SI Geology - Full Discipline Demo

Weathering and Erosion

Final Report - Answer Guide

Institution	Science Interactive University
Session	SI Geology - Full Discipline Demo
Course	SI Geology - Full Discipline Demo
Instructor	Sales SI Demo

Test Your Knowledge

Classify the following statements as true or false.

Frost action is a type of mechanical weathering.

Mass wasting is the movement of a continuous or discontinuous mass from high to low elevations due to gravity.

Oxidation occurs when the oxygen in water interacts with and exchanges electrons with the minerals in a rock to produce a chemical change.

Salt crystal growth is classified as chemical weathering.

The angle of repose is the shallowest angle at which slope materials will stay at rest and not slump.

The chemical composition of a rock changes during mechanical weathering.

True	False
1	2

Correct answers:

1 Frost action is a type of mechanical weathering.

Mass wasting is the movement of a continuous or discontinuous mass from high to low elevations due to gravity.

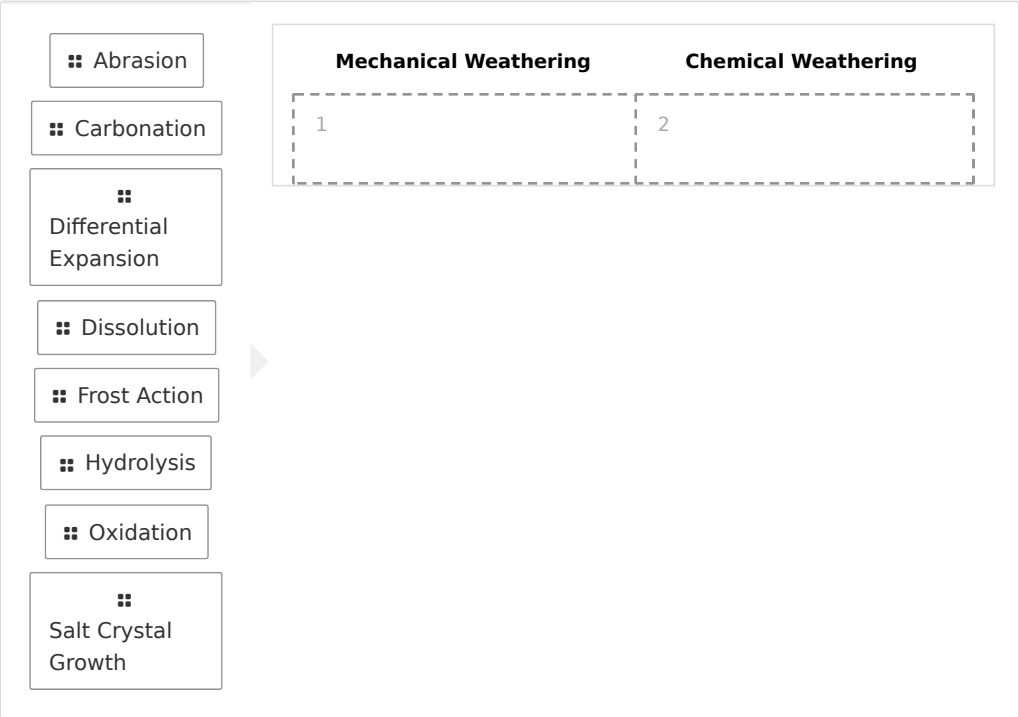
Oxidation occurs when the oxygen in water interacts with and exchanges electrons with the minerals in a rock to produce a chemical change.

2 Salt crystal growth is classified as chemical weathering.

The chemical composition of a rock changes during mechanical weathering.

The angle of repose is the shallowest angle at which slope materials will stay at rest and not slump.

Classify the types of weathering as mechanical or chemical weathering.



Correct answers:

1	Abrasion	Differential Expansion	Frost Action	Salt Crystal Growth
2	Carbonation	Dissolution	Hydrolysis	Oxidation

Exploration

____ occurs when precipitation that has seeped into cracks in a rock freezes and puts stress on the rock, thereby causing the rock to break down.

- Abrasion
- Frost action ✔
- Salt crystal growth
- Differential expansion

Which of the following is not a type of chemical weathering?

- Oxidation
- Hydrolysis
- Dissolution
- Differential expansion ✔

_____ is the process of displacing weathered materials by transporting agents.

- Mass wasting
- Erosion ✔
- Weathering
- Deposition

During a mass wasting event, if the gravitational force is less than the resisting force, the slope will likely fail by creeping, sliding, or falling.

- True
- False ✔

Exercise 1

Summarize the changes (or lack thereof) that occurred for each rock sample.

Which rock was the most resistant to mechanical weathering? Which rock was the least resistant?

Data Table 1: Mechanical Weathering Data
(SAMPLE ANSWER BELOW)

Rock Name	Initial Mass (g)	Final Mass (g)
Granite	27.9	27.9
Limestone	21.2	21.1
Shale	22.7	21.3

Data Table 2: Mechanical Weathering Observations
(SAMPLE ANSWER BELOW)

Rock Name	Initial Observations	Final Observations
Granite	Coarse, very jagged and rough edges. Faces are highly irregular.	Edges less sharp. Appears more sparkly than before.
Limestone	Rock is overall fairly smooth, but the edges are rough. Faces of the rock are pretty flat.	Edges are smoothed. Some surfaces are lighter, and you can see the individual grains better.
Shale	Very smooth. Some angular edges but mostly rounded	Rock is much more round in shape in general. No rough edges. Can see small pits and scratches on the flat faces.

Exercise 2

Which rock samples lost mass? Explain how/why this occurred.

Which rock was the most resistant to chemical weathering?

Based on your results in Exercise 1 AND Exercise 2, rank the rocks in order of resistance to weathering, with 1 being the most resistant and 3 being the least resistant. Explain your reasoning.

Of the three rocks, which would be the best option to use if you are constructing a monument? Why?

Data Table 3: Chemical Weathering Data
(SAMPLE ANSWER BELOW)

Sample	Rock Name	Initial Mass (g)	Final Mass (g)
1	Granite	29.9	29.9
2	Limestone	22.8	22.6
3	Shale	17.4	17.3

Data Table 4: Chemical Weathering Observations
(SAMPLE ANSWER BELOW)

Time	Rock 1 Observations	Rock 2 Observations	Rock 3 Observations
Initial	No noticeable changes	Some small bubbles and dust along the top of the acid (almost like a film)	Some small bubbles and dust along the top of the acid (almost like a film)
1 Hour	No noticeable changes- only tiny bubbles collecting on the surface of the rock	A few large bubbles collecting along the sides of the beaker. Many bubbles trapped on the underside of the rock. You can see tiny bubbles all over the surface of the rock and rising to the surface	Many tiny bubbles all over the surface of the rock- some rising to the surface
4 Hours	No noticeable changes- still only a few small bubbles on the surface of the rock	Some large bubbles along the sides of the beaker. Tapping the beaker released a lot of bubbles.	Many tiny bubbles along the surface of the rock. A small amount of sediment along the bottom of the beaker

Photo 1: Chemical Weathering Setup
(SAMPLE ANSWER BELOW)

Exercise 3

Which dry material had the steepest slope angle? Which had the lowest slope? Why do you think this was the case?

Which material required the most amount of water for the slope to fail? Which required the least? Why do you think this was the case?

Compare the average slope angle for each type of material to the information in Table 1 in the introduction. Does your data fall within the maximum angle of repose for each material given in Table 1? Why or why not?

Material	Angle of Repose
Clay (dry)	25–40°
Clay (wet)	15°
Soil	30–45°
Sand (dry)	34°
Sand (wet)	45°
Gravel	45°
Snow	38°
Ash	40°

Data Table 5: Slope Observations

(SAMPLE ANSWER BELOW)

Material	Slope Observations
Gravel	Observations will vary. Generally, the slope builds slowly. Individual grains tend to cause

	slope failure on impact. Depending on how fast students pour the water, it is unlikely that the slope fails.
Sand	Observations will vary. Generally, the hill builds quickly and forms steep slopes. Slopes will likely fail after a small amount of water is added.
Soil	Observations will vary. Generally, the soil behaves in a similar way to sand, but becomes steep more gradually. Slopes will likely fail after a moderate amount of water is added.

Data Table 6: Slope Angles
(SAMPLE ANSWER BELOW)

Material	Measurement 1 Angle (°)	Measurement 2 Angle (°)	Measurement 3 Angle (°)	Average Ang
Gravel	30–45°	30–45°	30–45°	30–45°
Sand	30–40°	30–40°	30–40°	30–40°
Soil	30–45°	30–45°	30–45°	30–45°

Photo 2: Photo of Three Hills
(SAMPLE ANSWER BELOW)

No sample answer provided

Competency Review

____ is a type of mechanical weathering that occurs when large shear stresses under the surface of the rock cause spalling.

- Abrasion
- Disolution
- Salt crystal growth
- Differential expansion ✔

Which of the following factors impacts the angle of repose for a material?

- Density of the slope material
- Surface area of the material
- Shape of the individual grains
- All of the above ✔

Which rock samples was the least resistant to mechanical weathering in Exercise 1?

- Granite
- Limestone
- Shale ✔

Which rock sample was resistant to both chemical and mechanical weathering?

- Granite ✔
- Limestone
- Shale

Rocks in regions with warm temperatures and high rainfall undergo chemical weathering more quickly than rocks in cold areas with less rainfall.

- True ✔
- False

In Exercise 3, which slope did not fail?

- Sand
- Gravel ✔
- Soil

What was the impact of mechanical weathering on limestone?

- It became more angular.
- It became smoother. ✔
- The limestone did not change.

_____ is the movement of a continuous or discontinuous mass of material from high to low elevations due to gravity.

- [x] Mass wasting
- [ ] Erosion
- [ ] Weathering
- [ ] Deposition

Extension Questions

List and discuss any natural sources that can give a slope greater shear strength. In addition to what you observed in this exercise, what other natural or manmade occurrences could cause a slope to fail? (SAMPLE ANSWER BELOW)

Examples of natural sources that can give a slope greater shear strength include vegetation, natural water content of the material, and natural barriers.

Natural examples that could cause a slope to fail include storms with high winds or precipitation, plant and animal activity, earthquakes, and wildfires. Manmade examples include building construction, paved road construction, water main bursts, deforestation, and human traffic (e.g., hiking, biking).