

Please read the highlighted text, and answer the questions at the end

Ancient Greece:

Ancient Greek thinkers believed in the Ptolemaic system, which explained the movement of the heavens above Earth. Invented around 2 CE, the Ptolemaic system was accepted for over a thousand years by the majority of people as the right system.

What was the system? The Ptolemaic system is the Earth center of the universe, and all “heavenly bodies” (other planets and stars) rotate around the Earth (also known as *geocentric view*).

The issues? Unfortunately, the system still did not quite match observations. Sometimes the size of a planet's retrograde loop (most notably that of Mars) would be smaller, and sometimes larger and Ptolemaic system could not explain this.

Middle Ages (~500 CE ~ 1400 CE):

During the Middle Ages, astronomy, as most of the sciences, didn't advance much in Europe, and many important works could have been forgotten but for the work of scholars of the Arabic world.

Priests in parishes needed elementary astronomical knowledge for calculating the exact date of the Easter. The Arabic world under Islam had become highly cultured, and many important works of knowledge from Ancient Greece were translated into Arabic, used and stored in libraries throughout the area.

Meanwhile in Europe, the model from the Greeks most remembered through the Middle Ages was the geocentric model, in which the Earth was in the center of the Universe, with the Sun, Moon and other planets..

Copernicus (1473 - 1534):

Copernicus' major theory was published in the book "On the Revolutions of the Heavenly Spheres" in the year of his death 1543, even though he had arrived at these ideas several decades earlier.

This book marks the beginning of the shift from a *geocentric* universe with the Earth at its center. Copernicus said that the Earth is another planet revolving around the fixed sun once a year, and turning on its axis once a day. He arrived at the correct order of the planets and explained the precession of the equinoxes correctly by a slow change in the position of the Earth's rotational axis.

His theory, unfortunately, still had some serious defects. Copernicus believed planets and moons rotate in perfect circles opposed to in ovals and ellipses. The system nevertheless had a large influence on scientists such as Galileo and Kepler, who adopted, championed and, in Kepler's case, improved the model.

Kepler (1571 - 1630):

Until Kepler, astronomers had generally assumed that celestial objects (planets, moons, stars etc) moved in perfect circles around the Sun. They argued that a perfect God would surely create objects that moved "perfectly". Kepler explained planetary movement with noncircular curves, known as ellipses (also known as ovals). By using ellipses, Kepler discovered that he could make calculations that matched observations with the naked eye. This means Kepler built off the theories and findings of Copernicus, helping support the heliocentric model (also known as the sun - not the earth - was the centre of the solar system).

Galileo (1564 - 1642):

Galileo was one of the first astronomers to use the telescope. He acquired a 10x telescope and then made an 20x one. He published his initial observations in March 1610 as Sidereus Nuncius (Sidereal Messenger). Galilei's work supported Copernicus' theory of heliocentrism. In addition, he was the first to report lunar mountains.

Galilei discovered Jupiter's 4 largest satellites in 1610. He determined that these moons were orbiting the planet since they would occasionally disappear; something he attributed to their movement behind Jupiter. Galileo had observed Neptune, in 1611, but had believed it to be a star.

Newton (1643 - 1727):

Newton was the first to demonstrate that natural laws govern earthly motion and celestial motion. He is associated with the Scientific Revolution and the advancement of heliocentrism (sun is the center of the universe. Newton is also credited with providing mathematical proof for Kepler's laws of planetary motion. He would expand these laws by arguing that orbits (such as those of comets) were not only elliptic; but could also be hyperbolic and parabolic.

Isaac Newton was the first scientist to marry physics with astronomy, discovering that the same force that causes objects to fall on Earth, causes the motion of planets and the moon. Using his Law of Gravity, the Laws of Kepler are explained, and the heliocentric system gained a sound physical basis. Newton also found out that the white light from the sun can be decomposed into its component colors; this fact is crucial for most of the 20th-century research.

Group members: _____

Questions to answer about your paragraph:

1) Who were the main figures discussed in your research?

2) What time period did your paragraph cover?

3) What was the theory at the time (was the Sun or Earth the centre of the universe)?

4) What were some of the problems the theory you researched had (if any)?

5) How is the theory discussed in your research connected or dependent on other theories?
