I. Destructive Forces Notes:

Destructive force: a process in which land is destroyed or changed such as weathering and erosion. All landforms are a result of a combination of constructive and destructive forces.

A. Weathering: the breaking down of rocks into smaller pieces by natural process (by things like wind, water, sun)

1. Physical Weathering: reduces rocks to smaller fragments without changing their composition. Quickness of weathering depends on size and texture of the rock.

2. Chemical Weathering: causes the minerals that make up the rocks to undergo a chemical change. Quickness of weathering depends on makeup of the rock.

3. Soil: A mixture of weathered rock, organic matter, water, and air; a combination of physical and chemical weathering makes soil

4. How quickly will it weather? Depends on the type of rock, what it’s made of, and if it has lots of cracks and holes in it.

B. Erosion

Erosion is the process by which soil and weathered rock particles (sediment - gravel, sand, silt, and clay) are transported, or moved from one place to another.

The causes of erosion are:

1. Running water
2. Wind
3. Ice (glaciers)
4. Waves
5. Gravity

Please note that weathering and erosion are two different things. Many people mistakenly say erosion when they really mean weathering.

Weathering = breakdown.
Erosion = transport.

1. Erosion by Running Water – *Most powerful cause of erosion*

Running water erodes soil and sediment in several ways:

1. **Abrasion** of the stream bed by gravel and sand carried by the water. Potholes may form.
2. **Dissolves** soluble rock types (such as limestones and marbles, or rocks with calcite cements)
3. **Scour** or lifting of loose particles due to the turbulence of the water.
2. Erosion by Wind

Wind erodes the Earth's surface in two ways:

1. Deflation (lifting of loose particles by the wind)
2. Abrasion (natural sandblasting caused by wind-borne particles of sediment striking the Earth's surface)

Particle size and weight affect the transportation and deposition of soil and sediment. Fine, light weight particles can be high up into the air, whereas larger, heavier particles may only roll or bounce along the ground.

The Dust Bowl of the 1930's was due to wind erosion of soil following extended drought and over-tilling of the soil.

How can we control erosion from running water and wind?

- Contour plowing
- Terraces on a hillside
- Planting groundcovers; roots hold the soil. (Kudzu)
- Windbreaks - a barrier or baffle that causes the wind to slow down. When windspeed is decreased, the load carried by the wind is dropped. Fences and plants are often used as windbreaks.

3. Erosion by Ice

A glacier is mass of ice and snow moving under the influence of gravity. Snow accumulating over many years without melting eventually compacts into glacial ice.

Glaciers erode the surface of the Earth in two ways:

1. Abrasion (rock materials carried by the glacial ice scrape and grind against the floor and walls of the valley, or the bedrock beneath the ice sheet, making scratches or grooves called glacial striations on the rock)
2. Plucking (the process by which loose particles become frozen into the glacial ice as the glacier moves over them, and then they are carried along by the glacier)

Glacial Deposits - When the edge of the glacier begins to melt, rock materials carried by the glacier are deposited.

4. Erosion by Waves - Shoreline Erosion

The powerful force of waves constantly erodes and shapes the shoreline.

Water movements along the shoreline:

1. Waves - caused by wind blowing over the water
2. Tides - caused by gravitational pull of moon on the water
3. Currents - unidirectional flow of water

Sediment is transported along the beach by the waves.
Controlling Shoreline Erosion

Man-made structures are sometimes built along the shoreline to try to reduce or prevent erosion.

Seawalls may be built along the beach to prevent the waves from eroding the shoreline, and to protect homes or other structures built along an eroding beach.

jetties are built perpendicular to the coastline in an attempt to trap some of the sand being carried by the current.

5. Erosion by Gravity or Mass Wasting

Mass wasting is the downslope movement of rock and soil, under the influence of gravity. Also called mass movement or mass wastage.

Types of mass wasting:

A. Rapid movement
   1. Rock fall - The free fall of detached pieces of material of any size; may fall directly downward or bounce and roll. May occur as result of freeze-thaw, or the loosening action of plant roots. sometimes seen along interstate highways where the graded soil on the sides of the road is a little too steep.
   2. Rockslide or debris slide - Also called "landslides". Occurs when blocks of rock, or masses of unconsolidated material slide down a slope. These are among the most destructive of mass movements. May be triggered by rain or melting snow, or earthquakes.
   3. Debris flow or mudflow - Commonly occur in volcanic areas, where they are called lahar. Mudflows generally follow established drainage patterns (valleys).

B. Slow movement
   1. Creep - A SLOW downhill movement of soil and regolith. Creep results in tree trunks that are curved at the base, tilted utility poles, fence posts, and tombstones, and causes retaining walls to be broken or overturned.
II. Constructive forces Notes

Constructive Forces: a buildup of landforms such as mountains and islands by processes such as crustal deformation, faulting, volcanic eruption, and deposition of sediment. Landforms are a result of the combination of constructive and destructive forces.

A. Types of Constructive Forces

1. Crustal Deformation: the bending and breaking of earth's crust

2. Faulting

   1. Faults are caused by the Earth's crust bending and breaking in the middle because of the forces pressing on it. These bends and breaks can form faults where the earth's crust is able to move. Faults also mark plate boundaries. There are three main types of faults and each are constructive in their own way.

      a. **Divergent Fault** is where two plates are moving away from each other. As plates pull apart from each other the earth's crust spreads apart. This usually causes rifts or rift valleys. The majority of this activity takes place deep within the oceans along plate boundaries. As the plates pull apart hot magma is pushed toward the surface and volcanoes occur. This affects the Earth's surface by adding new material to the surface.

      b. **Convergent Fault** is when two plates come together. Not only can this cause destruction it can also cause construction. When two plates collide in a collision zone the result is mountains. The pressure of these two plates hitting each other causes the crust of the earth to rise. This can occur in the oceans of the world and on land. Mountain building is a very slow process but it is caused by convergent faults.

      c. **Transform Fault** is when two plates slide past each other. Transform faults that occur in the continental crust usually involve characteristics of divergent and convergent faults. When there is divergence, the land is pulled apart causing a basin to form. These basins form under water which causes the ocean floors to grow. When it is convergent the land collides and pushes up forming mountains.

3. Volcanoes

   1. Volcanoes are one of the most powerful forces in nature. A volcano is a hole in the earth’s crust.

   2. Volcanoes can form on land but they can also form in water. Volcanoes can help build up the Earth's surface like the developing Hawaiian Islands but volcanoes can also be very destructive to the Earth's surface. Volcanoes can endanger anything that happens to be in the vicinity of an erupting volcano such as humans, property, and agriculture.

   3. There are many constructive properties of volcanoes. For example, volcanoes help the rock-cycle by bringing rocks to the surface to form new landforms like islands. All of the Hawaiian Islands were created by volcanoes. There is even a new island forming right now.

   4. Another example of a volcanoes' constructive force is that if there are enough eruptions or a constant lava flow a mountain can form. Some of these mountains form on land but many build from the bottom of oceans.
4. **Deposition of Sediments**: Deposition is a constructive force that is driven by gravity. Deposition of sediment like sand and mud builds beaches, river deltas, and deposits layers of sediment that if preserved over time will become layers of rock.

   **a. River deposits**
   Soil that is eroded and transported by streams will eventually be deposited as sandbars in streams, as pointbars on the inside curve of a meandering stream, on floodplains and levees, or at the mouth of the river in a delta. In mountainous areas, at the break in slope between the mountain front and the flat valley, running water decreases rapidly in velocity as it reaches the flat valley, and sediment is deposited as an alluvial fan. Today, much eroded soil will be trapped behind dams across rivers, filling reservoirs. Loss of sediment transport to the coast also depletes beaches of sand, and can lead to accelerated beach erosion.

   **b. Wind Deposits**
   Sand transported by the wind may be deposited as sand dunes.

   **c. Glacial Deposits**
   When the edge of the glacier begins to melt, rock materials carried by the glacier are deposited.

   **d. Shoreline deposition**
   Waves can deposit sediment, in addition to eroding it. Sediment that is eroded in one area will be deposited in another area. Depositional features along the shoreline formed by waves:
   - Beaches and barrier islands
   - Spits and sand bars