Name: _____ Class: _____ Date: _____ ID: A

Glaciers and Mass Movements Study Guide

Modified True/False
Indicate whether the sentence or statement is true or false. If false, change the identified word or phrase to make the sentence or statement true.

____ 1. After weathering processes take place, mass movements may occur. _____

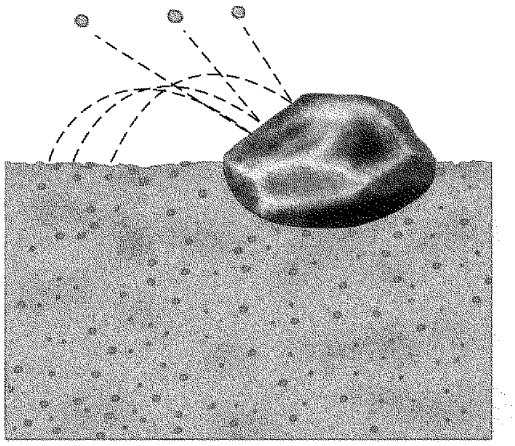
____ 2. A landslide in which layers of snow slide down a mountainside at speeds of up to 300km/hr is a(n) rockslide. _____

____ 3. Because a heavy saturation of water greatly increases the weight of soils, the force of friction is more likely to pull the material downhill. _____

____ 4. The best way to reduce the number of disasters related to mass movements is to relocate people. _____

____ 5. A method of transport by which strong winds cause particles to stay airborne for long distances is called saltation. _____

____ 6. The structure shown in the illustration below is shaped by wind-blown sediments and is called a(n) ventifact. _____



____ 7. Many parts of Earth's surface are covered by thick layers of windblown silt that are called loess. _____

____ 8. When glaciers with embedded rocks move over bedrock valley walls, they grind out perpendicular grooves and scratches. _____

Multiple Choice
Identify the letter of the choice that best completes the statement or answers the question.

____ 9. Which of the following statements is NOT true about the factors affecting mass movement?
a. Sudden mass movements are usually started by triggers such as earthquakes.
b. After a heavy rain, sediment moves along with the water.
c. A small amount of water may make the slope more stable.
d. An important force that determines a material's resistance to downhill movement is friction.

____ 10. Which of the following actions could prevent mass-movement disasters?
a. constructing buildings and roads in stream drainage paths
b. removing trees from steep slopes
c. educating people about the advantages of building on steep slopes
d. digging a series of trenches to divert water around a slope

____ 11. Which of the following statements is true about wind transport?
a. Wind, like water, can only move materials downhill.
b. Wind and water have the same relative ability to erode materials.
c. Wind transport and erosion primarily occur in areas with little vegetative cover.
d. Generally, wind can carry particles as large as those transported by moving water.

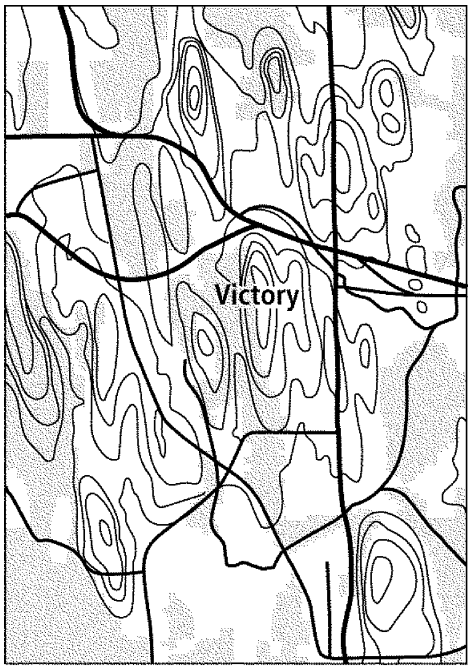
____ 12. Dune formation will take place when ____.
a. high winds, sand, and no vegetation are present
b. sand, high winds, and vegetation are present
c. only with quartz sand, high winds, and vegetation are present
d. high winds are available

____ 13. Where there is limited sand available and strong prevailing winds, ____.
a. longitudinal dunes are formed
b. parabolic dunes form
c. no dune formation can take place
d. transverse dunes are formed

____ 14. Which of the following statements is NOT true about valley glaciers?
a. Flow rates are the same within the various portions of the glacier.
b. The speed of the glacier is affected by the slope of the valley floor.
c. They widen V-shaped stream valleys in U-shaped glacial valleys.
d. Movement is usually less than a few millimeters a day.

____ 15. A ridge consisting of mixed debris deposited by a glacier is a(n) ____.
a. outwash plain
b. kettle
c. moraine
d. esker

____ 16. The glacial feature shown below is formed when ____.



a. glaciers pluck a large hole in the valley
b. water from an outwash plain flows into the valley
c. glaciers move over older moraines and form the material into elongated landforms
d. long, winding ridges of layered sediments are deposited by streams flowing under a melting glacier

____ 17. Which of the following is NOT an indication that creep has occurred?
a. Parallel grooves form in bedrock.
b. Vertical structures become tilted.
c. Trees become bent.
d. Underground pipelines break.

____ 18. Slumps are common after a rainfall because the water ____.
a. reduces friction between soil grains
b. breaks the underlying rock
c. causes snow to melt
d. washes away the vegetation cover

____ 19. Which of the following causes deflation?
a. glacial erosion
b. deposition by meltwaters
c. wind deposition
d. wind erosion

____ 20. Glaciers covered 30 percent of the earth during the last ice age that began about ____.
a. 10 000 years ago
b. 1.6 million years ago
c. 2000 years ago
d. 50 million years ago

____ 21. Which of the following is NOT true about glaciers?
a. Glaciers can form along the equator.
b. Glaciers carve U-shaped valleys.
c. Only valley glaciers flow.
d. Glaciers produce moraines.

____ 22. When two cirques on opposite sides of a valley meet, they form a(n) ____.
a. arête
b. drumlin
c. moraine
d. avalanche

____ 23. A landslide that occurs on steep slopes in mountainous area is called a(n) ____.
a. rockslide
b. slump
c. avalanche
d. mudflow

Completion
Complete each sentence or statement.

24. The slow, steady, downhill flow of loose, weathered earth materials is called _____.
25. Rocks that are shaped by windblown sediment are known as _____.
26. Streams flowing under a melting glacier deposit long, winding ridges of layered sediments called _____.
27. The lowering of the land surface that results from the wind's removal of surface particles is known as _____.

Matching

Match each item with the correct description below.
a. slump
b. creep
c. water
d. mudflow
e. landslide

____ 28. The slow, steady, downhill flow of loose, weathered earth materials
____ 29. Swiftly moving mixture of mud and water that causes many deaths
____ 30. A rapid, downslope slide of earth materials
____ 31. A landslide in which the material rotates and slides along a curved surface
____ 32. This acts as a lubricant between grains of soils and sediments

Match each item with the correct statement below so that you have arranged the steps of the formation of a glacier in order.
a. Step 1
b. Step 2
c. Step 3
d. Step 4

____ 33. The weight of the snow exerts extensive downward pressure.
____ 34. Cold temperatures keep fallen snow from completely melting.
____ 35. The snow recrystallizes to form ice.
____ 36. Snow accumulates in an area called a snowfield.

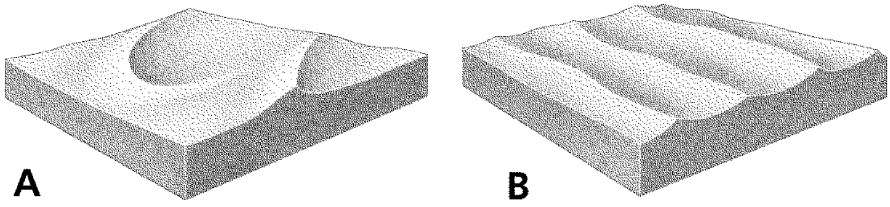
Match each item with the correct statement below.

a. continental glacier
b. outwash plain
c. valley glacier
d. cirque
e. drumlin
f. mass movement
g. loess
h. abrasion
i. mudflow
j. slump

____ 37. A mass of ice that forms in mountainous areas
____ 38. A downslope movement of loose sediment and rock under gravity
____ 39. A broad, continent-sized mass of ice
____ 40. Windblown deposits composed of silt
____ 41. A deep depression carved out by an alpine glacier
____ 42. Occurs when sand particles rub against the surface of rocks
____ 43. Where meltwater flows and deposits
____ 44. Swiftly moving mixture of mud and water sometimes triggered by an earthquake
____ 45. A landslide in which earth material rotates and slides along a curved surface
____ 46. An elongated landform produced when glaciers move over older moraines

Short Answer

47. Explain the importance of gravity in all mass movements.
48. What is deflation, and why is it a major problem in agricultural areas?
49. Why is dune vegetation important and what is the danger of removing it from a beach?
50. Compare and contrast the conditions that produce a valley glacier with those that produce continental glaciers.
51. Describe some of the erosional effects of a glacier found in the mountains.
52. Name and describe the four main classifications of mass movements.
53. What are eskers and how do they form?
54. Explain how and where valley glaciers form. Why do they move?
55. Explain how water can both limit and increase a material's potential for movement on a slope.
56. Compare and contrast erosion by wind and by glaciers.
57. Identify the landforms shown in the diagrams below. Then compare and contrast them.



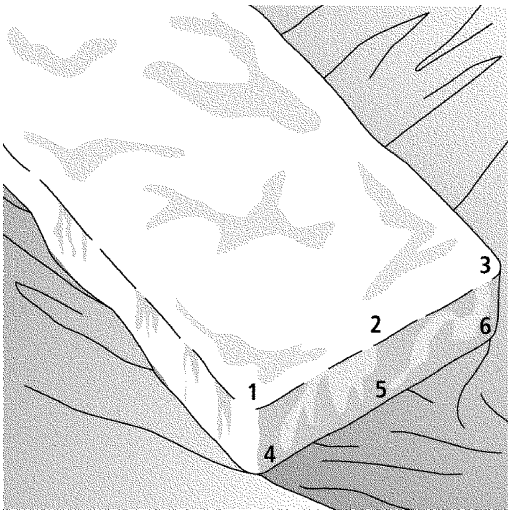
58. A family has decided to build their dream house on a dune on the shore of Lake Michigan. Their plans call for the natural vegetation to be dug up and construction begun. What are some possible consequences of their actions? What would you do differently to minimize these consequences?

59. "People impact mass movement just as mass movement impacts people." Do you agree or disagree with this statement? Explain your answer.

Problem

Glaciers are similar to great rivers of ice. Glaciers certainly move slower, but they experience changes in flow rate much like rivers do. In order to determine a glacier's flow rate, measurements are taken by a variety of methods. Some include the measurement of the movement of stakes placed in the ice, while other methods might include the observation of crevasses in the ice.

The table below contains measurements taken over 5 years. Two measurements were taken each year, one in April and the other in October. Measurements 1–3 are from the top of the glacier. Measurements 4–6 are from the bottom of the glacier. The numbers, in millimeters, represent the movement since the last measurement. Positive numbers mean the glacier is advancing. Negative numbers mean the glacier is retreating.



		Top of Glacier			Bottom of Glacier		
		Point 1	**Point 2**	**Point 3**	**Point 4**	**Point 5**	**Point 6**
Year 1	April	141	164	139	132	147	130
	October	–8	–22	–7	–12	–18	–13
Year 2	April	163	173	162	139	156	138
	October	8	11	7	3	5	2
Year 3	April	–2	–3	–1	–14	–15	–15
	October	–34	–46	–31	–55	–59	–54
Year 4	April	0	–5	–1	–3	–6	–3
	October	–14	–19	–13	–32	–49	–31
Year 5	April	80	106	78	68	92	68
	October	2	7	3	1	4	1

60. What general statement can you make about the movement of the top of the glacier relative to that at the bottom of the glacier? Explain why this might happen.

61. Make a general statement about the movement of the glacier over the 5 years of measurements. Explain your results.

62. Why might scientists wish to measure and track the movement of a glacier?

Glaciers and Mass Movements Study Guide
Answer Section

MODIFIED TRUE/FALSE

1. T
2. F, avalanche
3. F, gravity
4. F, educate
5. F, suspension
6. T
7. T
8. F, parallel

MULTIPLE CHOICE

9. B
10. D
11. C
12. B
13. A
14. A
15. C
16. C
17. A
18. A
19. D
20. B
21. C
22. A
23. C

COMPLETION

24. creep
25. ventifacts
26. eskers
27. deflation

MATCHING

28. B
29. D

30. E
31. A
32. C

33. C
34. A
35. D
36. B

37. C
38. F
39. A
40. G
41. D
42. H
43. B
44. I
45. J
46. E

SHORT ANSWER

47. All mass movement occurs on slopes. Without gravity, the material would remain in place and not move.
48. Deflation is the lowering of the land surfaces that results from the wind's removal of surface particles. It is a major problem in agricultural areas because the fertile topsoil is removed.
49. Dune vegetation helps to anchor coastal dunes, and removing the vegetation may disrupt and damage dune growth, which would cause increased beach erosion.
50. Valley glaciers are formed in high, mountainous areas and flow downslope like a thick liquid. Continental glaciers are formed under the same climatic conditions as valley glaciers, but continental glaciers are thickest in the center, which forces the rest of the glacier to flatten out in all directions.
51. Pieces of rock are removed through a process called plucking. Valley glaciers widen V-shaped stream valleys into U-shaped glacial valleys. Glaciers carve deep depressions in the side of mountains called cirques. Where two cirques on opposite sides of a valley meet, they form an arête. With glaciers on three or more sides of a mountaintop, a steep peak called a horn is formed.
52. Creep is the slow, steady downhill flow of loose, weathered earth materials. Flows are the slow to rapid flow of earth materials like thick liquids. Slides are a rapid downslope movement of earth material. Falls are downhill movements of loose rock at high elevations, in steep road cuts, and on rocky shorelines.
53. Eskers are winding ridges of layered sediment. They are deposited by streams flowing under glaciers that are melting.
54. Valley glaciers form in mountainous areas when accumulated snow packs down to recrystallize into ice. This ice becomes too heavy to maintain its rigid shape and begins to flow like a heavy liquid.

55. Too little water may prevent sediment grains from holding together, thus increasing the material's potential for movement. Too much water can increase the weight of soils and sediments, thus making them unstable and increasing their potential for movement. Water can also act as a lubricant between grains, reducing friction and increasing movement downhill. In contrast, a small amount of water can help hold the soil particles together, making them more stable and thus inhibiting the movement downslope.
56. Both wind and glaciers pick up and carry loose sediment. Wind transports sediment by rolling motion, suspension, and saltation and erodes rocks by abrasion. Wind erosion results in deflation blowouts and ventifacts. Like wind, glaciers also erode by abrasion, as well as by plucking. Glacial erosion results in striations, grooves, cirques, arêtes, and horns.
57. A shows a barchan dune, and B shows a transverse dune. Both are piles of sand deposited by wind. Barchan dunes are crescent-shaped dunes that form in flat areas where there is little sand or vegetation. Transverse dunes form in a series of long ridges perpendicular to the wind direction where there is plenty of sand, little or no vegetation, and strong, steady winds.
58. Dunes grow and migrate. This natural dune growth would be disrupted. After construction is completed, dune migration could bury and block off the structures and property. Also, dune vegetation helps anchor the sand. Removing the sand may increase beach erosion, and the area may suffer nearshore flooding. To minimize these consequences, one should disturb the dunes as little as possible and dig up as little vegetation as possible.
59. Students should recognize the truth in this statement. People do impact mass movement because their activities can contribute to factors that cause mass movement. Construction can make slopes unstable. Septic leaks can trigger slides, and excessive logging can promote mass movement. Mass movement also impacts people in several ways. It can cause damage to property. Villages can be buried, and homes and forests can be destroyed. Mass movement can also result in loss of lives.

PROBLEM

60. The bottom of the glacier moves slower than the top of the glacier. Friction occurs on the bottom of the glacier where it comes in contact with the ground. This friction slows down the ice.
61. The glacier does not move in a uniform manner from year to year. In some years, there is no movement or a retreat, while in other years there is an advance. The advance or retreat of a glacier is highly dependent upon the amount of snowfall and temperatures during the winter and the summer, and this varies from year to year, making the movement of this glacier unpredictable.
62. Scientists measure glacial movements as indicators of climate change. Advancing glaciers may also pose a threat to property downslope.