

2023 Beachwood Invitational
Dynamic Planet

Team _____ Team # _____

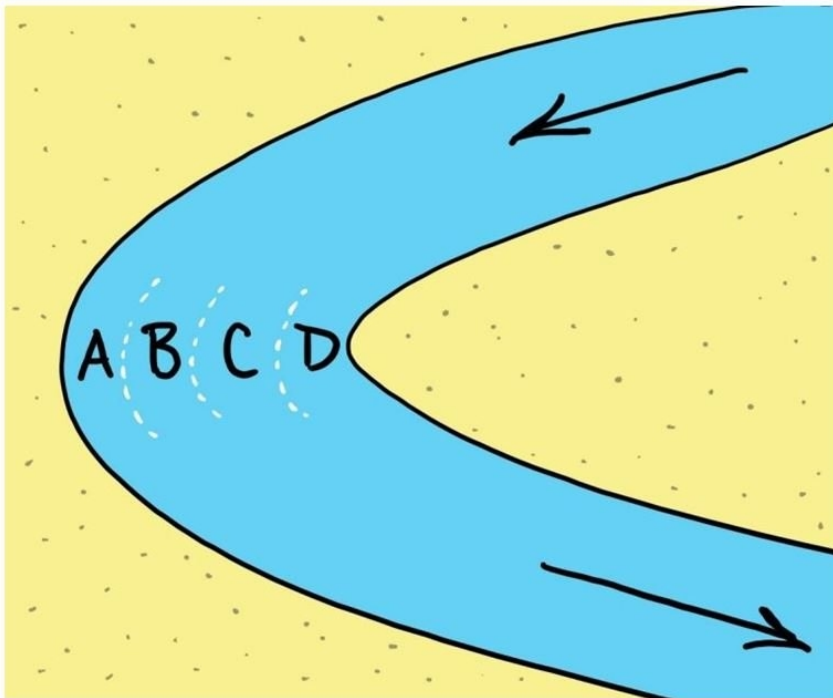
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1. Plants consume water during photosynthesis. They also release it to the atmosphere during _____.
A) degassing B) evaporation C) transpiration D) infiltration
2. The Mississippi Delta is an example of which of the following?
A) angle of repose B) zone of deposition
C) zone of transportation D) zone of sediment production
3. Gravel would most likely exist in the _____ of a river.
A) suspended load B) bed load C) cutbank D) dissolved load
4. If you were to examine the longitudinal profile of a typical river, you would probably find that the gradient is _____.
A) steepest near the mouth
B) roughly the same at the mouth and the headwaters
C) steepest near the headwaters
D) steepest in the zone of transport
5. Calcium and sodium ions make up much of the _____ of streams.
A) dissolved load B) sediment C) bed load D) suspended load
6. V-shaped valleys would most likely contain _____.
A) a braided stream B) waterfalls C) a delta D) floodplains
7. The flat area on either side of a stream's natural levee, where alluvium is deposited, is called the _____.
A) delta B) headwaters C) floodplain D) incised meander
8. A tributary stream that flows parallel to the main stream because a natural levee is present is called _____.
A) approaching base level B) a yazoo tributary
C) eroding a pothole D) flooding
9. Groundwater is the largest reservoir of _____.
A) freshwater that is readily available to humans B) seawater on Earth
C) glacial ice on Earth D) water on Earth

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D) D

17. Examine the sketch of a bend in a river. The arrows show the water flow direction. In which of the four lettered locations will erosion take place?



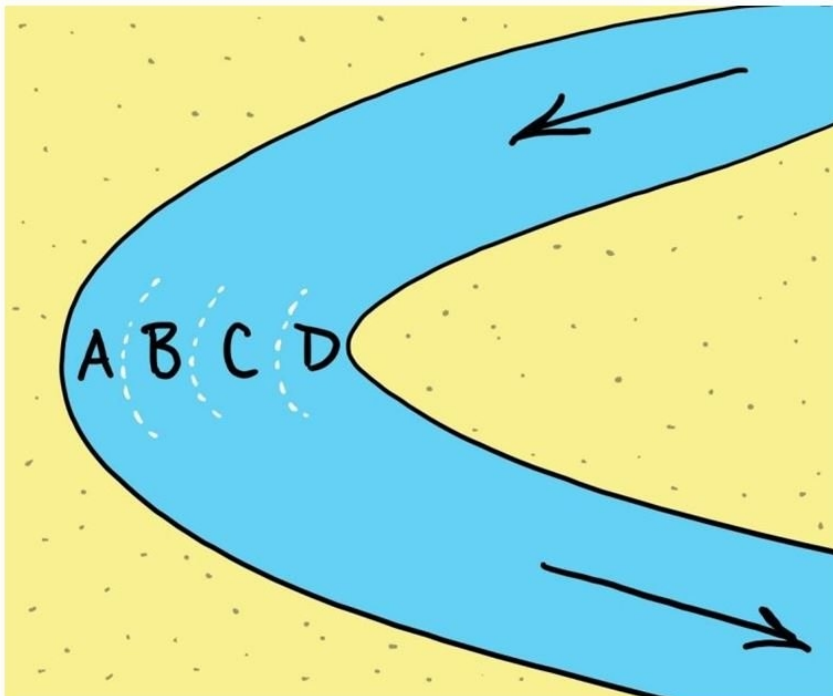
A) A

B) B

C) C

D) D

18. Examine the sketch of a bend in a river. The arrows show the water flow direction. In which of the four lettered locations is deposition most likely to occur?



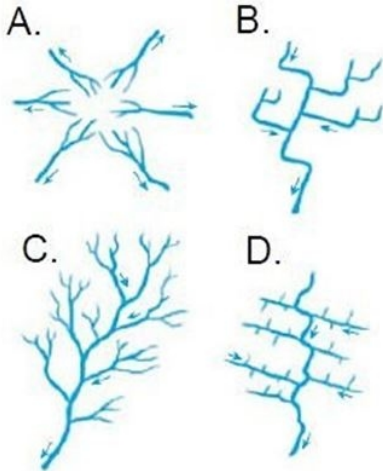
A) A

B) B

C) C

D) D

19. Which of the drainage patterns shown here might develop on relatively uniform surface materials?



A) A

B) B

C) C

D) D

20. Sandy soils tend to have

- A) high porosity and high permeability.
- C) low porosity and low permeability.

- B) low porosity and high permeability.
- D) high porosity and low permeability.

21. The flow of groundwater is

- A) from where the water table is high to where it is low.
- B) from where the water table is low to where it is high.
- C) insignificant.
- D) as fast as the water in streams.

22. Where groundwater discharges to a swamp, the elevation of the water table next to the swamp is

- A) at the same elevation as the surface of the swamp.
- B) lower than the surface of the swamp.
- C) slightly higher than the surface of the swamp.
- D) Not enough information is given.

23. A sub-surface region that holds and transmits water is called a/an

- A) water table.
- B) aquiclude.
- C) hydrometer.
- D) aquifer.

24. The region above the zone of saturation is called the

- A) zone of aeration.
- B) water table.
- C) aquifer zone.
- D) none of the above.

25. The greater the hydraulic gradient the

- A) faster the flow.
- B) slower the flow.
- C) less the permeability.
- D) greater the porosity.

26. When a perched water table intersects the surface on a hillside, the result is
A) a lake. B) a cone of depression.
C) a spring. D) an artesian well.
27. In general, sinkholes are found in areas
A) in which groundwater is being pumped out of the ground too quickly.
B) with extensive irrigation systems.
C) dominated by limestone.
D) where the dominant rock is shale.
28. Which of the following is not involved in cave formation in limestone?
A) dissolution of carbonate rocks B) mildly acidic groundwater
C) land subsidence D) a dropping water table
29. Stream velocity is dependent on
A) the gradient and stream dimension. B) gradient and friction.
C) gradient, channel geometry, and discharge. D) the size and shape of the stream's channel.
30. As a stream flows downslope, if stream discharge doubles and the cross-sectional area of the channel also doubles, what happens to the average stream speed?
A) Average stream speed stays the same. B) Average stream speed increases.
C) Average stream speed decreases. D) Not enough information is given.
31. Meandering streams are common in
A) V-shaped valleys. B) areas of accumulation.
C) natural levees. D) flat floodplain areas.
32. Which of the following is characteristic of mountain stream valleys?
A) They are V-shaped and have rapids. B) They are curvy and slow moving.
C) They have deltas. D) They are deep and wide.
33. In a delta environment we find that fine-grained sediments settle
A) far away from the mouth of the stream channel.
B) close to the mouth of the stream channel.
C) both of these
D) none of these
34. Movement of water erodes stream channels. The main source of erosion comes from
A) chemical erosion. B) laminar flow. C) physical abrasion. D) lithification.

35. Point bars typically form
- A) in the middle of a straight stream channel.
 - B) in the middle of a curved stream channel.
 - C) on the inside bend of a curved stream channel.
 - D) on the outside bend of a curved stream channel.
36. The maximum sediment load of a stream depends on
- A) channel geometry.
 - B) stream discharge.
 - C) stream gradient.
 - D) average stream speed.
37. Which one of the following statements correctly describes how stream terraces can form?
- A) A temporary base level is eliminated; the stream aggrades its channel upstream from the old temporary base level, and the former floodplain is left well above the present elevation of the stream.
 - B) Base level drops; the stream aggrades its channel, and the former floodplain is left below the present elevation of the stream.
 - C) A temporary base level is eliminated; the stream downcuts upstream from the old temporary base level, and the former floodplain is left well above the present elevation of the stream.
 - D) Base level rises; the stream downcuts, and the old floodplain is left well above the elevation of the present-day channel.
38. The _____ river has the largest discharge of any in the world.
- A) Congo
 - B) Mississippi
 - C) Amazon
 - D) Nile
39. In a _____ drainage pattern that is generally developed in areas underlain by tilted or folded strata, tributary streams flow along outcrop areas of the softer strata.
- A) trellis
 - B) coparallel
 - C) radial
 - D) dendritic
40. A stream begins at an elevation of 200 meters and flows a distance of 400 kilometers to the ocean? What is the average gradient?
- A) 2km/m
 - B) 0.5 km/in
 - C) 2m/km
 - D) 0.5m/km
41. Which one of the following best describes how urbanization affects small-stream watersheds?
- A) Infiltration decreases; lag time between storms and peak runoff is shortened.
 - B) Infiltration is reduced; lag time between storms and peak runoff is increased.
 - C) Infiltration and lag time between storms and peak runoff increase.
 - D) Infiltration increases slightly; lag time between storms and peak runoff decreases.
42. A dam and reservoir are constructed on a graded river. What will happen?
- A) deposition upstream and downstream from the dam
 - B) deposition upstream from the dam; channel downcutting below
 - C) channel downcutting upstream and downstream from the dam
 - D) channel downcutting upstream from the dam; deposition below

Word Analysis. Examine the words and/or phrases for each question below and determine the relationship among the majority of words/phrases. Choose the option which does not fit the pattern.

43. A. natural levees B. rapids C. backswamps D. yazoo tributaries

44. A. gradient B. velocity C. capacity D. discharge

45. A. artificial levees B. dams C. floodplains D. channelization

46. A. cut bank B. point bar C. natural levee D. delta

47. A. zone of saturation B. belt of soil moisture C. capillary fringe D. zone of aeration

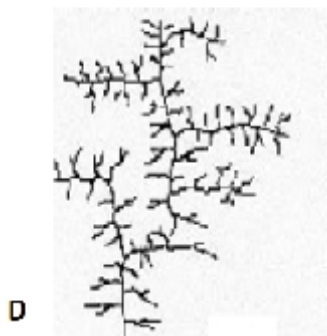
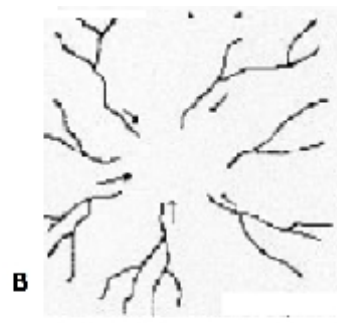
48. A. spring B. aquitard C. perched water table D. zone of saturation

49. A. stalagmite B. soda straw C. sinkhole D. stalactite

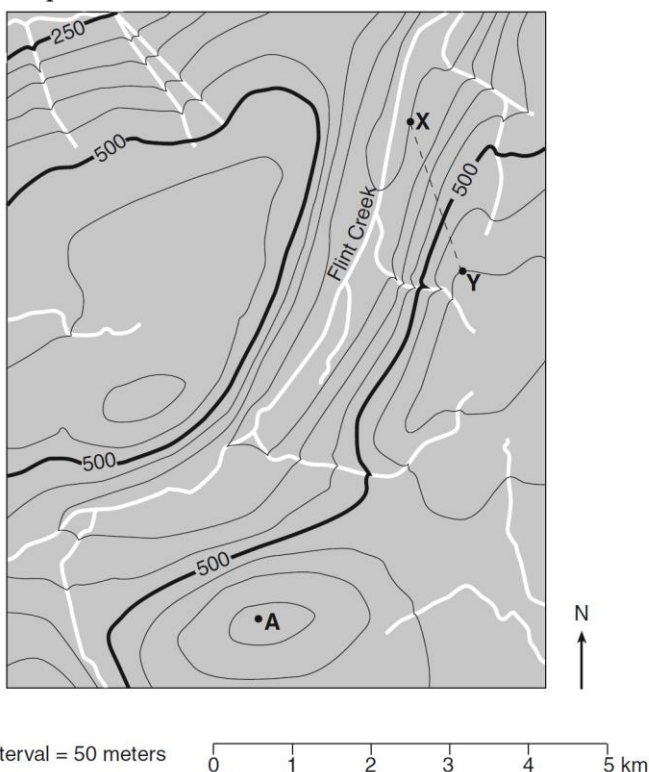
50. A. porosity B. permeability C. aquitard D. aquifer

51. Use the Manning equation to calculate the discharge for a full culvert that is 3.0 feet in diameter, made of cast iron ($n = 0.015$), and with a slope of 0.05.

52. Identify the following drainage patterns



Base your answers to questions 53 and 54 on the topographic map below. Points A, X, and Y are reference points on the map.

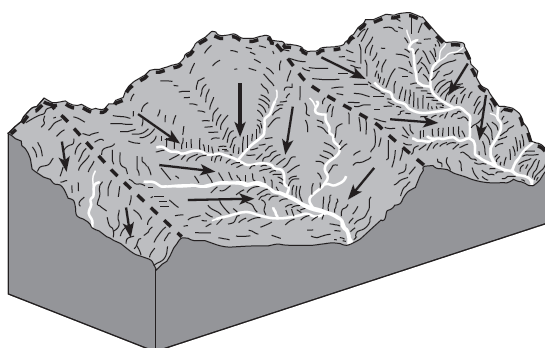


53. In which general direction does Flint Creek flow?

- A) southwest
- B) southeast
- C) northwest
- D) northeast

54. What is the approximate gradient along the straight dashed line between points X and Y?

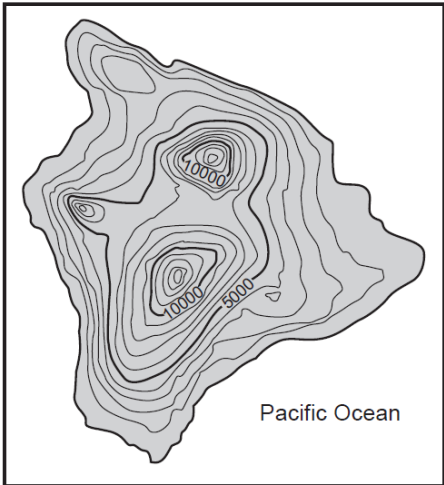
55. The block diagram below represents the drainage basins of some river systems separated by highland divides, shown with dashed lines. The arrows show the directions of surface-water flow.



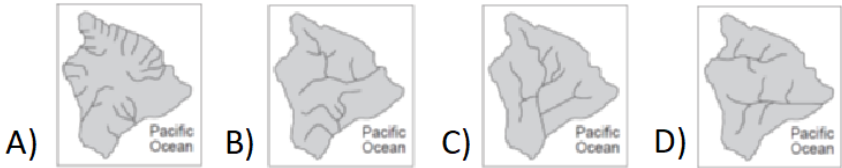
The three areas separated by highland divides are called

- A) Meanders
- B) watershed
- C) Floodplains
- D) Tributaries

56. The topographic map below shows the largest island of the Hawaiian Islands.

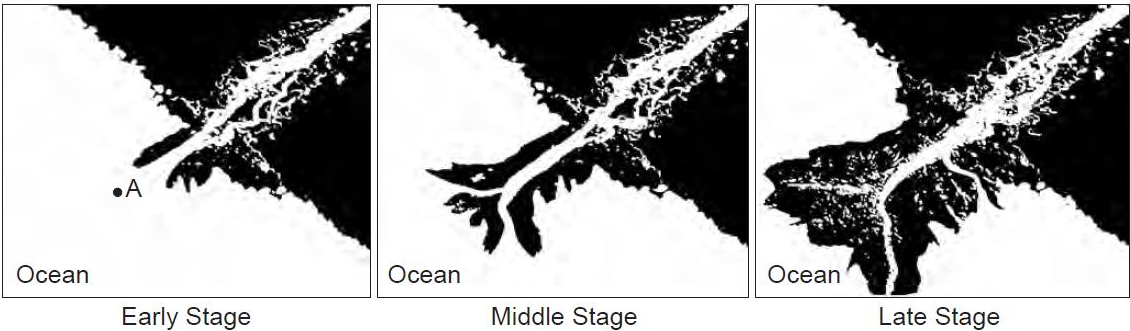


Which map below best shows the most likely stream drainage pattern of this island?



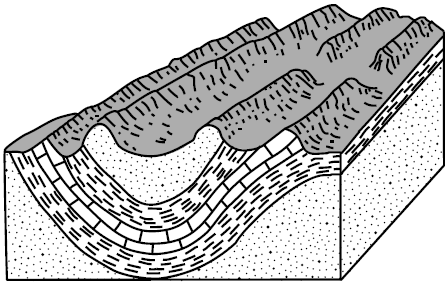
Base your answers to questions 57 and 58 on the three diagrams below. The diagrams represent stages in the formation of a large depositional feature formed as a river deposited sediment over time in the ocean. Letter A represents a location in the ocean.

Formation of a River Depositional Feature

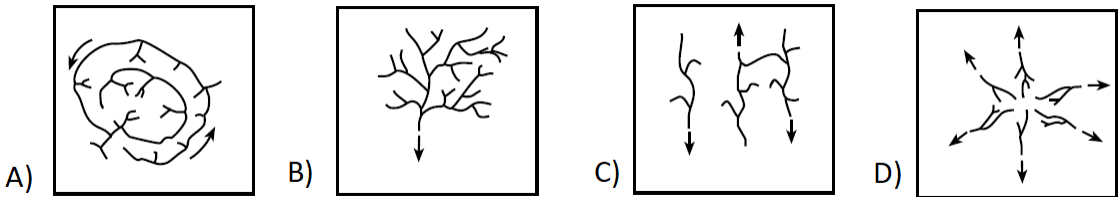


57. State the name of this large depositional feature forming in the ocean.
58. Identify the largest particle diameter of sediment that can be carried by the water current at location A, if the water has a velocity of 0.05 cm/s.

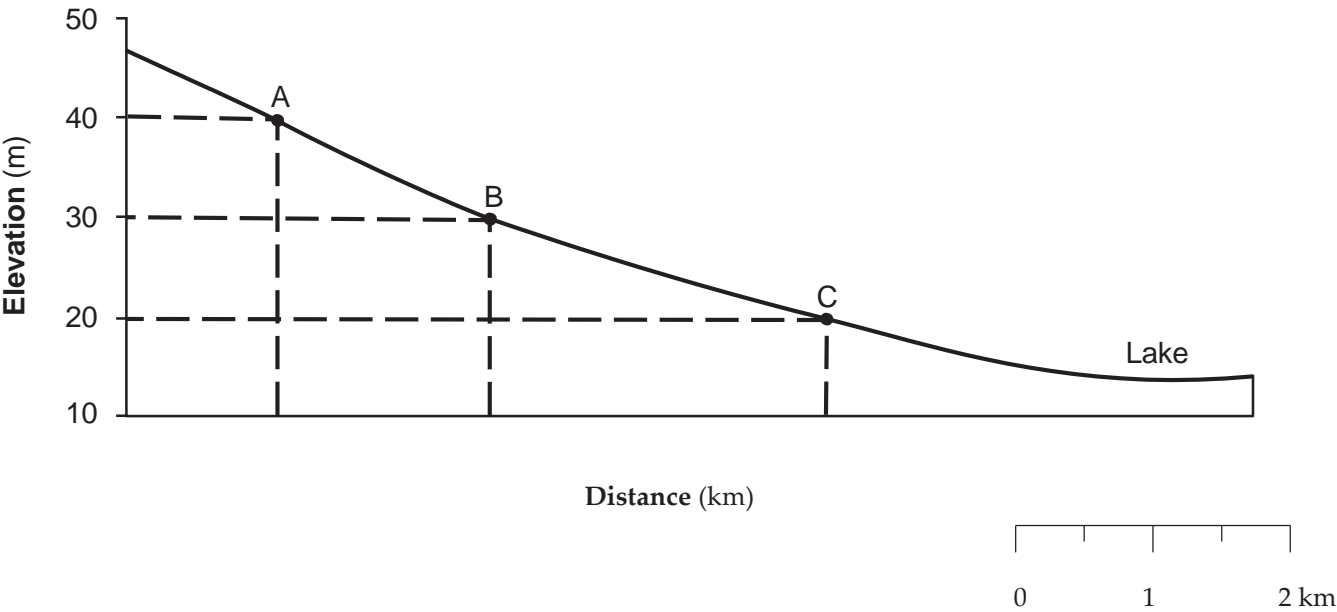
The block diagram below represents the surface features in a landscape region.



59. Which diagram best represents the general stream drainage pattern of this entire region?

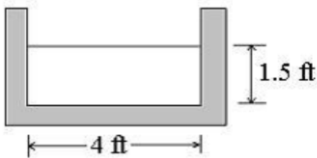


The stream profile below shows the locations of rock samples *A*, *B*, and *C* in the streambed.



60. Calculate the stream gradient between the locations of rock sample *A* and rock sample *C*.

61. Water is flowing 1.5 feet deep in a 4 foot wide, open channel of rectangular cross section, as shown in the diagram below. The channel is made of concrete (made with steel forms – $n = 0.011$), with a constant bottom slope of 0.003. Estimate the flow rate of water in the channel.



MATCHING. Match the type of lake with its description.

- | | |
|--|---------------------|
| 62. depression formed by displacements of Earth's crust due to faulting movements | A. cirque lake |
| 63. small but deep lake that forms within a volcanic cone | B. playa lake |
| 64. amphitheater-shaped depression found in mountainous areas that were scoured by glaciers | C. kettle lake |
| 65. series of connected mountainous lakes, each in a step-wise fashion at different elevations | D. graben lake |
| 66. U-shaped lake that is a remnant of a bend in a meandering river | E. oxbow lake |
| | F. maar lake |
| | G. paternoster lake |
| | H. cryogenic lake |
| 67. shallow lake that forms in a flat, arid region | I. doline |
| 68. small lake formed by the gradual dissolution of limestone rock | J. caldera |

STREAM ORDER: Label the stream order for A-E

69. A, B, C

70. D & E

