Unit 2: The Rise of Astronomy

Content Area: **Science**
Course(s):
Time Period: **Marking Period 1**
Length: **2 weeks**
Status: **Published**

Summary

Nearly all of modern science is built on the quest to understand the motion of the stars and planets. In this unit, discussions will focus on the significance of astronomy in ancient cultures and the evolution of peoples' understanding of the motion of the heavens. Some biographical information of the key figures in astronomical history is examined. Significant focus on the phenomenon that the Earth is a sphere and orbits the sun, and the search for an answer to the question, "How did the study of astronomy prove the Earth is moving?" in which two major turning points will be emphasized: Copernicus' heliocentric model and Galileo's discoveries.

Revision Date: July 2024

MATH.K-12.1	Make sense of problems and persevere in solving them
MATH.K-12.2	Reason abstractly and quantitatively
MATH.K-12.3	Construct viable arguments and critique the reasoning of others
MATH.K-12.4	Model with mathematics
MATH.K-12.5	Use appropriate tools strategically
MATH.K-12.6	Attend to precision
MATH.K-12.7	Look for and make use of structure
MATH.K-12.8	Look for and express regularity in repeated reasoning
ELA.RI.MF.9–10.6	Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem.
ELA.W.IW.9–10.2	Write informative/explanatory texts (including the narration of historical events, scientific procedures/experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
SCI.HS-ESS1-4	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
SCI.HS-ESS1	Earth's Place in the Universe
SCI.HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
SCI.HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
SCI.HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
SCI.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more

	manageable problems that can be solved through engineering.
SCI.HS-PS2	Motion and Stability: Forces and Interactions
WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.3	Consider the environmental, social and economic impacts of decisions.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.6	Model integrity, ethical leadership and effective management.
WRK.K-12.P.7	Plan education and career paths aligned to personal goals.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
TECH.9.4.12.CI	Creativity and Innovation
TECH.9.4.12.CT	Critical Thinking and Problem-solving
TECH.9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).

Essential Questions/Enduring Understandings

Essential Questions:

How has human understanding of the structure of the solar system changed throughout human history?

How were ancient astronomers able to measure and map the cosmic sky with such accuracy with primitive technology?

Why were principles of a geocentric universe so prevalent in medieval history?

Enduring Understandings:

Early studies of ancient astronomy describe observed motions of objects in the night sky.

Students' study of the Enlightenment Period in history unfolds how heliocentrism contradicts the teachings of geocentrism.

How later observations of objects in the night sky confirm heliocentrism with mathematical calculations.

Objectives

Students will know key terms: parallax, geocentric, heliocentric, epicycles, deferents, rotation, revolution, retrograde, orbit, and ellipse.

Students will know the contributions of selected Greek astronomers, mathematicians, and philosophers.
Students will know the contributions of Tycho Brahe and Johannes Kepler to astronomy.
Students will know Galileo's evidence supporting Copernicus' model and subsequent struggle with the Roman

Catholic Church.
Students will know how to apply Kepler's laws of planetary motion via investigation and calculation.
Students will know how to calculate the orbital periods and distances of the planets using Kepler's 3rd law.

Students will be skilled at differentiating a geocentric model of the universe from a heliocentric model.
Students will be skilled at applying epicycles and deferents to explain retrograde motion.
Students will be skilled at comparing ancient beliefs and theories of archaeoastronomy to modern astronomy.

Learning Plan

How big is Earth? Using Eratosthenes' method for calculating the size of Earth.

Explaining the motions of the night sky using ISLE.

Read about Aristotle's view of the universe.

PhET Lab: Worlds of Wonder

Use ISLE to study inertia and discuss what consequences it has for planetary instead of solar motion.

Storytelling: Galileo.

YouTube Video: Galileo Challenged Reason

Use 3D objects to model the solar system as hypothesized by different ancient and Renaissance astronomers.

Engineering Project: Build a telescope.

Write a defense for Galileo.

Assessment

Formative Assessment:

Do Now &/or Start-Up Questions, Discussions

Checks of historical knowledge through discussion, use of ISLE cycle to determine reasons for early astronomical beliefs.

Comparisons between motions of planets in a geocentric universe to a heliocentric universe.

Exit Ticket Submission

Alternative Assessment:

Computer website interactive analysis of the evolution of astronomical beliefs & structure of our solar system.

Mathematical calculations to Kepler's ellipse geometry to determine the orbital period of a planet.

Summative Assessment:

Topic & Vocabulary Quizzes

Unit Tests

Benchmark Assessment:

Final Exam

Materials

quantitative/qualitative lab equipment for activities, experiments
related astronomy maps, charts
supplementary interactive multimedia, internet websites, videos

Textbook: The Cosmic Perspective - 10th Edition

Integrated Accommodation and Modifications

https://docs.google.com/spreadsheets/d/1VPJNV9-GTZxi5VPcYkvEMPdHR8D8wTBI7zIj1BWYpek/edit?usp=drive_link