East Penn School District
Curriculum and Instruction

Curriculum for: Astronomy

Course(s): Astronomy

Grades: 10-12

Department: Science

Length of Period (average minutes): 42

Periods per cycle: 6

Length of Course (yrs): 0.5

Type of offering: elective

Credit(s) awarded: 0.5 4.0/4.0

Developed by: Andrew McConville and Kimberly Kneller

ADOPTED: 2018

Enduring Understandings	Essential Questions	Knowledge	Skills	Standards
• Constellations serve as compasses • Constellations map the observable universe • Seasons are driven by Earth's position in orbit around the sun, and tilt of its axis. • Time is determined by the Earth's rotation on its axis and its revolution around the sun.	• Where are we? • How are the stars used to determine location? • What is time? • How are the stars used as timepieces? • How are the stars used for navigation?	• Their cosmic address. • Their place and size in the universe. • Northern hemisphere constellations in each season. • Horizon Navigation System • How the Earth-Sun system generates seasons. • Constellation positions change with each season.	• Navigate, using the stars and cardinal directions. • Identify selected northern hemisphere constellations. • Map the stars above their heads. • Explain the driving mechanisms for the seasons. • Identify selected stars in the northern hemisphere. • Identify celestial objects visible in the night sky.	NGSS Standards: • HS-ESS1-2. Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.
• Every discovery is based on a previous discovery. • New discoveries and technology are changing the way we "see" the cosmos, and our planet. • Astronomers have played a key role in the understanding of our place in the universe.	• How has the history of astronomy driven our current and future advancements? • Where are we headed? • How do we know what we know? • What is the universe?	• Our knowledge of the universe is in a constant state of flux. • Key advancements made by astronomers. • How our idea of the universe has been formulated, based on observations. • The history of time began with the Big Bang.	• Link an astronomer from the past to a mission in the present or future. • Organize a timeline of astronomy. • Differentiate fact from opinion. • Defend assigned astronomical advancements in terms of their importance to subsequent advancements.	NGSS Standards: • ESS1.B: Earth and the Solar System Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system. (HS-ESS1-4)

● The universe is everything that has ever existed. ● What we know about the universe may only be 10% of what actually exists.		● Humans have used our orientation in space to create various types of calendars. ● Kepler's laws are fundamental to our understanding of the solar system.	● Predict changes to the orbit of a planet, given a change in mass. ● Cite evidence to support heliocentric model.	● ESS1.A: The Universe and Its Stars The Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non-stellar gases, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still fills the universe. (HS-ESS1-2)
● The moon plays a key role in the short and long-term evolution of the Earth. ● The Earth and the moon are locked gravitationally and historically. ● Without the moon, life would be very different on Earth.	● How does the moon impact the Earth? ● What resources could the moon provide? ● How does the moon's presence stabilize the Earth?	● The composition of the moon. ● How the moon interacts with Earth's oceans. ● How eclipses transpire. ● The generally accepted theory of moon formation. ● There are different types of eclipses. ● Solar eclipses are not safe to view without proper eye protection.	● Predict a tidal phase based on the moon phase. ● Identify phases of the moon. ● Explain the moon's formation, evolution, and evidence of each. ● Read a tide chart and relate it to the moon's phases. ● Simulate the moon's phases with provided classroom materials. ● Differentiate the different types of eclipses.	NGSS Standards: ● HS-ESS 1-6 Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.
● Kepler's laws govern the orbiting of planets around the sun.	● How does distance from the sun determine the	● A planet's distance is proportional to its orbital period.	● Use Kepler's laws to calculate the parameters of several planet's orbits.	NGSS Standards: ● HS-ESS1-4. Use mathematical or

● Each planet has a unique set of characteristics.	planet's individual characteristics? ● What makes a planet a planet? ● Why do planets orbit stars? ● How did our planet form?	● Identify solar system objects in our system and others. ● The sun holds the solar system in place. ● All stars have Protoplanetary discs. ● Each planet's characteristics are determined by its distance from the sun.	● Contrast the inner and outer planets. ● Explain the structure of the solar system. ● Contrast geocentric and heliocentric models of the solar system. ● Explain how the Earth's surface evolved.	computational representations to predict the motion of orbiting objects in the solar system. ● HS-ESS1-6. Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.
● Stars are all different and change ● Current technology continues to reveal that more stars have solar systems than not. ● We are all stardust. ● Most stars are members of star systems.	● How are star life cycles different? ● Are all stars the same? ● Is the end of a star really the end?	● How the Hertzsprung-Russell Diagram is organized. ● How stars generate energy. ● There are many paths in a star's evolution. ● Specific examples of star types in their sky. ● The path of a star's life is determined by its mass at birth.	● Given the mass of a star, predict its evolution. ● Contrast the Sun's evolution with other stars. ● Graph a given set of stellar data to reveal the H-R diagram. ● Interpret the H-R diagram.	NGSS Standards: ● HS-ESS 1-1 Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth. ● HS-ESS 1-3 Communicate scientific ideas about the way stars, over their life cycle, produce elements.
● Galaxies evolve. ● The universe is expanding. ● Light shows us the invisible.	● How is the comos evolving? ● What information do	● There is evidence to support the Big Bang Theory ● The different types of Galaxies.	● Classify given galaxies by shape. ● Interpret parts of the visible spectrum.	NGSS Standards: ● HS-ESS1-2. Construct an explanation of the Big Bang theory based on

● Telescopes are valuable tools for the astronomer. ● Different types of telescopes can measure different wavelengths of light across the electromagnetic spectrum. ● Spectroscopes are vital tools to understanding what celestial objects are composed of.	we get from starlight? ● What is outside of the Milky Way? ● Where are we in the Universe? ● How does a telescope work? ● How do humans see?	● The different parts of the electromagnetic spectrum. ● Objects in space give off energy across the electromagnetic spectrum. ● Binary stars are most often identified using their spectra. ● How light is gathered in a reflector/refractor.	● Contrast reflecting and refracting telescopes. ● Measure the Hubble constant. ● Identify the parts of a telescope. ● Write our cosmic address. ● Identify parts of the human eye and how they work together to see.	astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.
● All energy on earth is from the sun. ● The sun affects the earth. ● The sun changes.	● How does solar weather affect the Earth? ● Can we predict solar weather? ● Is the amount of solar energy we receive constant?	● The layers of the sun. ● The sun has weather, and that weather has an impact on the Earth. ● The sun will end as a black dwarf. ● The sun is the ultimate driver of all energy processes on Earth. ● The sun goes through regular patterns of change.	● Use sunspot and aurora historical data to predict the next solar maximum. ● Contrast Earth weather and solar weather. ● Identify solar phenomenon. ● Explain the role that the sun plays in the structure of the solar system. ● Predict the sun's eventual fate.	NGSS Standards: ● HS-ESS 1-1 Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth via radiation. ● HS-ESS 2-4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.

Materials and Resources: Internet resources