

Chapter 10 Forces That Change Earth's Surface

Introduction

Chapter 10 deals with the forces that change Earth's surface. Opposing forces wear down and build up the land. These opposing forces are associated with the water (**hydrosphere**), air (**atmosphere**), and land (**lithosphere**). Earth's external forces tend to wear down the land and earth's internal forces tend to build up the land.

Weathering and **erosion** are external forces that wear down the land. Weathering breaks rock into smaller particles and erosion carries the particles away. Some of the weathering forces are water and ice abrasion, plant roots, acids, and oxidation. Some of the erosion forces are running water, glaciers, and winds. These forces tend to lower land elevations and make the surface flat.

The idea that the continents move about on Earth's surface is relatively new (accepted within the last 60 years). In the early 1900s, a scientist suggested the continents were drifting. He proposed that the shape of the continents and similar rock, fossil, and landforms on separate continents were evidence. Because the force that moved the continents could not be identified, the theory was not accepted. In the 1960s, strong evidence supporting this theory was found on the ocean floor. This evidence proved that Earth's surface consists of plates and the plates are moving. The motion of these plates causes earthquakes, volcanoes, and mountain formation. The forces associated with plate tectonics tend to lift the land.

Students Should Understand the Following Concepts

- **Weathering** breaks down rocks into smaller pieces. Weathering is a slow process caused by

physical and chemical agents associated with the lithosphere, hydrosphere, and atmosphere.

- **Erosion** moves pieces of rock from one location to another; usually from higher elevations to lower elevations. Gravity and running water play a major role in erosion.
- Earth's surface is worn down by weathering and erosion forces and built up by earthquake and volcanic forces.
- Plate tectonics proposes that the Earth's crust consists of plates that shift and cause **earthquakes** and **volcanoes** mostly along plate boundaries. Mountain formation is also associated with the movement of plates.
- Seafloor features provide strong evidence that **plate tectonics** is occurring.

Activities to Develop the Topic

Use one or more of the following activities to help review this unit with your students.

Have students collect pictures of various landforms from old National Geographic magazines, travel brochures and magazines, and advertisement in other magazines. Have the students identify whether the picture shows weathering or erosion features. Ask students to write a sentence describing what force each picture shows. Label the features and processes in each picture. Place the pictures on a class bulletin board under the titles "Weathering" and "Erosion."

Ask students if they think earthquakes and volcanoes are constructional forces or destructional forces. The students will tend to say destructional forces. Explain that they are probably thinking in human terms. Ask them to think in terms of Earth's land surface. They should start to understand that all the land on Earth would wear away if it were not for forces associated with earthquakes and volcanoes.

A discussion about the history and development of continental drift leading to the theory of plate tectonics is an excellent way to incorporate science processes in your lesson. Such topics as evidence, theory, proof, publication, and acceptance can be highlighted during this discussion.

Photocopy a world map that shows all the continents and have the students cut out the continents. Have the class see how the east coast of North America and South America fit with the west coast of Europe and Africa. Ask them what evidence they would look for to determine whether the continents were once connected. Lead the stu-

dents in a discussion about similar landforms such as mountains and glacial features and similar rocks and fossils.

Students tend to enjoy learning about famous earthquakes and volcanic eruptions in history. Have your students use the Internet and library to research and/or report about a famous earthquake or volcanic eruption. Let them share their facts during a class discussion.

You should also bring up the fact that the discovery of *seafloor spreading* in the 1960s supported the theory of continental drift by showing that continental movement is still taking place.

Name _____

Date _____

Class _____

Review of Chapter 10

1. The layer of Earth affected by weathering and erosion is the
 - (1) crust
 - (2) mantle
 - (3) outer core
 - (4) inner core

2. Which of the following is an example of an interaction between the hydrosphere and lithosphere?
 - (1) open ocean waves being produced by wind blowing across the oceans' surface
 - (2) ocean waves breaking along the beach
 - (3) volcanic ash being sent into the atmosphere
 - (4) water evaporating into the air

3. The external forces of weathering and erosion tend to
 - (1) separate the continents
 - (2) wear land down to sea level
 - (3) push land up to sea level
 - (4) increase the height of continental mountains

4. An example of chemical weathering is
 - (1) ice prying apart rocks by water repeatedly melting and freezing in cracks
 - (2) tree roots prying rocks apart by widening existing cracks
 - (3) waves hitting a beach and washing away sand
 - (4) rainwater mixing with carbon dioxide to form an acid, which dissolves limestone

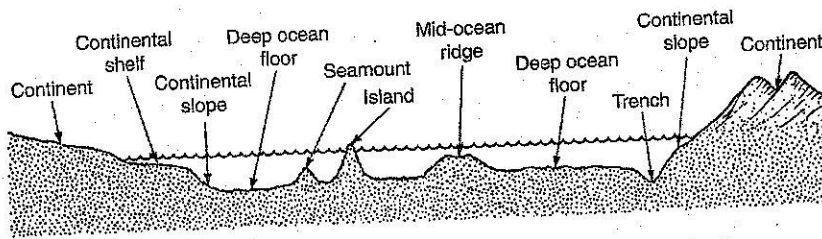
5. Two major forces that cause erosion are
 - (1) animals and wind
 - (2) gravity and running water
 - (3) volcanoes and earthquakes
 - (4) oxygen and carbon dioxide

6. Glaciers move large amounts of rock material. Glaciers cause
 - (1) weathering
 - (2) erosion
 - (3) mountain-building process
 - (4) internal Earth force

7. The agent of erosion that produced the Grand Canyon is
- (1) wind
 - (2) running water
 - (3) glaciers
 - (4) waves
8. Two processes that create mountains are
- (1) faulting and folding
 - (2) folding and erosion
 - (3) erosion and faulting
 - (4) metamorphism and erosion
9. Volcanic activity formed
- (1) the Great Lakes
 - (2) Long Island
 - (3) the Hawaiian islands
 - (4) Cape Cod
10. Central New York State is a plateau composed of horizontal layers of rock. Many of the layers contain fossils. The type of rock in Central New York is
- (1) igneous
 - (2) sedimentary
 - (3) metamorphic
 - (4) volcanic
11. When an earthquake occurs, it sends vibration waves through Earth's interior and along Earth's surface. Earthquake waves are called
- (1) seismic waves
 - (2) electro waves
 - (3) sound waves
 - (4) circular waves
12. Which layer of Earth do scientists know the most about?
- (1) crust
 - (2) mantle
 - (3) outer core
 - (4) inner core
13. Earth is composed of four layers: the crust, the mantle, the outer core, and the inner core. The thickest layer is the
- (1) inner core
 - (2) outer core
 - (3) mantle
 - (4) crust
14. The theory of continental drift was not accepted when proposed in the early 1900s because
- (1) no process could be identified that could cause it
 - (2) no evidence could be presented supporting it
 - (3) there were no earthquakes and volcanic eruptions
 - (4) the continents stopped drifting in the early 1900s
15. The most obvious evidence that supports the theory of continental drift is
- (1) the type of landforms under the Pacific Ocean
 - (2) similar mineral deposits in Africa and North America
 - (3) animal distribution in Africa and North America
 - (4) the shape of the continents on both sides of the Atlantic Ocean

16. One way mountains form is by
- (1) the pull of moon's gravity
 - (2) colliding tectonic plates
 - (3) erosion of plains
 - (4) accumulation of sand along a beach

17. Which body of water could be represented by the accompanying figure?



- (1) Lake Ontario
 - (2) Mississippi River
 - (3) Atlantic Ocean
 - (4) Mediterranean Sea
18. The edges of tectonic plates are zones where earthquakes and faulting occurs. Which state is located on the edge of a tectonic plate?
- (1) California
 - (2) Colorado
 - (3) New York
 - (4) Florida
19. An area where one plate subsides under another plate is a
- (1) mid-ocean ridge
 - (2) trench
 - (3) continental shelf
 - (4) continental slope
20. What causes the tectonic plates on Earth's surface to move?
- (1) the gravitational pull of the moon
 - (2) water currents moving through the ocean
 - (3) convection caused by rising heat in Earth's mantle
 - (4) the magnetic field formed by Earth's core