Name: _____

Science Olympiad Invitational Competition: 2012

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

1. What is the relationship between groundwater and surface water?
   a. Surface water percolates through the soil to form groundwater.
   b. There is no relationship between surface and groundwater, they form independently.
   c. Groundwater filters through the soil to form surface water.
   d. Surface water is found in lakes directly above underground water sources.

2. As the velocity of a stream decreases, which transported particle size would settle to the stream's bottom first?
   a. clay
   b. silt
   c. pebble
   d. sand

3. Which of the following is *not* one or the compositional layers of Earth?
   a. mesosphere
   b. mantle
   c. outer core
   d. inner core

4. Estuaries
   a. are always saltwater ecosystems.
   b. are always freshwater ecosystems.
   c. are ecosystems where both fresh water and salt water are present.
   d. prevent the development of salt marshes.

5. What are wind and water erosion *not* likely to affect?
   a. mountains
   b. rocks
   c. tides
   d. soil

6. In the _____ zone, the water is cool and dark.
   a. benthic
   b. eutrophic
   c. littoral
   d. plankton

7. Which or the following is *not* an environmental function of wetlands?
   a. increasing runoff
   b. absorbing and removing pollutants from water
   c. trapping carbon that would otherwise be released into the air
   d. controlling floods

8. The largest watershed in the United States is the
   a. Mississippi River.
   b. Yukon River.
   c. Colorado River.
   d. Rio Grande.

9. The terms *subsidence* refers to
   a. failure of the groundwater supply
   b. accumulation of sill behind a dam
   c. sinking of ground when water has been withdrawn
   d. intrusion of salt water into a freshwater aquifer
   e. money paid by the government to farmers

10. The effects of water pollution on ecosystems
    a. are always immediate and highly lethal.
    b. result mostly from point-source pollution sources.
    c. can magnify over time within food chains.
    d. can be demonstrated by natural eutrophication.

11. An estuary functions as a mineral trap due to
    a. its great depth and particularly sticky sediment.
    b. the mixing action of river water and ocean water.
    c. its storing of pesticides from agricultural runoff.
    d. the filtering action of bottom-feeding fish species.

12. A common feature of thermal pollution and artificial eutrophication is that they both
    a. have sources that are difficult to identify and control.
    b. cause large mats or algae to bloom in fresh water.
    c. are a result or power plants and other industrial activity.
    d. decrease the amount of oxygen dissolved in water.

13. Which of the following is *not* characteristic of salt marshes and mangrove swamps?
    a. Both provide habitats for wildlife.
    b. Both are dominated by marsh grasses.
    c. Both are found along coastal areas.
    d. Both are threatened by development.

14. Parasitic worms would be classified as which type of water pollutant?
    a. pathogen
    b. organic matter
    c. inorganic chemicals
    d. heavy metals

15. Karst landscapes occur in areas high in
    a. calcium
    b. limestone
    c. shale
    d. sandstone

16. Which of the following is a characteristic of valley glaciers?
    a. They form over broad regions.
    b. They move downslope.
    c. They are larger than continental glaciers.
    d. They completely melt each summer.

17. Aquifers provide drinking water for how much or the world's population?
    a. 25%
    b. 33%
    c. 50%
    d. 67%
    e. 75%

18. As they flow down a mountain to flatter ground, rivers generally become
    a. wider.
    b. warmer.
    c. slower.
    d. All of the above

19. Which of these landforms is characteristic of an area with karst topography?
    a. mountains
    b. canyons
    c. sinkholes
    d. drumlins

20. An effective approach to preventing future shortages of usable water should focus on
    a. emphasizing the additive effect of individual attempts to conserve water.
    b. reducing the pollution of existing water sources by education and enforcement.
    c. developing and refining new ways to produce fresh water such as desalination.
    d. All of the above

21. An estimate of the probability of a negative effect caused by a substance is a(n)
    a. educated guess.
    b. response assessment.
    c. risk assessment.
    d. dose-response curve.

22. The types of organisms found in a pond or lake depend on
    a. the amount of sunlight available.
    b. the temperature of the water.
    c. the presence of nutrients.
    d. All of the above

23. Four of the following are harmful environmental effects of a severe drought, one is not. Choose the one that is not.
    a. dries out soil
    b. reduces moisture in the air from evaporation
    c. reduces stream flows
    d. decreases tree growth and biomass
    e. reduces crop yields

24. What are the two main types or freshwater wetlands?
    a. lakes and ponds
    b. rivers and streams
    c. littoral zones and benthic zones
    d. marshes and swamps

25. Most of Earth's fresh water is
    a. suspended in atmospheric cloud formations.
    b. held in reservoirs behind huge dams.
    c. solidified at the North and South Poles.
    d. stored in large underground rock structures.

26. Ocean water _____ than fresh water.
    a. freezes at a higher temperature
    b. contains more salts
    c. supports fewer fish
    d. is less abundant

27. Which of the following are producers of oxygen?
    a. plants
    b. animals
    c. automobiles
    d. industries

28. Swamps are commonly found on
    a. rocky hillsides.
    b. flat, poorly drained land.
    c. forest clearings.
    d. bottoms of ponds or lakes.

29. Which of the following statements is *not* correct?
    a. Lakes may contain a region that receives little sunlight.
    b. Wetlands help remove Pollutants from water.
    c. Swamps are dominated by woody shrubs and water-loving trees.
    d. Rivers generally move faster, and their oxygen levels decrease, as they near the ocean.

30. One method of desalination uses high pressure to force saltwater through a membrane filter. This method is called
    a. diffusion
    b. distillation
    c. reverse osmosis
    d. active transport
    e. passive transport

31. What is the purpose or adding chlorine to water during the water treatment process?
    a. to filter and remove large debris
    b. to form flocs that bacteria and other impurities will cling to
    c. to kill bacteria that have accumulated, as well as prevent future bacterial growth
    d. to remove unwanted gases

32. Which of the following is the most geologically active region on the surface or Earth?
    a. glacial valleys
    b. mountain peaks
    c. boundaries between tectonic plates
    d. recharge zones

33. Where is ground water located?
    a. zone of aeration
    b. zone of reduction
    c. zone of saturation
    d. zone or distribution

34. The geological layer, consisting of underground caverns and porous layers of sand, gravel, or bedrock, where groundwater flows, is called
    a. the zone of saturation
    b. the water table
    c. an aquifer
    d. surface water
    e. the bedrock

35. Which factor least affects the rate of runoff?
    a. slope
    b. vegetation
    c. volume of runoff
    d. nearness to water

36. What part of Earth encompasses all areas where organisms can obtain the energy they need?
    a. biosphere
    b. hydrosphere
    c. atmosphere
    d. lithosphere

37. When neighborhood residents noticed a large number of dead fish in a local creek, they traced the problem to a nearby gas station. It turned out that a tank of gasoline had developed a leak. This is an example of
    a. point-source pollution.
    b. nonpoint-source pollution.
    c. thermal pollution.
    d. groundwater pollution.

38. Which ecosystem has the highest level of salinity?
    a. salt marsh
    b. brackish marsh
    c. river
    d. pond

39. Which type or stream valley is formed primarily by downcutting?
    a. V shaped valley
    b. Wide valley
    c. Floodplain valley
    d. Y shaped valley

40. What causes most coastal pollution in the United States?
    a. overfishing
    b. temperature changes
    c. industrial waste and sewage
    d. lakes and ponds

41. Most pollutants that enter estuaries break down over time, yet they are still considered a problem because
    a. the pollutants eventually concentrate In the ocean.
    b. it is the volume of the pollutants, more than the time factor, that harms estuaries.
    c. the pollutants break down into still more dangerous toxins.
    d. None of the above

42. A true statement about aquifers is that
    a. their water levels remain stable because they recharge so rapidly.
    b. they are hard to purify because the water collects in sand and rocks.
    c. they are formed by underground rivers and leakage from deep lakes.
    d. their water does not circulate in the water cycle because it cannot evaporate under the ground.

43. Which of the following is a true statement about surface water?
    a. All large cities use surface water as a water source.
    b. Drought conditions reduce the amount of surface water worldwide.
    c. Sluggish waters make natural lakes poor water sources.
    d. It makes up less than 1 percent of all water on Earth.

44. What mainly distinguishes nekton from benthos?
    a. One lives in a freshwater ecosystem and the other lives in salty water.
    b. One swims freely and the other often lives attached to a hard surface.
    c. One is a predator and the other is a primary producer.
    d. All of the above

45. Which or the following is *false*?
    a. Recharging of groundwater is a slow process.
    b. The water table moves down in dry weather.
    c. Water in a confined aquifer is under pressure.
    d. Groundwater is stationary, it does not move.
    e. The water table is the top of the zone of saturation.

Short Answer

46. Why does a stream's base level affect how it downcuts its channel?

47. Complete the data table that compares the various types of lakes, their origins and their characteristics.

Types of Lake	Where it forms	Shape
Oxbow		
Cirque		
Kettle		
Glacial		

48. Name 2 conditions that may increase stream's volume.

49. Complete the chart that describes the changes that a stream undergoes as it works its way toward the ocean.

The amount of water in the stream	increase or decrease
The velocity of the stream's water	increase or decrease
The stream channel becomes	wider or thinner
The stream channel becomes	more shallow or deeper

50. Give two reasons why groundwater is becoming a nonrenewable resource.

Sample Data

Figure 6.2 provides sample data for channel morphology versus time of water travel. Note that the water in the straight channel gets to the bottom of the board almost twice as fast as the water in the meandering channel.

Figure 6.2. Sample Data for Channel Morphology Versus Time of Water Travel

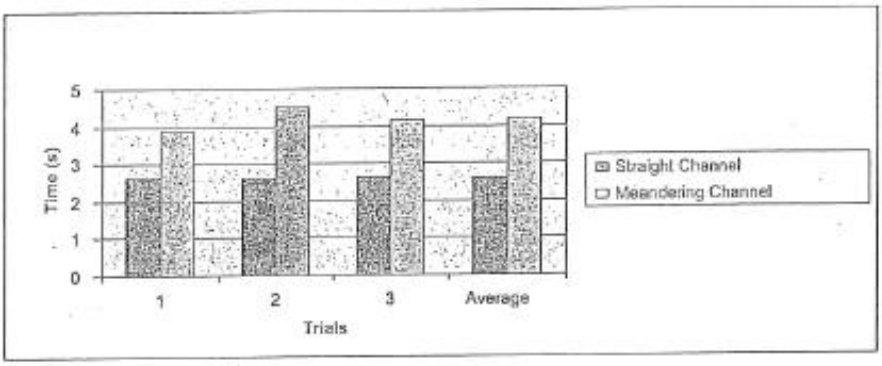


Figure 6.3 and 6.4 illustrate the amount of sediment dispersed in straight and meandering channels over four trials – two with the stream table at a gradient or 30 degrees and two with the stream table at a gradient of 60 degrees. In the low-gradient trials, the sediment is dispersed throughout the straight channel but stays at the top of the meandering channel. In the high-gradient trials, the sediment is again dispersed throughout the straight channel but because of the higher gradient is transported farther down the channel. In the meandering channel, sediment is not transported as far as in the straight channel but is transported farther at the high gradient then at the low gradient.

Figure 6.3. Amount of Sediment in Straight and Meandering Channels at Low Gradient (30°)

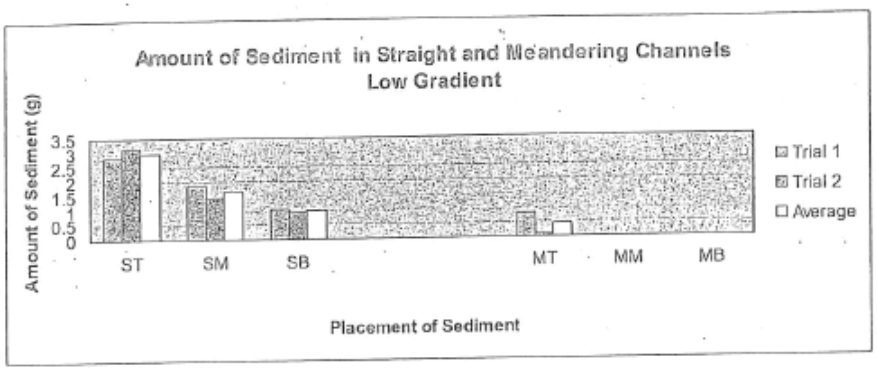
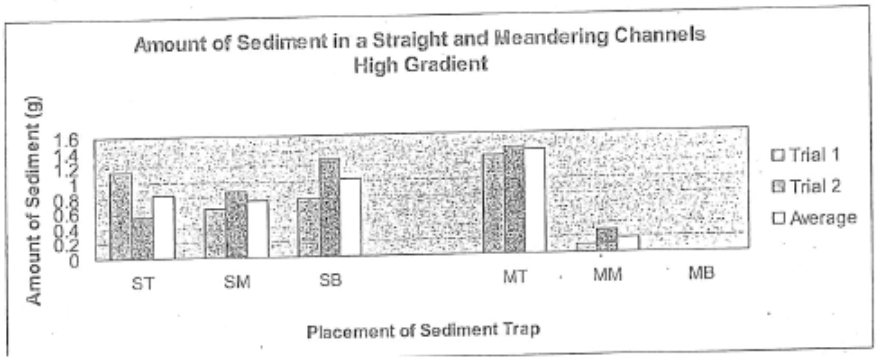


Figure 6.4. Amount of Sediment in Straight and Meandering Channels at High Gradient (60°)



Key to Figures 6.3 and 6.4

ST = straight channel top
SM = straight channel middle
SB = straight channel bottom
MT = meandering channel top
MM = meandering channel middle
MB = meandering channel bottom

Questions on Stream Channel Morphology

Part I

51. Draw a diagram of a straight and a meandering stream channel; sketch where sediment was deposited.

52. Would a straight channel or a meandering channel be better for slowing the transportation of phosphorus within a watershed? Support your answer with at least two pieces of evidence from your lab data.

3. Which type of stream channel will experience the most erosion? Use specific evidence from your experiment to support your answer.

Sample Data

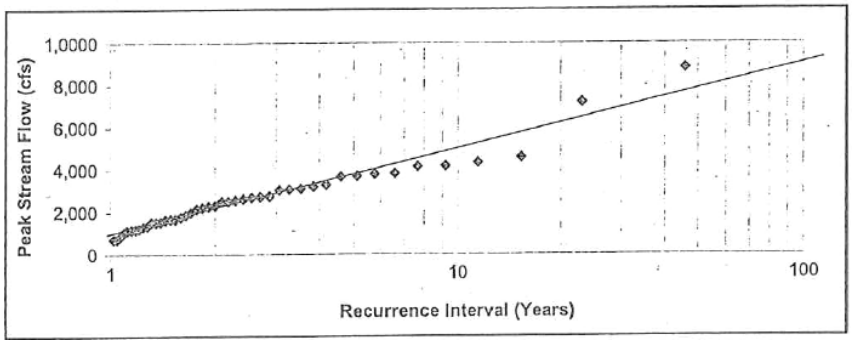
Table 8.1contains the data set from the Macatawa River ranked according to peak stream flow with AEP and *T* calculated. Give students this table if you choose to give them the data.

Table 8.1. Peak Flows for the Macatawa River

Rank	Year	Recurrence Interval (T)	Peak flow (Q) (cfs)	AEP
1	1997	46	8810	0.02173913
2	1981	23	7220	0.043478261
3	1982	15.33333333	4600	0.065217391
4	1996	11.5	4340	0.086956522
5	1979	9.2	4180	0.108695652
6	1989	7.666666667	4150	0.130434783
7	1978	6.571428571	3830	0.152173913
8	1994	5.75	3800	0.173913043
9	1973	5.111111111	3710	0.195652174
10	1985	4.6	3690	0.217391304
11	1980	4.181818182	3310	0.239130435
12	1983	3.833333333	3200	0.260869565
13	1984	3.538461538	3110	0.282608696
14	1991	3.285714286	3080	0.304347826
15	1986	3.066666667	3050	0.326086957
16	1966	2.875	2760	0.347826087
17	1976	2.705882353	2730	0.369565217
18	2000	2.555555556	2710	0.391304348
19	2001	2.421052632	2650	0.413043478
20	1974	2.3	2570	0.434782609
21	1965	2.19047619	2520	0.456521739
22	1993	2.090909091	2500	0.47826087
23	2002	2	2330	0.5
24	1999	1.916666667	2270	0.52173913
25	1995	1.84	2210	0.543478261
26	1971	1.769230769	2170	0.565217391
27	1972	1.703703704	2010	0.586956522
28	2005	1.642857143	1870	0.608695652
29	1963	1.586206897	1780	0.630434783
30	1962	1.533333333	1690	0.652173913
31	1967	1.483870968	1690	0.673913043
32	1975	1.4375	1660	0.695652174
33	1970	1.393939394	1570	0.717391304
34	2004	1.352941176	1530	0.739130435
35	1992	1.314285714	1520	0.760869565
36	1968	1.277777778	1370	0.782608696
37	1988	1.243243243	1320	0.804347826
38	1987	1.210526316	1240	0.826086957
39	1990	1.179487179	1220	0.847826087
40	1998	1.15	1180	0.869565217
41	1964	1.12195122	1130	0.891304348
42	2003	1.095238095	1040	0.913043478
43	1969	1.069767442	850	0.934782609
44	1977	1.045454545	728	0.956521739
45	1961	1.022222222	719	0.97826087

Note: AEP = annual exceedance probability; cfs = cubic feet per second.

Figure 8.1. Macatawa River Flood Frequency Curve



Questions on Flood Frequency Analysis

Use the spreadsheet and graph to answer the following questions:

54. Using the flood frequency graph for the river, estimate the discharges (peak stream flow) of 10-year, 25-year, 50-year, and 100-year floods. Read the years off the x-axis and find the discharge that corresponds on the y-axis.

10-year _____ 50-year _____

25-year _____ 100-year _____

55. What is the recurrence interval of a 50-year flood? _____

56. Approximately 1,500 cfs is needed to move sediment. Find the recurrence interval and the probability of this flow in any given year. What are the effects of increased sediment loads being transported down the river?

57. Since the USGS has been collecting data for the watershed, what was the highest peak stream flow and in what year did it occur? What are the probability and the recurrence interval of this discharge?

Science Olympiad: Dynamic Planet Answer Sheet

1. A
2. C
3. B
4. C
5. C
6. A
7. A
8. A
9. C
10. C
11. B
12. D
13. B
14. A
15. B
16. B
17. C
18. D
19. C
20. D
21. C
22. D
23. B
24. D
25. C
26. B
27. A
28. B
29. D
30. C
31. C
32. C
33. C
34. C
35. D
36. A
37. A
38. A
39. A
40. C
41. B
42. B
43. D
44. B
45. D

46. DOWNCUTS ITS CHANNEL UNTIL IT REACHES ITS BASE LEVEL
47. EACH LAKE EQUALS 2 PTS

Type of Lake	Where it Forms	Shape
Oxbow	FLOODPLAIN	CURVED SHAPE
Cirque	MOUNTAINS	BASIN SHAPE
Kettle	FIELDS	ROUND
Glacial	VARIES	LONG

48.

MOVE FASTER	INCREASE ITS CARRY POWER

49.

INCREASES
DECREASES
WIDER
DEEPER

50.

OVERUSE	CONTAMINATION

51. DRAW AT THE END OF THIS ANSWER SHEET (TIEBREAKER)

52.

MEANDERING CHANNELS SINCE SLOWING THE FLOW OF WATER IT LETS SEDIMENTS SETTLE OUT, SINCE PHOSPHOROUS IS ATTACHED TO SEDIMENTS
SUPPORT: CITE: • TIMES OF WATER TRAVEL • DEPOSITION PATTERNS • SEDIMENTS AMOUNTS THAT WERE TRANSPORTED

53.

MEANDERING CHANNELS BECAUSE OF THE HIGH VELOCITY OF WATER ON THE OUTER BANKS (BASED ON THE DATA)
SUPPORT: DEGREE OF EROSION DEPENDS ON • GRADIENT • CHANNEL WIDTH AND DEPTH • BOTTOM ROUGHNESS

54.

10 YEARS	5000 CFS
25 YEARS	6500 CFS
50 YEARS	7700 CFS
100 YEARS	9000 CFS

55. (TIEBREAKER)

USUALLY 50 YEARS

56. (TIEBREAKER)

RECURRENCE INTERVAL T = 1.5 YEARS	PROBABILITY OF THIS FLOW AEP = 65%
EFFECTS OF INCREASE OF SEDIMENT DOWNSTREAM: • INCREASE PHOSPHOROUS • INCREASE EUTROPHICATION	

57. (TIEBREAKER)

HIGHEST PEAK STREAM FLOW	YEAR IT OCCURRED	PROBABILITY	RECURRENCE INTERVAL
8810 CFS	1997	AEP = 2%	T = 46 YEARS