Murrieta Valley Unified School District
High School Course Outline
October 2005

Department: Science

Course Title: Earth Science

Course Number: 3500

Grade Level: 10-12

Length of Course: Year

Prerequisite: Completion of CP Biology with a grade of "C"or better.

UC/CSU (A-G) Requirement: G (Pending UC Approval)

Brief Course Description: Students gain an understanding of the Earth's place in the Universe, as well as the dynamic external and internal processes that shape the Earth and impact life. This course meets the Physical Science requirement for graduation as well as the "G" elective requirement for UC/CSU schools.

I. Goals

The student will:

A. Understand the structure, scale, and change of the solar system over time.

1. 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 (*Earth Science Standard 1.a*).

2. Know the evidence from Earth and Moon rocks indicates that the solar system was formed from a nebula cloud of dust and gas approximately 4.6 billion years ago (*Earth Science Standard 1.b*).

3. Know the evidence from geological studies of Earth and other planets suggests that the early Earth was very different from Earth today (*Earth Science Standard 1.c*).

4 Know the evidence indicating that the planets are much closer to Earth than the stars are (*Earth Science Standard 1.d*).

5. Know the Sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to form helium (*Earth Science Standard 1.e*).

6. 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 (*Earth Science Standard 1.f*).

7. Know the evidence for the existence of planets orbiting other stars (*Earth Science Standard 1.g*).

B. Understand the structure, scale, and change of the universe over time.

1. Know the solar system is located in an outer edge of the disc-shaped Milky Way galaxy, which spans 100,000 light years (*Earth Science Standard 2.a*).

2. Know galaxies are made of billions of stars and comprise most of the visible mass of the universe (*Earth Science Standard 21.b*).

3. Know the evidence indicating that all elements with an atomic number greater than that of lithium have been formed by nuclear fusion in stars (*Earth Science Standard 2.c*).

4. 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 (*Earth Science Standard 2d*).

5. Know accelerator boost subatomic particles to energy levels that simulate conditions in the stars and in the early history of the universe before stars formed (*Earth Science Standard 2.e*).

6. Know the evidence indicating that the color, brightness, and evolution of a star are determined by a balance between gravitational collapse and nuclear fusion (*Earth Science Standard 2.f*).

7. Know 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 (*Earth Science Standard 2.g*).

C. Describe the processes that have shaped the Earth’s surface features over time.

1. Know features of the ocean floor (magnetic patterns, age, and sea-floor topography) provide evidence of plate tectonics (*Earth Science Standard 3.a*).

2. Know the principal structures that form at the three different kinds of plate boundaries (*Earth Science Standard 3.b*).

3 Know how to explain the properties of rocks based on the physical and chemical conditions in which they formed, including plate tectonic processes (*Earth Science Standard 3.c*).

4. Know why and how earthquakes occur and the scales used to measure their intensity and magnitude (*Earth Science Standard 3.d*).

5. 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 (*Earth Science Standard 3.e*).

6. Know the explanation for the location and properties of volcanoes that are due to hot spots and the explanation for those that are due to subduction (*Earth Science Standard 3.f*).

D. Explain the exchange of energy into and out of the Earth system.

1. Know the relative amount of incoming solar energy compared with Earth's internal energy and the energy used by society (*Earth Science Standard 4.a*).

2. Know the fate of incoming solar radiation in terms of reflection, absorption, and photosynthesis (*Earth Science Standard 4.b*).

3. Know the difference atmospheric gases that absorb the Earth's thermal radiation and the mechanism and significance of the greenhouse effect (*Earth Science Standard 4.c*).

4. Know the differing greenhouse conditions of Earth, Mars, and Venus; the origins of those conditions; and the climatic consequences of each (*Earth Science Standard 4.d*).

E. Demonstrate an understanding of the solar driven circulation systems within the Earth's oceans and atmosphere.

1. Know how differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat (*Earth Science Standard 5.a*).

2. Know the relationship between the rotation of Earth and the circular motions of ocean currents and air in pressure centers (*Earth Science Standard 5.b*).

3 Know the origin and effects of temperature inversions (*Earth Science Standard 5.c*).

4. 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 (*Earth Science Standard 5.d*).

5. Know rain forests and deserts on Earth are distributed in bands at specific latitudes (*Earth Science Standard 5.e*).

6. Know the interaction of wind patters, ocean currents, and mountain ranges results in the global pattern of latitudinal bands of rain forests and deserts (*Earth Science Standard 5.f*).

7. Know features of the ENSO (El Nino southern oscillation) cycle in terms of sea-surface and air temperature variations across the Pacific and some climatic results of this cycle (*Earth Science Standard 5.g*).

F. Analyze local and global climate factors and their influence over time.

1. Know weather (in the short run) and climate (in the long run) involve the transfer of energy into and out of the atmosphere (*Earth Science Standard 6.a*).

2. Know the effects on climate of latitude, elevation, topography, and proximity to large bodies of water and cold or warm ocean currents (*Earth Science Standard 6.b*).

3. Know how the 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 (*Earth Science Standard 6.c*).

G. Use appropriate tools and technology to recognize and solve physical problems by experimental investigation, formal logic, and mathematical reasoning when appropriate.

1. Select and use appropriate tools and technology (such as computer-lined probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data (*Investigation and Experimentation Standard 1.a)*.

2. Identify and communicate sources of unavoidable experimental error (*Investigation and Experimentation Standard 1.b).*

3. Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions (*Investigation and Experimentation Standard 1.c).*

4. Formulate explanations by using logic and evidence (*Investigation and Experimentation Standard 1.d).*

5. Solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions (*Investigation and Experimentation Standard 1.e).*

6. Distinguish between hypothesis and theory as scientific terms (*Investigation and Experimentation Standard 1.f).*

7. Recognize the usefulness and limitations of models and theories as scientific representations of reality (*Investigation and Experimentation Standard 1.g).*

8. Read and interpret topographic and geologic maps (*Investigation and Experimentation Standard 1.h).*

9. 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.) (*Investigation and Experimentation Standard 1.i)*

10. Recognize the issues of statistical variability and the need for controlled tests (*Investigation and Experimentation Standard 1.j).*

11. Recognize the cumulative nature of scientific evidence (*Investigation and Experimentation Standard 1.k).*

12. Analyze situations and solve problems that require combining and applying concepts from more than one area of science (*Investigation and Experimentation Standard 1.l).*

15. 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 (*Investigation and Experimentation Standard 1.m).*

16. 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) (*Investigation and Experimentation Standard 1.n).*

II. Outline of Content for Major Areas of Study

Semester I

A. Measurement
   1. Metric system.
   2. Experimental techniques

B. The Universe and its Elements, Galaxies and Stars
   1. Exploration of the structure, scale, and dynamics of the universe.
   2. Galaxies and our home in the Milky Way.
   3. The life cycle of stars.

C. Our place in the Universe, the Solar System
   1. The Sun and the formation of the Solar System.
   2. Planets and other elements of the Solar System.
   3. Interactions within the Solar System.

D. Dynamic Earth processes
   1. Plate tectonics shape the surface of the Earth.
   2. Volcanoes and earthquakes provide evidence of change.
   3. The geologic record, clues to the past.

E. Key geologic features of California
   1. Faults, volcanoes, and earthquakes.
   2. Natural resources and energy.

Semester II

A. Energy in the Earth System: Energy in and out
   1. External vs. internal sources and uses of energy on Earth.

2. Impact of reflection, absorption, and photosynthesis on incoming solar radiation
3. Greenhouse gases, their abundance, sources, and impact on global temperatures

B. Effects of heat in the Earth system
1. Circulation patterns in atmosphere and oceans
2. Earth's rotation and the effect on surface currents and winds
3. Temperature inversions
4. Layering of the oceans (temperature and salinity) and effect on marine life
5. Distribution of rain forests and deserts and relationship to circulation patterns

C. Climate
1. Effect of latitude, elevation, and distances from large bodies of water on climate of a region
2. Climate change – past, present, and future. What drives climate change?
3. Computer modeling of climate future – limitations and possibilities

D. Biogeochemical Cycles
1. Carbon Cycle
2. Movement within Earth's internal reservoirs (water, plate material, etc.)

E. Earth's Atmosphere
1. Composition and thermal structure of atmospheric layers
2. Evolution of Earth's atmosphere
3. Ozone layer – location, importance, source, status

III. Accountability Determinants

A. Key Assignments

1. Star Map Lab – Create and learn to use a star map
2. Spectrograph Lab – Analyze sunlight to discover element content.
3. Eclipse Lab – Modeling of solar and lunar eclipses.
4. Night Sky Survey Lab - Use of the school telescope for a survey of planetary and celestial objects.
5. Earthquake Plotting and Triangulation Lab – Surface location and depth profiling of earthquakes.
6. Volcano Lab – Plotting volcanic chains and type analysis.
7. San Andreas Fault Report and Presentation – Internet research and reports on segments of the San Andreas Fault.

8. California Resources Project – Research and Power Point presentation on one of California's resources or geologic features.
9. Greenhouse Gases Lab – Analysis of greenhouse gases and their effects on the climate.
10. Ocean Currents Lab – Mapping of ocean currents and prediction of effects caused by their disappearance.
11. Weather Prediction Lab – Use of instruments to collect weather data and local forecasting.
12. Weather Power Point Presentations – Research and presentations on severe weather.
13. Climate Zone Lab – Creation of climate zone maps for the continents.
14. Water Cycle Lab – Modeling of the water cycle.
15. Mineral Identification Lab – Testing and identification of mineral samples.
16. Alternative Energy Resources Project – Research and report on alternative energy resources that are currently available.
17. Hydrocarbon Web Quest – Internet activity.

B. Assessment Methods

1. Teacher observations of day-to-day classroom participation and problem solving ability
2. Performance on laboratory component of the course by evaluation of formal lab write-ups.
3. Individual performance on exams and quizzes.
4. Evaluation of group and individual projects.
5. Performance on standardized tests.

IV. Instructional Materials and Methodologies

A. Required Textbook(s)

Lutgens, Frederick K & Tarbuck, Edward J. *Earth Science: California Edition*. New Jersey: Prentice Hall, 2006.

B. Instructional Methodologies

1. Lectures
2. Laboratory activities
3. Demonstrations
4. Cooperative Learning activities
5. Research projects
6. Multimedia presentations