

SC.7.E.6.2 Identify the patterns within the rock cycle and relate them to surface events (weathering and erosion) and sub-surface events (plate tectonics and mountain building). **SC.7.E.6.6** Identify the impact that humans have on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, and changing the flow of water.

The Rock Cycle and Human Impact on Earth

Earth's Rocky Surface

Earth's solid parts are mostly made of rock. This rock is constantly changing and cycling through Earth. These changes cause Earth to look very differently over time.

Changing Rock

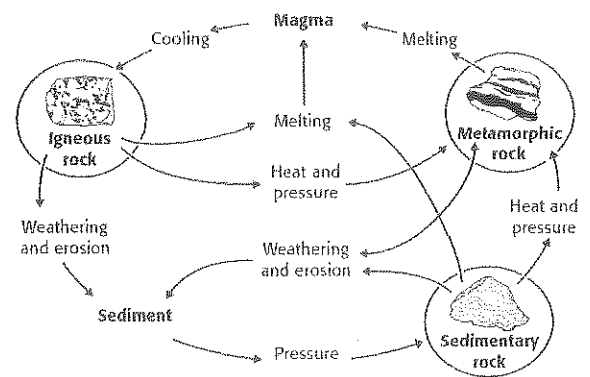
There are many processes that change rock on Earth's surface. When rock is broken down by wind, water, ice, and temperature changes, weathering occurs. When rock is weathered, it breaks down into small pieces called sediment. Water, wind, ice, and gravity can carry this sediment from one place to another through the process of erosion. When this sediment is left in one place after it has been carried, this is called deposition.

Rock can also be changed by temperature and pressure. Rocks and other materials exert pressure on the rock below it. The deeper a rock is under Earth's surface, the more pressure that is exerted on the rock. Very high temperatures can also change and melt rock.

The Rock Cycle

There are three main types of rock that exist on Earth. Igneous rock forms when magma or lava cools and hardens into a solid. Sedimentary rock forms when pieces of sediment are cemented together. Metamorphic rock is formed by pressure and temperature changes that cause rocks to undergo chemical changes.

The Rock Cycle



Over millions of years, rocks can change from one form to another. The series of processes that change rock in this way is called the **rock cycle**. When igneous rock is on Earth's surface, weathering can break it down into sediment. When deep below Earth's surface, high temperatures and pressure may change igneous rock into metamorphic rock. Hot temperatures can also melt igneous rock. When the melted rock cools and hardens again, it forms a new igneous rock.

As with igneous rock, high temperatures and pressure can turn sedimentary rock into metamorphic rock. High temperatures alone can melt sedimentary rock and turn it into igneous rock when it cools and hardens. If sedimentary rock is further broken down into sediments, new sedimentary rock is formed as it cements.

Metamorphic rock will change into new metamorphic rock when exposed to heat and pressure. It can also form sedimentary rock when weathered into pieces of sediment that are then cemented together. When metamorphic rock is melted, it forms igneous rock when it cools and hardens.

Plate Tectonics

When plates in Earth's lithosphere move, surrounding rocks may move as well. This movement can result in changes that contribute to the rock cycle. For example, the movement of rocks beneath Earth's surface can cause rocks to be exposed. This makes the rock more likely to undergo weathering. Plate collisions can also apply heat and pressure, which could result in rock changing into metamorphic rock. The movement of plates could also cause sediment on Earth's surface to be buried beneath the surface. This would expose rocks to higher temperatures and pressures and potentially result in the formation of igneous and metamorphic rocks.

Human Impacts on Earth

We live on land in urban or rural areas. Cities and towns are urban areas. Rural areas are open lands that may be used for farming. Humans use land in many ways. We use natural areas for recreation. We use roads that are built on land for transport. We grow crops and raise livestock on agricultural land. We live in residential areas. We build commercial businesses on land and extract resources such as metals and water from the land.

Human activities can have positive and negative effects on land and soil. Some activities restore land to its natural state, or increase the amount of fertile soil on land. Other activities can degrade land. Land degradation is the process by which human activity and natural processes damage land to the point that it can no longer support the local ecosystem. Urbanization, deforestation, and poor farming practices can all lead to land degradation.

Deforestation

The removal of trees and other vegetation from an area is called **deforestation**. Logging for wood can cause deforestation. Surface mining causes deforestation by removing vegetation and soil to get to the minerals below. Deforestation also occurs in rain forests when farmers cut or burn down trees so they can grow crops. Deforestation leads to increased soil erosion.

Urbanization

Rural areas have large areas of open land and low densities of people. Urban areas have dense human populations and small areas of open land. This means that more people live in a square km of an urban area than live in a square km of a rural area. **Urbanization** is the growth of urban areas caused by people moving into cities. When cities increase in size, the population of rural areas near the city may decrease. When an area becomes urbanized, buildings, parking lots, and roads replace its natural land surface. City parks, which contain natural surfaces, may also be built in urban areas. Urbanization can cause deforestation when forests are replaced with buildings.

Desertification

When too many livestock are kept in one area, they can overgraze the area. Overgrazing removes the plants and roots that hold topsoil together. Overgrazing and other poor farming methods can cause desertification. **Desertification** is the process by which land becomes more desert-like and unable to support life. Without plants, soil becomes dusty and prone to wind erosion. Deforestation and urbanization can also lead to desertification.

Erosion

Erosion is the process by which wind, water, or gravity transports soil and sediment from one place to another. Some type of erosion occurs on most land. However, erosion can speed up when land is degraded. Roots of trees and plants act as anchors to the soil. When land is cleared for farming, the trees and plants are removed, and the soil is no longer protected. This exposes soil to blowing wind and running water that can wash away the soil.

Air and Water Quality

The contamination of the atmosphere by pollutants from human and natural sources is called air pollution. Natural sources of air pollution include volcanic eruptions, wildfires, and dust storms. In cities and suburbs, most air pollution comes from the burning of fossil fuels such as oil, gasoline, and coal. Oil refineries, chemical manufacturing plants, dry-cleaning businesses, and auto-repair shops are just some potential sources of air pollution. Scientists classify air pollutants as either gases or particulates.

When waste or other material is added to water so that it is harmful to organisms that use it or live in it, water pollution occurs. It is useful to divide pollution sources into two types. Point-source pollution comes from one specific site. For example, a major chemical spill is point-source pollution. Usually this type of pollution can be controlled once its source is found. Nonpoint-source pollution comes from many small sources and is more difficult to control. Most nonpoint-source pollution reaches water supplies by runoff or by seeping into groundwater. The main sources of nonpoint-source pollution are city streets, roads and drains, farms, and mines.

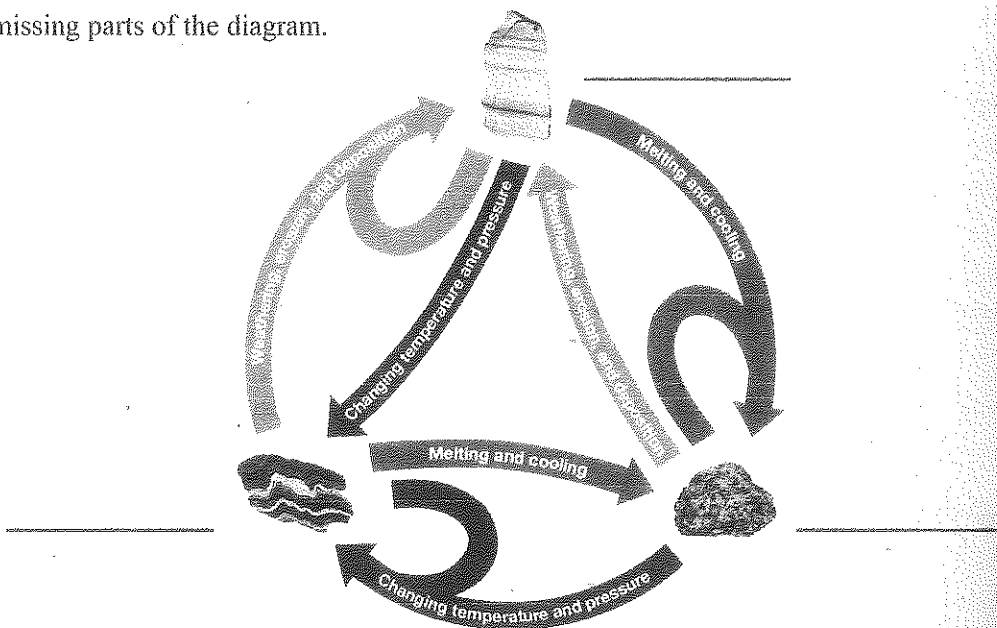
Changing the Flow of Water

Pumping and collecting groundwater and surface waters changes how water flows in natural systems. For example, a reservoir is a body of water that usually forms behind a dam. Dams stop river waters from flowing along their natural course. The water in a reservoir would naturally have flowed to the sea. Instead, the water can be diverted into a pipeline or into artificial channels called canals or aqueducts.

Student-Response Activity

- 1 Describe the role that weathering and erosion play in the rock cycle.

2 Label the missing parts of the diagram.



3 Compare and contrast how sedimentary and metamorphic rocks form.

4 What are three ways humans impact the Earth? Explain your reasoning.

Benchmark Assessment SC.7.E.6.2, SC.7.E.6.6

Fill in the letter of the best choice.

- 1 These rock formations in Turkey are known as the fairy chimneys. Which natural process **most likely** shaped these rocks?



- (A) deposition
(B) erosion
(C) temperature and pressure
(D) weathering
- 2 Which **best** describes deposition?
- (F) It is the process by which rocks change from one form to another.
(G) It is the process by which sediment comes to rest.
(H) It is the process by which sediment is moved from one place to another.
(I) It is the process by which water, wind, ice and temperature changes break down rock.
- 3 Which ways can plate-tectonic motion cause changes in rock?
- (A) It can expose rock beneath Earth's surface to wind and water.
(B) It can expose rock to energy from the sun, which breaks rock down.
(C) The movement of plates changes sediments into igneous rock.
(D) The shaking of plates causes rock to undergo chemical reactions.
- 4 What can result from deforestation by humans?
- (F) better water quality
(G) desertification
(H) less erosion
(I) less urbanization
- 5 Which describes how igneous rock forms?
- (A) Magma or lava cools and hardens into a solid.
(B) Pieces of sediment are broken down.
(C) Pieces of sediment are cemented together.
(D) Pressure and temperature changes cause chemical changes.