Perlite Hills:
In-Class Activity and Teacher's Guide

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Introduction:

Two important factors that influence whether a hill slope will fail are: the angle of repose, and the amount of water in the hill. In this activity, students will experiment with the angle of repose and with various moisture levels to observe the behavior of slope material under different environmental conditions.

Learning Objectives:

Through this activity, students will

- Have a better understanding of the angle of repose
- understand the relationship between the angle of repose and slope failures
- understand that the angle of repose is the stable angle of a hill slope.

Materials List:

Each group will need the following:

1 plastic plate
1 cup of Perlite
1/3 to ½ cup of water
1 ruler

Background:

The Angle of Repose: *steepest* angle at which material remains stable.

- This angle varies depending upon the material that composes the slope. Each slope has its own specific angle of repose.
- When the slope of a hill resides at the angle of repose, the slope is stable.
- A slope will readjust to reach the angle of repose by landsliding.
- Over steepening either naturally by erosion or by people cutting into hill slopes without grading the hill back to the angle of repose, causes a slope to fail. This is just the hill's natural way of reaching a state of equilibrium.

The Effects of Water:

- Hill slopes need moisture to remain stable. Moisture binds mineral grains together by forming a film of water around each grain which causes the grains to adhere.
- Too much water separates grains and allows them to glide past instead of cling to each other. In other words, the water lubricates the hillside and makes sliding easier.
- Too much water also exerts pressure on the hillside. The heaviness of a water logged hill will also helps pull the hillside down hill.
- Lack of water can also cause slope failures. Drying out causes crumbling as the particles in the hill slope have no moisture to bind them to each other.

Topics for Further Discussion:

- What other factors may contribute to slope stability? (Consider vegetation, orientation of rock layers, type of rocks.)
- What are other causes of landslides? (Earthquakes, volcanic eruptions, waves undercutting or over steepening a beach cliff, etc.)
- How to people cause landslides?
- Why does too little moisture cause landslides?

Learning Outcomes:

Through this activity, students will discover that

- the slope of a stable hill reflects the hill's angle of repose
- over steepening the hill slope causes the hill to collapse (landslide) back into the angle of repose
- moisture helps hill slope material to cling together, keeping the hill stable
- too much water will force slope material particles apart, causing landslides
- dry conditions also cause slope failures because the material is loose
- when the angle of repose is disturbed, a slope will adjust itself to be at the angle of repose again.

Helpful Hints:

- Perlite can be purchased at a gardening center. It can be reused over and over. Just let it dry out between uses.
- The perlite should be completely dry to begin with in order to create landslides and a greater difference in height with the moistened perlite.
- After repeated reuse of the perlite, the angle of repose will change as the pieces of perlite get crushed into smaller and smaller particles.
- A variation on this activity might be to measure the angle of repose in addition to measuring the height of the perlite hill.

Group Activity: Perlite Hills

The *angle of repose* is the angle of the steepest slope that a pile of unconsolidated material can obtain before collapsing.

1. Make the tallest pile possible with the dry perlite.
2. Measure the height of the pile with the ruler: _____cm.
3. Observe the steepness of the hill. Cut away part of the hill and describe what happens.

4. Add just a little water to the perlite to **dampen** it, *but not drown* it.
5. Make the tallest possible pile with the moist perlite.
6. Measure the height of the pile with the ruler: _____cm.
7. Is the damp pile taller or shorter than the dry pile and by how much? Circle the + or – symbol and write the change in height in centimeters: +/- _____cm.
8. Add more water to the perlite to make it wet—*soaked*. What happens to the hill?

9. Make the tallest possible pile with the wet perlite and measure again: +/- _____cm.
10. Explain the relationship between pile height and moisture content in the Perlite.