ASTRONOMY: ACADEMIC STANDARDS

Academic standards for Astronomy build on content mastered in Algebra 1 and Geometry. These standards prepare students for a working knowledge of the Universe and planetary science and how this impacts them. These standards utilize scientific and engineering practices to further enhance scientific thinking to understand and evaluate the world around them.

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AST.ESS1.A The Universe and Its Stars

1. Student should be able to explain the significance of the polestar, Polaris, and its connection with the apparent motion of the celestial sphere.

2. The student will be use the various models of celestial mechanics to explain and predict various patterns inherent in astronomy such as sidereal and solar day, sidereal and synodic month, sidereal and tropical year, precession, the equinoxes and solstices and explain the yearly cycle of the seasons.

3. Students will investigate the patterns that they see in the night sky, including the apparent motion of the stars and the motion of the moon and planets in relation to those stars. This may be done either with the naked eye, or by simulation. Students will develop models to explain such things as apparent brightness, prograde and retrograde motion of the planets, conjunction and opposition.

4. Students will construct an explanation of how gravity affects the shape and construction of planets, moons and asteroids.

5. Students will investigate the development of the Big Bang theory of the formation of the Universe communicate how the and how the scientific method was utilized to form support this theory. They will evaluate the merits of this theory.
6. Students will understand electromagnetic radiation and the electromagnetic spectrum. They analyze and interpret data of astronomical objects seen in different parts of the electromagnetic spectrum to investigate different features and phenomena seen in that data.
7. Students will analyze and interpret data of electromagnetic spectra to understand their chemical composition. This will be applied to understanding the composition of celestial bodies.
8. Students will analyze electromagnetic spectra of galaxies and apply the idea of Doppler shift to show the relative speed of galaxies relative to the Earth.
9. Students will use the mathematical model of blackbody radiation to explain such phenomena as the colors of stars and the temperature of the cosmic microwave background.
10. Students will analyze electromagnetic spectra of galaxies and apply the idea of Doppler shift to show the relative speed of galaxies relative to the Earth.
11. Students will use the mathematical model of blackbody radiation to explain such phenomena as the colors of stars and the temperature of the cosmic microwave background.
12. The student is able to engage in argument from evidence in order to classify solar system bodies according to classifications such as terrestrial and jovial planets, dwarf planets, asteroids, moons, and comets.
13. The student is able to engage in argument based on evidence and construct explanations for existence of the Kuiper Belt and the Oort Cloud.
14. The student is able to develop and use models to analyze the observed structure of and properties of the Sun's photosphere and components of its atmosphere including the chromosphere, transition zone, corona, and solar wind.

15. The student is able to engage in argument based on evidence and construct explanations for existence of various components of the Sun's interior including convection zone, radiation zone, and core.
16. The student is able to develop and use models to construct explanations for the fusion processes thought to occur in the core of the Sun, most notably the proton-proton chain.

17. The student will be able to analyze and interpret sunspot data and construct explanations and models of the solar magnetic cycle and solar activity, including phenomena such as prominences, flares, and coronal mass ejections.

18. The student will use models and construct explanations for the astronomical systems for quantifying brightness of stars such as apparent and absolute magnitude and luminosity.

19. The student will use mathematics and computational thinking to apply quantitative relationships used to determine the distance to stars, including use of parallax and parallactic angle.

20. The student will use mathematics and computational thinking to apply quantitative relationships used to determine the motion and velocity of stars, including use of proper motion and Doppler effect.

21. The student will engage in argument based on evidence and construct explanations for methods to determine and infer stars' masses, diameters, and temperatures.
22. The student will analyze and interpret data by construction of Hertzsprung-Russell diagrams and construct explanations for observed features and patterns, most notably the main sequence.

23. The student is able to engage in argument from evidence in order to classify stars according to classifications such as red giant, blue giant, red dwarf, white dwarf, and spectral type and luminosity class.

24. The student will engage in argument based on evidence and construct explanations for the existence and classification of common binary star systems.

AST.ESS1.B Earth and the Solar System

1. Student will be able to use mathematical and computational thinking and techniques such as skinny triangles, and algebraic and geometric models to analyze various astronomical phenomena and express their results in appropriate units.

2. The student will develop and use celestial models to map and locate objects in the sky including standard celestial models such as the celestial sphere. They will be able to communicate this information interpreting such data as latitude, longitude, altitude, azimuth, right ascension and declination.

3. The student will use geometric models to construct explanations and demonstrate the phases of the moon and various types of eclipses.

4. Students will explain the apparent motion of the sun, moon, stars and planets using the ancient geocentric model of the universe, including such complications as deferent and epicycles.

5. Students will explain the apparent motion of the sun, moon, stars and planets using the heliocentric model of the solar system. Students will use evidence to argue the advantages and disadvantages of this model compared to the geocentric model.

6. Students will engage in mathematical and computational thinking to quantitatively describe the motion of celestial bodies, such as the planets using physical data about these bodies and Kepler's three laws Newton's laws of motion to find the period and speed of those bodies.

AST.ESS3.C Human Impacts on Earth Systems

1. The student is able to engage in argument based on evidence and construct explanations for various planetary environments and observed features in terms of dynamic processes and phenomena such as cratering, greenhouse effect, axial tilt, magnetic fields, etc.

AST.ETS2 Links Among Engineering, Technology, Science, and Society

1. Students will research and investigate various designs of optical telescopes and argue the merits and limitations of these designs.

2. Students investigate where the best place to put a remote telescope would be and be prepared to argue and defend their choice of location. The student is able to develop and use models to analyze the observed structure and variability in the components of the solar system.