

Earth and Space Science:

STANDARD 1: SCIENCE AS INQUIRY

Benchmark 1: Students will demonstrate the abilities necessary to do scientific inquiry.

Indicators:

1. develops an understanding of the natural world through experience in order to ask and evaluate research questions.
 - a. *Read scientific information.*
 - b. *Know that science changes -*
 - c. *To .develop these skills, students might be involved in such activities as: investigating mass, length, volume, and density; neutralizing acids/bases; simulating half-lives of radioactive isotopes; investigating velocity and acceleration with paper airplanes; developing student-build models for friction and motion; investigating models that demonstrate knowledge of Newton's laws of motion.*

2. ▲ identifies and utilizes concepts that guide scientific investigations, including developing questions, gathering data, designing and conducting research
 - a. *Understand and use the scientific method (1. state the problem; 2. research; 3. form a hypothesis; 4. gather materials; 5. carry, out a procedure; 6. gather data; 7. form conclusions and report).*
 - b. *Design and conduct investigations*
 - c. *Analyze and explain data; then modify the procedure to get better results (e.g. the scientific method is not always a linear process)*
 - d. *Utilize controls and independent and dependent variables.*
 - e. *Determine methods for gathering data that is observable, measurable and replicable.*

3. ▲ uses technological tools and mathematics in scientific investigations.
 - a. *Interpret and communicate scientific results using mathematics and technology.*
 - b. *Choose appropriate tools for measurement; measure accurately with proper metric units.*
 - c. *Investigate phenomena using technology appropriately and safely (such as balance scales, spring scales, thermometers, stopwatches, graduated cylinders, beakers, flasks and other glassware)*

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- d. uses common mathematical functions (linear, exponential, etc.) to analyze and describe data.
 - e. recognizes that the accuracy and precision of the data, and therefore the quality of the investigation, depends on the instruments used.
4. ▲ as part of conducting an inquiry, formulates and revises his or her scientific explanations and models (physical, conceptual, or mathematical) using logic and evidence, recognizing that potential alternative explanations and models should be considered.
- a. evaluates personal preconceptions and biases with respect to his/her conclusions.
5. communicates and defends the design, results, and conclusion of his/her investigation.
- a. *Writes procedures, expresses concepts reviews information, summarizes data, and uses language appropriately.*
 - b. *Develops diagrams and charts to summarize and analyze data.*
 - c. *Presents information clearly and logically, both orally and in writing.*
 - d. *Constructs reasoned arguments.*
 - e. *Responds appropriately to critical comments.*
 - f. *Apply concepts and skills to everyday experiences.*

STANDARD 4: EARTH AND SPACE SCIENCE

Benchmark 1: Students will develop an understanding of the sources of energy that power the subsystems and cycles of the dynamic earth: the geosphere, hydrosphere, atmosphere and biosphere.

Indicators:

1. **▲** The theory of Plate Tectonics explains that internal energy drives the earth's ever changing structure.
 - a. Describe the theory of continental drift.*
 - b. Identify supporting evidence of continental drift.*
 - c. Explain sea floor spreading and recognize supporting evidence there of.*
 - d. Compare and contrast different types of plate boundaries.*
 - e. Explain the roll of heat from the Earth's interior in plate tectonics.*
 - f. Recognize features that are caused by plate tectonics.*

2. The ultimate source of atmospheric and oceanic energy comes from the sun. Energy flow determines global climate and weather, which is influenced by geographic features, cloud cover, and the earth's rotation.

Atmosphere:

- a. Describe what happens to the energy that the Earth receives from the sun.*
- b. Describe the structure and identify the gases of the Earth's atmosphere.*
- c. Explain air pressure.*
- d. Compare and contrast radiation, conduction, and convection.*
- e. Discuss the water cycle and its effect on the Earth's weather patterns.*
- f. Explain how land and water surfaces affect the overlying air.*

Weather

- a. Explain how solar heating and water vapor in the atmosphere affect weather.*
- b. Discuss how clouds form and how they are classified.*
- c. Describe the development of the different types of precipitation.*
- d. Describe how weather is associated with fronts and high and low pressure areas.*
- e. Explain how tornadoes develop from thunderstorms.*
- f. Explain how data are collected for weather maps and forecasts.*

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- g. Identify the symbols used in a weather station model.*
- h. Concepts and skills include basic weather forecasting, weather maps, fronts, pressure systems, severe storms and safety precautions*

Climate

- a. Describe what determines climate.*
- b. Explain how latitude, oceans, and other factors affect the climate of a region.*
- c. Describe a climate classification system.*
- d. Explain how organisms adapt to particular climates.*
- e. Explain what causes seasons.*
- f. Describe how El Nino affects climate.*
- g. Explore possible causes of climatic change.*

Benchmark 2. Students will develop an understanding of the origin and development of the dynamic earth system.

Indicators:

- 1. Describe the rock cycle and changes rocks undergo.*
- 2. Identify the different types of igneous, metamorphic, and sedimentary rock and describe the formation of each.*
- 3. Distinguish between rocks and minerals.*

Minerals

- 1. Describe the characteristics of minerals and how they form.*
- 2. State the physical properties of minerals.*
- 3. Identify minerals based on their physical properties.*

Land formations

- 1. Discuss each of the following landforms: Plains, plateaus, folded mountains, up warped mountains, fault block mountains, and volcanic mountains.*
 - a. Earth changes can be short term (during a human's lifetime), such as earthquakes and volcanic eruptions, or long term (over a geological time scale), such as mountain building and plate movements.*

The Ocean

- 1. Identify the origin of the water of the Earth's oceans.*
- 2. Explain how dissolved salts and other substances get into seawater.*
- 3. Describe the composition of seawater.*
- 4. Explain how winds and Coriolis effect influence surface currents.*
- 5. Discuss the temperature of coastal waters.*

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6. *Describe density currents.*
7. *Describe wave formation.*
8. *Distinguish between the movement of water particles in a wave and the movement of the wave.*
9. *Explain how ocean tides form.*

Oceanography

1. *Differentiate between continental shelf and continental slope.*
2. *Describe a mid-ocean ridge, abyssal plain, and an ocean trench.*
3. *Identify the mineral resources found on the continental shelf and the deep ocean.*
4. *Describe photosynthesis and chemosynthesis in the oceans.*
5. *List the five types of ocean pollution.*
6. *Explain how ocean pollution affects the entire world.*
7. *Describe how ocean pollution can be controlled.*

Benchmark 3. Students will develop an understanding of dynamics of our solar system.

Indicators:

1. ▲ The sun's gravity holds the earth and other planets and solar system objects in orbit. The uniqueness of our solar system provides a balance needed for the existence of life on earth.

The Solar System

- a. *Compare the Earth-centered and Sun-centered models of the solar system.*
- b. *Explain that gravity holds the planets in their orbits around the Sun.*
- c. *List the inner planets in order from the Sun.*
- d. *Describe each inner planet.*
- e. *Compare and contrast Venus and Earth.*
- f. *Describe the characteristics of Jupiter, Saturn, Uranus, and Neptune.*
- g. *Explain how Pluto differs from the other outer planets.*
- h. *Describe comets and how comets change when they approach the Sun.*
- i. *Distinguish among comets, meteoroids, and asteroids.*
- j. *Explain that objects from space sometimes impact Earth.*

2. ▲ The relationship between the earth, moon, and sun explains the seasons, tides and moon phases.

Earth-Sun and moon System.

- a. Examine the Earth's physical characteristics.*
- b. Differentiate between rotation and revolution.*
- c. Discuss what causes seasons to change.*
- d. Identify phases of the moon and their cause.*
- e. Explain why solar and lunar eclipses occur.*
- f. Infer what the moon's surface may reveal about its history.*
- g. Describe recent discoveries about the moon.*
- h. Examine facts about the Moon that might influence future space travel.*

Benchmark 4. Students will develop an understanding of the organization of the universe, and its development

Indicators:

1. ▲ Maturation of stars, solar systems, and galaxies can be explained by the classification of bright stars visible from earth by their color, temperature, age, apparent brightness, and distance from earth.

Stars and Galaxies

- a. Explain why some constellations are visible only during certain seasons.*
 - b. Distinguish between absolute magnitude and apparent magnitude.*
 - c. Explain that the Sun is the closest star to Earth.*
 - d. Describe the structure of the Sun.*
 - e. Describe Sun spots, prominences, and solar flares.*
 - f. Describe how stars are classified.*
 - g. Compare the sun to other types of stars on the H-R diagram.*
 - h. Describe how stars evolve.*
 - i. Describe the Sun's position in the Milky Way Galaxy.*
 - j. Explain that the same natural laws apply to our solar system also apply in other galaxies.*
2. ▲ Current explanation of the origin of the universe includes expansion of gases from a hot dense early state. Condensation of gases, due to gravity, is a foundation for the formation of stars.

3. Astronomy has been revolutionized by the tools and skills of astronomers for researching phenomena and objects that cannot be observed and measured directly.
 - a. Galaxies are a level of organization of the universe. There are at least 100 billion galaxies in the observable universe.
 - b. Galaxies are organized into superclusters with large voids between them.
 - c. *Identify the differences between refracting and reflecting telescopes*

STANDARD 5: SCIENCE AND TECHNOLOGY

Benchmark 1 : Students will develop *an understanding that technology is applied science.*

Indicators:

1. Technology is the application of scientific knowledge for functional purposes.
 - a. *Explain the electromagnetic spectrum.*
 - b. *Identify the applications of space technology to everyday life.*
 - c. *Identify the usefulness of orbital space stations.*
 - d. *Recognize the differences between optical and radio telescopes.*
 - e. *Compare and contrast natural and artificial satellites.*
 - f. *Identify the differences between artificial satellites and space probes.*
 - g. *Identify the differences between refracting and reflecting telescopes.*
 - h. *Compare, contrast and analyze information from the following types of maps: topographic, geologic, and satellite.*
 - i. *Explain the history of the space race.*
 - j. *Explain the benefits of the space shuttle.*
2. Creativity, imagination, and a broad science knowledge base are all required to produce useful results. i.e., engineering
3. Science advances new technologies. New technologies open new areas for scientific inquiry.
 - a. *Explore future space missions.*
4. Scientific knowledge is made public through presentations at professional meetings and publications in scientific journals.

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STANDARD 6: SCIENCE IN PERSONAL AND ENVIRONMENTAL PERSPECTIVES

Benchmark 3: Students will understand that human populations use natural resources and influence environmental quality.

Indicators:

1. ▲ natural resources from the lithosphere and ecosystems are required to sustain human populations.
2. earth does not have infinite resources.
 - a. *Distinguish between nonrenewable and renewable resources and give advantages and disadvantages of using each.*

Benchmark 4: Students will understand the effect of natural and human-influenced hazards.

Indicators:

1. natural processes of earth may be hazardous for humans.
 - a. *Explain how earthquakes result from the build up of energy in rocks.*
 - b. *Describe how compression, tension, and shear forces make rocks move along faults.*
 - c. *Distinguish among normal, reverse and strike-slip faults.*
 - d. *Explain how earthquake energy travels in seismic waves.*
 - e. *Distinguish among primary, secondary, and surface waves.*
 - f. *Describe the structure of the Earth's interior.*
 - g. *Explain where most earthquakes occur in the U.S. and how scientists measure earthquakes.*
 - h. *List some measure that can be made in order to make an area like a classroom or home more earthquake safe.*
 - i. *List conditions that cause volcanoes to form.*
 - j. *Describe how volcanoes affect humans.*
 - k. *Identify the relationship between volcanoes and the Earth's moving plates.*
 - l. *Explain the relationship between the explosiveness of a volcanic eruption and the contents of its magma.*
 - m. *List the forms of volcanoes.*
 - n. *Describe intrusive igneous rock features and how they form.*
 - o. *Explain how a volcanic neck and caldera form.*

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