

# FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT

## Final Course Outline Physical/Earth Science

**Date: September 2005**  
**Proposed grade level(s): 9**  
**Grading: A – F**  
**Prerequisites: none**

**Subject Area: Physical Science**  
**Course Length: 1 Year**  
**Number of Credits: 5/Semester**

### **COURSE DESCRIPTION:**

Physical/Earth Science is an introductory laboratory science course that focuses on student education in chemistry, physics, earth science, and ecology. Incorporated within earth science and ecology will be instruction in astronomy, geology, mapping skills, latitude and longitude, topographic maps, California geography and how organisms interact with the environment. The protocol of lab experiments and lab write-ups will also be introduced to the student. Elements of critical thinking are indicated throughout the outline.

### **GENERAL GOALS/PURPOSES:**

Science is an active dynamic pursuit that utilizes human ability to make observations, experiment and then draw conclusions that explain our universe. The conclusions obtained through experiment are called scientific theories. These theories are taken as scientific fact but are always subject to change as new scientific evidence is discovered through advances in technology and experimental techniques. In keeping with this standard, 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.

Physical/Earth science 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.

The subject areas covered are:

- Investigation and Experimentation
- Chemistry:
  - Atomic and Molecular Structure
  - Chemical Bonds
  - Acids and Bases
  - Chemical Thermodynamics
  - Nuclear Processes
- Earth Science:
  - Earth's Place in the Universe
  - Dynamic Earth Process
  - Energy in the Earth System
  - Biochemical Cycles
  - California Geology

- Physics:
  - Motion and Forces
  - Conservation of Energy and Momentum
  - Electric and Magnetic Phenomena

### **STUDENT READING COMPONENT:**

The goal of reading in Physical Science is to create scientifically literate students. The reading strategies emphasize key concepts students need to understand our universe.

The text for this course is, Holt Science Spectrum: Physical Science, A Physical Approach authored by Ken Dobson, John Holman, and Michael Roberts, and published by Holt, Rinehart and Winston. 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 or texts.

### **STUDENT WRITING COMPONENT:**

Students will be expected to write and complete, grammatically correct sentences to answer questions about science material. They will follow a prescribed format to write lab reports. Some assessments will require short essay answers. There will be at least one project per quarter that will have a written component. This component will be primarily evaluated on the quality of its scientific content.

### **STUDENT ORAL COMPONENT:**

Students will work collaboratively during laboratory experiments.

Students 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 class projects.

### **DETAILED UNITS OF INSTRUCTION:**

The following time line is for general reference only. As students become actively involved in exploring science concepts and processes that are part of each unit, the time line will be adjusted to allow for student-initiated learning activities and projects. In these cases, subsequent units may be shortened or lengthened at the teacher's discretion. While all the standards will be covered, time lines are flexible.

The learning of science by students is an ongoing process. Previous classes taken in science set a foundation to build upon in more advanced classes. Advanced classes cover more complex concepts both conceptually and mathematically. The eighth grade General Science Class Outline sets the foundation for ninth grade Physical Science.

Note – The number and letter sequencing is intentionally listed out of order. They directly correspond to the California State Science Standards for 8<sup>th</sup> grade science.

### **SEMESTER 1:**

**California Content Standard: Investigation and Experimentation.** (2 weeks)

**1. Scientific Progress is made by 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 explain sources of unavoidable experimental error.
- c) Identify possible reasons for inconsistent results such as uncontrolled conditions or instrument error.
- d) Formulate explanations using logic and evidence.
- e) Solve scientific problems using principles of algebra.
- f) Distinguish between hypothesis and theory as used in science.
- 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. For example, the relative age of rocks, the locations of planets over time and the 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. Some examples 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 usually mistaken or fraudulent (e.g. the Piltdown Man fossil or unidentified flying objects) and that theory is sometimes wrong and must be modified or thrown out to fit the new data (e.g. Ptolemaic model of the movement of our solar system).

**This standard correlates specifically to chapter 1 (2001 and 2004 ed.) but also relates to all chapters and laboratory exercises in Holt Science Spectrum text.**

**California Content Standard: Chemistry**

**Atomic and Molecular Structure of Matter. (6 weeks)**

**1. The Periodic table displays the elements in increasing atomic number and shows how periodicity of the physical and chemical properties of the elements relates to atomic structure. As a basis for understanding this concept students will:**

- a) Know what matter is, how it is different than energy and be able to distinguish its physical and chemical properties.
- b) Know how to relate the position of an element in the periodic table to its atomic number and atomic mass.
- c) Know how to use the periodic table to identify metals, semimetals, nonmetals and halogens.
- d) Know how to use the periodic table to identify alkali metals, alkaline earth metals and transition metals, trends in ionization energy, electronegativity, and the relative sizes of atoms and ions.
- e) Know how to use the periodic table to determine the number of electrons available for bonding.
- f) Know the nucleus of an atom is much smaller than the atom yet contains most of its mass.

- g) Know how to use the periodic table to identify the lanthanide, actinide, and transactinide elements and know that the transuranium elements were synthesized and identified through the use of nuclear accelerators.

**This standard correlates to chapters 2 and 3 (2001 ed.) and chapters 2, 3, 4 (2004 ed.) in Holt Science Spectrum.**

**Chemical Bonds.** (2 weeks)

**2. Biological, chemical, and physical properties of matter result from the ability of atoms to form bonds from electrostatic forces between electrons and protons and between atoms and molecules. As a basis for understanding this concept:**

- Students know atoms combine to form molecules by sharing electrons to form covalent or metallic bonds or by exchanging electrons to form ionic bonds.
- Students know chemical bonds between atoms in molecules such as H<sub>2</sub>, CH<sub>4</sub>, NH<sub>3</sub>, H<sub>2</sub>CCH<sub>2</sub>, N<sub>2</sub>, Cl<sub>2</sub>, and many large molecules are covalent.
- Students know salt crystals, such as NaCl, are repeating patterns of positive and negative ions held together by electrostatic attraction.

**This standard correlates to chapter 4 (2001 ed.) and chapters 5, 6 (2004 ed.) in Holt Science Spectrum.**

**Acids and Bases** (2 weeks)

**5. Acids, bases, and salts are three classes of compounds that form ions in water solutions. As a basis for understanding this concept:**

- Students know the observable properties of acids, bases, and salt solutions.
- Students know strong acids and bases fully dissociate and weak acids and bases partially dissociate.

**This standard correlates to chapter 6 (2001 ed.) and chapter 8 (2004 ed.) in Holt Science Spectrum.**

**Chemical Thermodynamics** (2 weeks)

**7. Energy is exchanged or transformed in all chemical reactions and physical changes of matter. As a basis for understanding this concept:**

- Students know chemical processes can either release (exothermic) or absorb (endothermic) thermal energy.
- Students know energy is released when a material condenses or freezes and is absorbed when a material evaporates or melts.

**This standard correlates to chapter 5 (2001 ed.) and chapter 3 (2004 ed.) in Holt Science Spectrum.**

**Nuclear Processes** (2 weeks)

**11. Nuclear processes are those in which an atomic nucleus changes, including radioactive decay of naturally occurring and human-made isotopes, nuclear fission, and nuclear fusion. As a basis for understanding this concept:**

- Students know protons and neutrons in the nucleus are held together by nuclear forces that overcome the electromagnetic repulsion between the protons.
- Students know the energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions. The change in mass (calculated by  $E = mc^2$ ) is small but significant in nuclear reactions.
- Students know some naturally occurring isotopes of elements are radioactive, as are isotopes formed in nuclear reactions.
- Students know the three most common forms of radioactive decay (alpha, beta, and gamma) and know how the nucleus changes in each type of decay.
- Students know alpha, beta, and gamma radiation produce different amounts and kinds of damage in matter and have different penetrations.

**This standard correlates to chapter 7 (2001 ed.) and chapter 9 (2004 ed.) in Holt Science Spectrum.**

## **SEMESTER 2**

**California Standard: Earth Science (14- 20 weeks)**

**Earth's Place in the Universe (4 weeks)**

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

- a) Students know 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.
- b) Students know 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.
- c) Students know that the evidence from geological studies of Earth and other planets suggests that the early Earth was very different from Earth today.
- d) Students know the evidence indicating the planets are much closer to Earth than the stars are.
- e) Students know the Sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to helium.
- f) Students know 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.

**This standard correlates to chapter 16 (2001 ed.) and chapters 19, 20 (2004 ed.) in Holt Science Spectrum and chapter 1 in Prentice Hall Earth Science.**

**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:**

- a) Students know the solar system is located in an outer edge of the disc-shaped Milky Way galaxy, which spans 100,000 light years.
- b) Students know galaxies are made of billions of stars and comprise most of the visible mass of the universe.
- c) Students know the evidence indicating that all elements with an atomic number greater than that of lithium have been formed by nuclear fusion in stars.
- d) Students know 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.

**This standard correlates to chapter 16 (2001 ed.) and chapters 19, 20 (2004 ed.) in Holt Science Spectrum.**

**Dynamic Earth Process (5 weeks)**

**3. Plate tectonics operating over geologic time have changed the patterns of land, sea, and mountains on Earth's surface. As the basis for understanding this concept:**

- a) Students know features of the ocean floor (magnetic patterns, age, and sea-floor topography) provide evidence of plate tectonics.
- b) Students know the principle structures that form at the three different kinds of plate boundaries.
- c) Students know how to explain the properties of rocks based on physical and chemical conditions in which they formed, including plate tectonic processes.
- d) Students know why and how earthquakes occur and the scales used to measure their intensity and magnitude.
- e) Students know there are two kinds of volcanoes: one kind with violent eruptions producing steep slopes and the other kind with voluminous lava flows producing gentle slopes.

**This standard correlates to chapter 17 (2001 ed.) and chapter 21 (2004 ed.) in Holt Science Spectrum and chapters 3, 8, 9, 10 in Prentice Hall Earth Science.**

**Energy in the Earth system (4 weeks)**

**4. Energy enters the Earth system primarily as solar radiation and eventually escapes as heat. As the basis for understanding this concept:**

- a) Students know the relative amount of incoming solar energy compared with the Earth's internal energy and the energy used by society.
- b) Students know the fate of incoming solar radiation in terms of reflection, absorption, and photosynthesis.
- c) Students know the different atmospheric gases that absorb the Earth's thermal radiation and mechanism and the significance of the greenhouse effect.

**This standard correlates to chapter 16 (2001 ed.) and chapter 22 (2004 ed.) Holt Science Spectrum.**

**5. Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and the oceans, producing winds and ocean currents. As a basis for understanding this concept:**

- a) Students know how differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat.
- b) Students know the relationship between the rotation of the Earth and the circular motions of ocean currents and air in pressure centers.
- c) Students know the origin and effects of temperature inversions.
- d) Students know properties of ocean water, such as temperature and salinity, can be used to explain the layered structure of the oceans, the generation of horizontal and vertical ocean currents, and the geographic distribution of marine organisms.
- e) Students know rain forests and deserts on Earth are distributed in bands at specific latitudes.

**This standard correlates to chapter 18 (2001 ed.) and chapter 22 (2004 ed.) in Holt Science Spectrum and chapters 14 –19 in Prentice Hall Earth Science.**

**6. Climate is the long-term average of a region's weather and depends on many factors. As a basis for understanding this concept:**

- a) Students know weather (in the short run) and climate (in the long run) involve the transfer of energy into and out of the atmosphere.
- b) Students know the effects on climate of altitude, elevation, topography, and proximity to large bodies of water and cold or warm ocean currents.
- c) Students know how Earth's climate has changed over time, corresponding to changes in Earth's geography, atmospheric composition, and other factors, such as solar radiation and plate movement.

**This standard correlates to chapter 18 (2001 ed.) and chapter 22 (2004 ed.) in Holt Science Spectrum and chapters 20 and 21 in Prentice Hall Earth Science.**

#### **Biochemical Cycles (2 weeks)**

**7. Each element on Earth moves among reservoirs, which exist in the solid earth, in oceans, in the atmosphere, and within and among organisms as part of biogeochemical cycles. As a basis for understanding this concept:**

- a) Students know the carbon cycle of photosynthesis and respiration and the nitrogen cycle.
- b) Students know the global carbon cycle: the different physical and chemical forms of carbon in the atmosphere, oceans, biomass, fossil fuels, and the movement of carbon among these reservoirs.
- c) Students know the movement of matter among reservoirs is driven by Earth's internal and external sources of energy.

**This standard correlates to chapters 3, 4, 15 and 17 in Prentice Hall Earth Science.**

#### **Structure and composition of the atmosphere (2 weeks)**

**8. Life has changed Earth's atmosphere, and changes in the atmosphere affect conditions for life. As a basis for understanding this concept:**

- a) Students know the thermal structure and chemical composition of the atmosphere.

- b) Students know how the composition of Earth's atmosphere has evolved over geologic time and know the effect of outgassing, the variations of carbon dioxide concentration, and the origin of atmospheric oxygen.
- c) Students know the location of the ozone layer in the upper atmosphere, its role in absorbing ultraviolet radiation, and the way in which this layer varies both naturally and in response to human activities.

**This standard correlates to chapter 18 (2001 ed.) and chapter 22 (2004 ed.) in Holt Science Spectrum and chapters 17 in Prentice Hall Earth Science.**

### California Geology (2 weeks)

**9. The geology of California underlies the state's wealth of natural resources as well as its natural hazards. As a basis for understating this concept:**

- a) Students know the resources of major economic importance in California and their relation to California's geology.
- b) Students know the principle natural hazards in different California regions and the geologic basis of those hazards.
- c) Students know the importance of water to society, the origins of California's fresh water, and the relationship between supply and need.

**This standard correlates to chapter 19 in Holt Science Spectrum and chapter 13A in Prentice Hall Earth Science.**

### California State Standard: PHYSICS (Time left in school year.)

Teachers can choose from the chapters below to cover as much as time allows. Although there is a state standard as indicated below, the Earth Science State Test does not address this area of science. These areas are important concepts for students in science because they prepare them for more advanced classes.

#### Motion and Forces

**1. Newton's laws predict the motion of most objects. As a basis for understanding this concept:**

- a) Students know how to solve problems that involve constant speed and average speed.
- b) Students know that when forces are balanced, no acceleration occurs; thus an object continues to move at a constant speed or stays at rest (Newton's first law).
- c) Students know how to apply the law  $F=ma$  to solve one-dimensional motion problems that involve constant forces (Newton's second law).
- d) Students know that when one object exerts a force on a second object, the second object always exerts a force of equal magnitude and in the opposite direction (Newton's third law).
- e) Students know the relationship between the universal law of gravitation and the effect of gravity on an object at the surface of Earth.
- f) Students know applying a force to an object perpendicular to the direction of its motion causes the object to change direction but not speed (e.g., Earth's gravitational forces causes a satellite in a circular orbit to change direction, but not speed).

**This standard correlates to chapter 8 (2001 ed.) and chapters 10, 11 (2004 ed.) in Holt Science Spectrum.**

#### Conservation of Energy and Momentum

**2. The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects. As a basis for understanding this concept:**

- a) Students know how to calculate kinetic energy by using the formula  $E=1/2mv^2$ .
- b) Students know how to calculate changes in gravitational potential energy near Earth by using the formula (change in potential energy) =  $mgh$  (h is the change in elevation).
- c) Students know how to solve problems involving conservation of energy in simple systems, such as falling objects.
- d) Students know how to calculate momentum as the product  $mv$ .

**This standard correlates to chapter 9 (2001 ed.) and chapter 12 (2004 ed.) Holt Science Spectrum.  
Electric and Magnetic Phenomena**

**5. Electric and magnetic phenomena are related and have many practical applications. As a basis for understanding this concept:**

- f) Students know magnetic materials and electric currents (moving electric charges) are sources of magnetic fields and are subject to forces arising from the magnetic fields of other sources.
- g) Students know how to determine the direction of a magnetic field produced by a current flowing in a straight wire or in a coil.

**This standard correlates to chapters 13 and 14 (2001 ed.) and chapters 16, 17 (2004 ed.) Holt Science Spectrum.**

### **Waves, Sound, and Light**

**3. Waves have characteristic properties that do not depend on the type of wave. As a basis for understanding this concept:**

- a) Students know that waves carry energy from one point to another.
- b) Students know how to identify transverse and longitudinal waves in mechanical media, such as springs and rope, and on the Earth (seismic waves).
- c) Students know sound is a longitudinal wave whose speed is depends on the properties of the medium in which it propagates.
- d) Students know that radio waves, light and X-rays are different wavelength bands in the spectrum of electromagnetic waves whose speed in a vacuum is approximately  $3 \times 10^8$  m/s (186,000 mile/second).
- e) Students know how to identify the characteristic properties of waves: interference (beats), diffraction, reflection, Doppler effect, and polarization.

**This standard correlates to chapters 11, 12 (2001 ed.) and chapters 14, 15 (2004 ed.) Holt Science Spectrum.**

### **THIS COURSE WILL PREPARE STUDENTS FOR THE CAHSEE AND / OR THE FCUSD EXIT EXAMS:**

Writing, Reading, Math, Science

### **LAB FEE, IF REQUIRED:**

None

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

Ninth Grade Science Standards.

### **DISTRICT ESLRs TO BE ADDRESSED:**

- **SELF – DIRECTED LEARNERS:** All students will be expected to have assignments turned in on time, and be prepared for class. In this respect, success depends on being a self-directed learner.
- **EFFECTIVE COMMUNICATORS:** Written and oral communications are both important in this class. Students will be expected to be effective communicators as they explain physical science concepts and their relationships to daily life.
- **QUALITY PRODUCERS / PERFORMERS:** Assessment of written and oral work requires students to be quality producers in order to be successful in this class.

- **CONSTRUCTIVE THINKERS:** 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.
- **COLLABORATIVE WORKERS:** Lab activities and several projects are done in cooperative groups. Students need to be collaborative workers in order to complete these tasks efficiently.
- **RESPONSIBLE CITIZENS:** Students use physical science knowledge and scientific inquiry skills to make informed decisions about issues related to physical science and technology. This requires students to be responsible citizens.