

Test 3 Study Guide

Mass Wasting

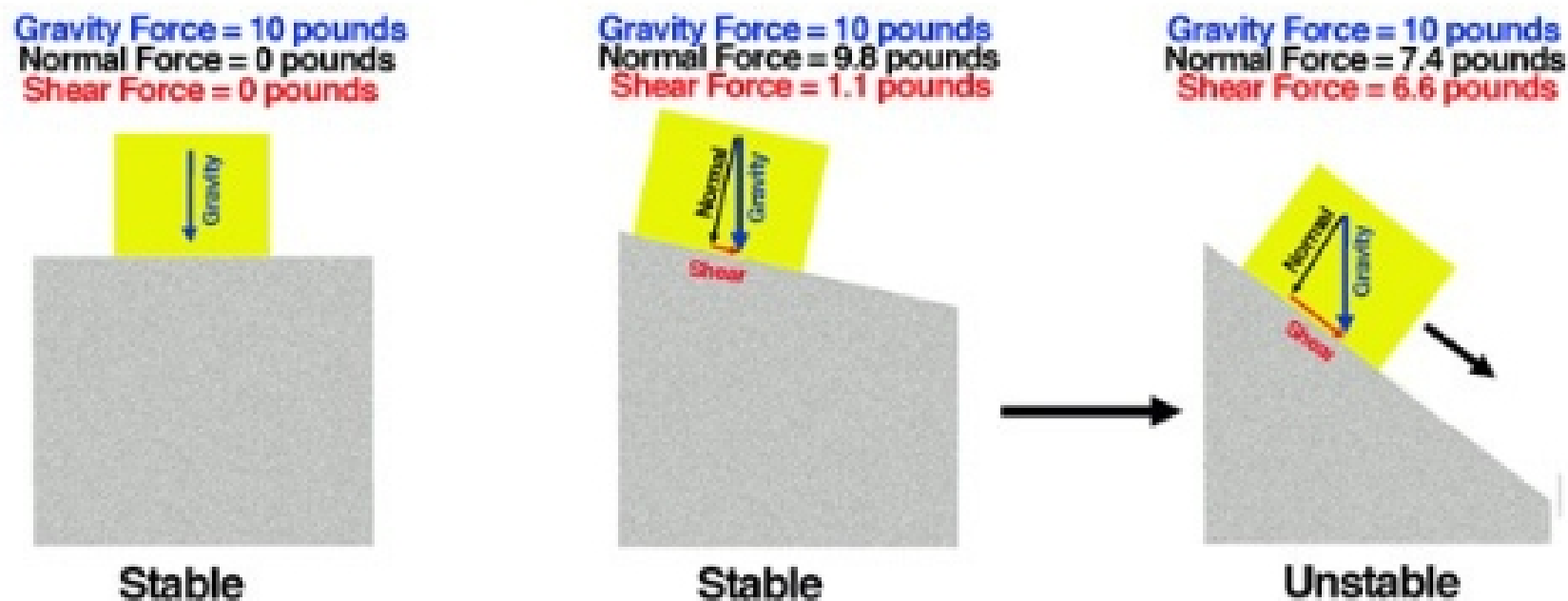
Understand all the factors that affect mass wasting (i.e. what factors influence the stabilities of slopes) and how they affect it. Such factors include

- Nature of the materials (unconsolidated sediment-soil or consolidated rock)

Unconsolidated materials, such as soil and sediment, tend to be more prone to slope failure than rocks. Sand-rich sediment tends to be the least stable because there is more void space and the packing of individual grains is not as close as sediment with clay sand and silt. Layered rocks are more stable than sediment or soil but are less stable than massive igneous rocks. Layered rocks tend to be more friable and can be fragmented and broken away from the bedrock. Massive rocks tend to be less prone to fracturing and fragmentation except when they are highly fractured.

- Steepness of slope

The angle at which material slopes is the major determining how much of the force of gravity is directed downslope.



- Water

Water can play a significant role in mass wasting, sometimes acting as the key component to a mass-wasting event, or serving as a lubricant within a mass of sediment and rock, enabling it to travel faster and further than it would otherwise

- Vegetation

Vegetation has an anchoring effect on slopes. The roots of the vegetation form a physical anchor for the soil and sediment along the slope. Vegetation also reduces the amount of water in the pore spaces for nutrition. When human development occurs vegetation is often stripped from slopes, increasing the risk of slope failure.

- Presence and orientation of planes of weakness (bedding, joints, metamorphic foliations (i.e. potential slide surfaces))

Planes of weakness in the material can facilitate mass wasting if the planes are oriented parallel to the slope. Planes of weakness include bedding planes in sedimentary rocks and foliation planes in metamorphic rocks. The orientation of rock layers has a significant effect on the stability of the slopes containing layered rock units. When rock layers dip in the same direction as the slope, failure of the slope is most likely. Horizontal layering is a somewhat more stable configuration. The most stable configuration is when the rock layering dips into the slope, in the opposite direction of the slope direction.

- Climate (in addition to precipitation, freeze-thaw cycles are important)

The creep of soil and other unconsolidated material can be a "grain by grain" process facilitated by freeze-thaw cycles. As water between grains crystallizes to ice and expands, a grain is pushed away from the surface of the ground. On thawing, that grain falls under the influence of gravity, ever so slightly farther down slope than it was.

Think about some ways in which human activity can influence these factors and what the results of such activity might be.

Like it says above, when human activity eliminated vegetation from an area, it increases the risk of slope failure which can lead to unnecessary mass wasting.

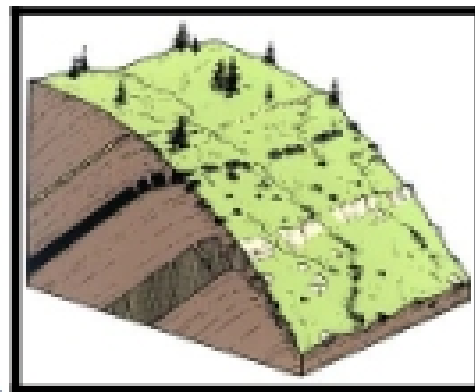
Because the steepness of a slope is one of the primary factors contributing to slope stability, anything that people do to cause a slope to become steeper will generally decrease that slope's stability.

Some natural processes that over steepen slopes include

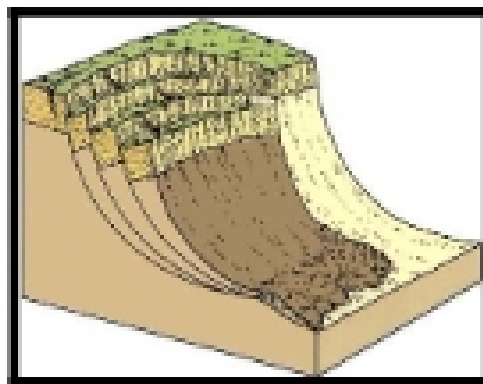
- stream erosion
- wave erosion
- tectonic uplift
- volcanic activity

*Mass wasting events are manifested in different ways and at different rates depending on the types of materials involved (such as rock, earth, mud, debris) and the type of motion involved (such as fall, slide, flow). To what do the terms creep, slump, and avalanche refer; what about the rates at which they occur? *

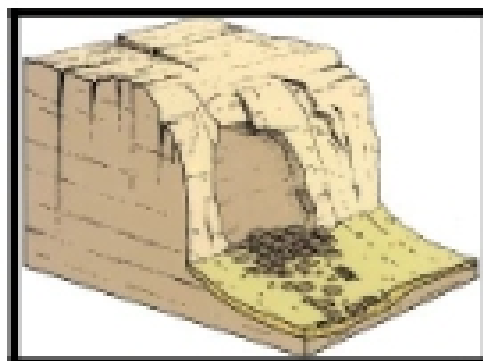
Creep (flow) occurs at the slowest rate of mass wasting processes, often at a cm/year or less. Bent tree trunks, fence posts, utility poles as well as gravestones tilted downslope indicate that creep has occurred



Slump (slide) occurs at a faster rate than creeps but are still fairly slow at roughly 1 km/hr. Slumps occur when a coherent mass of loosely consolidated materials or rock layers moves a short distance down a slope. Movement is characterized by sliding along a concave-upward or planar surface.



Avalanche (flow) occurs at the fastest rate at around 5 km/hr. Avalanches occur when a mass of material breaks loose from its surroundings causing it to move rapidly down a slope.



"Landslide" is a general term referring to all slides, flows (even falls) that occur at a moderately fast rate.