Arkansas Science

Astronomy: Grades 9, 10, 11, 12

Adopted 2018

Observational Astronomy	**A-ESS1-1AR.**	**Develop a model using observational evidence that accounts for patterns in the diurnal, seasonal, and annual movements of objects on the celestial sphere.** A-ESS1-1AR
	A-ESS1-2AR.	**Obtain, evaluate, and communicate information gathered from observational evidence, maps, and charts to demonstrate an understanding of the ecliptic patterns, magnitudes, and colors of stars, and the dynamic locations of constellations, asterisms, and planets.** A-ESS1-2AR
	A1-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.** A1-ETS1-2
Early History of Astronomy	**A-ESS2-1AR.**	**Engage in arguments from evidence about how the development of astronomy in the pre-telescopic age laid the groundwork for modern astronomy.** A-ESS2-1AR
	A-ESS2-2AR.	**Construct explanations of how the telescope impacted the evolution of solar system models from geocentric to heliocentric.** A-ESS2-2AR
Gravitation	**A-ESS1-4.**	**Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.** A-ESS1-4
	A-ESS3-1AR.	**Use mathematics and computational thinking to demonstrate rotationally dynamic systems and how these structures scale from solar systems to galaxies to bound galactic clusters.** A-ESS3-1AR
	A-ESS3-2AR.	**Construct an explanation of how gravitational forces are influenced by mass, density, and radius and how these forces impact the evolution of planetary structure, surfaces, atmospheres, and rings.** A-ESS3-2AR
	A3-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.** A3-ETS1-4

Formation of the Solar System	**A-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.** A-ESS1-6
	A-ESS4-1AR.	**Analyze and interpret data to describe how nebular theory and gravitational collapse result in star and solar system formation with distinct regions characterized by different types of planetary and other bodies.** A-ESS4-1AR
	A-ESS4-2AR.	**Obtain, evaluate, and communicate information about patterns of size and scale of the solar system, our galaxy, and the universe.** A-ESS4-2AR
The Earth-Moon-Sun System	**A5-ESS1-1.**	**Develop a model based on evidence to illustrate the lifespan of the sun and the role of nuclear fusion in the sun's core to release energy in the form of radiation.** A5-ESS1-1
	A-ESS5-1AR.	**Ask questions about relationships among the Earth, Moon, and sun to clarify the patterns of orbital positions that produce lunar phases and eclipses.** A-ESS5-1AR
	A-ESS5-2AR.	**Plan and carry out investigations to demonstrate how relative orbital positions of the Earth, Moon, and sun influence energy and matter flow into and out of a system to create tides and seasons, orbital angles between Earth, Moon, and sun create these effects.** A-ESS5-2AR
Electromagnetic Radiation and Matter	**A6-ESS1-1.**	**Develop a model based on evidence to illustrate the lifespan of the sun and the role of nuclear fusion in the sun's core to release energy in the form of radiation.** A6-ESS1-1
	A-ESS6-1AR.	**Plan and carry out investigations to demonstrate the dual nature of light as a wave and particle that transmits energy and information about the nature and motion of the matter that emitted it.** A-ESS6-1AR
	A6-ETS1-1.	**Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.** A6-ETS1-1
Stellar Evolution	**A7-ESS1-1.**	**Develop a model based on evidence to illustrate the lifespan of the sun and the role of nuclear fusion in the sun's core to release energy in the form of radiation.** A7-ESS1-1
	A-ESS1-3.	**Communicate scientific ideas about the way stars, over their lifecycle, produce elements.** A-ESS1-3
	A-ESS7-1AR.	**Construct an explanation of how a star's initial mass uniquely determines the conditions that affect stability and factors that control rates of change over its lifetime.** A-ESS7-1AR

Cosmology

A-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.** A-ESS1-2

A-ESS8-1AR. **Construct an argument from evidence that the formation of galactic structures depends on a spherical dark matter halo that surrounds a galaxy and supermassive black holes at the center of the galaxy.** A-ESS8-1AR

A8-ETS1-3. **Evaluate a solution to a complex real world problem based upon prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.** A8-ETS1-3