Content covered in this course is described in the High School Course of Study. Based upon student needs, teachers select appropriate materials from the Instructional Materials List. Classroom presentations of course content are determined by the instructor and described under Teacher Activities. A more detailed outline of this course can be obtained from the instructor.

OVERVIEW:
Earth Science is a one-year, lab based science course designed to allow freshman high school students the opportunity to learn about the role of physical and chemical processes that have formed the universe as we know it as well as the unique planet on which we live. This course is designed to serve as the physical science requirement for graduation as well as the first high school science course in a four-year science curriculum.

COURSE OF STUDY OBJECTIVES:
1.0 Astronomy and planetary exploration reveal the solar system's structure, scale, and change over time. The student will learn:
   a. 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. 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. Evidence from geological studies of Earth and other planets suggest that the early Earth was very different from Earth today.
   d. Evidence indicating that the planets are much closer to Earth than the stars are.
   e. The Sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to form helium.
   f. 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.

   1.1 SUGGESTED STUDENT ACTIVITIES:
   - Reading, note taking, review questions, concept maps
   - Labs
   - Computer study links
   - Content reading worksheets

   1.2 INSTRUCTIONAL MATERIALS USED:
   - Adopted textbook
   - Computers
   - Supplemental material

   1.3 TEACHER ACTIVITIES:
   - Guided lecture
   - Reading for content
   - PowerPoint
   - Demonstration

2.0 Earth-based and space-based astronomy reveal the structure, scale, and changes in stars, galaxies, and the universe over time. The student will understand:
   a. The solar system is located in an outer edge of the disc-shaped Milky Way galaxy, which spans 100,000 light years
   b. Galaxies are made of billions of stars and comprise most of the visible mass of the universe.
   c. The evidence indicating that all elements with an atomic number greater than that of
lithium have been formed by nuclear fusion in stars.
d. Stars differ in their life cycles and that visual, radio, and X-ray telescopes may be used
to collect data that reveal those differences.
e. Accelerators boost subatomic particles to energy levels that simulate conditions in the
stars and in the early history of the universe before stars formed.
f. The evidence indicating that the color, brightness, and evolution of a star are
determined by a balance between gravitational collapse and nuclear fusion.
g. 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.
2.1  SUGGESTED STUDENT ACTIVITIES:
• Reading, note taking, review questions, concept maps
• Labs
• Computer study links
• Content reading worksheets

2.2  INSTRUCTIONAL MATERIALS USED:
• Adopted textbook
• Computers
• Supplemental material

2.3  TEACHER ACTIVITIES:
• Guided lecture
• Reading for content
• PowerPoint
• Demonstration

3.0  Plate tectonics operating over geologic time has changed the patterns of land, sea,
and mountains on Earth’s surface. The student will understand:
a. Features of the ocean floor (magnetic patterns, age, and sea-floor topography)
provide evidence of plate tectonics.
b. Principal structures that form at the three different kinds of plate boundaries.
c. The properties of rocks are based on the physical and chemical conditions in
which they formed, including plate tectonic processes.
d. Why and how earthquakes occur and the scales used to measure their intensity and
magnitude.
e. Two kinds of volcanoes: one kind with violent eruptions producing steep slopes and
the other kind with voluminous lava flows producing gentle slopes.
f. The explanation for the location and properties of volcanoes are due to hot spots and
the explanation for those that are due to subduction.
3.1  SUGGESTED STUDENT ACTIVITIES:
• Reading, note taking, review questions, concept maps.
• Labs and investigations
• Computer study links
• Content reading worksheets

3.2  INSTRUCTIONAL MATERIALS USED:
• Adopted textbook
• Computers
• Supplemental material

3.3  TEACHER ACTIVITIES:
• Guided lecture
• Reading for content
• PowerPoint
• Demonstration
4.0 **Energy enters the Earth system primarily as solar radiation and eventually escapes as heat.** The student will understand:
- The relative amount of incoming solar energy compared with Earth’s internal energy and the energy used by society.
- The fate of incoming solar radiation in terms of reflection, absorption, and photosynthesis.
- The different atmospheric gases that absorb the Earth’s thermal radiation and the mechanism and significance of the greenhouse effect.
- The differing greenhouse conditions on Earth, Mars, and Venus; the origins of those conditions; and the climatic consequences of each.

4.1 **SUGGESTED STUDENT ACTIVITIES:**
- Reading, note taking, review questions, concept maps.
- Labs and investigations
- Computer study links
- Content reading worksheets

4.2 **INSTRUCTIONAL MATERIALS USED:**
- Adopted textbook
- Computers
- Supplemental material

4.3 **TEACHER ACTIVITIES:**
- Guided lecture
- Reading for content
- PowerPoint
- Demonstration

5.0 **Heating of Earth’s surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents.** The student will understand:
- How differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat.
- The relationship between the rotation of Earth and the circular motions of ocean currents and air in pressure centers.
- The origin and effects of temperature inversions
- 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.
- Rain forests and deserts on Earth are distributed in bands at specific latitudes.
- The interaction of wind patterns, ocean currents, and mountain ranges results in the global pattern of latitudinal bands of rain forests and deserts.
- Features of the ENSO (El Niño southern oscillation) cycle in terms of sea surface and air temperature variations across the Pacific and some climatic results of this cycle.

5.1 **SUGGESTED STUDENT ACTIVITIES:**
- Reading, note taking, review questions, concept maps
- Labs and investigations
- Computer study links
- Content reading worksheets

5.2 **INSTRUCTIONAL MATERIALS USED:**
- Adopted textbook
- Computers
- Supplemental material

5.3 **TEACHER ACTIVITIES:**
- Guided lecture
- Reading for content
- PowerPoint
6.0 **Climate is the long-term average of a region’s weather and depends on many factors. The student will understand:**

a. Weather (in the short run) and climate (in the long run) involve the transfer of energy into and out of the atmosphere.

b. The effects on climate of latitude, elevation, topography, and proximity to large bodies of water and cold or warm ocean currents.

c. 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.

d. Computer models are used to predict the effects of the increase in greenhouse gases on climate for the planet as a whole and for specific regions.

6.1 **SUGGESTED STUDENT ACTIVITIES:**

- Reading, note taking, review questions, concept maps.
- Labs and investigations
- Computer study links
- Content reading worksheets

6.2 **INSTRUCTIONAL MATERIALS USED:**

- Adopted textbook
- Computers
- Supplemental material

6.3 **TEACHER ACTIVITIES:**

- Guided lectures
- Reading for content
- PowerPoint
- Demonstration

7.0 **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. The student will learn:**

a. The carbon cycle of photosynthesis and respiration and the nitrogen cycle.

b. 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. The movement of matter among reservoirs is driven by Earth’s internal and external sources of energy.

d. The relative residence times and flow characteristics of carbon in and out of its different reservoirs.

7.1 **SUGGESTED STUDENT ACTIVITIES:**

- Reading, note taking, review questions, concept maps.
- Labs and investigations
- Computer study links
- Content reading worksheets

7.2 **INSTRUCTIONAL MATERIALS USED:**

- Adopted textbook
- Computers
- Supplemental material

7.3 **TEACHER ACTIVITIES:**

- Guided lecture
- Reading for content
- PowerPoint
- Demonstration
8.0 **Life has changed Earth's atmosphere, and changes in the atmosphere affect conditions for life. The student will learn:**

a. The thermal structure and chemical composition of the atmosphere.

b. How the composition of Earth's atmosphere has evolved over geologic time and know the effect of out gassing, the variations of carbon dioxide concentration, and the origin of atmospheric oxygen.

c. 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.

8.1 **SUGGESTED STUDENT ACTIVITIES:**

- Reading, note taking, review questions, concept maps.
- Labs and investigations
- Computer study links
- Content reading worksheets

8.2 **INSTRUCTIONAL MATERIALS USED:**

- Adopted textbook
- Computers
- Supplemental material

8.3 **TEACHER ACTIVITIES:**

- Guided lecture
- Reading for content
- PowerPoint
- Demonstration

9.0 **The geology of California underlies the state's wealth of natural resources as well as its natural hazards. The student will acknowledge:**

a. The resources of major economic importance in California and their relation to California's geology.

b. The principal natural hazards in different California regions and the geologic basis of those hazards.

c. The importance of water to society, the origins of California's fresh water, and the relationship between supply and need.

d. How to analyze published geologic hazard maps of California and know how to use the map's information to identify evidence of geologic events of the past and predict geologic changes in the future.

9.1 **SUGGESTED STUDENT ACTIVITIES:**

- Reading, note taking, review questions, concept maps.
- Labs and investigations
- Computer study links
- Content reading worksheets

9.2 **INSTRUCTIONAL MATERIALS USED:**

- Adopted textbook and workbook
- Computers
- Supplemental material

9.3 **TEACHER ACTIVITIES:**

- Guided lecture
- Reading for content
- PowerPoint
- Demonstration

10.0 **Scientific progress is made by asking meaningful questions and conducting careful investigations. The student 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).

10.1 SUGGESTED STUDENT ACTIVITIES:
   • Labs and investigations
   • Computer study links

10.2 INSTRUCTIONAL MATERIALS USED:
   • Computers
   • Lab equipment

10.3 TEACHER ACTIVITIES:
   • Demonstrations

INSTRUCTIONAL MATERIALS:

TEXTBOOKS

Course submitted by Don Ryan, Costa Mesa High School, April, 2004