Team Name:_____ Team Number: _____

SCIENCE OLYMPIAD

Exploring the World of Science

Dynamic Planet

Key

Division C
Battle at Valley Forge Invitational
January 8, 2011

Rank _____

Total Points _____

Tie Breakers Marked w/*, will be applied in numerical order.

1. (5 pts) List 5 possible natural processes leading to lake formation:

- Tectonic Activity
- Glacial Activity
- Volcanic Activity
- Sinkholes
- Levees/River Deltas
- Landslides Damning Stream Valleys
- Wind Action
- Sediment Deposition (embayments along coastline)
- Meteorites

2. (3 pts) What type of lake is likely to hold highly acidic water? Caldera (Also accepted, crater or cauldron lake.) Why?

A caldera is a volcanic feature usually formed by the collapse of land following a volcanic eruption. The lake occurs when the crater is filled with precipitation.

3. (6 pts) Define the classes of lakes below (include characteristic qualities of each which may include nutrient levels, oxygen levels, and/or algae production):
a) Oligotrophic:

low nutrients content, low algal product, clear water, high drinking-water quality, well oxygenated, most common in cold regions underlain by resistant igneous rocks.

b) Mesotrophic:

medium nutrient levels, submerged aquatic plants

c) Eutrophic:

low nutrient levels, algal blooms, poor water quality.

4. (2 pts) * Name an anthropogenic influence which may cause the trophic index of a lake to change from ogligotrophic to eutrophic. Pollution, agriculture run-off, sewage, residential fertilizers (Anthropogenic=man-made or derived from human activities.)

Points

5. (3 pts) Identify and label the eplimnion, metalimnion and hypolimnion:

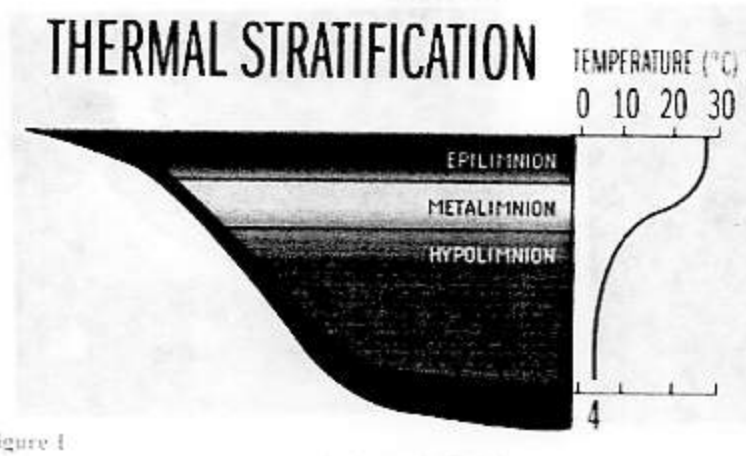


Figure 1

6. (2 pts) Assuming it is a temperate lake, based on the stratification depicted in figure 1, what season is it most likely to be and why? Summer, because the temperature (and density) differences between upper and lower water layers become are more distinct. Due to rising air temperatures the surface water is being heated more rapidly than can be distributed by mixing. The density difference soon becomes sufficient to prevent circulation.

7. (2 pts) Define thermocline, and add to Figure 1, above : The plane or surface of maximum rate of decrease of temperature with respect to depth. The thermocline is the point of maximum temperature change within the metalimnion.

Points _____

8. (6 pts) Identify the following features:

(a) Alluvial Fan

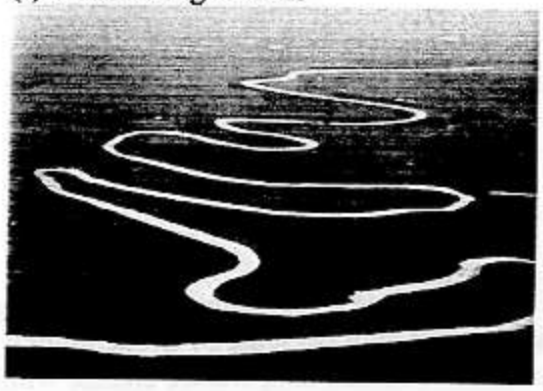
(d) Delta

(b) Braided Stream

(e) Oxbow Lake

(c) Glacial Lake

(f) Meandering Stream



Points _____

9. (1 pt) What is a terrain full of sinkholes and disappearing streams called?
a) Dendritic drainage
b) Inverted valleys
c) Karst topography
d) patterned ground
e) potholes

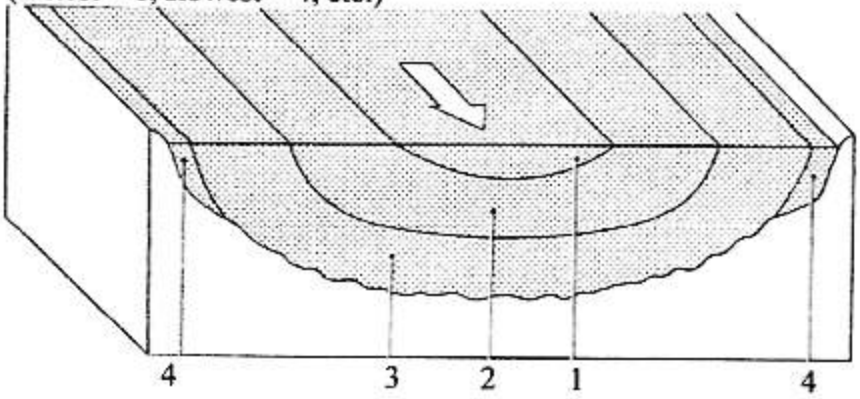
10. (1 pt) What term refers to the total amount of material carried by the water of a stream or river?
a) Capacity
b) Competence
c) Discharge
d) Load
e) Saltation

11. (1 pt) Where does the maximum water velocity occur in a straight river channel?
a) On the bottom near the middle
b) On the bottom near the shore
c) On the surface near the middle
d) On the surface near the shore
e) Velocity is nearly uniform throughout

12. (1 pt) Where does the maximum water velocity occur in a meander bend?
a) In the middle of the river channel
b) On the inside of the bend
c) On the outside of the bend
d) Velocity is nearly uniform throughout
e) It depends on how much water is flowing

13. (1 pt) What type of sediment load is deposited first when a river enters the ocean?
a) Bed load
b) Dissolved load
c) Suspended load

14. (5 pts) On the diagram below, label the relative water velocity in the zones or areas indicated. (fastest = 1, slowest = 4, etc.)



Points _____

15. (1 pt each=12 pts total) Identify the following feature as either *E-erosional* or *D-depositional:*

a) Cirque - E

b) Alluvial Fan - D

c) Meander – E

d) Delta – D

e) Stream Channel – E

f) Stalactite – D

g) Point Bar – D

h) Oxbow Lake – E

i) Fjord – E

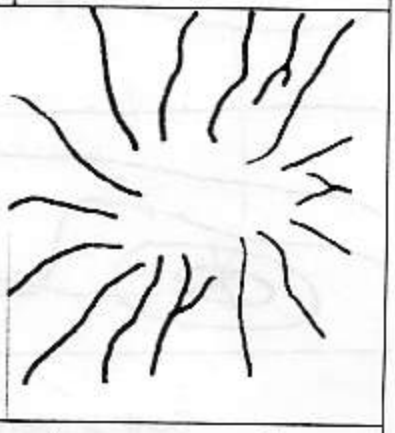
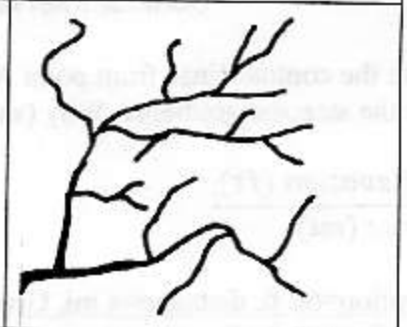
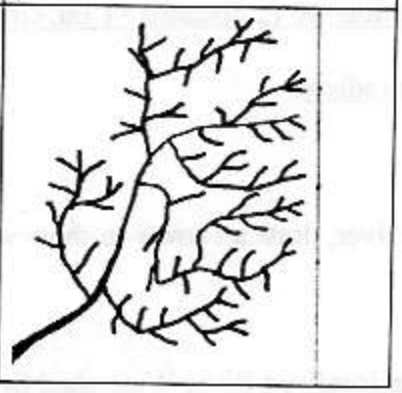
j) Solution Cave – E

k) Moraine – D

l) Cutoff - D

Points _____

16. (12 pts, 2 each for Characteristic, 1 for typical pattern) Define the stream drainage patterns listed below, draw what a typical example of this pattern:

Drainage Pattern	Characteristics	Example:
Dendritic	occurs in homogeneous regions, little or no resistance to water flow, water funnels in all directions showing little preference for one area over another	
Radial	Typically from dome mountains and volcanoes, streams emanate from a central focus and flow radially downward	
Rectangular	Region consists of many rectangular joints and faults	
Trellis	The trellis drainage pattern develops when the underlying rock is strongly folded or sharply dipping. The longer streams will have preference to one particular orientation and the other tributaries will have an orientation at right angles to this.	

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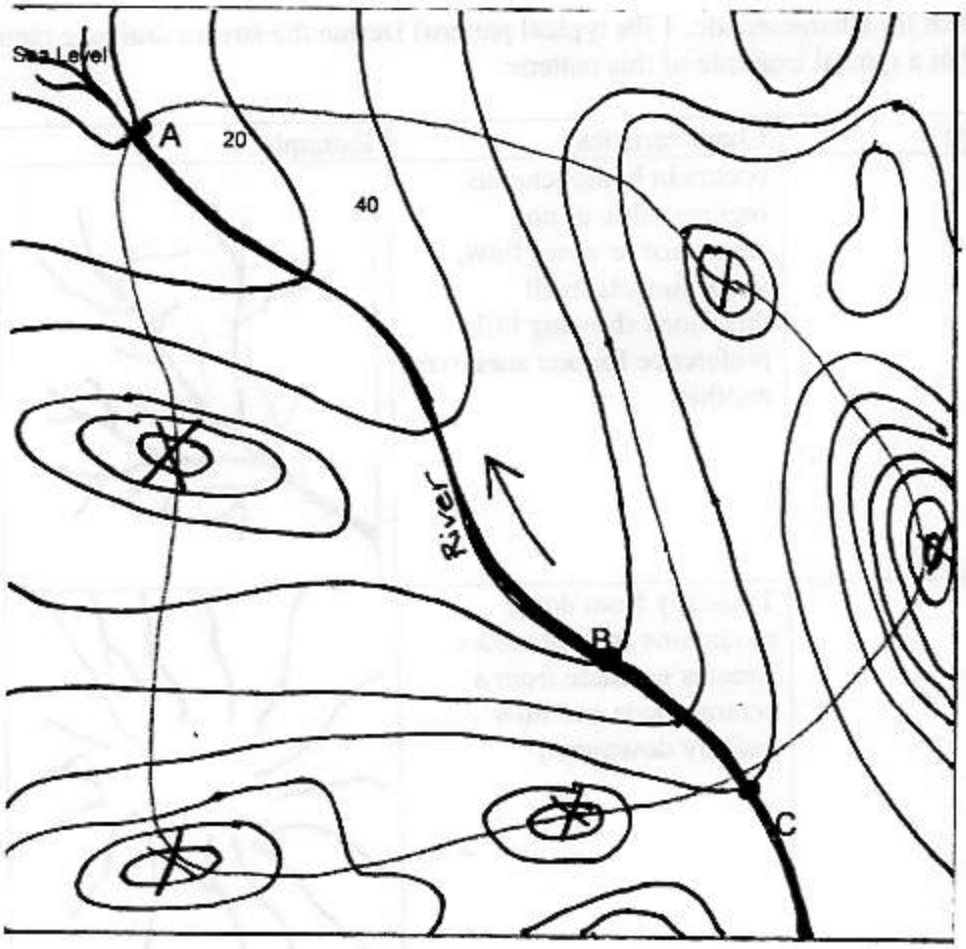


Contour Interval 20' - Scale 1 in = 1 mi

18.* (3pts) Observe the contour lines from point A to point B and from point B to point C. Which of the two distances has the steepest gradient? Why (show calculations & use correct units)?

$$\frac{Change\ in\ Elevation\ (ft)}{Distance\ (mi)}$$

AB, Change in Elevation=60 ft, distance=4 mi, Gradient=15 ft/mi
BC, Change in Elevation=40 ft, distance =1 mi, Gradient=40 ft/mi

BC has the steepest gradient.

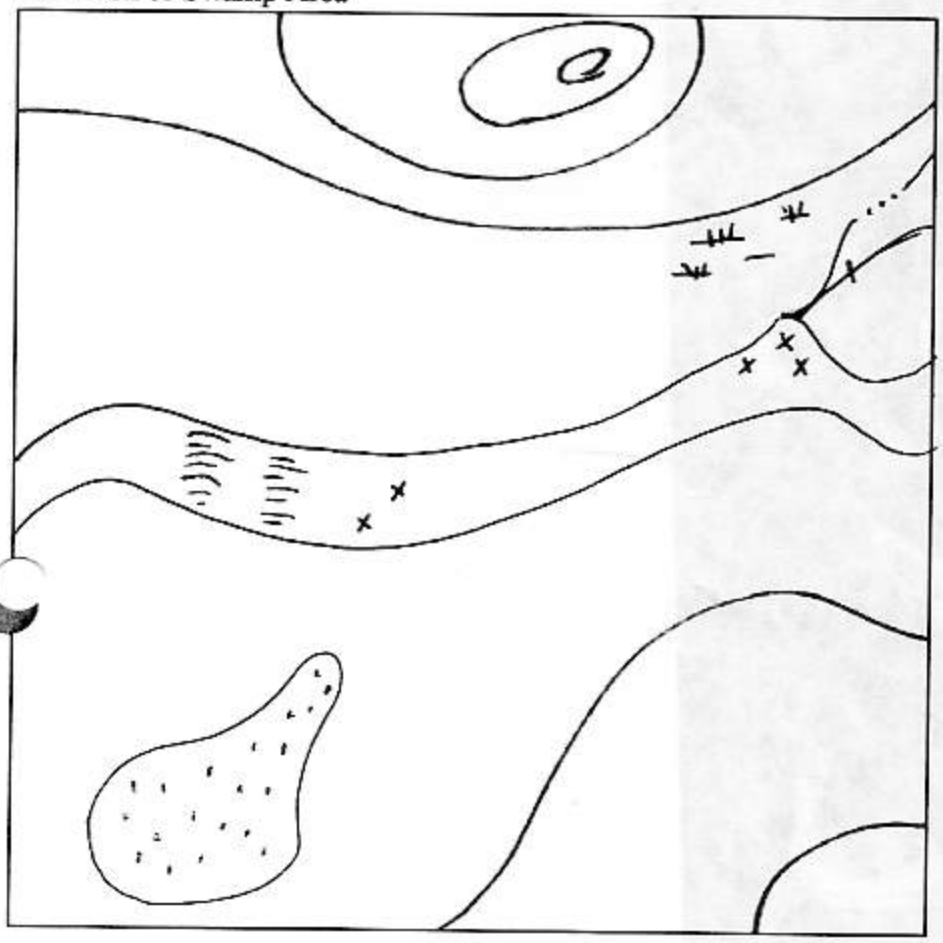
19. (1 pt) Along the river, draw an arrow to show which direction the river is flowing.

20. (3 pts) Outline an idealized River Watershed from point A to point C.

Points _____

. (8 total) On the map below, add and label the following water features.

- 1 Perennial River w/large rapids, various sunken rocks
- 1 Perennial Stream w/small falls
- 1 Intermittent Stream
- 1 Dry Lake
- 1 Marsh or Swamp Area



Intermittent stream	
Intermittent river	
Disappearing stream	
Perennial stream	
Perennial river	
Small falls; small rapids	
Large falls; large rapids	

Perennial lake; Intermittent lake or pond	
Dry lake	

Marsh or swamp	

Points

Study the aerial photograph of the Mississippi River and use it to answer the questions 22-25 below:

22. What type of sediment transport would you expect for this part of the Mississippi? (1pt.)
Mostly suspended transport.

Points _____

23. * (4 pts.) Label 2 oxbow lakes. How do they form? What do they say about the path of the Mississippi River?

They have formed has the path of the Mississippi River has migrated over time. This indicates that the Mississippi is a meandering river.

24. (2 pts.) List 2 other features evident in the aerial photograph
Cut banks, point bars, young mud deposits, and the floodplain

25. (1 pt.) This part of the river could be categorized as what type of river? Meandering

Points _____

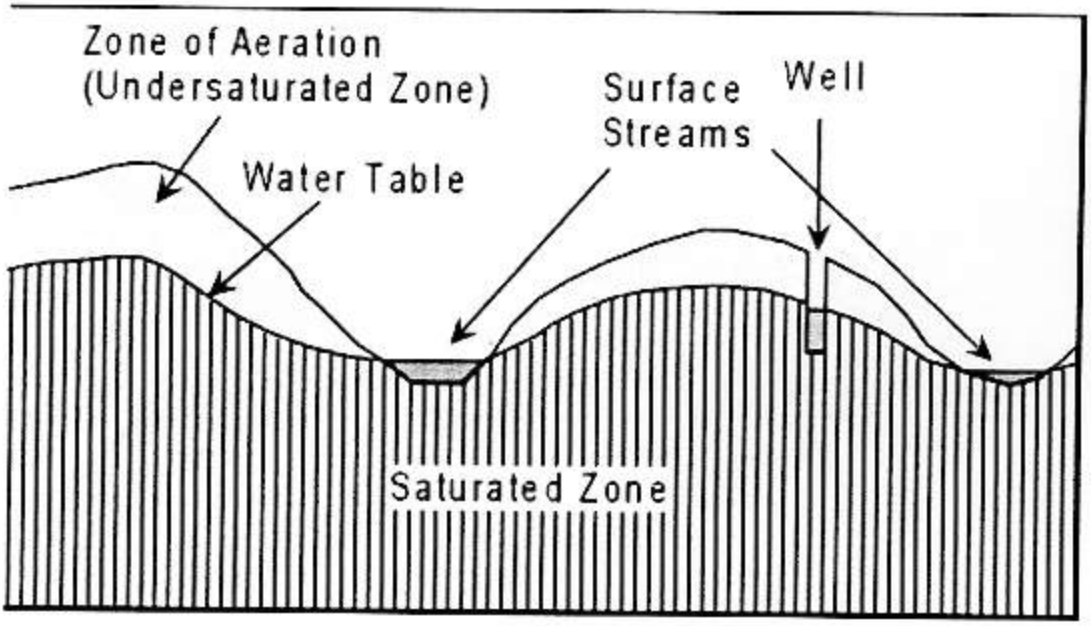
* 26. (2 pts.) Chezy and Manning equations are used to measure open channel fluid flow. Given Manning's equation:

$$V = \frac{k}{n} R_h^{2/3} \cdot S^{1/2}$$

Define *n* and how you would *best* determine its value:

n=Manning's Roughness Coefficient, common values may be looked up in a table of roughness coefficients.

27. (5 pts.) On the figure below, label:
- Zone of Aeration
- Water Table
- Surface Streams
- Well
- Saturated Zone



28. (2 pt) The rate of groundwater flow is controlled by two properties of the underlying rock, what are they?
Porosity and permeability.

Points _____