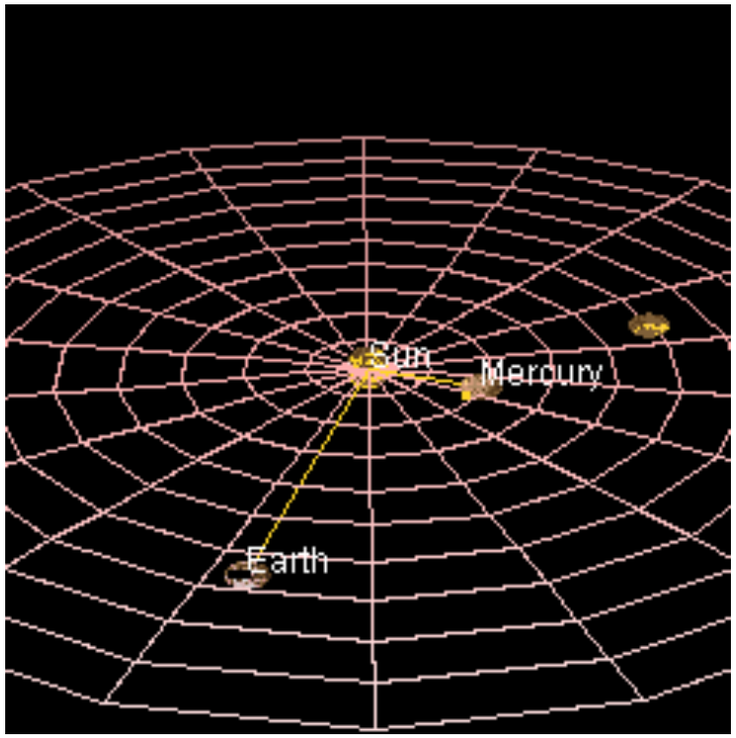
Seasons

Return to Table of Contents

Review

Right now Earth is moving in two different ways:

Earth is rotating or spinning about on its axis (or center-line)



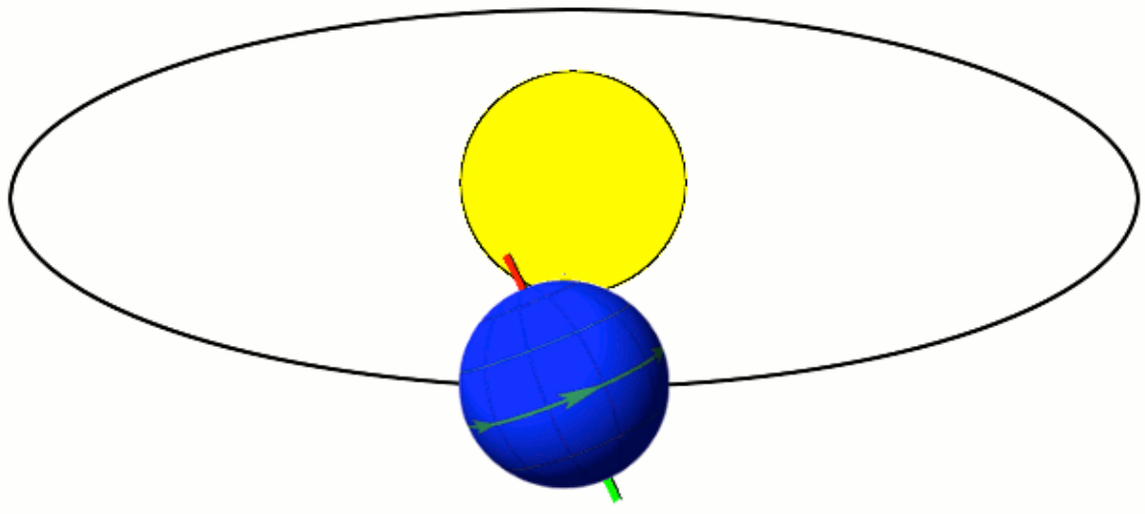
Earth is revolving or moving around the Sun

We will be focusing on the Earth's revolution in this section.

Review

In the first unit this year, we simulated Earth's revolution using flashlights.

Because of the tilt of Earth and its revolution around the Sun, the Sun appears to be at different heights throughout the year.

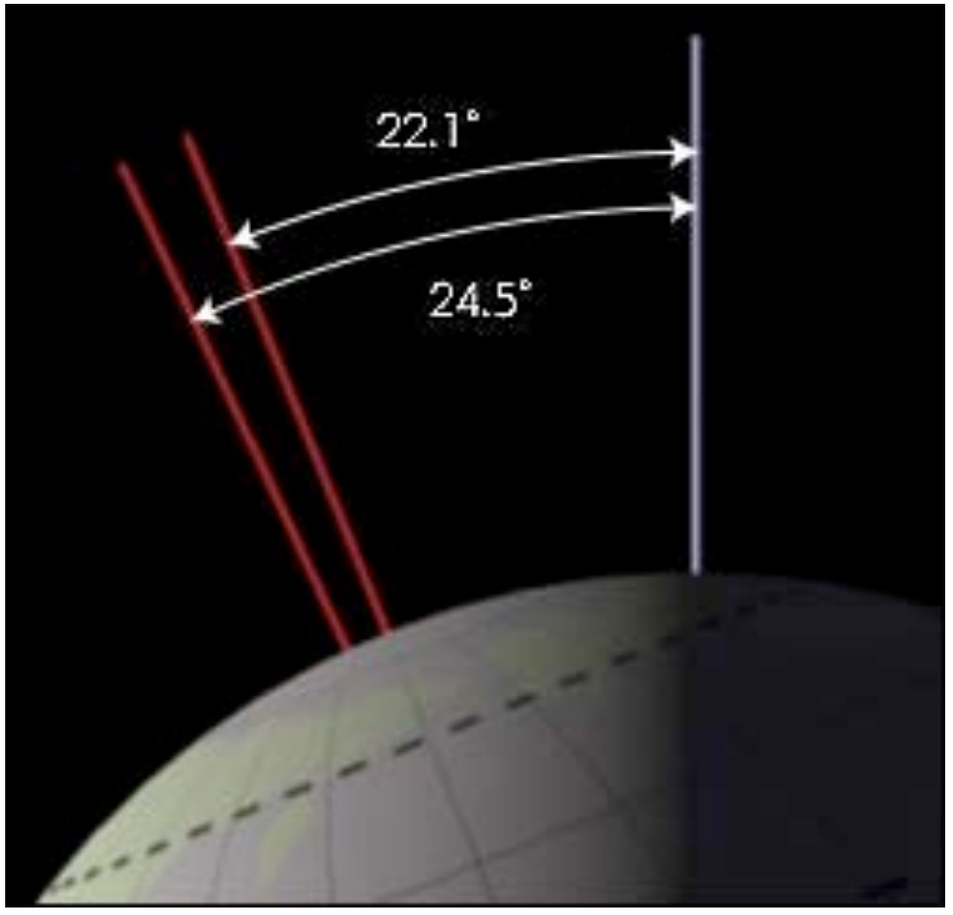


The Earth's Tilt

A common misconception is that the seasons are determined by how far Earth is from the Sun during its orbit. This, however, is not true.

The Earth is actually tilted at a 23.5° angle.

It is this tilt of Earth that causes the seasons.



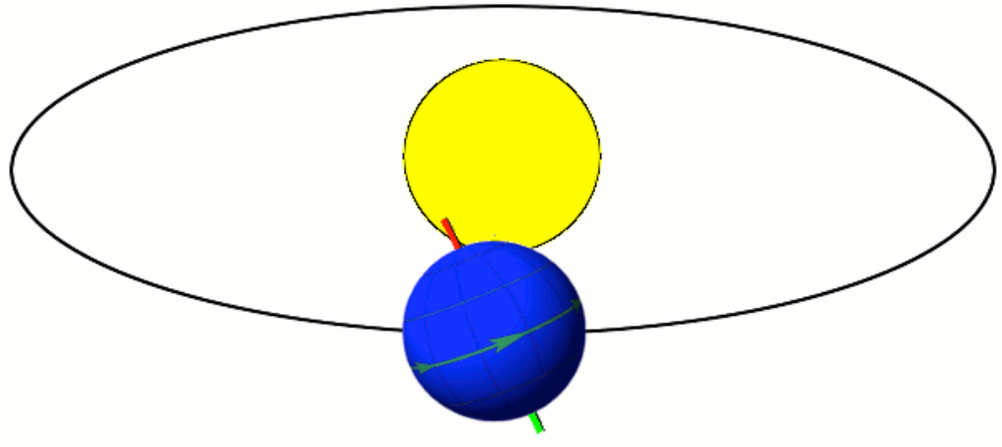
The Earth's Tilt

As you can see in the image below, Earth maintains this tilt throughout its entire journey around the Sun. On top of this, the direction of the tilt never changes.

Notice how the red pole (North) is always pointing towards the left side of the page and the green pole (South) faces to the right.

This allows both halves of Earth to experience the seasons.

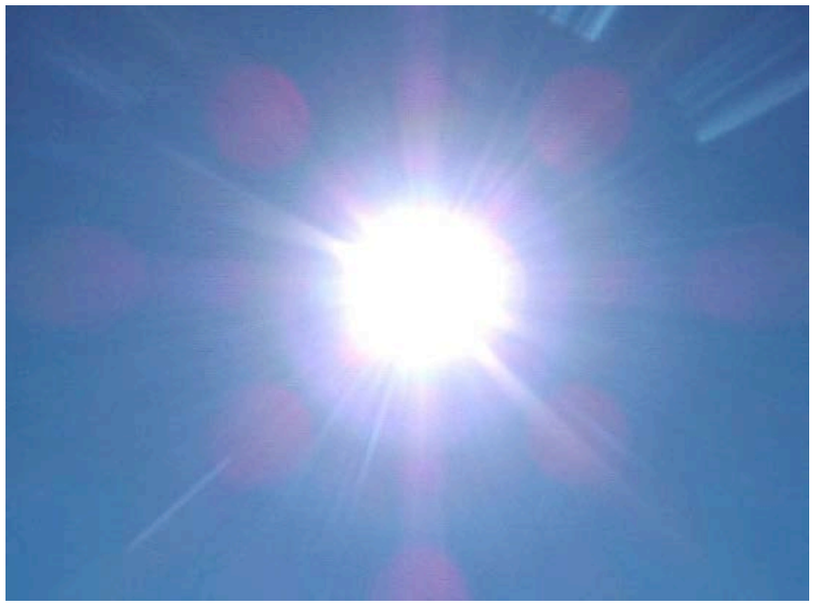
This also leads to two important effects...



1) The concentration of light on Earth's surface varies with the time of year.

In the summertime, the angle between the sun's rays and Earth's surface is greater than in the winter.

This means that the Sun is higher in the sky during the Summer and lower during the Winter.



The heat energy from the Sun will shine more directly on Earth's surface, making it warmer!

2) The days are longer in the summer than in the winter.

Because of the tilt of Earth, one half of Earth (known as a hemisphere) is going to be leaning towards the Sun while the other hemisphere is leaning away. These two areas would be experiencing opposite seasons.

This makes the days longer for some areas of the world. In the summer, the longer days allow Earth's surface to be heated by the Sun for a longer period of time.

This makes the air, ground, and water (and in turn the temperatures) heat up!

46 If the Northern Hemisphere is experiencing summer, what season would the Southern Hemisphere be experiencing?

A Spring

B Summer

C Autumn

D Winter

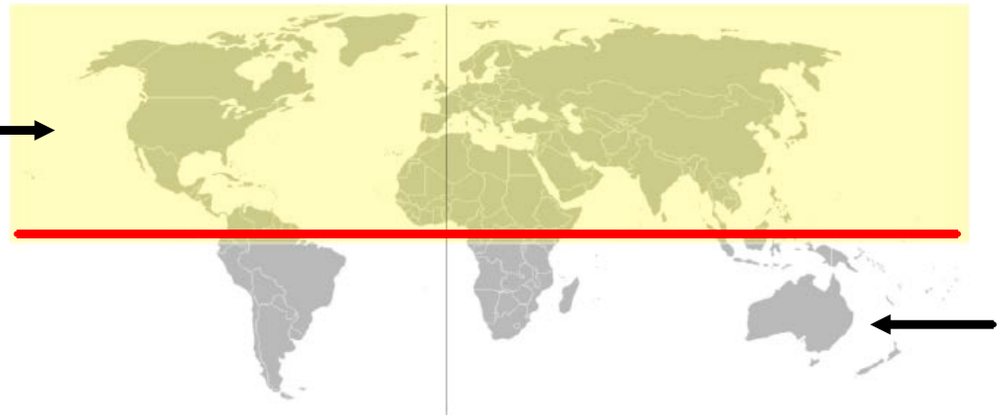
Answer

Hemispheres

A Hemisphere is literally "half of the sphere" or "half of Earth."

Earth can be split in one of two ways:

Northern

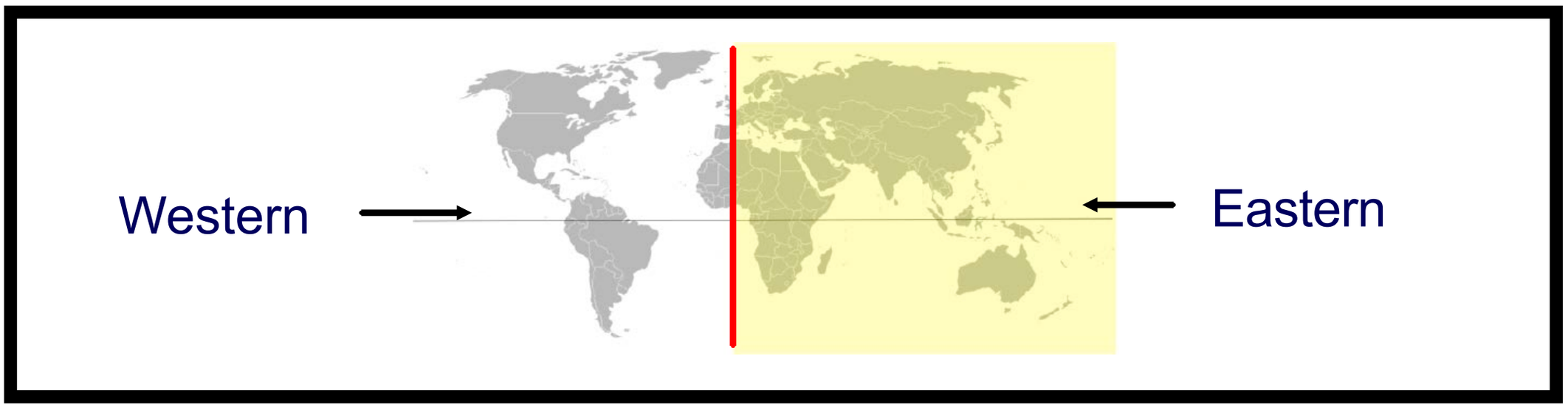


Southern

The Northern and Southern Hemispheres are divided by the _____ which is an imaginary horizontal line around the center of Earth.

Hemispheres

The Eastern and Western Hemispheres are divided by thePrime Meridian - an imaginary vertical line that splits Earth in two equal halves.



47 Look at the maps on the previous slides. Depending on how you slice Earth, the United States resides in two hemispheres. What are they?

A Northern

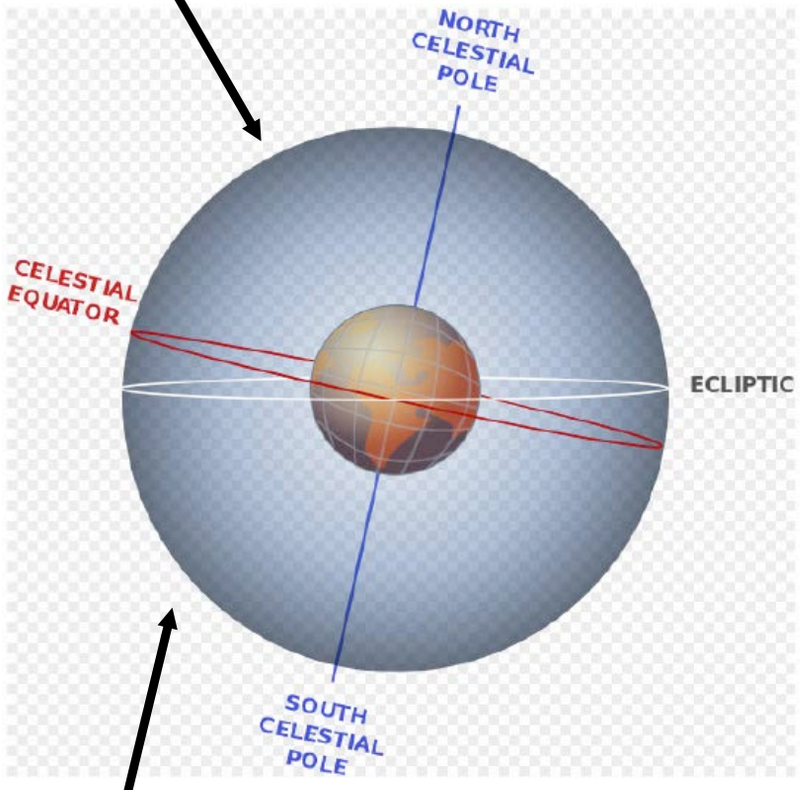
B Southern

C Eastern

D Western

Answer

The Hemisphere tilted towards the Sun is experiencing Summer.



The Hemisphere tilted away from the Sun is experiencing Winter.

Equator

People who live near, or on, the Equator generally experience the same temperatures year round.

This is because the Equator stays basically the same distance from the Sun all year. There is never a point where the Equator tilts to or away from the Sun.

The closer you get to the Equator, the less your seasons will change over the course of the year.

What about Spring and Fall?

Spring and Fall occur when neither pole is pointing toward or away from the Sun.

The Sun heats both hemispheres equally at these times. This is why Spring and Fall have fairly similar temperatures (although Spring tends to gradually heat up, while Fall starts to cool down).

Equinox

The beginning of Spring and Fall is marked by an equinox .

As you can tell by the name, "equinox" has to do with things being "equal."

More precisely, the Spring and Autumn equinox are the two days on which the amount of daytime and nighttime is completely equal.

The Spring Equinox is March 20 or 21 and the Autumn Equinox is either September 22 or 23.

Solstice

The beginning of Summer and Winter is marked by a solstice .

The Summer Solstice (June 21 or 22) is the day when Earth is tilted most toward the Sun. This results in the longest period of daytime.

The Winter Solstice (December 21 or 22) is the day when Earth is tilted furthest from the Sun. This results in the shortest period of daytime.

48 Which day of the year would have the longest daytime?

A Spring Equinox

B Summer Solstice

C Autumn Equinox

D Winter Solstice

Answer