



Shakopee Area Catholic School

Earth Materials and Processes(F)
The Changing Surface of Earth (G)

Grade Level: 8

Scientific Thinking and Inquiry

Standard: Scientific progress is made by asking questions and conducting careful investigations. As a basis for understanding this concept and to address the content in this grade, students should develop their own questions perform investigations. Students:

1. Explain that when similar investigations give different results, further studies may help to show whether the differences are significant.
2. Explain why it is important to keep honest, clear, and accurate records.
3. Explain why research involving human subjects requires that potential subjects be fully informed about the risks and benefits associated with the research and that they have the right to refuse to participate.
4. Recognize testable hypotheses in investigations that pertain to the content under study, and write instructions that others can follow in carrying out the investigation.
5. Communicate the steps and results from an investigation in written reports and verbal presentations.
6. Incorporate circle charts, bar and line graphs, diagrams, scatter plots, and symbols into writing, such as lab or research reports, to serve as visual displays of evidence for claims and/or conclusions.
7. Recognize whether evidence is consistent with a proposed explanation. Know that different explanations can be given for the same evidence, and that partial evidence may be exploited for reasons other than truth seeking.
8. Question claims based on vague attributes or on authority, such as “leading doctors say”, or based on statements made by celebrities or others outside the area of their particular expertise.
9. Describe how scientific knowledge is subject to modification and refinement as new information challenges prevailing theories.
10. Test hypotheses that pertain to the content under study.
11. Describe how if more than one variable changes at the same time in an experiment, the outcome of the experiment may not be attributable to a change in any single variable.
12. Explain why accuracy and openness in record keeping and replication are essential for maintaining an investigator’s credibility with other scientists and society.
13. Write clear step-by-step instructions (procedural summaries) for conducting investigations.
14. Participate in group discussion on scientific topics by restating or summarizing accurately what others have said, asking for clarification or elaboration, and expressing alternative positions.
15. Use tables, charts, and graphs in making arguments and claims in presentations about lab work.
16. Explain why arguments may be invalid if based on very small samples of data, biased samples, or experiments in which there was no control sample.
17. Identify and criticize the reasoning in arguments in which fact and opinion are intermingled or the conclusions do not follow logically from the evidence given, an analogy is not apt, no mention is made of whether the control group is very much like the experimental group, or all members of a group are implied to have nearly identical characteristics that differ from those of other groups.

Heat (Thermal Energy)

Standard: The transfer of energy through radiation and convection currents affects many phenomena on the Earth’s surface. Students:

1. Explain the meaning of radiation, convection, and conduction (three mechanisms by which heat is transferred to, through, and out of the Earth’s system).

2. Describe that the heat from the sun falls on Earth unevenly because of its spherical shape. Describe that regions close to the equator receive more concentrated solar energy than those closer to the poles.
3. Observe and explain how uneven heating sets up convective cells in the atmosphere and oceans that distribute heat away from the equator.
4. Explain that much of the heat from the sun is absorbed by the land and oceans and then is released into the atmosphere.
5. Recognize that, compared to other substances such as rock and soil, a given mass of water requires a greater input or output of heat energy to change its temperature by a given amount.

Weather and Climate

Standard: Weather (in the short run) and climate (in the long run) involve the transfer of energy in and out of the atmosphere. As a basis for understanding this concept, students:

1. Explain how different regions receive different amounts of solar heating because of their latitude, clouds, surface water, ice, and other variables. Understand that this results in large scale convective air flow and weather patterns.
2. Recognize and describe that the currents in the air and ocean distribute heat energy.
3. Explain that a great deal of energy is absorbed when water evaporates and is released when it condenses.
4. Illustrate that this cycling of water and heat in and out of the atmosphere plays a critical role in climatic patterns.
5. Explain how mountain ranges and other major geographical features affect climate (e.g., mountains produce rain shadows, land masses interrupt ocean currents).
6. Describe how climates may have changed abruptly in the past as a result of changes in earth's crust, such as gas and dust from volcanic eruptions or impacts of meteorites, asteroids, and comets from space.
7. Describe how the earth's atmosphere exerts a pressure that decreases with distance above sea level and, at every point, is the same in all directions.

Resources

Standard: Sources of materials differ in amounts, distribution, usefulness, and the time required for their formation. As a basis for understanding this concept, students:

1. Explain that fresh water is limited in supply and uneven in distribution; describe why it is essential for life as we know it and also for most human activities, including industrial processes.
2. Recognize that fresh water is a resource that can be depleted or polluted, making it unavailable or unsuitable for humans.
3. Recognize that the Earth's resources for humans, such as fresh water, air, arable soil, and trees, are finite.
4. Explain that the atmosphere and the oceans have a limited capacity to absorb wastes and recycle materials naturally.
5. Investigate and describe how pollutants can affect weather and the atmosphere.
6. Explain that recycling, reuse, and the development of substitutes can reduce the rate of depletion of many minerals.
7. Describe forms of energy, including chemical, heat, light, and mechanical. Identifying types of potential and kinetic energy. Examples: potential water behind a dam, battery; kinetic-water moving across turbine blades.
8. Describe alternatives to the use of fossil fuels. Examples: solar energy, geothermal energy, windmill, hydroelectric power, biomass.
9. Identify the transfer of energy by conduction, convection, and radiation. Examples: Conduction-hot plate heating a pan, convection-space heater heating air, radiation-sun heating Earth's surface.

The Rock Cycle

Standard: Rock materials are continuously recycled in the rock cycle. As a basis for understanding this concept, students:

1. Recognize minerals are naturally occurring crystalline solids with definite chemical compositions, and identify common minerals using a key to their diagnostic properties.

2. Examine and recognize most rocks are made of one or more minerals.
3. Describe how igneous rocks are formed when older rocks are melted and then re-crystallized. Understand they may be cooled deep in the Earth or at the surface as part of volcanic systems.
4. Explain how metamorphic rocks are formed when older rocks are heated (short of melting) and/or subjected to increased pressure.
5. Describe how sedimentary rocks are formed when older rocks are subjected to weathering in to sediments, and those sediments are eroded, transported, deposited, then compacted and cemented.
6. 6. Observe and describe common igneous, metamorphic, and sedimentary rocks, including granite, obsidian, pumice (igneous); slate, schist, marble (metamorphic); sandstone, shale, and limestone (sedimentary).

Plate Tectonics

► Standard: Plate tectonics explain important features of the Earth's surface and major geologic events. As a basis for understanding this concept, students:

- Describe the solid lithosphere of Earth, including both the continents and the ocean basins, and how it is broken into several plates that ride on a denser, hot, and gradually deformable layer in the mantle called the *asthenosphere* (weak sphere).
- Explain why the Earth has a hot interior.
- Explain how lithosphere plates move very slowly, pressing against one another in some places, pulling apart in other places, and sliding past one another in others.
- Compare and contrast oceanic plates and continental plates.
- Explain the process in which push against one another; one of them may be dense enough to sink under the other, a process called *subduction*.
- Explain that oceanic lithosphere may sink under continental or oceanic lithosphere, but continental lithosphere does not subduct.
- Describe that subducting plates may partially melt and form magma, which rises to the surface as lava to feed volcanoes and form volcanic mountain chains associated with deep-sea trenches.
- Explain when plates push against each other and neither is dense enough to subduct (both continental), the plates will crumble and fold and form large mountain chains.
- Explain that earthquakes are sudden motions along breaks in the crust called *faults*, and volcanoes/fissures are locations where magma reaches the surface as lava.
- Describe how earthquakes and volcanoes often, but not always, occur along the boundaries between plates.
- Describe that under the ocean basins, molten rock may well up between separating plates to create new ocean floor.
- Explain how volcanic activity along the ocean floor may form undersea mountains, which can grow above the ocean's surface to become islands (e.g., the Hawaiian islands).
- Explain how physical evidence, such as fossils and surface features of glaciations, supports detailed explanations of how Earth's surface has evolved over geologic time.
- Describe the properties and the composition of the following major layers of the Earth.

Earth and Life History

Standard: Evidence from rocks allows us to understand the evolution of life on Earth.

As a basis for understanding this concept, students:

1. Explain how the Earth's surface is built up and broken down by natural processes, including deposition of sediments, rock formation, erosion, and weathering.
2. Describe that the history of life on Earth has been disrupted by major catastrophic events, such as major volcanic eruptions or the impact of asteroids.
3. Explain that although weather rock is the basic component of soil, the composition and texture of soil and its fertility and resistance to erosion are greatly influenced by plant roots and debris, bacteria, fungi, worms, insects, and other organisms.
4. Explain how thousands of layers of rock confirm the long history of the changing surface of Earth.
5. Illustrate and describe that remains of changing life forms are found in successive layers, although the youngest layers are not always found on the top because of folding, breaking, and uplifting of layers.

6. Recognize that evidence from geologic layers and radioactive dating indicates that Earth is approximately 4.6 billion years old and life on this planet has existed for more than 3 billion years.
7. Observe and explain that fossils provide evidence of how life and environmental conditions have changed.

The Solar System

Standard: Astronomy and planetary exploration reveal the structure and scale of the solar system. As a basis for understanding this concept, students:

1. Recognize that the solar system consists of the Earth, moon, sun, eight generally recognized other planets that orbit the sun and their satellites, and smaller objects, such as asteroids and comets.
2. Describe how the planets move around the sun in elliptical orbits, and explain how the near coplanarity of the orbits, along with the principle of conservation of momentum, is evidence essential to our understanding of how the solar system was originally formed.
3. Explain that the moon is Earth's only natural satellite, but several of the other planets have natural satellites as well. Understand Earth also has many artificial satellites and that all of those satellites, artificial and natural, are in elliptical orbits around their primaries.
4. Explain that large numbers of chunks of rock and ice (asteroids and comets), much smaller than planets, orbit the sun.
5. Describe, as seen from Earth, how planets change their position relative to the background of stars.
6. Construct models or drawings to explain that the seasons are caused by the tilt of the earth's axis relative to the plane of its orbit and its revolution around the sun. Explain how this results in uneven heating of the various parts of Earth's surface that varies over the course of the year.
7. Describe that as spring turns into summer at a particular place on earth, the days grow longer and the sun moves higher in the sky, resulting in more intense heating. In fall and winter, the opposite occurs. Explain how this variation in heating results in the seasons.
8. Recognize and describe the sun as a midsize star located near the edge of a disk-shaped galaxy of stars called the *Milky Way*. Recognize that the universe contains many billions of galaxies, and each galaxy contains billions of stars.
9. Recognize that the sun-to-Earth distance is such that it takes about eight minutes for light from the sun to reach Earth. Know that the next nearest star is many thousands of times farther from earth, and its light takes about four years to reach Earth.
10. Explain that gravity is a force of attraction that every mass in the universe exerts on every other mass, and everything on or near anywhere near earth is attracted toward and attracts Earth's center by a gravitational force.
11. Describe that the sun's gravitational attraction holds Earth and the other planets in their orbits, just as the planets' gravitational attraction keeps their moons in orbit around them.