What Is Mass Movement?

Gravity can cause erosion and deposition. Gravity makes water and ice move. It also causes rock, soil, snow, or other material to move downhill in a process called **mass movement**.

**ANGLE OF REPPOSE**

Particles in a steep sand pile move downhill. They stop when the slope of the pile becomes stable. The *angle of repose* is the steepest angle, or slope, at which the loose material no longer moves downhill. If the slope of a pile of material is larger than the angle of repose, mass movement happens.

The slope of this pile of sand is equal to the sand’s angle of repose. The sand pile is stable. The sand particles are not moving.

The slope of this pile of sand is larger than the angle of repose. Therefore, particles of sand move down the slope of the pile.

The angle of repose can be different in different situations. The composition, size, weight, and shape of the particles in a material affect its angle of repose. The amount of water in a material can also change the material’s angle of repose.
What Are the Kinds of Mass Movement?

Mass movement can happen suddenly and quickly. Rapid mass movement can be very dangerous. It can destroy or bury everything in its path.

**LANDSLIDES**

A *landslide* happens when a large amount of rock and soil moves suddenly and rapidly downhill. Landslides can carry away or bury plants and animals and destroy their habitats. Several factors can make landslides more likely.✓

- Heavy rains can make soil wet and heavy, which makes the soil more likely to move downhill.
- Tree roots help to keep land from moving. Therefore, *deforestation*, or cutting down trees, can make landslides more likely.
- Earthquakes can cause rock and soil to start moving.
- People may build houses and other buildings on unstable hillsides. The extra weight of the buildings can cause a landslide. ✓

The most common kind of landslide is a *slump*. Slumps happen when a block of material moves downhill along a curved surface.

**ROCK FALLS**

A *rock fall* happens when loose rocks fall down a steep slope. Many such slopes are found on the sides of roads that run through mountains. Gravity can cause the loose and broken rocks above the road to fall. The rocks in a rock fall may be many different sizes.

**MUDFLOWS**

A *mudflow* is a rapid movement of a large amount of mud. Mudflows can happen when a lot of water mixes with soil and rock. The water makes the slippery mud flow downhill very quickly. A mudflow can carry away cars, trees, houses, and other objects that are in its path.

Mudflows are common in mountain regions when a long dry season is followed by heavy rain. Mudflows may also happen when trees and other plants are cut down. Without plant roots to hold soil in place and help water drain away, large amounts of mud can quickly form.
LAHARS

Volcanic eruptions can produce dangerous mudflows called *lahars*. A volcanic eruption on a snowy peak can suddenly melt a great amount of snow and ice. The water mixes with soil and ash to produce a hot flow that rushes downhill. Lahars can travel faster than 80 km/h.

CREEP

Not all mass movement is fast. In fact, very slow mass movement is happening on almost all slopes. Creep is the name given to this very slow movement of material downhill. Even though creep happens very slowly, it can move large amounts of material over a long period of time.

Many factors can affect creep. Water can loosen soil and rock so that they move more easily. Plant roots can cause rocks to crack and can push soil particles apart. Burrowing animals, such as moles and gophers, can loosen rock and soil particles. All of these factors may make creep more likely.

<table>
<thead>
<tr>
<th>Type of Mass Movement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landslide</td>
<td>Material moves suddenly and rapidly down a slope.</td>
</tr>
<tr>
<td>Rock fall</td>
<td>Water mixes with volcanic ash to produce a fast-moving, dangerous mudflow.</td>
</tr>
<tr>
<td>Mudflow</td>
<td>Material moves downhill very slowly.</td>
</tr>
</tbody>
</table>

**READING CHECK**

6. **Compare** How is creep different from the other kinds of mass movement that are discussed in this section?

**TAKE A LOOK**

7. **Describe** Fill in the blank spaces in the table.
Section 4 Review

SECTION VOCABULARY

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>creep</td>
<td>the slow downhill movement of weathered rock material</td>
</tr>
<tr>
<td>landslide</td>
<td>the sudden movement of rock and soil down a slope</td>
</tr>
<tr>
<td>mass movement</td>
<td>the movement of a large mass of sediment or a section of land down a slope</td>
</tr>
<tr>
<td>mudflow</td>
<td>the flow of a mass of mud or rock and soil mixed with a large amount of water</td>
</tr>
<tr>
<td>rock fall</td>
<td>the rapid mass movement of rock down a steep slope or cliff</td>
</tr>
</tbody>
</table>

1. **List** What are four kinds of mass movement?

2. **Infer** Why is it important for people to think about mass movement when they decide how to use land?

3. **Identify Relationships** How is mass movement related to the angle of repose?

4. **Identify** What force causes mass movements?

5. **Compare** How are landslides different from mudflows?

6. **List** Give four things that can affect a material’s angle of repose.
6. A glacier deposits unsorted material if, as it melts, the sediment in it drops to the ground. A glacier deposits sorted material if, as it melts, its water carries smaller sediment farther than larger sediment.

SECTION 4 THE EFFECT OF GRAVITY ON EROSION AND DEPOSITION
1. the steepest slope at which particles do not move downhill
2. The slope is greater than the angle of repose.
3. They can carry away, bury, and destroy habitats.
4. heavy, wet soil; removal of plant roots; earthquakes; construction
5. Water probably decreases the angle of repose, because wetting soil that is not moving can cause it to start moving downhill.
6. Creep happens slowly.

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Review
1. landslides, mudflows, rock falls, creep, lahars
2. Mass movement can cause property damage and injury.
3. If the angle of a slope is greater than the angle of repose, mass movement will occur.
4. gravity
5. Landslides involve the fast movement of large amounts of materials of many different sizes. In mudflows, there is fast movement of mud only.
6. size, shape, weight, and composition of the particles making up the material

Chapter 13 Exploring the Oceans

SECTION 1 EARTH’S OCEANS
1. the continents
2. Pacific, Atlantic, Indian, Southern, Arctic
3. volcanoes

4. Plate tectonics has caused the continents to move.
5. sodium and chlorine
6. rocks and minerals on land
7. The hot, dry weather causes ocean water to evaporate, and salt is left behind.
8. The Mississippi River brings fresh water into the Gulf of Mexico.
9. Fast-moving water tends to have low salinity.
10. by convection
11. The temperature would be less uniform, because the cool and warm water would not mix as efficiently.
12. The equator receives more sunlight.
13. the movement of water between the ocean, the atmosphere, and the land
14. into the oceans
15. Air absorbs heat from the oceans.
16. currents

Review
1. All of the oceans are connected, so water and other materials can flow between them. Therefore, they can all be considered to be part of a single body of water.
2. water movement and climate
3. The hot, dry climate causes water to evaporate from the oceans, but the salt remains behind in the liquid water.
4. The sun cannot heat the water in the thermocline, and the warm water above cannot easily mix with the colder water.
5. A simple diagram of the water cycle should be drawn. It should include descriptions of evaporation, condensation, and precipitation.

SECTION 2 THE OCEAN FLOOR
1. The pressure there is too high for people to survive without a ship.
2. They need to be thick in order to withstand the high pressures in the deep ocean.
3. a process in which sound signals are used to determine the distance to an object
4. The time for sound to travel to the ocean floor is 2 s. Then, \(2 \text{s} \times 1,500 \text{ m/s} = 3,000 \text{ m}\).
5. continental margin, deep-ocean basin
6. continental shelf, continental slope, continental rise
7. continental shelf, continental slope, continental rise