

#401 INTEGRATED SCIENCE - EARTH SCIENCE

GRADE: 9

LEVEL: 1

CREDITS: 2.5

PREREQUISITE: None

BASIC TEXT: Level 1: Earth Science – Spaulding, Namowitz, 2003

SUPPLEMENTAL READINGS: None

REQUIRED MATERIALS: Notebook, calculator and writing materials.

COURSE DESCRIPTION: Students will be introduced to the four branches of Earth Science and learn how each branch applies to a specific aspect of the Earth. They will learn about the origin of the Solar System and the Universe, and the interrelationship of galaxies, stars, the Sun, planets, and their satellites. Included will be the concept that the Sun is a star and as such releases electromagnetic energy, as do all stars. This energy causes the unequal heating of the Earth's atmosphere and therefore creates climactic and daily weather changes, wind patterns, and air pressure systems. The concept of energy flow will also be related to the forces that cause the movement of tectonic plates in the Earth's crust and the resulting earthquakes, volcanoes, and mountain building processes. These forces also relate to the rock cycle and Earth's structural layers.

MISSION RELATED GOALS:

- Foster communication
- Foster problem solving
- Academic excellence
- Intellectual curiosity
- Respect rights of others
- Self-confidence

STUDENT EXPECTATIONS FOR LEARNING ADDRESSED:

- 1) Demonstrate effective written and oral communication skills.
- 2) Research, focus, and apply resources to the solution of problems.
- 3) Demonstrate the ability to apply computational skills to the solution of problems.
- 4) Demonstrate the ability to apply the scientific method to the solution of problems.

GENERAL PERFORMANCE OBJECTIVES:

- Identify and describe standard tests used to identify Earth's materials, e.g., carbon dating, chemical tests
- Describe geological and biological processes that result in changes in Earth's features and systems.
- Describe tools and methods used to explore the universe.
- Examine and describe evidence that explains characteristics of the universe, e.g., red and blue shifts, star clusters, and types of galaxies.
- Identify and compare scientific theories of how the universe was formed, e.g., the Big Bang theory.
- Define and describe characteristics of celestial objects, e.g., stars, planets, moons, etc.
- Describe stellar evolution with the use of the Hertzsprung-Russell diagram.
- Describe and provide examples of the effects of gravity and electromagnetism on the Earth.

MASSACHUSETTS FRAMEWORKS STRANDS

INQUIRY: DESIGNING AN INVESTIGATION:

- Distinguish those observations that are relevant to the question or problem at hand.
- Formulate testable questions and generate explanations using the results of predictions.
- Make decisions about the range and number of independent variables and how to control other variables in designing experiments.
- Select and use common and specialized tools to measure the dependent variable.
- Select appropriate methods of recording and interpreting data.

INQUIRY: ANALYSIS & INTERPRETATION OF DATA:

- Accurately use scientific and technological nomenclature, symbols and conventions when representing and communication ideas, procedures and findings.
- Use mathematics to analyze and support findings and to model conclusions.
- Question interpretations or conclusions for which there is insufficient supporting evidence; recognize that any conclusion can be challenged by further evidence.
- Identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.
- Formulate further testable hypotheses based on the knowledge and understanding generated.

MASSACHUSETTS FRAMEWORKS STANDARDS :

1. Matter and Energy in the Earth System
 - 1.1 Identify the Earth's principal sources of internal and external energy

- 1.2 Describe the components of the electromagnetic spectrum and give examples of its impact on our lives.
- 1.3 Describe the characteristics of waves.
- 1.4 Describe the nature of the continuous emission and absorption spectrum that indicates the composition of stars.
- 1.5 Explain how the transfer of energy through radiation, conduction, and convection contributes to global atmospheric processes, storms and winds.
- 1.8 Explain how the revolution of the Earth and the inclination of the axis causes the Earth's seasons.
- 1.14 Explain how scientists study the Earth system through the use of a combination of ground-based observations, satellites, and computer models of the Earth.
2. Recognize, describe, and differentiate between renewable and non-renewable sources of energy.
- 2.6 Describe ways in which scientists are addressing effects on the environment of using both renewable and non-renewable sources of energy.
3. Earth Processes and Cycles
- 3.1 Explain that weather is the most significant sources of erosion and how both physical and chemical weathering lead to the formation of sediments.
- 3.2 Describe how glaciers, gravity, wind, temperature changes, waves and rivers cause weathering and erosion.
- 3.4 Describe the evolution of the atmosphere.
- 3.5 Describe how the oceans store carbon dioxide.
- 3.6 Explain how water flows into and through a watershed.
- 3.7 Compare and contrast the processes of the hydrologic cycle.
- 3.8 Describe the rock cycle.
- 3.9 Compare the physical properties and the mineral combinations found in rocks.
- 3.10 Explain how the composition and arrangement of atoms determine a mineral's physical and chemical characteristics.
- 3.11 Describe the absolute and relative dating methods for measuring time.
- 3.13 Explain how seismic data is used to reveal the interior structure of the Earth.
- 3.14 Explain how seismic data is used to locate an earthquake epicenter.
- 3.15 Recognize the magnitude values of earthquakes.
- 3.16 Explain how the magnetic field of the Earth is produced.
- 3.18 Explain how paleomagnetic patterns preserved in rocks provide evidence of the Earth's magnetic field over geologic time.
- 3.19 Trace the development of a lithospheric plate from its growing margin at a divergent boundary.
- 3.20 Relate earthquakes, volcanic activity, mountain building and tectonic uplift to plate movements.
- 3.21 Relate the effects of sudden sea floor movements to the generation of tsunamis.
- 3.22 Provide examples of how societies have been affected by tectonic activity.

- 4. The Origin and Evolution of the Universe
- 4.1 Explain the Big Bang Theory.
- 4.2 Define the unit of distance called a light year.
- 4.3 Use the Hertzsprung-Russell diagram to explain the life histories of stars.
- 4.4 Compare and contrast the final three outcomes of stellar evolution based on mass.
- 4.5 Compare and contrast the motions of rotation and rotation of orbiting bodies.
- 4.7 Compare and contrast the various instrumentation used to study deep space.
- 4.8 Explain how the Sun, Earth, and Solar System formed from a nebula.

UNITS AND THEMES:

- I. Branches of Earth Science
- II. Tools of Earth and Space Scientists
4.2, 4.3, 4.7, 1.2, 1.3
- III. Stars and Galaxies
4.1, 4.2, 4.3, 4.4
- IV. Solar System
4.1, 4.6, 4.5, 4.8
- V. Earth and It's Moon
4.8
- VI. Earth's Interior
1.1, 3.13, 3.14
- VII. Plate Tectonics
3.13, 3.19, 3.20, 3.21, 3.22
- VIII. Rocks and Minerals
3.8, 3.9, 3.10, 3.11, 3.12
- IX. Meteorology
1.8, 1.9, 1.10
- X. Oceanography
1.11, 1.12, 1.13
- XI. Earth's Nonliving Resources
2.1, 2.2, 2.3, 2.4

COURSE OUTLINE:

- I. Branches of Earth Science
- II. Tools of Earth and Space Scientists
 - a. Optical telescopes
 - b. Radio telescopes
 - c. Infrared and Ultraviolet telescopes
 - d. X-ray and Gamma ray telescopes
- III. Stars and Galaxies
 - a. Overview of the universe
 - b. Formation of the universe
 - c. Characteristics of stars
 - d. The Sun

- e. Evolution of stars
- IV. Solar System
 - a. Evolution of the Solar System
 - b. Motion of the planets
 - c. Members of the Solar System
- V. Earth and it's Moon
 - a. Earth in space
 - b. Earth's Moon
- VI. Earth's Interior
 - a. Core
 - b. Mantle
 - c. Crust
- VII. Plate Tectonics
 - a. Earth's drifting continents
 - b. Earth's spreading ocean floor
 - c. Earth's moving plates
 - d. Earthquakes
 - e. Volcanoes
- VIII. Rocks and Minerals
 - a. What is a mineral?
 - b. Tests for mineral identification
 - c. What is a rock?
 - d. The rock cycle
 - e. Igneous, Sedimentary, and Metamorphic rocks
 - f. Topographic maps
- IX. Meteorology
 - a. Air pressure
 - b. Winds
 - c. Weather maps
- X. Oceanography
 - a. Ocean properties
 - b. Ocean currents
- XI. Earth's Nonliving Resources
 - a. Land and soil
 - b. Water
 - c. Mineral

SUGGESTED INSTRUCTIONAL ACTIVITIES:

- Collage created by groups of four students representing each branch of Earth Science.
- Count the number of stars visible in the night sky using a random sampling method.
- Identify well-known constellations and the North Star in the night sky.
- Observe stars of different magnitudes and colors; graph the magnitudes vs. temperatures to create a Hertzsprung-Russell diagram.
- Use spectroscopes to observe continuous and emission spectra.

- Plot the locations of volcanoes and earthquakes on a world map.
- Cut out, piece together, and label outlines of earth plates.
- Use world maps to locate and label trenches, ridges, and mountain ranges.
- Draw isotherms and isobars on weather maps.
- Label high and low pressure systems on weather maps.
- Use the information on a weather map to forecast the weather for several locations.

SUGGESTED INTEGRATED ACTIVITIES:

1. Integrate activities with Biology when discussing oceanography and life in the oceans.
2. Integrate activities with Physics when discussing stars and the planets.
3. Integrate activities with Chemistry when discussing the chemical nature of minerals.

USE OF TECHNOLOGY:

- Use classroom computer and integrated software package.
- Use dedicated software for investigating different types of mapping.
- Use scientific calculators.
- Use overhead projectors.
- Use TV and VCR for viewing video selections.
- Use computer laboratory.

ASSESSMENTS: All assessments follow the school wide rubric.

- Quizzes and tests.
- Essay questions (including open-ended questions).
- Quizzes on comprehension of videotapes shown.
- Group projects.
- Lab reports.
- Collaborative efforts.
- Research projects.