

1.1.2 External or Gradational Forces and Resultant Landforms

External forces are the forces that act upon the earth's surface from the outside. These forces level the ups and downs of the earth's surface. This process occurs in two ways: denudation and deposition.

Denudation: is the lowering of the land by wearing away of the surface of the earth. It consists of weathering and erosion.

1. Weathering

Weathering refers to the breaking down of rocks into smaller particles. There are two types of weathering. These are physical (mechanical) and chemical weathering.

- i. **Physical weathering:** it is the process by which rocks are broken into smaller pieces. Its main agents (causes) are temperature change, frost action and plant and animal action.
 - a. **Temperature change:** The temperature variation between day and night causes rock to expand and contract. Due to this process the rock layers peel off and fall to the ground. The process of breaking rock layers because of changes of temperature is called exfoliation (Onion skin weathering).
 - b. **Frost action:** Rain water fills the cracks and the pores of rocks, and expands on freezing, by exerting a great pressure on the rocks. The alternate thawing (warming) and freezing in time make the rocks break up into pieces. These fragments pile up at the bottom of the main rocks forming screes.
 - c. **Plant and animal action:** The roots of some plants may enter the cracks of rocks and push the rock apart. This leads to the breakdown of the rocks. Some animals make holes into the ground to find food and shelter. This also breaks up rocks.

- ii. **Chemical weathering:** it is a process which causes complete change in the internal structure of rocks. Its main agents are rain action and plant and animal action.
- a. **Rain action:** When rain water passes through the atmosphere, it takes in carbon dioxide and forms carbonic acid. When carbonic acid comes in contact with limestone, it dissolves the limestone and forms caves. The cave contains features, such as: stalactites, stalagmites and pillars.
- Stalactite:** is a limestone column that hangs down from the roof of the cave.
- Stalagmite:** is a limestone column that grows upwards from the floor of the cave.
- Pillar:** is formed when stalactite and stalagmite join together.
- b. **Plant and animal action:** Bacteria in the presence of water break down certain minerals in the soil. Plants absorb minerals, and decaying vegetation produces organic acid which cause a further breakdown of minerals.

2. Erosion

Erosion is the movement of broken rock and soil particles from one place to another by running water, wind, moving ice or sea waves.

A. Erosion by Running Water

Rivers are the most important of all natural agents which play a great role in shaping the earth's surface. The work of running water includes eroding, transporting and depositing eroded material. There are three types of running water erosion and they are described as follows:

Sheet erosion: occurs when surface water moves in a wide flow.

Rill erosion: occurs when surface water cuts relatively small channels.

Gully erosion: occurs when floods cut deep wide gorges.

B. Wind erosion

Wind is the strongest force of erosion in deserts. As it blows across the desert surfaces, it picks up and transports grains of sand from one part to another part of the desert. Wind erosion and deposition form different landforms, such as:

Sand dune is a small hill of sand formed by the action of the wind.

Barchan is a sand hill that has a crescent-moon shape.

Loess deposit is a deposition of fertile soil in the desert by wind.

Unit One Section 1.1.2

Worksheet One

Section A

1. **What are external forces in relation to the Earth's surface?**
 - a) Forces from earthquakes and volcanoes
 - b) Forces that originate within the Earth's crust
 - c) Forces that act upon the Earth's surface from the outside
 - d) Forces that create mountains and valleys
2. **Which of the following processes are included in denudation?**

a) Earthquakes and folding	b) Weathering and erosion
c) Deposition and faulting	d) Volcanism and sedimentation

3. **What is the main result of external forces on the Earth's surface?**

- a) Formation of new land
- b) Movement of tectonic plates
- c) Leveling of the ups and downs of the Earth's surface
- d) Creation of earthquakes

4. **Which of the following are agents of erosion?**

- a) Wind, water, ice, and gravity
- b) Earthquakes and volcanoes
- c) Heat and light
- d) Fossils and rocks

5. **Which agent of erosion is most significant in desert areas?**

- a) Water
- b) Ice
- c) Wind
- d) Gravity

6. **Which landform is created by wind erosion?**

- a) Moraines
- b) Mushroom rocks
- c) River valleys
- d) Glacial lakes

7. **What is weathering?**

- a) The movement of rocks from one place to another
- b) The breaking down of rocks into smaller particles
- c) The formation of mountains
- d) The freezing of water in the atmosphere

8. What are the two main types of weathering?

- a) Erosion and deposition
- b) Physical and chemical
- c) Volcanic and tectonic
- d) Wind and water

9. What is the difference between physical and chemical weathering?

- a) Physical changes the rock's chemical makeup
- b) Chemical weathering adds mass to the rock
- c) Physical weathering breaks rocks without changing their composition
- d) Chemical weathering only occurs in deserts

10. Which of the following causes physical weathering?

- a) Acid rain
- b) Oxidation
- c) Temperature changes and freezing of water
- d) Reaction with oxygen

11. What is physical weathering?

- a) The chemical breakdown of rocks
- b) The melting of rocks
- c) The breaking of rocks into smaller pieces without changing their composition
- d) The burning of rocks

12. Which of the following is an agent of physical weathering?

- a) Acid rain
- b) Carbon dioxide
- c) Temperature change
- d) Rusting

13. What is exfoliation (onion skin weathering)?

- a) Freezing and thawing of water in rock cracks
- b) Peeling off of rock layers due to temperature change
- c) Roots growing in rocks
- d) Wind erosion of desert rocks

14. How does frost action contribute to weathering?

- a) By melting the rocks
- b) By softening rock surfaces
- c) By water freezing and expanding in rock cracks
- d) By drying up the rocks

15. What are the fragments formed by frost action called when they pile up?

- a) Dunes
- b) Sediments
- c) Screens
- d) Boulders

16. How do plant roots cause physical weathering?

- a) By melting the rock
- b) By absorbing minerals
- c) By entering cracks and pushing the rocks apart
- d) By changing the color of the rock

17. How do animals contribute to physical weathering?

- a) By eating plants on the rock
- b) By changing the chemical structure of rocks

- c) By digging holes that break rocks apart
- d) By sitting on top of rocks

18. Which one of the following is true about the main difference between physical and chemical weathering?

- a) Physical weathering changes chemical composition, chemical does not
- b) Physical weathering involves only animals
- c) Physical weathering breaks rocks without changing composition, chemical changes the rock's substance
- d) Chemical weathering always involves water freezing

19. Why do rocks break apart due to temperature changes?

- a) Because water dissolves them
- b) Because they melt during the day and freeze at night
- c) Because they expand when hot and contract when cold
- d) Because wind removes their outer layers

20. What do we call the process where rock layers peel off due to temperature change?

- a) Frost shattering
- b) Abrasion
- c) Exfoliation
- d) Erosion