

Astronomy

Semesters: 2

Grade(s): 10-12

Prerequisite(s): Physical or Earth Science; Algebra I recommended

Astronomy is a fusion of concepts and applications from physics, chemistry, geology, biology and mathematics. As such, students experience science in a broad integrated manner. Throughout the course, mathematics is incorporated as a tool for understanding. Major themes include: methods and technology of astronomy investigation, Earth's place in the solar system and universe, stellar and planetary system formation and cycles, organization and processes of the universe, and cosmology. Students explore the ever-advancing astronomy topics through multiple print and digital sources, including online and print material research. A variety of hands-on and virtual investigations support the understanding of astronomy concepts. The implications of the technologies and theories of astronomy upon Earth's societies are examined and discussed. Larger scale projects give students the opportunity to incorporate astronomy concepts in creative endeavors.

Course Competencies

Course Title	
Competency 1	THE SCIENCE OF ASTRONOMY Understanding of astronomy is gained through the gathering of reflected and emitted electromagnetic radiation.
Sub-Topics	1. Be familiar with the tools used to collect electromagnetic radiation: different types of telescopes, spectrosopes, satellites and probes. 2. Define electromagnetic radiation and apply equations related to the electromagnetic spectrum. 3. Explain the optics and other technologies involved with telescopes. 4. Evaluate the theories based on observations about the nature of the components and structures of the solar system and universe. 5. Apply mathematics to understand the forces and processes occurring in the solar system and the universe. 6. Explain the physical principles of rocketry as used for space exploration. 7. Apply Newtonian mechanics to the dynamics of space and space exploration. 8. Describe and evaluate how space exploration technology is applied to daily life on Earth. 9. Outline the history of astronomy and space exploration.
Competency 2	PLANET EARTH Understand the earth as a unique planet on our solar system.
Sub-Topics	1. Relate Earth's location in the solar system to the nature of the lithosphere, hydrosphere, atmosphere and biosphere. 2. Describe the technologies used to study and monitor Earth on a global scale. 3. Evaluate the technologies of GPS and GIS as applied to study the Earth.
Competency 3	EARTH'S MOON Lunar exploration has made contributions to the overall study of space.
Sub-Topics	1. Summarize the advances in space exploration technology developed for lunar exploration. 2. Describe the theories for the formation of the moon. 3. Recognize the lunar properties and structures. 4. Identify the features of the moon and explanations for their formation.
Competency 4	THE SUN-EARTH-MOON SYSTEM The sun, Earth, and moon comprise a dynamic system that creates a uniquely suitable environment for life on Earth.
Sub-Topics	1. Identify the relative positions and motions of the Sun, Earth, and the Moon. 2. Analyze the effects on Earth's systems of the dynamics of the Sun, Earth, and

	Moon. - Describe the phases of the moon and relate the relative motions of the Earth and Moon to these appearances. - Distinguish between solstices and equinoxes. Describe the seasons relative to the northern and southern hemispheres. - Explain eclipses of the Sun and Moon.
Competency 5	FORMATION OF OUR SOLAR SYSTEM
Sub-Topics	Describe the theory for the formation of our solar system. - Describe early concepts of the structure of the solar system. - Describe how our current knowledge of the solar system developed. - Sequence the steps in the formation of the solar system from a gradual coalescence of a vast cloud of interstellar gas and dust. - Apply the principles of physics to the composition and location of the terrestrial and gas giant planets. - Explain why the inner, terrestrial planets have high densities, while the outer gas giant planets have low densities. - Identify the other objects in the solar system: asteroids, meteoroids, comets, dwarf planets, etc. - Relate gravity to the motions of the objects in the solar system. - Apply the mathematics of ellipses to the motion paths of solar system objects.
Competency 6	INNER PLANETS
Sub-Topics	Mercury, Venus, Earth and Mars are the terrestrial planets - Compare the characteristics of the inner planets. - Contrast the formation of the inner planets to the outer planets. - Describe the methods and tools used to study the inner planets. Compare these with methods and tool used to study the outer planets. - Explain the differences among the terrestrial planets. Why is Earth uniquely suitable for life?
Competency 7	OUTER PLANETS
Sub-Topics	Jupiter, Saturn, Uranus, and Neptune have large masses, low densities, and many moons and rings. - Compare and contrast the composition of the gas giant planets. - Identify the major moons for the outer planets. - Explain the leading theory for the formation of the moons and the rings. - Compare the composition and the size of the outer planets and the sun.
Competency 8	OTHER SOLAR SYSTEM OBJECTS
Sub-Topics	Rocks, dust, and ice compose about two percent of the solar system mass. - Distinguish between plants and dwarf planets. Discuss how this relates to Pluto's classification. - Identify the oldest members of the solar system. - Describe meteoroids, meteors, and meteorites. - Determine the structure and behavior of comets.
Competency 9	THE SUN AS A STAR
Sub-Topics	The Sun contains most of the mass of the solar system and has many features typical of other stars. - Describe the layers and features of the Sun. - Explain the process of energy production in the Sun. - Define the three types of spectra.
Competency 10	MEASURING THE STARS
Sub-Topics	Stellar classification is based on measurements of light spectra, temperature and composition. - Determine how distances between stars are measured. - Distinguish between brightness and luminosity. - Identify the properties of the stars. - Relate star classification to the Hertzsprung-Russell diagram. - Apply scientific notation and measurement units to distances between stars.

Competency 11	STELLAR EVOLUTION The Sun and other stars follow similar life cycles, leaving the galaxy enriched with heavy elements.
Sub-Topics	1. Determine the effect of mass on a star's evolution. 2. Compare and contrast the features and life cycles of massive, average, and dwarf stars. 3. Use the Hertzsprung-Russell Diagram as a tool for analyzing the life cycles of different classes of stars. 4. Relate the nuclei of elements to stellar nucleosynthesis.
Competency 12	THE MILKY WAY GALAXY Stars with varying light output allowed astronomers to map the Milky Way, which has a halo, spiral arms, and a massive galactic black hole at its center.
Sub-Topics	1. Determine the size and shape of our galaxy. 2. Distinguish the different kinds of variable stars. 3. Identify the different kinds of stars in a galaxy and their locations. 4. Identify the location of our solar system in the Milky Way galaxy.
Competency 13	OTHER GALAXIES IN THE UNIVERSE Finding galaxies with different shapes reveals the past, present, and future of the universe.
Sub-Topics	1. Describe how astronomers classify galaxies. 2. Identify how galaxies are organized into clusters and superclusters. 3. Describe the expansion of the Universe and the latest leading theories. 4. Describe the quasars and the theories of their formation and characteristics.
Competency 14	COSMOLOGY The Big Bang theory was formulated by comparing evidence and models to describe the beginning of the universe.
Sub-Topics	1. Distinguish the different models of the universe. 2. Compare and contrast how expansion is relative to each model. 3. Explain the importance of the Hubble Constant. 4. Research and evaluate the most current theories concerning the history and nature of energy, matter and the universe(s)