

Surface Water 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. Some runoff initially flows in thin sheets and eventually collects in miniature channels called rills and brooks. _____
- ____ 2. There is a greater potential for erosion on shallow slopes. _____
- ____ 3. When water runs through or over rocks containing soluble minerals, it dissolves small amounts of the minerals and carries them away in solution. _____
- ____ 4. Both water velocity and volume increase during times of heavy precipitation. _____
- ____ 5. During rejuvenation, the stream actively resumes the process of downcutting toward its bed. _____
- ____ 6. Lakes can be common in areas where limestone is the dominant bedrock. _____
- ____ 7. When huge numbers of plants and animals decay, a lake's phosphate supply is depleted. _____
- ____ 8. A major source of algae-supporting nutrients that concentrate in lakes is phosphate detergents. _____
- ____ 9. Stream banks have historically enticed farmers to use the land for crop production, even at the risk of losing crops to flooding. _____
- ____ 10. In a stream, small particles, such as silt, clay, and sand are carried in solution. _____
- ____ 11. Deltas are fan-shaped deposits found on valley floors at the base of mountains. _____
- ____ 12. Heavy accumulations of excess water from large regional drainage systems can result in downstream floods. _____

Multiple Choice

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

- ____ 13. The three ways in which a stream carries its load are in solution, suspension, and _____.
 - a. stream velocity
 - b. stream channel
 - c. bed load
 - d. channel capacity

- _____ 14. Which of the following is the formula for discharge?
- discharge = width \times depth \times velocity
 - discharge = stream load \times depth \times velocity
 - discharge = stream load \times friction \times velocity
 - discharge = width \times depth \times velocity \times friction
- _____ 15. In order for rejuvenation to take place in a stream, what must occur first?
- Deposition must stop.
 - The stream must dry up.
 - The land over which the stream flows uplifts.
 - The discharge must increase.
- _____ 16. Which of the following statements is true about the development of a stream?
- A stream's slope increases as it approaches base level.
 - Water along the sides and bottom of the channel flows more rapidly.
 - Deposition is greater in the outside curve of a meander.
 - The velocity of water is greater along the outside of a meander curve.
- _____ 17. The eutrophication of a lake leads to _____.
- the formation of a bog
 - the decay of dead plants and animals
 - the death of all life in the lake
 - fertilizers from farmers fields being picked up by the lake
- _____ 18. Potholes form in the stream bottom when _____.
- the water dissolves the bedrock
 - turbulence causes pebbles to swirl
 - an increase in suspended load occurs
 - the stream's carrying capacity decreases
- _____ 19. The carrying capacity of a stream is its _____.
- | | |
|--|-----------------------|
| a. ability to transport sediment | c. volume of flow |
| b. rate of runoff entering the channel | d. stream bank height |
- _____ 20. Streams lengthen through _____.
- | | |
|-------------------|----------------------|
| a. eutrophication | c. headward erosion |
| b. suspension | d. upstream flooding |
- _____ 21. V-shaped channels like the Grand Canyon are formed by _____.
- | | |
|---|-------------------------------------|
| a. a sudden decrease in stream gradient | c. streams overflowing their banks |
| b. stream downcutting | d. streams capturing another stream |
- _____ 22. A blocked-off meander eventually becomes _____.
- | | |
|-----------------------------|--------------------|
| a. part of the stream again | c. an oxbow lake |
| b. rejuvenated | d. an alluvial fan |
- _____ 23. Which of the following statements is NOT true about wetlands?
- Wetlands result from the eutrophication of a lake.
 - Lack of oxygen and lack of minerals create an atmosphere that is inhospitable to many plants.
 - Freshwater marshes often form along the stream's mouth and in areas with deltas.
 - Wetlands only exist in freshwater areas.

Completion*Complete each sentence or statement.*

24. Water that flows downslope along Earth's surface is called _____.
25. A stream has a(n) _____, which is the land area whose water drains into the stream's system.
26. Any high land area that separates one watershed from another is termed a(n) _____.
27. Material is carried in _____ after it becomes dissolved in a stream's water.
28. All particles small enough to be held up by the turbulence of a stream's moving water are carried in _____.
29. A stream's _____ consists of all sand, pebbles, and cobbles that the stream's water can roll or push along the bed of the stream.
30. _____ is the total volume of stream water that flows over a particular location within a given period of time.
31. Flowing surface water carves a(n) _____, or a narrow pathway, into rock.

Matching*Match each item with the correct definition below.*

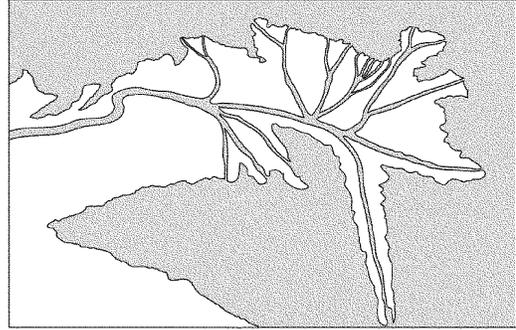
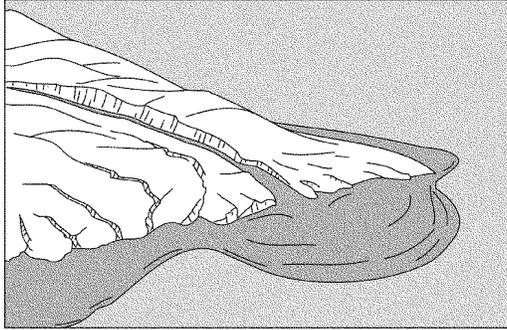
- | | |
|-----------------|------------|
| a. rejuvenation | e. meander |
| b. lake | f. delta |
| c. stream banks | g. wetland |
| d. flood | |

- _____ 32. The ground that borders a stream and holds the water within the confines of the channel
- _____ 33. A bend or curve in a stream channel
- _____ 34. A triangular deposit that forms where a stream enters a large body of water
- _____ 35. A stream resumes the process of downcutting
- _____ 36. A depression in the land that holds water
- _____ 37. An area periodically saturated with water
- _____ 38. Water spills over the sides of a stream's banks

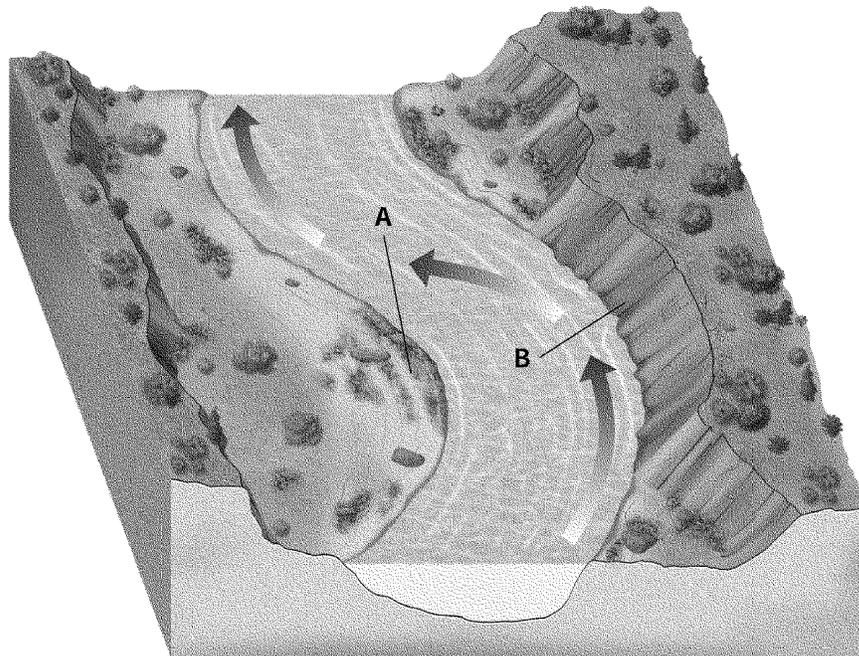
Short Answer

39. Compare and contrast materials carried in suspension and solution by the stream.

40. Identify the two stream formations shown below. Compare how each is formed.



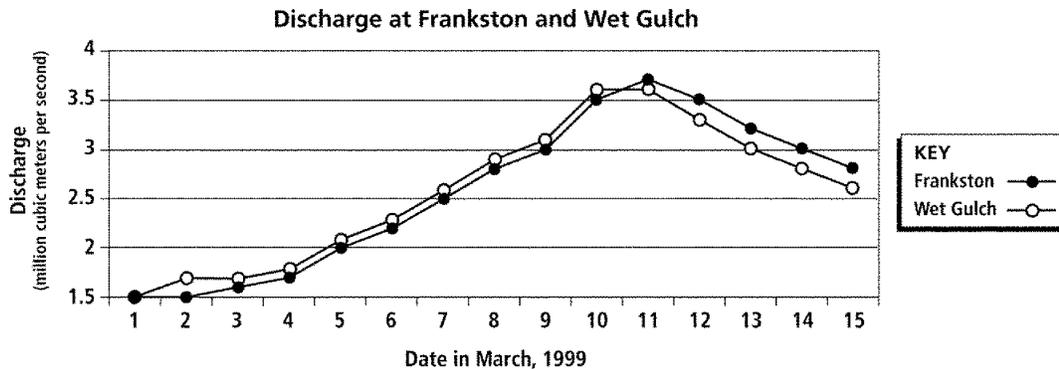
41. Describe three processes of lake formation.
42. Explain how people have contributed to the destruction of wetlands.
43. Explain how floodplains develop such highly fertile soils.
44. Compare downstream and upstream flooding.
45. What factors increase or decrease the amount of runoff in an area?
46. In the diagram below, a section of a meandering stream is shown. What occurs at the areas labeled A and B?



47. Describe what causes a stream to stop downcutting its bed and what causes it to start again.
48. Compare the velocity of water, the erosion, and the deposition along the inside and outside of a meander curve.
49. Describe three ways a natural lake can form.

50. How does an increase in a stream's velocity affect its discharge and carrying capacity?
51. How do vegetation and slope affect runoff?

The graph shows the discharge of a river that flows through two cities, Frankston and Wet Gulch. At either city, the river's banks cannot handle a discharge of 3.5 million cubic meters per second or more. At that point, the river reaches its flood stage. Study the graph and answer the questions.



52. During how many days in March did the river at Wet Gulch and Frankston overflow its banks?
53. Wet Gulch is downstream from Frankston. How might this account for the difference in discharge between the two towns after March 10?
54. Both cities were founded as farming communities during the 1800s on the floodplain. Describe the physical features of a floodplain, and hypothesize as to why people wanted to live on them.

Problem

The table lists water quality measurements that were taken over a 40-year period at Lake Smith. Measurements included dissolved oxygen, pH, phosphate, nitrogen, the number of largemouth bass, and mosses and grasses. Dissolved oxygen is the measure of the amount of oxygen available to life-forms in the water. Largemouth bass is a common variety of fish found in healthy lakes. Mosses and grasses start to appear as the pH of the water becomes more acidic.

Water Quality at Lake Smith									
	1950	1955	1960	1965	1970	1975	1980	1985	1990
Dissolved oxygen (parts per million, or ppm)	20	19	18	18	16	17	15	11	9
pH	7.6	7.2	7.1	7.0	6.8	6.8	6.5	6.1	5.8
Phosphate (ppm)	0.0	0.10	0.20	0.25	0.28	0.28	0.45	0.55	0.55
Nitrogen (ppm)	0.05	0.18	0.19	0.25	0.28	0.28	0.35	0.40	0.45
Largemouth bass	450	455	448	338	235	220	155	125	50
Mosses and grasses	0	0	2	5	15	18	29	35	55

55. What is eutrophication? Did it occur at Lake Smith? Explain your answer.
56. After 1950, farmers in the Lake Smith area increased their use of fertilizers. Does the data support this statement? Explain your answer.
57. How do changes in phosphate and dissolved oxygen content over time compare? Explain the changes that took place.
58. What do you predict will happen to the lake in the next 40 years?
59. The table shows that the number of largemouth bass decreased as the number of mosses and grasses increased. From this data, can you conclude that the increase of mosses and grasses caused the largemouth bass population to decline? Explain your answer.

**Surface Water Study Guide
Answer Section**

MODIFIED TRUE/FALSE

1. F, gullies
2. F, steep
3. T
4. T
5. F, base level
6. T
7. F, oxygen
8. T
9. F, Floodplains
10. F, suspension
11. F, Alluvial fans
12. T

MULTIPLE CHOICE

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

COMPLETION

24. runoff
25. watershed
26. divide
27. solution
28. suspension
29. bed load
30. Discharge
31. stream channel

MATCHING

- 32. C
- 33. E
- 34. F
- 35. A
- 36. B
- 37. G
- 38. D

SHORT ANSWER

- 39. Both materials are part of the stream's load. Materials carried in solution are dissolved in the water. Materials carried in suspension, which vary in amount according to the stream's velocity, have a larger particle size like sand and silt.
- 40. The example on the left is an alluvial fan. The example on the right is a delta. Alluvial fans are sloping depositional features formed at the bases of slopes and composed mostly of sand and gravel. Deltas are triangular deposits that form where a stream enters a large, quiet body of water.
- 41. Answers may vary. Lakes can form from cutoff meanders that isolate channels of water, other lakes form when streams are blocked off by landslides. Some lakes are remnants of former ocean waters. Lakes can also form from glacial origin.
- 42. Many wetlands have been filled in to create more land for building and for agriculture.
- 43. Each time a flood occurs, the floodwater carries along with it a great amount of sediment eroded from Earth's surface and the sides of stream channels. After each subsequent flood, more sediment is deposited and the soil becomes more fertile.
- 44. Downstream floods occur during or after long-lasting or intense storms. The volume of water involved in a downstream flood is high. Upstream floods are caused by sudden rainstorms that drop large amounts of rain within a short period of time. They also flood a smaller area.
- 45. Saturated or frozen ground and soil and rocks with few spaces between the particles increase runoff because the ground cannot absorb the water. Soil and rocks with large spaces between the particles and areas with vegetation decrease runoff because more water is absorbed into the ground.
- 46. Area A indicates where deposition is dominant. Area B indicates where erosion is dominant.
- 47. During the process of stream formation, downcutting of the stream bed is a major erosional process until the stream reaches its base level and downcutting stops. If the land over which the stream is flowing uplifts or the base level drops, the process of downcutting resumes.
- 48. The velocity of water is greater along the outside of a meander curve, where erosion takes place. The water moves slower along the inside of the curve, which results in deposition.
- 49. Possible responses: Oxbow lakes form when streams cut off meanders and leave isolated channels of water. Lakes can form when stream flow becomes blocked by sediment from landslides. Some form as remnants of former ocean water that have receded to lower-lying areas. Others form because glacial moraines dammed water in ice-gouged basins, or when blocks of ice melt on outwash plains.
- 50. As a stream's velocity increases, its discharge increases. As its discharge increases, its carrying capacity also increases.

51. Dense vegetation allows more water to enter the ground, thus reducing runoff. The steeper the slope, the faster water flows, and the less water that seeps into the ground, thus increasing runoff.
52. Wet Gulch, 3; Frankston, 2
53. Additional tributaries and runoff likely flow into the river downstream from Frankston, resulting in a greater flood discharge at Wet Gulch.
54. A floodplain is the broad, flat area that extends out from a stream's bank. Since it is covered by excess water during floods, and floodwater carries a great amount of sediment, floodplains are usually covered with highly fertile soil. People probably wanted to live on floodplains because they could farm the fertile soil with great success.

PROBLEM

55. Eutrophication is the filling in of a lake due to excessive organic growth. This excessive growth then dies and decays, which depletes the available oxygen, leaving less for the other life-forms. Animals, such as largemouth bass, cannot survive in water when the dissolved oxygen falls below a certain level. And since the data show a decrease in largemouth bass, eutrophication at Lake Smith is indicated. As eutrophication continues and the lake fills in, the oxygen content decreases and the acidity increases, which the data suggest took place at Lake Smith. The data also show an increase in mosses and grasses, which thrive when eutrophication fills in a lake and a wetland forms.
56. Possible response: Yes; the phosphate content in the lake water increased after 1950. Agricultural fertilizers contain phosphates, which may have been picked up by runoff and carried into the lake after 1950, thus accounting for the increase in phosphate content.
57. As the phosphate content increased, the amount of dissolved oxygen decreased. Lake organisms like algae most likely thrived on the increased phosphate, then grew rapidly, died, and decayed. The resulting decaying process depleted the water's oxygen and further increased the phosphate content.
58. Possible response: The amounts of phosphate and nitrogen will continue to increase, the pH will drop, the dissolved oxygen will become less, bass will die out, and the mosses and grasses will thrive. The lake will start to fill in.
59. No, the data do not prove a causal relationship between the increase in the number of mosses and grasses and the decline in largemouth bass population. For example, largemouth bass could be negatively affected by the other variables in the chart, such as the decrease in dissolved oxygen, the decreasing pH, and the increasing phosphate level. It is theoretically possible that the increase in vegetation has no impact, a negative impact, or a positive impact on the bass population. However, without scientific testing, it is impossible to conclude one way or another.