The Mountains Come Down – Breaking Down the Rocks

Essential Question: How do mountains shrink?

As we look upwards, it's hard to imagine the mountains almost twice their present size – however in their infancy they were almost that large. Slowly, through the processes of weathering and erosion, the mountains have been reduced to a fraction of their original size. The material removed or eroded from these mountains has been used to help fill in the many lakes and deltas in the area. This will all lead to a very different terrain in a few dozen million years from now.

How are the Mountains Slowly Shrinking?

Chemical Weathering - many of the rocks that make up the mountains, in particular limestone, are susceptible to chemical reactions with materials carried in the air and water. The water dissolves the limestone and other rocks forming Karst topography or underground cave. The most common types of chemical weathering are oxidation, hydrolysis and carbonation. Chemical weathering is fastest in warm climates.

Physical weathering process of rocks breaking apart without changing their chemical composition. Examples of physical weathering are freeze and thaw or frost wedging and exfoliation.

Freeze and Thaw - water is unique. As it freezes, it expands in volume. In the mountains, snow melts during the day, and the resulting water flows into cracks in rocks. Overnight, as temperatures drop, the water expands and freezes. This expansion provides an incredible wedging force that break rocks.

Glaciation - glaciers take the landscape and sculpt it. Sharp v-shaped valleys are smoothed into rounded u-shaped valleys. Gravity plays a major in glaciations.

Avalanches - as snow accumulates high in the mountains, eventually gravity take over and the excess is released in the form of avalanches.

Running Water - water is the king of erosion. Nothing carves up a landscape like the action of water.

Soil Creep - very subtle, creep can be almost undetectable. It is normally found on weathered mountain slopes. Under the force of gravity, the material slowly begins to slide downhill, and eventually the signs of creep become evident.

Slumping - in many situations, a steep hillside will show a spoon-shaped depression within which the material has begun to slide downhill.

Rockslides - sometimes, as layers of rock are steeply uplifted, the bonding of one layer to another may be weakened by the action of water or other agents of erosion. As the force of gravity constantly pulls down on the surface of a steep slope, there may eventually be a failure. As a fracture occurs at the top, a layer may slide down suddenly creating a large rockslide.

Wind - wind blows away sediment. In areas where the wind constantly blasts, as in the Bow Valley, the wind may add to the effects of other forces. Sand dunes form because of wind erosion. Wind is the greatest agent of weathering and erosion in the desert.

Biological Action - the orange and green lichens that coat many of our rocks are slowly breaking them down. Lichens are composite organisms consisting of a fungus and a photosynthetic partner growing together in a symbiotic relationship.

http://www.mountainnature.com/geology/Erosion.htm
Clarifying questions:

1. Why are mountains shrinking?

2. What happens to the materials eroded from the mountains?

3. What is Karst topography?

4. How do caves and sinkholes form?

5. How can freezing and thawing break rocks?

6. Glaciation is erosion by ________________________________

7. Avalanches are made up of ____________________________

8. What is the king of erosion? ____________________________

9. What causes soil creep? ________________________________

10. What is slumping? __________________________________

11. What is a rockslide? ________________________________

12. What causes the formation of sand dunes? ______________

13. What are lichens? __________________________________

Use Venn diagram to show the similarities and differences between glaciations, avalanche, soil creep, and rock slide.

Matching Type:

___ 14. Chemical Weathering
___ 15. Physical weathering
___ 16. Freeze and thaw
___ 17. Glaciation
___ 18. Soil creep
___ 19. Slumping
___ 20. Wind
___ 21. Biological action

A. lichens produce a weak acid that breaks down rocks
B. oxidation, hydrolysis and carbonation
C. exfoliation and frost wedging
D. forms sand dunes
E. water expands when it freezes causing rocks to break
F. a spoon-shaped depression
G. materials, soil and rocks, slowly to slide downhill
H. glaciers sculpt the land

Research: How do sinkholes form?
Physical weathering is caused by the effects of changing temperature on rocks, causing the rock to break apart. The process is sometimes assisted by water.

There are two main types of physical weathering:

- Freeze-thaw occurs when water continually seeps into cracks, freezes and expands, eventually breaking the rock apart.
- Exfoliation occurs as cracks develop parallel to the land surface a consequence of the reduction in pressure during uplift and erosion.

Where does it occur?
Physical weathering happens especially in places where there is little soil and few plants grow, such as in mountain regions and hot deserts.

How does it occur?
Either through repeated melting and freezing of water (mountains and tundra) or through expansion and contraction of the surface layer of rocks that are baked by the sun (hot deserts).

https://www.geolsoc.org.uk/ks3/gsl/education/resources/rockcycle/page3561.html

Questions and Answers
1. Subsoil, more clay is washed down.
   A. "A (horizon)"
   B. "B (horizon)"
   C. "C (horizon)"

2. What may occur in dry regions during a sudden, heavy rainfall or as a result of volcanic eruptions, with mud churning and tumbling down slopes and through valleys?
   A. A rockfall
   B. A mudflow
   C. A landslide
   D. A slump
3. The breakdown of rock due to exposure to the atmosphere, weather, plants and animals.

A. Mechanical weathering 
B. Chemical weathering 
C. Expansion/contraction 
D. Oxidation 
E. Weathering 

4. Examples of chemical weathering. (mark all that apply)

A. Abrasion 
B. Plants/animals (lichens) 
C. Ice wedging 
D. Acid rain 
E. Exfoliation 
F. Oxidation 
G. Hydrolysis 
H. Wetting and drying 
I. Carbonic acid/carbonation 
J. Expansion/contraction 

5. Found in eastern half of U.S. where amount of rainfall exceeds 25 inches a year, a lot of vegetation and acidic soil.

A. Pedocal 
B. Desert areas 
C. Pedalfers 
D. Weathered soil 

6. High elevation and latitude, very few layers, shallow...permafrost.

A. Tropical soil 
B. Temperate soil 
C. Arctic soil 

7. An accelerated soil erosion caused by the plowing of furrows up and down slopes that allows water to run swiftly over soil, carrying away the topsoil, is called

A. Mudflow 
B. Erosion 
C. Gullyling 

8. The entire arrangement of horizons are called

A. Dunes
9. What occurs along very steep slopes when saturation by water and loss of friction with underlying rock cause loose soil to slip downhill in one huge piece?

A. A rockfall
B. A mudflow
C. A landslide
D. A slump

10. Rates of weathering. (mark all that apply)

A. Time
B. The rocks themselves
C. Surface area
D. Climate
E. Mechanical weathering
F. Topography

11. The slow, downslope flow of soil saturated with water over hard or frozen layers in areas surrounding glaciers at high elevations is called

A. Creep
B. Solifuction
C. Talus
D. Landslide

12. How do some farming and ranching practices increase soil erosion?

A. By clearing plants.
B. By allowing water to go on the land.
C. By letting the land die and buring the crops.
D. By clearing plants or allowing animals to overgraze destroys this groundcover.
E. By removing all the horizons in the soil and letting bedrocks form.

13. Found in western half of U.S. where rainfall is less than 25 inches a year, basic soil.

A. Pedocal
B. Pedalfers
C. Mature soil

14. A smaller plateau that are tablelike areas.

A. Mesas
B. Buttes
15. What are the factors that determine soil makeup?
   A. Climate, parent rock, topography, time and vegetation.
   B. Parent rock, climate, topography, time and humus.
   C. Vegetation, parent rock, time, age of soil, pedocals.

16. Zone of soil are called
   A. Horizons
   B. Profiles
   C. Young soil

17. Topsoil, gray or black, has humus.
   A. "A (horizon)"
   B. "B (horizon)"
   C. "C (horizon)"

18. Definition of creep.
   A. Very, very slow down slope movement of rocks. (no water needed)
   B. Very, very slow down slope movement of soil. (water in soil adds to it)
   C. Very, very slow down hill movement of rocks. (no water needed)
   D. Very, very slow downhill movement of soil. (water in soil adds to it)

19. Occurring as a result of heavy rainfall, spring thaws, volcanic eruptions, or earthquakes, the sudden fall down a steep slope of masses of loose rock combined with soil is called a
   A. Rockfall
   B. Mudflow
   C. Landslide
   D. Slump

20. Rock fragments and slightly weathered bedrock, you keep digging here, you'll eventually hit soil rock.
   A. "A (horizon)"
   B. "B (horizon)"
   C. "C (horizon)"

21. Rock is split or broken into smaller material without changing its composition.
   A. Oxidation
   B. Surface area
   C. Weathering
   D. Mechanical weathering
What are five examples of mass movements?

A. Creeps, talus's, avalanche, streams, mudflow.
B. Avalanche, mudflow, landslide, dune.
C. Gullying, creep, talus, landslide, earthquake.
D. Avalanche, mudflow, creep, landslide, slump.

Warm and wet, speed up chemical weathering.

A. Arctic soil
B. Tropical soil
C. Temperate soil

Examples of mechanical weathering. (mark all that apply)

A. Ice wedging
B. Oxidation
C. Plants (lichens)
D. Wetting and drying
E. Acid rain
F. Carbonic acid/carbonation
G. Hydrolysis
H. Abrasion
I. Expansion/contraction
J. Exfoliation

This horizon is formed from the leaching of horizon A.

A. No horizon is made
B. "B (horizon)"
C. "C (horizon)"

Plowing soil in curved bands that follow the shape of the land, thus preventing soil from flowing directly down slopes.

A. Contour plowing
B. Strip-cropping
C. Terracing
D. Crop rotation

Wearing down of particles.

A. Abrasion
The movement of a large mass of sediment or a section of land down a slope is called

A. Gullying
B. Mass movement
C. Erosion
D. A rockslide

What are the four agents of erosion?

A. Gravity, soil, landslides, water
B. Wind, water, landslides, air
C. Gravity, glaciers, wind, water
D. Glaciers, gravity, air, soil

Three examples of wind erosion.

A. Sand storms, deflation, abrasion
B. Abrasion, erosion, dunes
C. Dunes, deflation, abrasion

Constant erosion reduces the _______ of the soil by removing the A horizon, which contains humus.

A. Topsoil
B. Fertility
C. Erosion

Planting crops in alternating bands, one of which is a cover crop that slows rain runoff.

A. Contour plowing
B. Strip-cropping
C. Terracing
D. Crop rotation

What is the rapid fall of rocks, ranging in size from tiny fragments to large boulders, from a steep cliff?

A. A rockfall
B. A mudflow
C. A landslide
D. A slump

Soil that was moved by wind or glacier.

A. Residual soil
B. Tropical soil
C. Transport soil

35. Most important result of weathering is
A. New rock
B. Soil
C. Sediment rock

36. Removal of loose particles by wind—most important effect by wind.
A. Abrasion
B. Deflation
C. Dunes

37. Process by which rocks break down as a result of chemical reactions.
A. Mechanical weathering
B. Chemical weathering
C. Weathering

38. Most important factor affecting soil is
A. Climate
B. Topography
C. Time

39. Building steplike ridges that follow the contours of a sloped field, thus slowing the down slope movement of water.
A. Contour plowing
B. Strip-cropping
C. Terracing
D. Crop rotation

40. Planting a field with one type of crop one year and a different type of crop the next year.
A. Contour plowing
B. Strip-cropping
C. Terracing
D. Crop rotation

41. Thin sheets of soil removed prevent by--grass, continued plowing, crop rotation, strip crop, terraces.
A. Gullying
B. Sheet wash
C. Contour plowing
42. A broad, flat landform that has a high elevation. Subject to much more erosion than a plain.
A. Butte
B. Mesa
C. Plateau

43. Running what is the most effective agent of erosion.
A. True
B. False

44. Once the plants die that are on top of the horizon, the nutrients make
A. "A (horizon)"
B. "B (horizon)"
C. "C (horizon)"

45. Small, narrow-topped formations.
A. Mesa
B. Plain
C. Butte

46. A relatively flat landform near sea level.
A. Plateau
B. Plain
C. Mesa

47. Soil made from local bedrock.
A. Tropical soil.
B. Arctic soil.
C. Residual soil.