# **Earth’s Processes and Changes Discussion Guide (for use during or after reading)**

1. Briefly summarize how Earth has changed over its 4.6-billion-year history. (Changing Earth, p. 4-5)
   1. Earth is constantly changing. Some changes are slow and others are fast, some changes are big and others are small. Earth is over 4.6 billion years old, and in that time has undergone some serious changes. About 200 million years ago, Earth formed its crust and oceans. Since then, the tectonic plates making up the crust have constantly moved and formed the continents and land features we know today.
2. What are physical, chemical, and biological weathering? (Physical Weathering, Chemical Weathering, and Biological Weathering, p. 6-11)
   1. Weathering refers to changes in the shape of rock caused by some force. Physical weather is the wearing down or breaking up of rocks through contact with water, wind, and temperature changes. Chemical weathering occurs when minerals in some rocks react with carbonic acid found in rainwater. Caves, fissures, and other landforms are created from chemical weathering. Finally, biological weathering refers to the wearing down or breaking up of rocks by plants and animals. Weathering is the first step in the process of erosion and contributes to the constant changing of landforms.

1. How does water cause erosion? Highlight water erosion from rainfall and flooding, rivers, and seas and how these processes change Earth. (Erosion and Deposition, Water Erosion from Rainfall and Flooding, Water Erosion from Rivers, and Water Erosion from the Sea, p. 12-19)
   1. Water causes erosion in three main ways, from rainfall and flooding, from rivers, and from seas. Rainfall can cause small marks to form in pieces of earth in a process called splash erosion. Eventually, soil becomes saturated with rainwater which becomes runoff that transports some of the soil particles through a process called sheet erosion. Sometimes heavy rains cause floods, which carry away even more topsoil than rains do.
   2. Water erosion from rivers occurs when sediment is transported by a river from one area to another. Sediment is often referred to as a river’s load. A river’s load changes as water travels from its start through bends and banks, meanders, flood plains, and its mouth to the ocean or other large body of water.
   3. The sea also causes a fair amount of water erosion. When waves continually pound the shore, they erode the rock to form various cliffs, coves, and caves. In addition, coastal deposition leads to the formation of beaches and other sandy land features.
2. What is wind erosion and how does it change Earth? (Wind Erosion, p. 20-21)
   1. Wind erosion changes landscapes through the process of weathering. Surface creep occurs when wind slides particles too heavy to blow across the ground. Saltation occurs when wind makes small particles skip or bounce across the ground. Suspension occurs when the wind blows very small particles into the air. Because the wind moves particles, it causes erosion and deposition.
3. What is ice erosion and how does it change Earth? (Ice Erosion, p. 22-23)
   1. Ice erosion occurs when massive glaciers, thick sheets of ice, interact with land. In abrasion, bits of rock get stuck in the glacier itself. As the glacier continues to move over the land, the little bits of rock act as sandpaper and wear away at the land. Plunking refers to the freezing and thawing of glaciers that cause bedrock to crack and break off in chunks. Finally, in ice thrusting, large sheets of ice freeze to the sediment. When they suddenly lurch forward, they take a chunk of the land with them.
4. What is gravity erosion and how does it change Earth? (Gravity Erosion, p. 24-25)
   1. Gravity pulls at rock and soil from higher places to lower ones, causing erosion. Gravity is also responsible for pulling rain and ice downhill, causing their own types of erosion, too. The force of gravity is strong enough to create landslides as slow and gradual as creeps or as large and dangerous as mudslides or avalanches.
5. Describe the internal processes contributing to changes underneath Earth’s surface. (Internal Processes, p. 26-27)
   1. Earth’s crust is made of tectonic plates, massive sections of land that move continuously and very slowly on the layer of hot, soft rock in the upper mantle. When plates shift, they interact with one another at their boundaries and affect Earth’s surface.
6. Explain how Earth’s internal changes cause volcanoes and earthquakes. What are the effects of these dangerous events? (Volcanoes and Earthquakes, p. 28-31)
   1. As tectonic plates move and interact with one another, Earth’s surface changes. For example, volcanoes form as openings in Earth’s crust. Gas, ash, and molten rock from deep inside the earth can erupt and escape through these openings. As they erupt, ash, lava, and/or cinders form around the vent, changing Earth’s landscape.
   2. Earthquakes can also change Earth’s landscape. Earthquakes often happen along faults, deep cracks in Earth’s crust near the edges of tectonic plates. Heat and pressure put stress along the faults, causing the rock to stretch and break. We feel the rocks breaking as massive vibrations that can trigger other Earth-altering dangers like landslides, avalanches, mudslides, slumps, and even tsunamis.
7. Humans have also contributed to changes on Earth. Choose two human activities from the text and describe their impact on Earth. (Human Activities That Change Earth, p. 32-33)
   1. Students’ responses will vary but may include the following information:
   2. People have destroyed forests, prairies, wetlands, and other natural environments for agricultural purposes.
   3. Cutting down trees not only leads to deforestation, but also can lead to more wind and water erosion because there are no long plants to hold down the soil and keep it together.
   4. Acid rain, burning fossil fuels, and removing large sections of Earth for resources such as mineral depositions also lead to increased water and wind erosion.
   5. Many people are experimenting with a variety of cleaner energies like hydroelectricity, but even this can have negative effects as some areas of land can become blocked off from their freshwater resources.
8. What is climate change and why is it important we take action against it? What can we do to help limit climate change? (Climate Change and the Future, p. 34-37)
   1. Climate change refers to the general pattern of warming on Earth due to human activity. Change in Earth’s temperature such as this has led to many issues for both plants and animals alike. Many habitats and entire ecosystems are in danger of dying out for good unless we act to stop climate change and reverse its effects. One way to help limit climate change is by changing our day-to-day behaviors to reduce the size of our carbon footprint, or how much energy we use. In addition, governments and businesses can work together to pass laws and follow rules in ways that support our planet.