

SSWH13: Examine the intellectual, political, social, and economic factors that changed the European worldview from the 16th century to the late 18th century CE



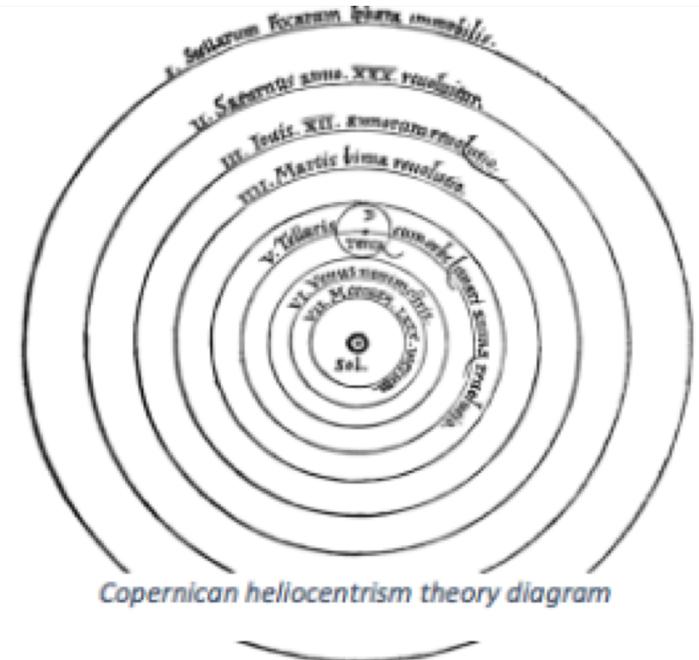
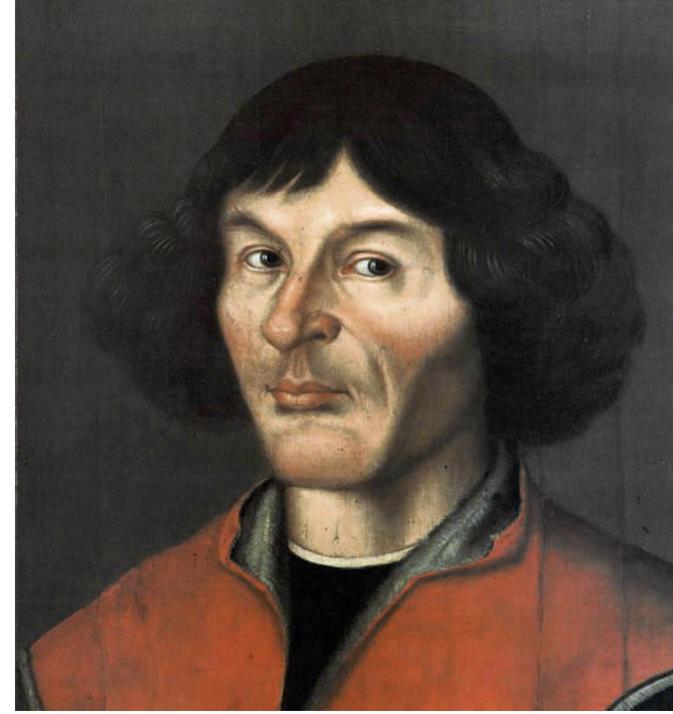
Element A: Explain the scientific contributions of Copernicus, Galileo, Kepler, and Newton and how these ideas changed the European worldview

Overview

- ❑ *Students will be expected to explain how and why Europe experienced an intellectual awakening in the sixteenth century that led to a scientific revolution.*
- ❑ *Students are expected to explain how this Scientific Revolution led to the decline of superstition and the rise of reason in European intellectual circles and how this contributed to modern scientific processes.*
- ❑ *Further, students are expected to link these scientific advances to the rise of Enlightenment philosophies on the proper role of government in people's lives.*

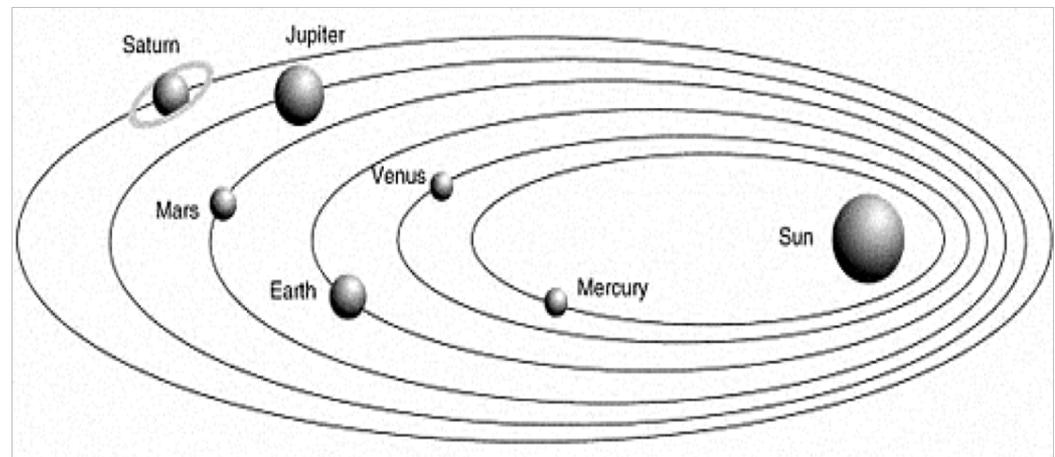
Copernicus

- Nicolaus Copernicus, a Polish scientist, published his argument for a helio- or sun-centered universe in 1543.
 - Although his work received little notice, it importantly abandoned Ptolemy's geo- or earth-centered construction of the universe that had been the accepted understanding since the 100s CE.
 - His case for the helio-centered universe denied experience: one could see the sun moving around the earth and couldn't feel the earth moving at all.



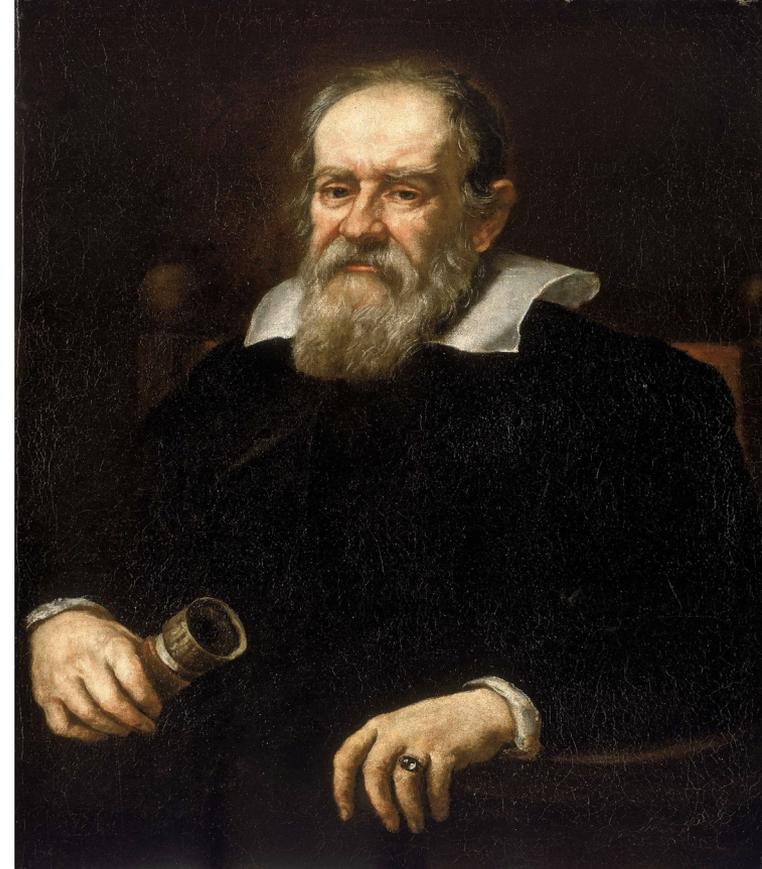
Kepler

- More than 60 years later, Johannes Kepler, a Danish mathematician tested and proved Copernicus' idea using models and mathematics.
 - He also discovered that planets orbit the sun, not in a circle, but in an oval-shaped ellipse (Theory of Planetary Motion).



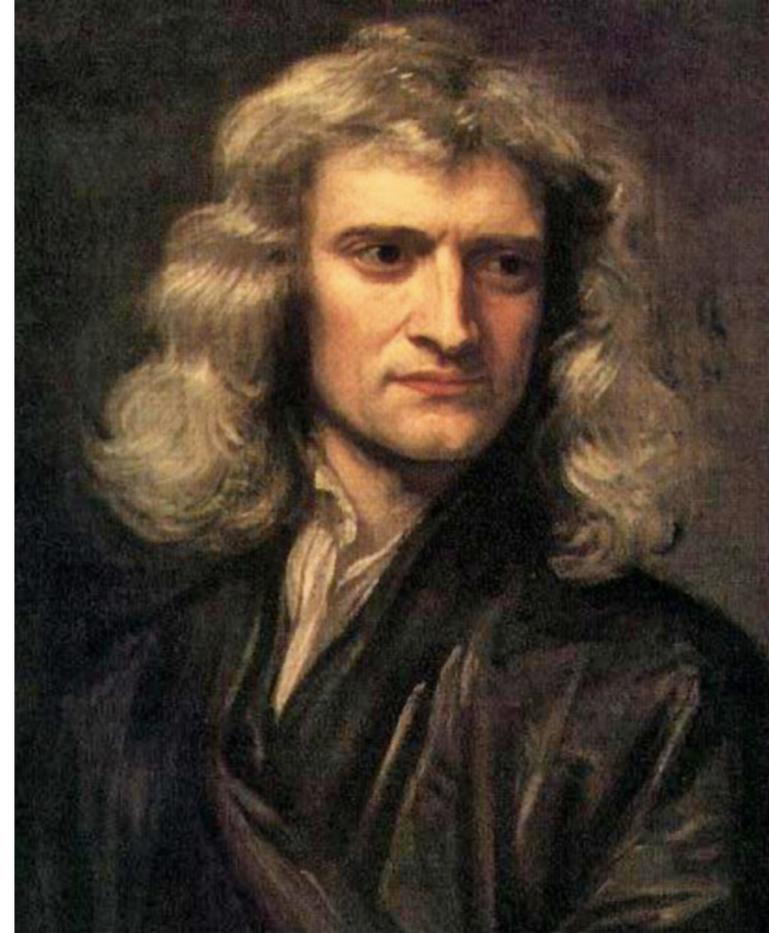
Galileo

- In Italy, Galileo Galilei looked in his telescope and, for the first time, saw mountains and valleys on the moon, spots on the sun, rings around Saturn, and moons orbiting Jupiter.
 - He thus further proved that not everything in the universe revolved around the earth.
 - He also disproved Aristotle by demonstrating that all objects fall at the same rate.
- His work, published in 1632, created an uproar in European society.
 - His challenge to the ancient worldview and church teachings was so upsetting that he was tried before the Inquisition and forced to recant his findings.



Newton

- English scientist, Isaac Newton, built on the work of Copernicus, Kepler, and Galileo in the 1680s.
 - He realized that the same force, gravity, that made objects fall to the earth also kept the planets in their orbits around the sun.
 - He explained the laws of motion and developed mathematics to measure motion.



Newton's Law of Universal Gravitation

The force of gravity, F_g , is given by

$$F_g = \frac{G m_1 m_2}{R^2}$$

where,

G = gravitational constant = $6.668 \times 10^{-8} \text{ dynes cm}^3 \text{ g}^{-2}$

m_1 = mass of object #1

m_2 = mass of object #2

R = distance between the objects

Scientific Revolution's Impact

- ❑ With the discoveries of these scientists, educated Europeans no longer believed the universe was being held in place and order by God.
 - They had to abandon ancient views of the universe and long-standing church doctrine.
 - Instead, they began to acknowledge the workings of physics and new understandings brought about by the Scientific Revolution.

