

**Science Standard  
Catalina Foothills School District  
High School: Astronomy (Physics-based)**

Astronomy is an inquiry- and physics-based laboratory course that focuses on the properties and dynamics of the universe. Concepts of motion, forces of nature, energy, optics, radiation, and thermodynamics are applied to concepts in astronomy. First semester introduces students to the history and methods of observational astronomy and the study of the solar system. Second semester includes the study of the life cycle of stars, astrophysics, and cosmology. Students will make extensive use of Internet sources and tools as well as in-class technology to learn how astronomers make and analyze their observations. A strong background in algebra and geometry is important, as mathematics will be a key tool to learning about physics through astronomy. This course fulfills the CFHS third year science credit requirement.

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## **SCIENTIFIC INQUIRY**

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### **SCIENTIFIC INQUIRY: GENERATING SCIENTIFIC QUESTIONS**

ASTR.1a.1 Frames testable questions showing evidence of observations and connections to prior knowledge.

ASTR.1a.2 Develops a testable question appropriate to the scientific domain being investigated.

### **SCIENTIFIC INQUIRY: FORMULATING HYPOTHESES**

ASTR.1b.1 Develops a testable hypothesis based upon evidence of scientific principles, probability and/or modeling.

ASTR.1b.2 Clearly distinguishes relationships between variables (required: cause and effect or correlation) within a testable hypothesis.

### **SCIENTIFIC INQUIRY: DESIGNING INVESTIGATIONS**

ASTR.1c.1 Specifies the parameters of measurement.

ASTR.1c.2 Describes suitable controls for the investigation.

ASTR.1c.3 Designs procedures that appropriately address the hypothesis.

### **SCIENTIFIC INQUIRY: DATA COLLECTION**

ASTR.1d.1 Creates and demonstrates safe and ethical procedures.

ASTR.1d.2 Uses units of measurement with appropriate degree of accuracy.

ASTR.1d.3 Creates procedures that appropriately and adequately address the hypothesis (for example: adequate sample size, multiple trials).

ASTR.1d.4 Creates a suitable method of recording data.

### **SCIENTIFIC INQUIRY: ANALYSIS**

ASTR.1e.1 Interprets data to describe relationships between variables (for example: positive, negative, no relationship).

ASTR.1e.2 Incorporates mathematical analysis, where appropriate.

ASTR.1e.3 Critiques the investigation for possible sources of error and suggests corrections.

### **CONCLUSIONS AND EXTENSIONS**

ASTR.1f.1 Makes evidence-based predictions (for example: extrapolations and interpolations).

ASTR.1f.2 Evaluates whether the data support the hypothesis.

### **COMMUNICATION**

ASTR.1g.1 Uses suitable media to inform an audience about an investigation.

ASTR.1g.2 Applies appropriate ethics (for example: language, style, citations).

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## **INTERACTION OF SCIENCE AND SOCIETY**

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ASTR.2.1 Describes the interaction of science, human curiosity and societal needs (for example: how Copernicus's scientific ideas helped humans discover the structure of the solar system; development of calendars).

ASTR.2.2 Critically analyzes the science concepts behind societal issues (for example: cost/benefits of the space program).

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## **SYSTEMS THINKING (CFSD Deep Learning Proficiency – DLP)**

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### **SYSTEMS THINKING: CHANGE OVER TIME**

ASTR.3a.1 Explains how a system's components change over time (for example: development of present characteristics of members of the solar system).

### **SYSTEMS THINKING: INTERDEPENDENCIES**

ASTR.3b.1 Explains the causal relationships in a system as being either positive or negative feedback relationships (for example: radiation pressure and gravitation in the stellar cycle).

### **SYSTEMS THINKING: SYSTEM-AS-CAUSE**

ASTR.3c.1 Explains the reasons why specific behaviors result from the organization of a system (for example: origin of the solar system).

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## **MOTION AND FORCES**

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ASTR.4.1 Analyzes relationships between forces and motion.

ASTR.4.2 Determines the rate of change of a quantity (for example: rate of erosion, rate of reaction, rate of growth, velocity).

ASTR.4.3 Analyzes the relationships among position, velocity, acceleration, and time.

ASTR.4.4 Explains how Newton's Laws apply to a variety of situations.

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## **INTERACTIONS OF ENERGY AND MATTER**

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ASTR.5.1 Describes various ways in which matter and energy interact.

ASTR.5.2 Describes various ways in which energy is transferred from one system to another (required: various ways in which waves interact with each other and with other materials).

ASTR.5.3 Describes the characteristics of waves (required: wavelength, frequency, period, amplitude).

ASTR.5.4 Explains the relationship between the wavelength of light absorbed or released by an atom or molecule, and the transfer of a discrete amount of energy.

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## **GEOCHEMICAL CYCLES**

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ASTR.6. Describes the interactions between the planetary structures, atmosphere and geochemical cycles.

ASTR.6.2 Explains how dynamic processes such as weathering, erosion, sedimentation, metamorphism, and orogenesis relate to distribution of materials within the Earth system.

ASTR.6.3 Demonstrates the relationship between the Earth's internal convective heat flow and plate tectonics.

ASTR.6.4 Explains physical processes active on other planets (required: sequencing surface features on satellite images).

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## **ENERGY IN PLANETARY SYSTEMS**

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ASTR.7.1 Describes the flow of energy to and from planets and its influence in planetary systems.

ASTR.7.2 Explains the mechanisms of heat transfer (convection, conduction, radiation) among planets and their atmospheres.

ASTR.7.3 Demonstrates the effect of a planet's rotation on the movement of its atmosphere.

ASTR.7.4 Explains the cause and/or effects of climate changes over long periods of time.

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## **STELLAR SYSTEMS**

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ASTR.8.1 Describes the stages of a star's life using a Hertzsprung-Russell Diagram.

ASTR.8.2 Analyzes the effects of mass on the developmental stages of a star.

ASTR.8.3 Selects appropriate methods for observing, classifying, and determining distances to stars.

ASTR.8.4 Describes stages in the nebular theory of the origin of planets and planetary systems.

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## **COSMOLOGY**

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ASTR.9.1 Describes the Big Bang Theory as an explanation for the origin of the universe.

ASTR.9.2 Explains the evolution and life cycles of galaxies.

ASTR.9.3 Explains the reasoning leading to the acceptance of the existence of dark energy and dark matter.