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Warm-Up | The Solar System

Lesson Question

What contributions led to the acceptance of the heliocentric model of the solar system?

Lesson Goals

Learn about the solar system.

Compare the geocentric and heliocentric models of the solar system.

Explain how Copernicus, Galileo, and Kepler contributed to the acceptance of the heliocentric model.

Identify objects that make up the solar system.

Words to Know

Fill in this table as you work through the lesson. You may also use the glossary to help you.

heliocentric	a model of the solar system where planets orbit the Sun
meteoroid	a small chunk of rock and metal debris in space
celestial	belonging to or related to the sky
epicycle	a mini-orbit that explains the variations in movement of planets in the solar system
comet	a small object made of ice and dust that orbits the Sun
asteroid	a rocky object that orbits the Sun
geocentric	a model of the solar system where the Sun and planets orbit around Earth

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Early Greeks and the Heavens

The ancient Greeks were sophisticated [astronomers].

- Early Greeks thought planets were being moved across the sky by gods.
- They noticed stars did not [move].
- They named many [constellations] after characters in Greek myths.

Greek Astronomers

The Greeks studied the stars and solar system.

- Created star [maps]
- Built instruments to help understand and predict the movement of [heavenly] bodies
- Observed and understood equinoxes, solstices, and [phases] of the moon

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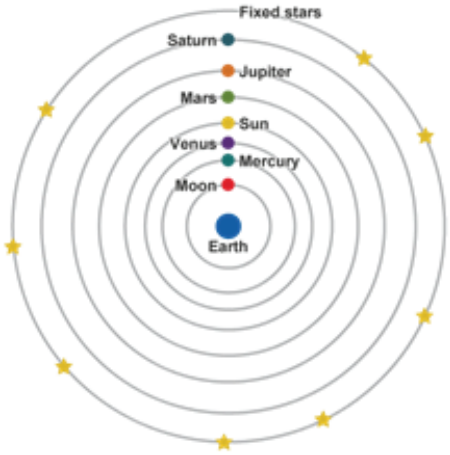
Aristotle's Geocentric Model

Aristotle established the **geocentric model** in [350] BCE.

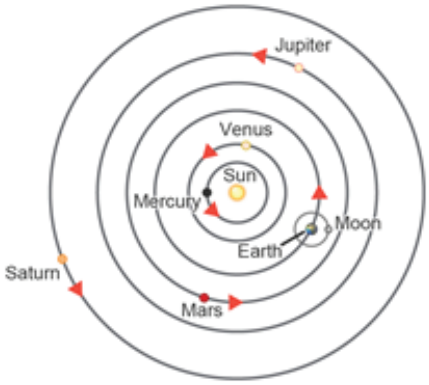
- Aristotle proposed that all [celestial] bodies revolved around Earth.
- This model persisted for more than a [millennium] due to Aristotle's fame.



Aristarchus's Early Heliocentric Model

Aristarchus stated that the Sun is the [center] of the universe.

- This is known as the **heliocentric model**.
- Aristarchus also believed that Earth rotates on its [axis] once a day.
- He argued this model gave the appearance that bodies moved in the [sky].



Aristarchus's Heliocentric Model
(Not to Scale)

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The Ptolemaic Model

Greek astronomer Ptolemy created a complex geocentric model.

- Each planet spun in an [epicycle] (mini-orbit) while orbiting Earth.
- This model explained why planets appear to move backward.
- This model persisted for centuries due to [culture], religion, and philosophy.



Retrograde Motion

- Retrograde motion is caused by Earth moving [faster] than other planets.

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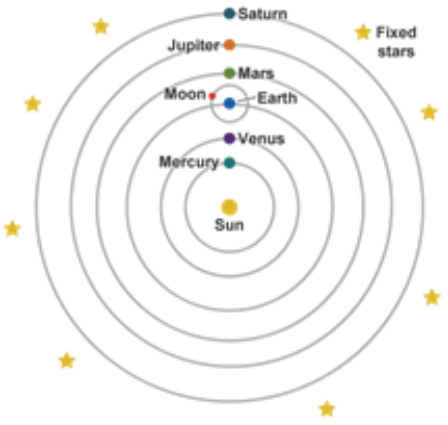
Copernicus's Heliocentric Model

Copernicus rediscovered Aristarchus's heliocentric model.

- His model had planets orbiting the [Sun] and the [moon] orbiting Earth.
- This model explains the Sun's rising and setting is due to Earth's [rotation].
- His model was rejected because it went against [religious] teachings.



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Galileo's Support of Copernicus's Model

Galileo Galilei later made observations that supported Copernicus's model.

- Found moons of Jupiter, conflicting with teachings of [Aristotle] and [Ptolemy]
- Discovered that [Venus] has phases, proving it orbits the Sun
- Published his evidence in [Italian], reaching a wider audience

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Kepler's Modifications to Copernicus's Model

Johannes Kepler accurately described the [motions] of the planets.

- Used [data] collected by Tycho Brahe
- Constructed the [laws] of planetary motion
- Demonstrated that [orbits] were elliptical
- Determined that planets move faster when closer to the [Sun]

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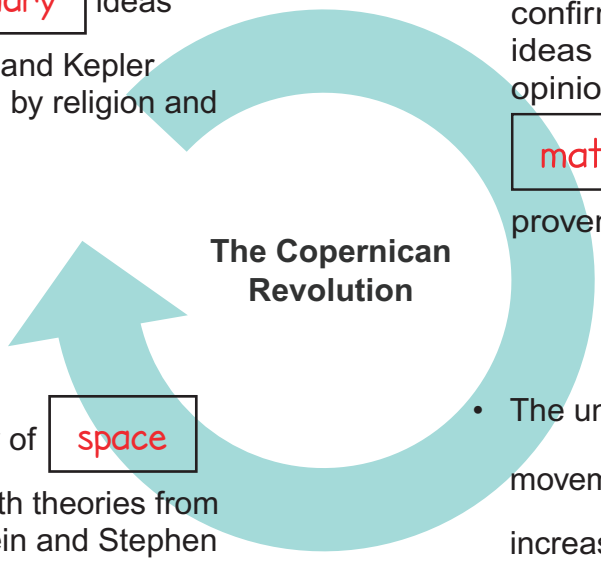
The Copernican Revolution



- [Revolutionary] ideas from Galileo and Kepler were hushed by religion and politics.
- Scientists checked, confirmed, and refined ideas until nonscientific opinions could be [mathematically] proven.
- The curiosity of [space] increased with theories from Albert Einstein and Stephen Hawking.
- The understanding of the movement of [planets] increased with Isaac Newton's theories of gravity.

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Planets in the Solar System

The planets are part of the solar system.

- [Ancient] people knew about Mercury, Venus, Earth, Mars, Jupiter, and Saturn.
- [Uranus] and [Neptune] were discovered later, as was the dwarf planet Pluto.

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Terrestrial Planets and Gas Giants

The planets in the solar system are divided into two categories: terrestrial planets and gas giants.

Terrestrial Planets

- Consist mostly of rock
- Have an atmosphere
- Include Mercury, Venus, Earth, and Mars

Gas Giants

- Made of gases, including helium, water vapor, and hydrogen
- Are much larger than terrestrial planets
- Include Jupiter, Saturn, Uranus, and Neptune

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Other Objects in the Solar System

Besides the planets, the solar system is also made up of different bodies.

- The Sun: a star that is the center of our solar system
- Comets: small objects of ice and dust that orbit the Sun
- Asteroids: small, rocky objects that orbit the Sun
- Meteoroids: small chunks of rock and metal debris in space

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Knowledge of the Solar System

Today, we know the solar system consists of the Sun, the planets, and other bodies.

- We continue to learn about the solar system through:
  - lunar explorations.
  - space probes such as Juno, which is exploring Jupiter.

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Lesson Question

What contributions led to the acceptance of the heliocentric model of the solar system?

Answer

(Sample answer) Advances in understanding by astronomers Aristarchus and Ptolemy led to the conclusion that the solar system was centered on the Sun. Galileo Galilei provided evidence that supported the heliocentric model. The work of Tyco Brahe and Johannes Kepler refined the heliocentric model.

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Review: Key Concepts

Geocentric Model

- Earth is the center of the universe.
- Aristotle established this model around 350 BCE.
- Ptolemy expanded this model to include epicycles.

Heliocentric Model

- The Sun is the center of the universe.
- Aristarchus first proposed this model.
- Copernicus, Galileo, and Kepler refined this model till it was later accepted.

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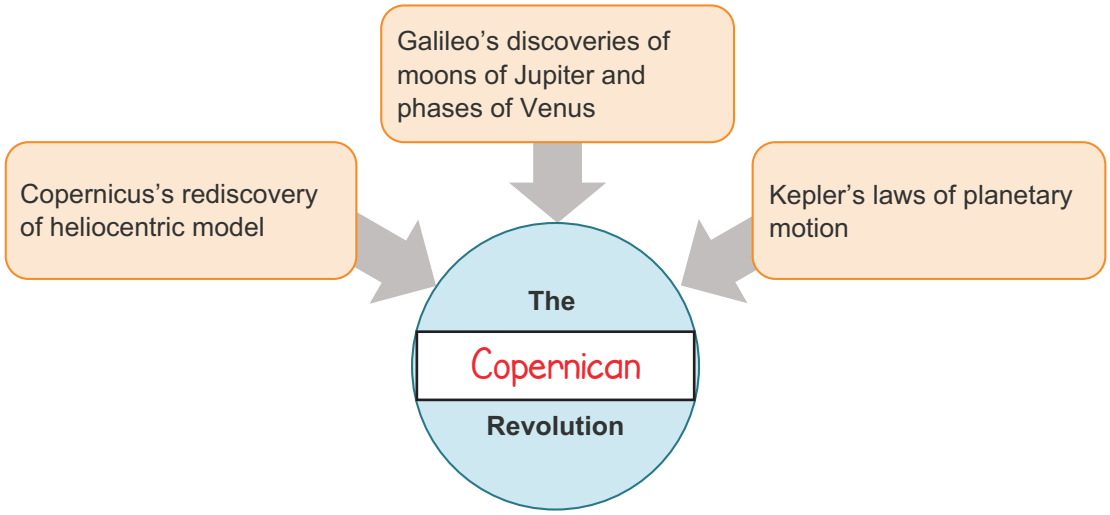
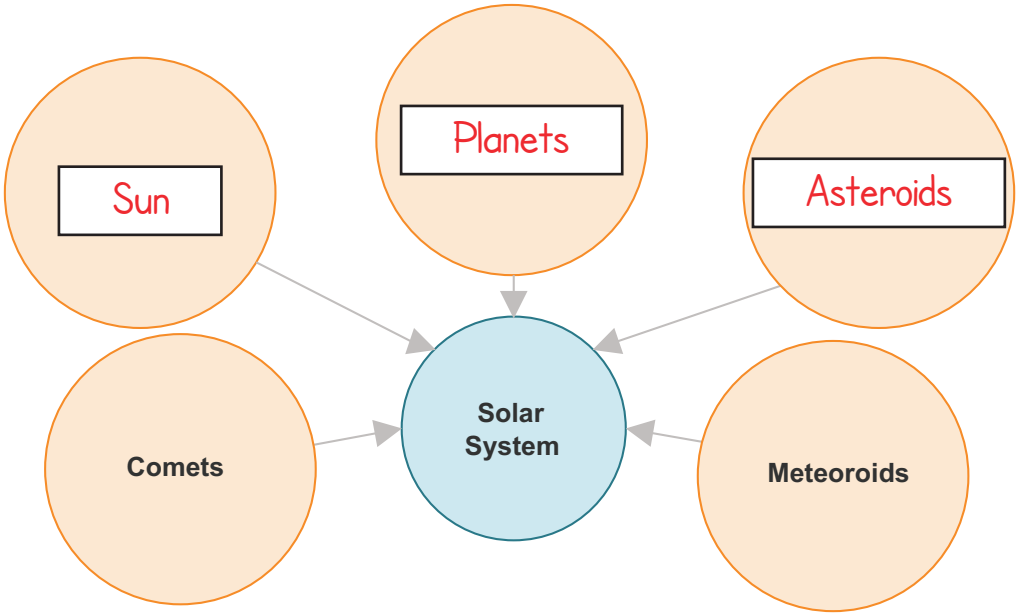
Review: Key Concepts



Review: Key Concepts



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Use this space to write any questions or thoughts about this lesson.

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