

Space Notes

1—Our Changing Understanding of Our Solar System

*Early astronomers believed that Earth was the center of the universe & that all other heavenly bodies orbited around Earth. Two astronomers who wrote about this Earth-centered model were Aristotle & Ptolemy.

*Today, astronomers understand that the sun is the center of our solar system. Copernicus & Galileo were 2 astronomers who helped to develop our understanding of a sun-centered model of the solar system.

*Our understanding of the space continues to change with new scientific discoveries. Today we understand that within our Universe there are billions of galaxies. Our galaxy, the Milky Way Galaxy, contains billions of solar systems with suns, planets, & other objects like satellites, asteroids, etc.

2— The Solar System

*The Sun is the center of our solar system. Revolving around our sun are 8 planets and other objects like dwarf planets, moons, asteroids, comets, dust and gas.

*The planets in order based on their position from the sun are: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, & Neptune.

*The planets in order from largest to smallest are: Jupiter, Saturn, Uranus, Neptune, Earth, Venus, Mars, & Mercury.

*The four inner planets (Mercury, Venus, Earth, Mars) are terrestrial planets with solid surfaces.

*The four outer planets (Jupiter, Saturn, Uranus, Neptune) are gas giants with a gaseous surface.

3—The Sun

*A Sun is actually a star! A star is a huge sphere of burning gases. There are billions of stars in our universe.

*Our sun is an average-sized star that is MUCH bigger than the Earth. Its diameter is about 110 times the diameter of the Earth. (However, the Sun is much more than 110 times the overall size of the Earth—more than a million Earths would fit inside of our Sun!)

-Our sun is yellow because of its temperature.

-Our sun is approximately 4.6 billion years old.

4—The Earth

*Earth is the third planet from the sun. It is approximately 150 million kilometers/93 million miles away from the sun.

*Earth's atmosphere, liquid water, distance from the sun, and other factors make life possible.

*Earth is a geologically active planet with a surface that is constantly changing.

*Scientists believe that the Earth is approximately 4.6 billion years old.

6—The Moon

*The Moon is our only natural satellite. Its surface is rocky with extreme temperatures, almost no atmosphere, no life, and very little water.

*It is much smaller than the Earth—about 1/4 the diameter of the Earth.

*Scientists think that the Moon is about the same age as the Earth—approximately 4.6 billion years old.

*The average distance from the Moon to the Earth is about 239,000 miles/380,000 kilometers.

*"Moonlight" is actually sunlight! Depending on where the moon is in relation to the Earth & Sun, we see different amounts of light on the moon throughout the month. There are 8 main moon phases: New Moon, Waxing Crescent, First Quarter, Waxing Gibbous, Full, Waning Gibbous, Third Quarter, & Waning Crescent).

*NASA is a government agency that made it its mission to put a man on the moon in the 1960's. They named these missions the "Apollo" missions; there were 17 missions altogether. Apollo 11 successfully landed an American man, Neil Armstrong, on the moon on July 20, 1969.

*The NASA Apollo missions added greatly to our understanding of the moon. One way that NASA astronauts learned more about the moon was by bring moon rocks back to the Earth to be studied.

7—Rotation vs. Revolution


*The Earth rotates (turns/spins) around its axis approximately once every 24 hours. This rotation of the Earth causes us to have night and day. (Earth's axis is an invisible line that runs through Earth's north & south poles.)

*The Earth revolves (circles/orbits) around the sun approximately once every 365 days. The path that the Earth makes around the sun is called its orbit. (Orbit can also be used as a verb which is a synonym for revolve.) As the Earth revolves around the sun, it does so at an angle. Because of Earth's axial tilt, Earth experiences seasons during its revolution around the sun.

*As the Earth revolves around the Sun, the Moon is revolving around the Earth.

EARTH PATTERNS, CYCLES, AND CHANGE STUDY GUIDE

EARTH, MOON, SUN

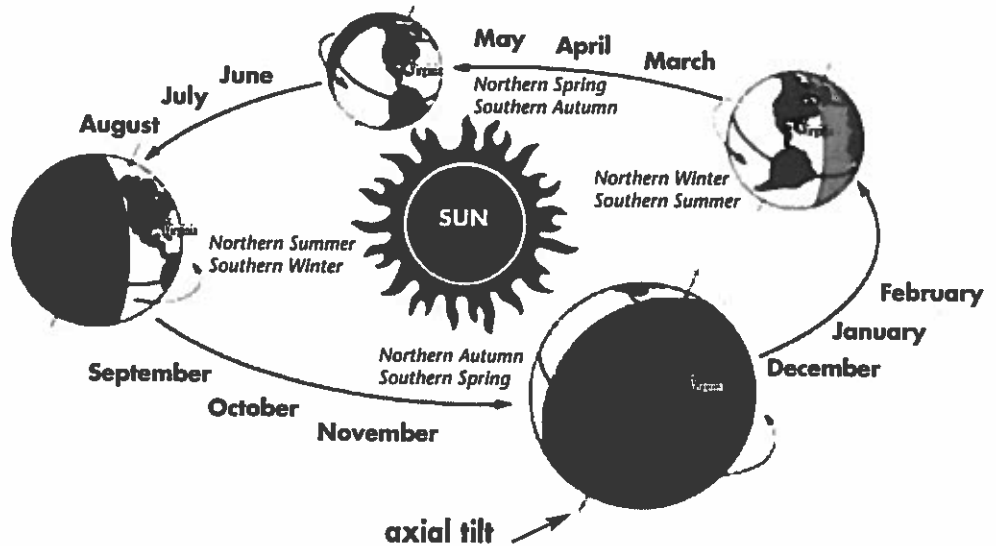
	EARTH	MOON	SUN
Position and Movements 	<ul style="list-style-type: none"> • Earth rotates (spins) on its axis once every 24 hours. This gives us day and night. • Earth revolves around the sun once every 365¼ days (one year). 	<ul style="list-style-type: none"> • The moon revolves around Earth once every 28 days (about one month). 	<ul style="list-style-type: none"> • The sun is the center of our solar system. Earth and the other planets revolve around it.
Surface Conditions	<ul style="list-style-type: none"> • Large amount of water • Diversity of organisms • Oxygen-rich atmosphere 	<ul style="list-style-type: none"> • Rocky with craters • Temperature extremes • No atmosphere or life • Very little water 	<ul style="list-style-type: none"> • Extremely hot gaseous plasma • 5500 °C • Mostly made of hydrogen and helium
Other Facts		<ul style="list-style-type: none"> • About four moons could fit across the diameter of Earth 	<ul style="list-style-type: none"> • Average-sized yellow star • 110 times the diameter of Earth • About 4.6 billion years old

SEASONS

Earth is tilted on an imaginary axis as it revolves around the sun. This is called **axial tilt**. It is the reason for the seasons.

When the sun's rays hit one hemisphere of Earth more directly, that hemisphere has summer and the other hemisphere has winter.

In spring and autumn, the sun's rays aren't hitting either hemisphere directly, so temperatures are milder for us.



PHASES OF THE MOON

As the moon revolves around Earth, sunlight reflects off of it. The phases of the moon are the parts of the moon we see that reflect sunlight at different positions as the moon orbits Earth. **Remember:** if the right is bright it's waxing; if left is light it's leaving (waning).

New	Waxing Crescent	First Quarter	Waxing Gibbous	Full	Waning Gibbous	Third Quarter	Waning Crescent	New



MOON EXPLORATION

NASA astronauts explored the moon during the Apollo missions and made the following discoveries:

- *No living organisms live on the moon.*
- *The moon is made of igneous rocks.*
- *No evidence of water has been found on the moon.*
- *The moon has layers.*
- *The surface of the moon is covered with a powdery substance.*
- *Evidence was found to date the moon to be about 4.6 million years old.*

OUR SOLAR SYSTEM

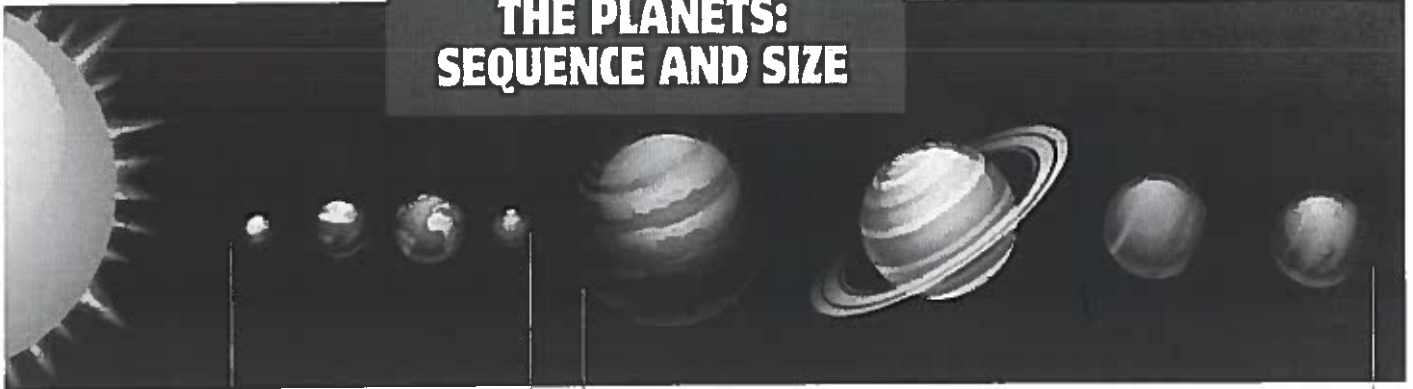
HISTORICAL CONTRIBUTIONS

Aristotle and **Ptolemy** believed that all of the planets and the sun revolved around Earth.

Copernicus challenged that idea and argued that all of the planets, including Earth, revolve around the sun.

Galileo, the first scientist to use a telescope to study space. He used the telescope to observe that planets revolved around the sun.

THE PLANETS: SEQUENCE AND SIZE



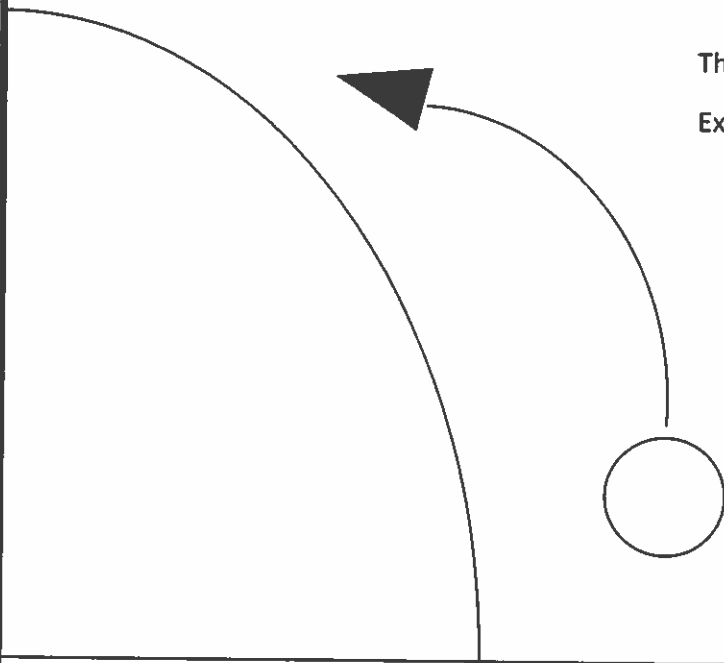
The first four planets (Mercury, Venus, Earth, and Mars) are called **terrestrial planets** because they are rocky planets.

The last four planets (Jupiter, Saturn, Uranus, and Neptune) are called **gas giants** because they are made of mostly gases. They are also the four largest planets.

The planets in order from biggest to smallest are: Jupiter, Saturn, Uranus, Neptune, Earth, Venus, Mars, Mercury.

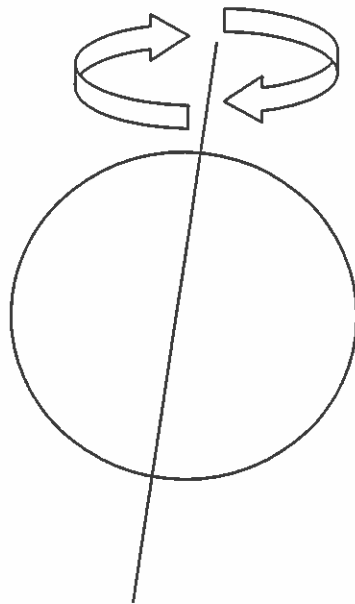
Rotation or Revolution?

Decide which diagram illustrates rotation and which illustrates revolution. Label the diagrams and explain your answers



This shows _____

Explain:



This shows _____

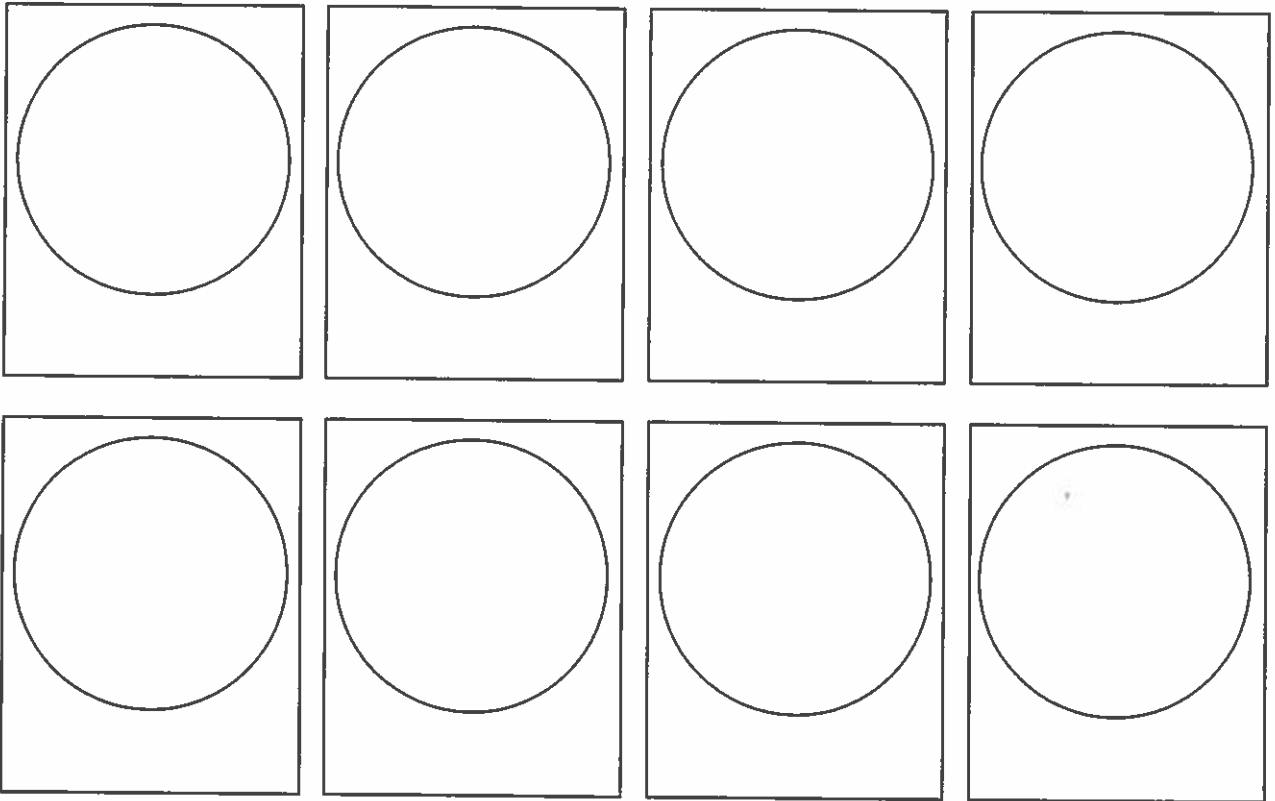
Explain:

8 Main Moon Phases

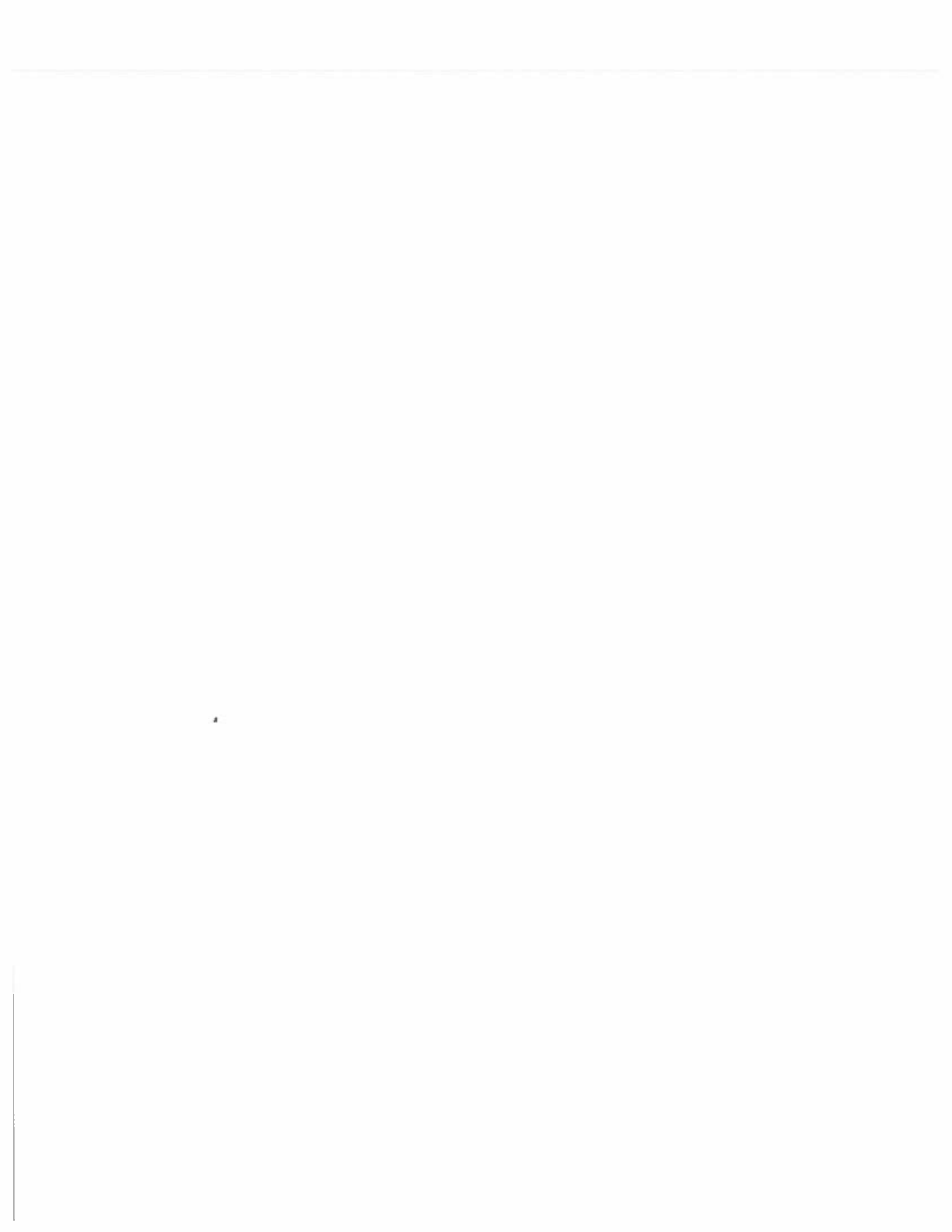
*Our moon _____ around the Earth once every _____.

*Depending on where the moon is in its path around us, we see different amounts of reflected _____ light.

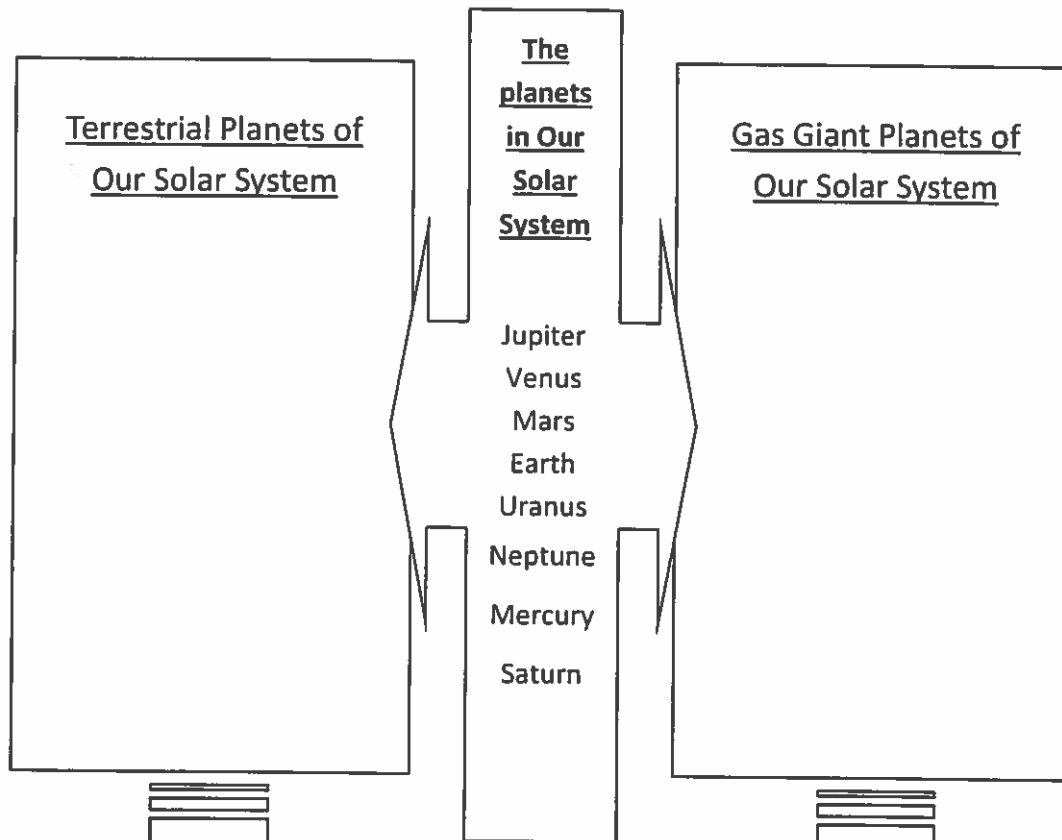
*While the amount of light we see changes a little every night, there are _____ main moon phases. Draw & label those moon phases below:



Fun Fact! The Moon rotates at about the same speed that it revolves around the Earth. Therefore, we only ever see one side of the moon from Earth. The side that we don't see is nicknamed "The Dark Side of the Moon."



Classifying the Planets of Our Solar System



Since these planets are the closest planets to the Sun, they are also called the

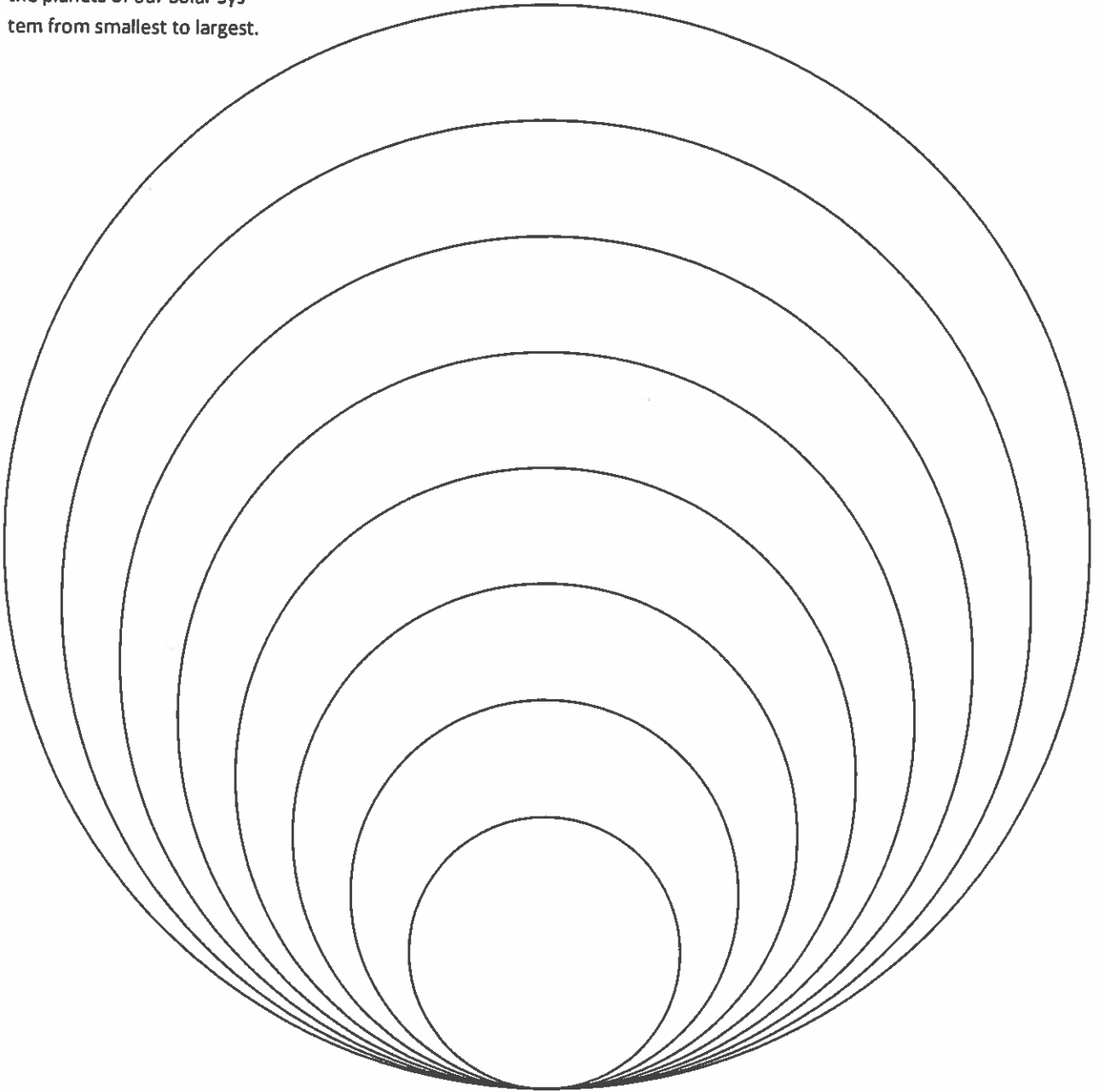
_____ Planets

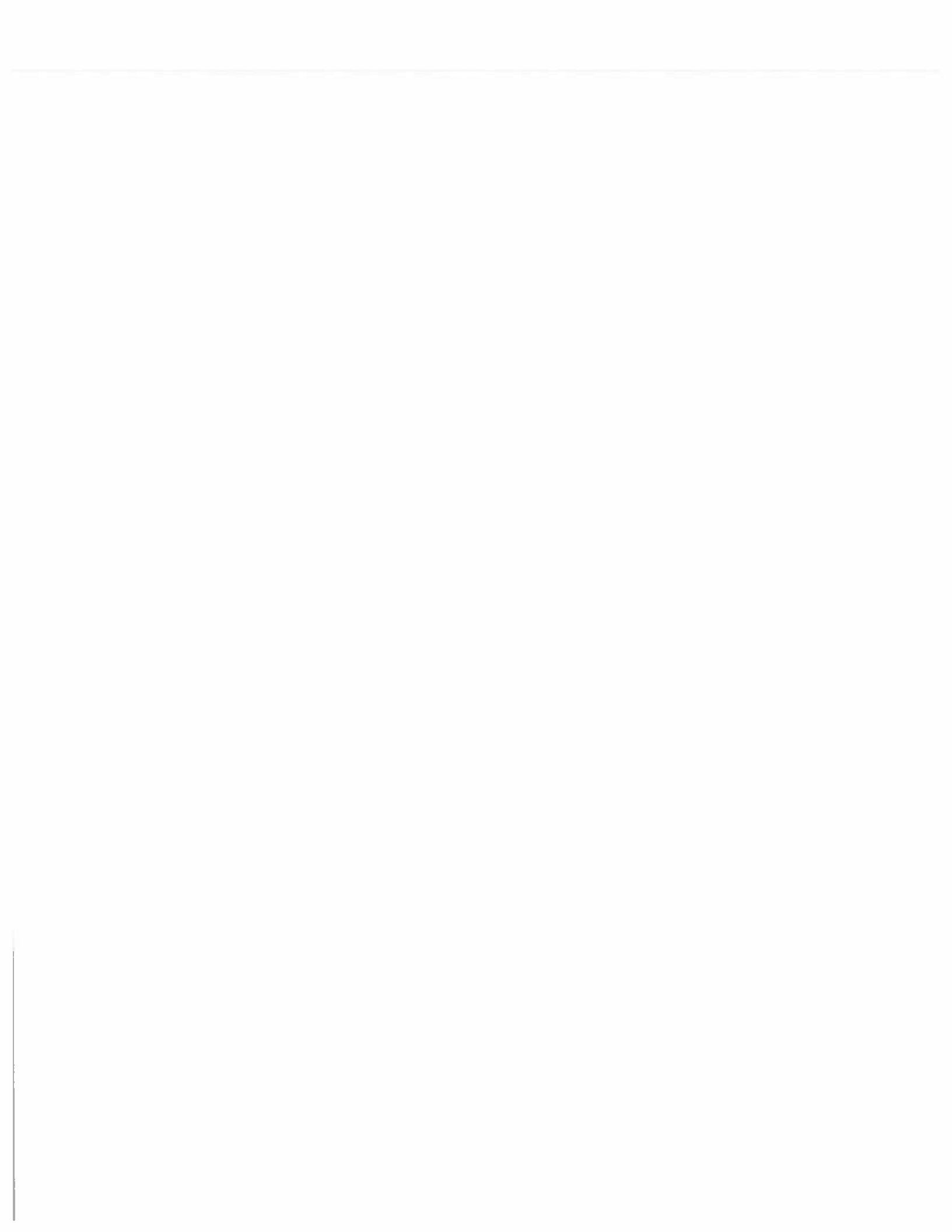
Since these planets are the farthest planets from the Sun, they are also called the

_____ Planets

The Planets of Our Solar System in Order from Smallest to Largest

Directions: Label and color
the planets of our Solar Sys-
tem from smallest to largest.

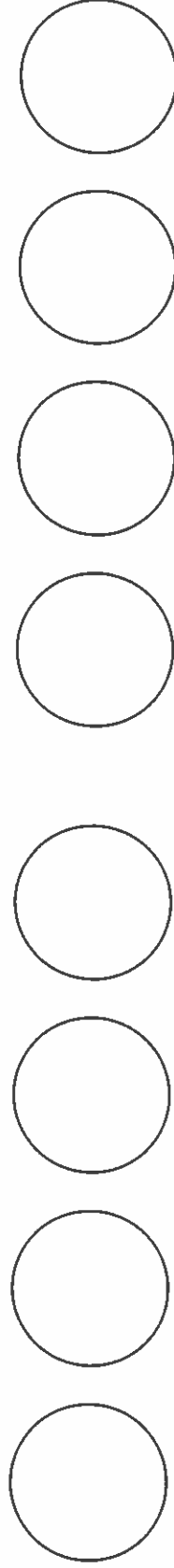




The Planets of Our Solar System in Order Based on....

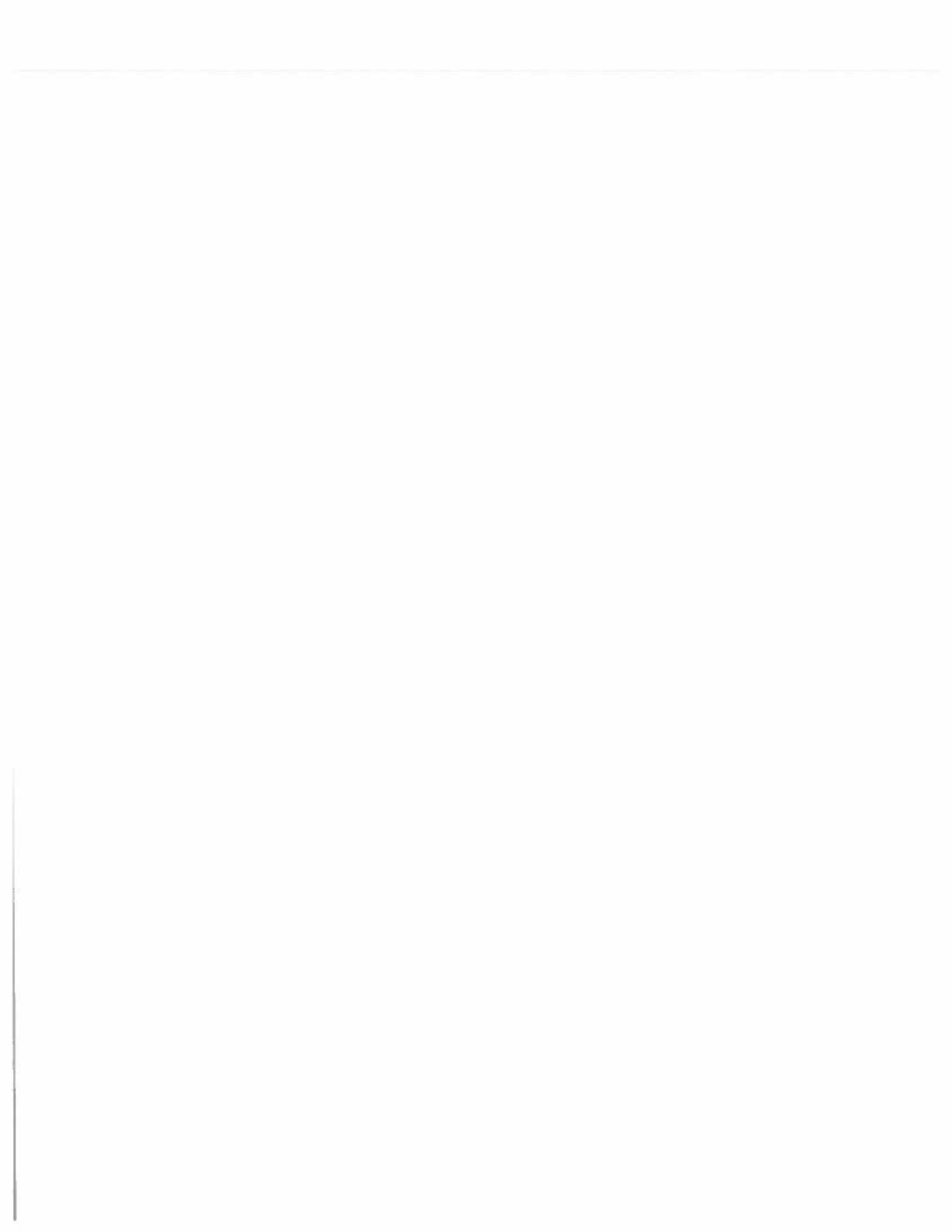
their Position from the Sun

Directions: Number & Label the planets of our solar system in their correct order of their position from the Sun. Next, add the Asteroid Belt to divide the Inner Planets from the Outer Planets. Then, write the mnemonic under the planets that help you remember the order of the planets.



How is this a good model of our Solar System?

How is this a bad model of our Solar System?



SUN-CENTERED MODELS OF THE SOLAR SYSTEM



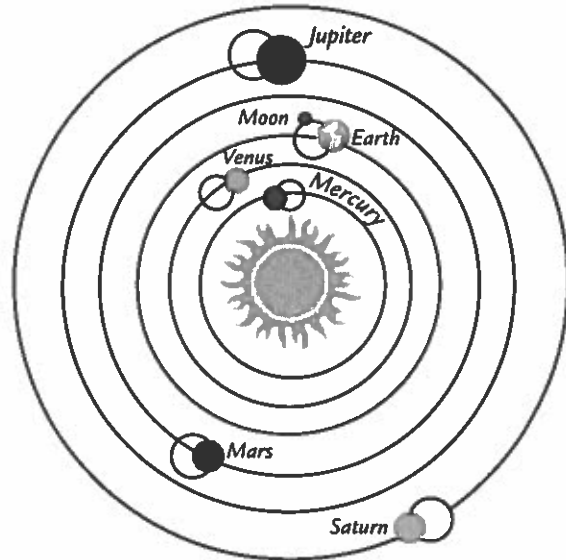
COPERNICUS'S MODEL

Strength of Model:

Although his model included epicycles to explain predictions for planet positions, the model did not rely on epicycles to explain why planets seem to backtrack at times. He explained that planets seem to backtrack because Earth was also revolving! Earth wasn't the center.

Weakness of Model:

Model still argued that planets revolved in a perfectly circular path. Also included epicycles.



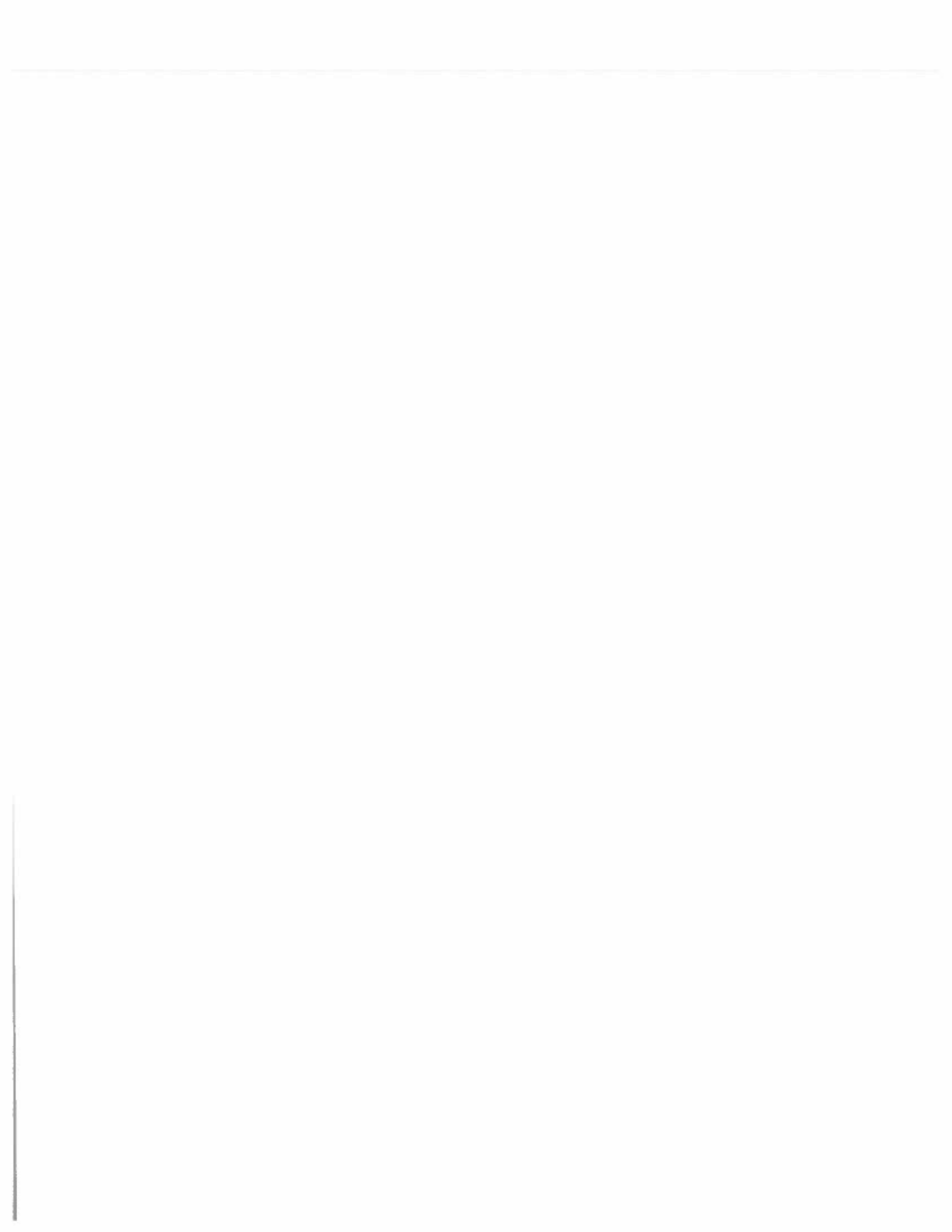
GALILEO'S MODEL



In 1610, Galileo used a telescope to observe that moons orbited Jupiter. This observation surprised him. But he believed in what he observed. What Galileo saw helped him realize that all objects did not orbit the Earth. It was part of the evidence that helped him decide to support Copernicus' sun-centered model of the solar system.

OTHER BREAKTHROUGHS

- In 1609 **Johannes Kepler** argued that planets moved in an elliptical (oval-shaped) orbit, not a circular one. This allowed scientists to better predict planet positions.
- In 1684 **Isaac Newton** combined the ideas of Copernicus, Galileo, and Kepler, and explained that a force called gravity caused planets to move in an elliptical orbit around the sun.



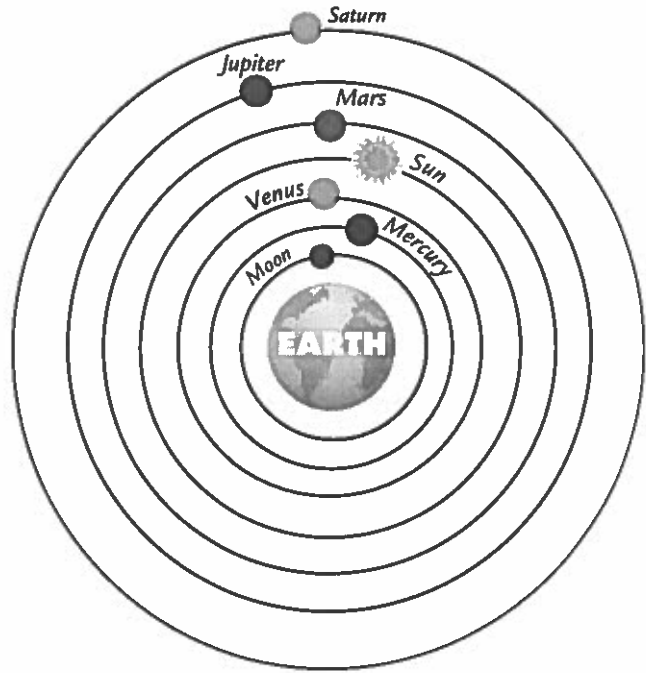
EARTH-CENTERED MODELS OF THE SOLAR SYSTEM



ARISTOTLE'S MODEL

Strength of Model:
Able to explain why the sun and planets seem to move across the sky

Weakness of Model:
Not able to explain why the planets seem to backtrack at times



PTOLEMY'S MODEL

Strength of Model:
Able to explain why the sun and planets seem to move across the sky AND his idea of **epicycles** explained why the planets seem to backtrack at times

Weakness of Model:
Very complicated; goes against the notion that simple is usually accurate

Ptolemy's **epicycles** showed that planets orbited in small circles as they revolved around the Earth.

