**FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT**

# Final Course Outline
# Astronomy

**Date: October 2003**

**Subject Area: Physical/Earth Science**

**Proposed Grade Level(s): 10-12**

**Course Length: 1 Year**

**Grading: A-F**

**Number Of Credits: 5/Semester**

**Prerequisites: None**

## BRIEF COURSE DESCRIPTION:

Astronomy is a college-prep, physical/earth science, and descriptive course in modern astronomy from the Solar System to the stars, the galaxy, and the Big Bang theory of cosmology. The history and development of astronomy to present time will be examined. An understanding of how starlight reveals information about the size, structure, temperature, and distance of stars and galaxies will be developed. Laboratory exercises will reinforce the physical concepts learned.

## GENERAL GOALS/PURPOSES:

Students will learn facts, the difference between observations and inferences, science process skills, and critical thinking skills that will assist them in interpreting the natural environment. Astronomy is designed to help students realize the important role that science will play in their personal and professional lives. This knowledge will help them think through challenges and make informed decisions about issues involving science and technology. It is hoped that all students will develop a lifelong awareness of the potential and limitations of science and technology.

## STUDENT READING COMPONENT:

The text for this course is *Astronomy Today 4th Edition*, Chaisson and McMillan, 2002 (Upper Saddle River, NJ 07458, Prentice-Hall, Inc.). Reading and interpreting textual material and/or following laboratory directions are daily components of this class. There will also be supplemental reading assignments of current science events from the newspaper, the internet, and various science magazines.

Internet Resource URL: http://www.prenhall.com/chaisson

## STUDENT WRITING COMPONENT:

Students will be expected to write complete, grammatically correct sentences to answer questions about textual material. They will follow a prescribed format to write lab reports. Some assessments will require short essay answers. At least one project per quarter will have a written component.

**STUDENT ORAL COMPONENT:**

Students will work collaboratively during laboratory experiments. They will be expected to participate in class discussions about scientific principles currently being studied. Periodically, they will present information (i.e. whiteboard, PowerPoint, video) to the rest of the class about selected science concepts. There will be at least one formal presentation, which will be about one of the four projects.

**DETAILED UNITS OF INSTRUCTION:**

1. **Charting the Heavens**
   Foundations of Astronomy: Our Place in Space; Earth's Orbital Motion; Motion of the Moon; Measurement of Distance
2. **The Copernican Revolution**
   Birth of Modern Science: Ancient Astronomy; Geocentric Universe; Heliocentric Model of Solar System; Birth of modern Astronomy; Laws of Planetary Motion; Solar System Dimensions; Newton's Laws
3. **Radiation**
   Information from the Cosmos: Information from the Skies; Electromagnetic Spectrum; Distribution of Radiation; Doppler Effect
4. **Spectroscopy**
   Inner Workings of Atoms: Spectral Lines; Formation of Spectral Lines; Molecules; Spectral-Line Analysis
5. **Telescopes**
   Tools of Astronomy: Optical Telescopes; Telescope Size; High-Resolution Astronomy; Radio Astronomy; Interferometry; Space-Based Astronomy; Full-Spectrum Coverage
6. **The Solar System**
   Intro to Comparative Planetology: Inventory of Solar System; Planetary Properties; Overall Layout of Solar System; Terrestrial and Jovian Planets; Interplanetary Debris; Spacecraft Exploration of Solar System
7. **Earth**
   Our Home in Space: Overall structure of Earth; Earth's Atmosphere; Earth's Interior; Surface Activity; Earth's Magnetosphere; The Tides
8. **The Moon and Mercury**
   Scorched and Battered Worlds: Orbital Properties; Physical Properties; Surface Features; Rotation Rates; Cratering and Surface Composition; Interiors; History of the Moon and Mercury
9. **Venus**
   Earth's Sister Planet: Orbital Properties; Physical Properties; Observations of Venus; Surface of Venus; Atmosphere of Venus; Magnetic Field and Internal Structure
10. **Mars**
    Orbital Properties; Physical Properties; Observations of Mars; Surface of Mars; Martian Atmosphere and Internal Structure; Moons of Mars
11. **Jupiter**
    Giant of the Solar System: Orbital and Physical Properties; Atmosphere of Jupiter; Internal Structure; Magnetosphere; Moons of Jupiter; Jupiter's Rings
12. **Saturn**
    Spectacular Rings and Mysterious Moons: Orbital and Physical Properties; Saturn's Atmosphere; Interior and Magnetosphere; Ring System; Moons of Saturn
13. **Uranus, Neptune, Pluto**
    Outer Worlds of Solar System: Discovery of Uranus; Discovery of Neptune; Physical Properties of Uranus and Neptune; Atmospheres; Magnetospheres and Internal Structure; Moon Systems; Rings; Discovery of Pluto
14. **Solar System Debris**
    Keys to Solar System's Origin: Asteroids; Comets; Meteoroids
15. **The Formation of Planetary Systems**

Birth of Solar System: Modeling origin of Solar System; Condensation Theory; Differentiation of Solar System; Role of Catastrophes; Planets Beyond the Solar System

16. **The Sun**
    Our Parent Star: Physical Properties of Sun; Solar Interior; Solar Atmosphere; Active Sun; Heart of the Sun; Solar Neutrino Observations
17. **Measuring the Stars**
    Giants, Dwarfs, and the Main Sequence: Distances to Stars; Stellar Motion; Luminosity and Apparent Brightness; Inverse Square Law; Stellar Temperature; Stellar Sizes; Hertzsprung-Russell Diagram; Stellar Masses
18. **The Interstellar Medium**
    Gas and Dust among the Stars: Interstellar Matter; Emission Nebulae; Dark Dust Clouds; 21-centimeter Radiation; Interstellar Molecules
19. **Star Formation**
    A Traumatic Birth: Star-forming Regions; Formation of sun-like stars; Stars of other masses; Observations of Cloud Fragments and Proto-stars
20. **Stellar Evolution**
    Life of a Star: Leaving the Main Sequence; Evolution of a Sun-Like Star; Death of a Low Mass Star; Evolution of Stars more massive than the Sun; Observing Stellar Evolution in Star Clusters; Evolution of Binary-Star Systems
21. **Stellar Explosions**
    Novae, Supernovae, Formation of Heavy Elements: Life after Death for White Dwarfs; End of a High Mass Star; Supernovae Explosions; Formation of Elements; Cycle of Stellar Evolution
22. **Neutron Stars and Black Holes**
    Strange States of Matter: Neutron Stars; Pulsars; Neutron Star Binaries; Gamma-Ray Bursts; Black Holes; Black Holes and Curved Space; Space Travel Near Black Holes; Observational Evidence for Black Holes
23. **The Milky Way Galaxy**
    A Grand Design: Parent Galaxy; Measuring the Milky Way; Large-Scale Structure of Our Galaxy; Formation of the Milky Way; Galactic Spiral Arms; Mass of Milky Way Galaxy; Galactic Center
24. **Normal Galaxies**
    Large-Scale Structure of the Universe: Hubble Galaxy Classification; Distribution of Galaxies in Space; Galaxy Masses; Galaxy Formation and Evolution; Hubble's Law
25. **Active Galaxies and Quasars**
    Limits of the Observable Universe: Beyond the Local realm; Properties of Active Galaxies; Quasi-stellar objects; Central Engine of Active Galaxy; Quasars as Cosmic Probes; Active Galaxy Evolution
26. **Cosmology**
    Big-Bang and Fate of Universe: Universe on Largest Scales; Expanding Universe; Fate of Universe; Geometry of Space; Cosmic Microwave Background Radiation; Age of Universe

**THIS COURSE WILL PREPARE STUDENTS FOR THE HSEE AND FCUSD EXIT EXAM IN:**

Science

**LAB FEE, IF REQUIRED:** None

**SUBJECT AREA CONTENT STANDARDS TO BE ADDRESSED:**

**Specific California Science Content Standards** covered are listed with the units of instruction.

## EARTH SCIENCE - ASTRONOMY

**1. Astronomy and planetary exploration reveal the solar system's structure, scale, and change over time. As a basis for understanding this concept, students know:**

a. How the differences and similarities among the sun, the terrestrial planets, and the gas planets may have been established during the formation of the solar system. Units 3 - 15
b. How the evidence from Earth and moon rocks indicates that the solar system was formed from a nebular cloud of dust and gas approximately 4.6 billion years ago. Units 7, 8, 14 & 15
c. The evidence from geological studies of Earth and other planets suggest that the early Earth was very different from Earth today. Unit 7
d. The evidence indicating that the planets are much closer to Earth than the stars are.

**Units 1,2,6**
**Students will know:**
e. The Sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to form helium. Units 16 – 20
f. The evidence for the dramatic effects that asteroid impacts have had in shaping the surface of planets and their moons and in mass extinctions of life on Earth. Units 14 – 15
g. * The evidence for the existence of planets orbiting other stars. Unit 15

**2. Earth-based and space-based astronomy reveal the structure, scale, and changes in stars, galaxies, and the universe over time.**
**As a basis for understanding this concept students know:**
a. The solar system is located in an outer edge of the disc-shaped Milky Way galaxy, which spans 100,000 light years. Units 23 & 24
b. Galaxies are made of billions of stars and comprise most of the visible mass of the universe. Units 23 & 24
c. The evidence indicating that all elements with an atomic number greater than that of lithium have been formed by nuclear fusion in stars. Units 16 - 21
d. That stars differ in their life cycles and that visual, radio, and X-ray telescopes may be used to collect data that reveal those differences. Units 16 - 22
e. *The evidence indicating that the color, brightness, and evolution of a star are determined by a balance between gravitational collapse and nuclear fusion. Units 16 – 21
f. *How the red-shift from distant galaxies and the cosmic background radiation provide evidence for the "big bang" model that suggests that the universe has been expanding for 10 to 20 billion years. Units 25 & 26

**Investigation and Experimentation – Various Laboratory Exercises during each Unit of Instruction**
**1. Scientific progress is made by asking meaningful questions and conducting careful investigations.**
**As a basis for understanding this concept and addressing the content in the other four strands, students should develop their own questions and perform investigations. Students will:**
a. Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
b. Identify and communicate sources of unavoidable experimental error.
c. Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.
d. Formulate explanations by using logic and evidence.
e. Solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions.
f. Distinguish between hypothesis and theory as scientific terms.
g. Recognize the usefulness and limitations of models and theories as scientific representations of reality.
h. Read and interpret topographic and geologic maps.
i. Analyze the locations, sequences, or time intervals that are characteristic of natural phenomena (e.g., relative ages of rocks, locations of planets over time, and succession of species in an ecosystem).
j. Recognize the issues of statistical variability and the need for controlled tests.
k. Recognize the cumulative nature of scientific evidence.
l. Analyze situations and solve problems that require combining and applying concepts from more than one area of science.

m. Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. Examples of issues include irradiation of food, cloning of animals by somatic cell nuclear transfer, choice of energy sources, and land and water use decisions in California.
n. Know that when an observation does not agree with an accepted scientific theory, the observation is sometimes mistaken or fraudulent (e.g., the Piltdown Man fossil or unidentified flying objects) and that the theory is sometimes wrong (e.g., the Ptolemaic model of the movement of the Sun, Moon, and planets).

**DISTRICT ESLRs TO BE ADDRESSED:**

- All students will be expected to have assignments turned in on time and be prepared for class on any given day. In this respect, success depends on being a **self-directed learner**.
- Written and oral communications are both important in this class. Students will be expected to **communicate effectively** as they explain physical / earth science concepts and their relationships to daily life.
- Assessment of written and oral work requires students to be **quality producers** in order to be successful in this class.
- The lab activities that students are involved in require analysis and application of concepts to other situations. In order to synthesize and apply information, students need to be **constructive thinkers**.
- Lab activities and several other projects are done in cooperative groups. Students need to be **collaborative workers** in order to complete these tasks efficiently.
- In order to become **responsible citizens**, students use physical / earth science knowledge and scientific inquiry skills to make informed decisions about issues related to physical / earth science and modern technology