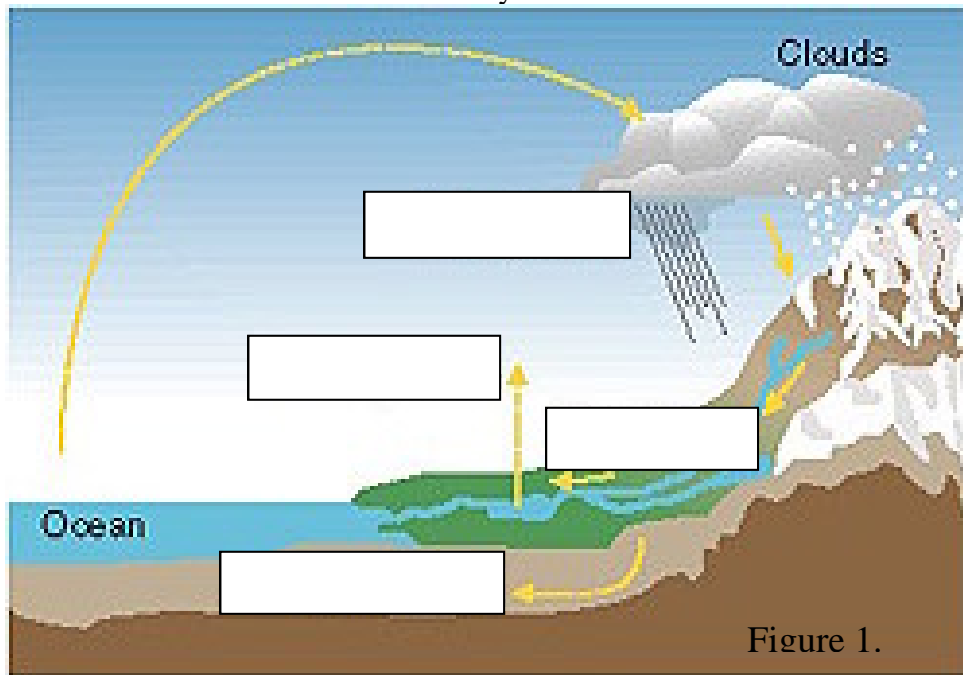


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2007 California Envirothon  
 Aquatics Station  
 Total = 100 points

Please write team number on top of each page of test. You may un-staple the test and work on questions in any order, however, pages should be returned to their correct order when turned in. You may choose to *split your team up* and work on multiple questions at once or work on questions together. Please show all work, as you may receive partial credit where possible.

I. Water Cycle



2. There are four blanks on figure 1 these blanks define processes. Chose from the following list and fill in those blanks on figure. (4 pts)

- |              |               |               |
|--------------|---------------|---------------|
| Runoff       | Percolation   | Precipitation |
| Infiltration | Evaporation   | Transpiration |
| Erosion      | Consolidation | Perspiration  |

3. Where does moisture for cloud formation comes from? List in the blanks provided below. (4 pts)

- A. \_\_\_\_\_ B. \_\_\_\_\_  
 C. \_\_\_\_\_ D. \_\_\_\_\_

4. Precipitation can do one of three things once it reaches the earth. What are those three things?

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(3 pts)

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_

5. Figure 1 is an illustration of the transfer of water from precipitation to surface water and ground water, to storage and runoff, and eventually back to the atmosphere. What is this cycle called? \_\_\_\_\_ (1 pt)

6. A portion of precipitation never reaches the ground because of vegetation, forest floors, or other surfaces. What is this process called? (Hint it is not evaporation, it is the process of being hung up on surface objects) (1 pt) \_\_\_\_\_

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II. Physical Processes

7. You will be using channel geometry to estimate the amount of water that could flow into the Frog Pond at the pool cross-section site using a rod and a tape. To do this you will need to collect the data to create a cross-section of the channel.
- a. A tape has been set up across the channel to read distance across the channel. This serves as the “X” coordinate. A wading rod or pole will give you the elevation from the channel bottom to the tape, or the “Y” coordinates. Starting on the left bank at 0, 0 collect the coordinates that define the channel and enter them into the chart below. Be sure to take a reading at the following features and enter them into the notes section of the table below:

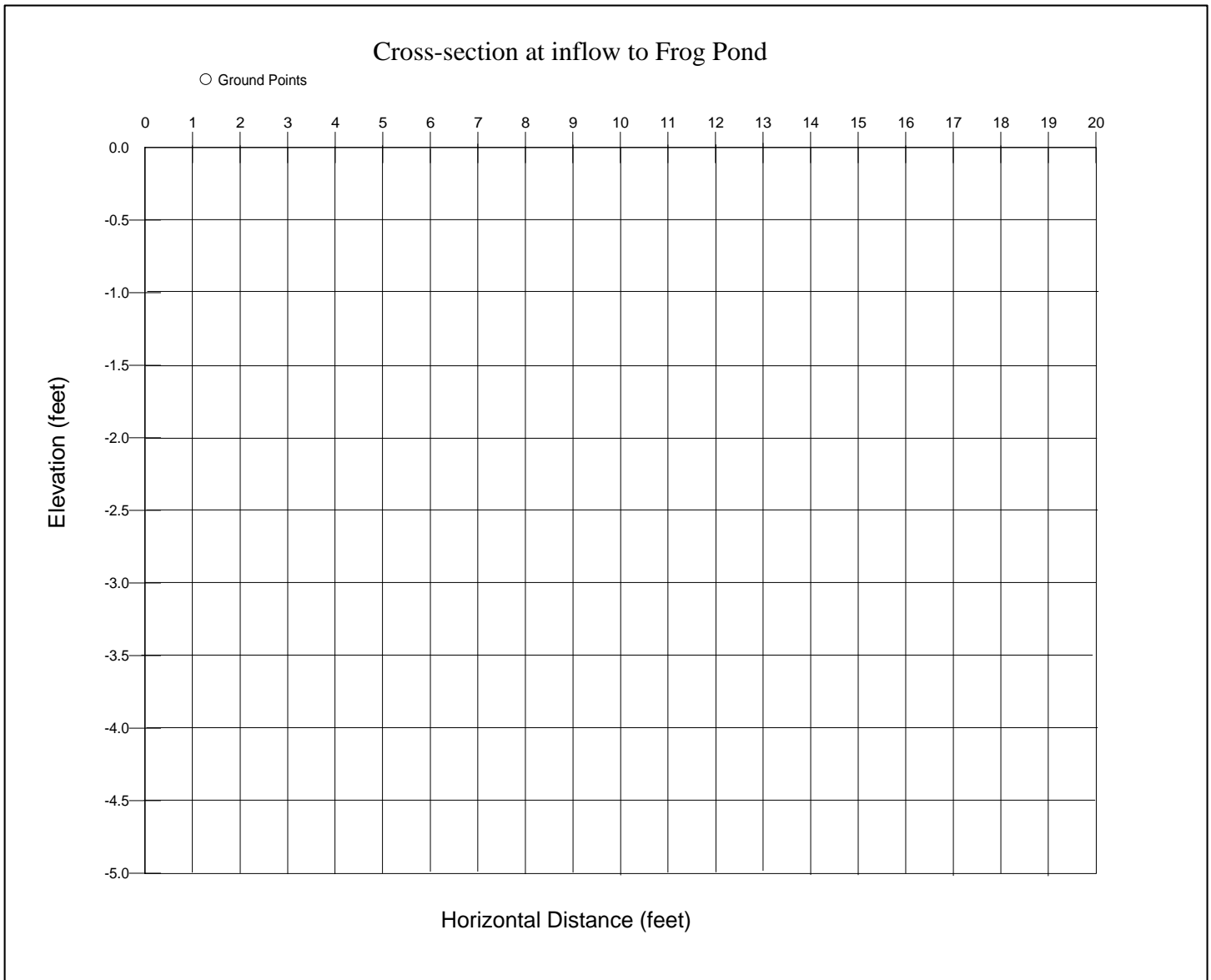
Left Stream Bank	Right Pin
Right Stream Bank	Right Edge of Water
Channel Bottom	Left Edge of Water

Note: More points may be taken to get an accurate drawing of the channel bottom, not every entry needs to have accompanying notes. (12 pts)

Distance	Elevation	Notes
0	0	Left Pin

- b. Plot the coordinates on the graph below realizing that the tape represents a zero point for elevations and all elevations taken below the tape are recorded as negative values. (10 pts)
- c. Also assume that the tape represents the water elevation at the channels fullest level just before flooding starts. This elevation is called bankfull. Using the bankfull elevations determine the area that the water would occupy in the channel. Enter this value in the chart on the next page. (5 pts)
- d. Because you know the volume of water at the cross-section you can determine a rough estimate of discharge using the continuity equation  $Q=VA$ ; where Q is discharge in feet<sup>3</sup>/second, V is velocity in feet/second, and A is area in feet<sup>2</sup>. If the water is flowing at 0.5 feet per second what is the discharge at the pool site in feet<sup>3</sup>/second (cfs)? Enter this value in the chart on the next page. (2 pts)

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Item	Value
<ul style="list-style-type: none"> <li>• <b>7c. answer</b> Cross-Sectional Area (calculate)</li> </ul>	<b>(5 pts)</b>
<ul style="list-style-type: none"> <li>• <b>7d answer</b> Discharge in cubic feet/sec (calculate)</li> </ul>	<b>(2 pts)</b>

8. The continuity equation does not account for physical conditions of the channel as it leaves out roughness of the bed and does not account for slope of the channel; Manning's accounts for roughness and slope. Manning's equation is as follows:

$$Q = 1.486/n (A) (A/WP)^{2/3} (S)^{1/2}$$

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Where: Q =discharge in cfs  
 n=Manning's roughness coefficient=.035  
 A=Area in feet<sup>2</sup> (calculated above)  
 WP=wetted perimeter (measure off cross-section above)  
 S=slope = .02

Using values from the problem above for A (area), measure the wetted perimeter from the cross-section, use 0.035 for n, 0.02 for S, and calculate the new Q or discharge. Be sure to set up the problem on the test so we may see your work. Record this value in the chart below. (4 pts total)

a. Discharge using $Q=VA$	(1 pt)
b. Discharge using Manning's Equation $Q=1.46/n (A) (A/WP)^{2/3} (S)^{1/2}$	(2 pts)
c. Difference	(1 pt)

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III. Chemical Processes

9. The following table has water perform appropriate tests to find the chemical characteristics identified below. Fill in the blanks in the table using the water quality test kits provided. (18 pts total)

Test	Results
a. Time/Date	(2 pts)
b. Air Temperature	(2 pts)
c. Water Temperature	(2 pts)
d. PH	(4 pts)
e. Dissolved Oxygen (DO)	(4 pts)
f. Alkalinity	(4 pts)

Circle the correct answer (3 pts total)

10. Dissolved oxygen can be affected by hydropower? T F

11. Does this sample look as if it were affected? Y N

12. What type of hydropower facility has the potential to affect dissolved oxygen?  
 a. Impoundment  
 b. Diversion  
 c. Pumped Storage

Fill in the blank (2pts total)

13. What about this site would be good for the generation of hydroelectric power? Hint look downstream past the road?

---

14. What about this site is bad for the generation of hydroelectric power?

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IV. Biological Processes

15. Laid out on the table are some aquatic insects. Using the identification cards, classify the insects and draw them below. You may draw the insects you discovered from your investigation above and you may use the back of this paper if you need to. (12 pts)

Name (2 pts each)	Drawing (1 pt each)
a.	
b.	
c.	
d.	

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V. Aquatics and Current Issue

16. Hydropower is an alternate energy source that affects the aquatic resources. Match the cause and effect statements for advantages and disadvantages of hydropower use and definition of hydropower terms. (15 pts)

Define or finish the statement in this column with the matching term, answer or definition in the next column	Matching term, answer or definition	Place number from column 1 that complements the statement in column 2.
1. Hydropower relies on	clean fuel source	
2. Water cycle is	driven by the sun	
3. Hydropower	Utilize the a stream's natural pathway	
4. Sunflower	domestic source of energy	
5. Simple power	considered a renewable energy	
6. Superpower	A closed conduit or pipe for conducting water to the powerhouse.	
7. Kinetic systems	Uses water to power machinery or make electricity	
8. Hydropower plants impacted by drought	Channels a portion of a river through a canal or penstock.	
9. Fish populations can be mitigated by	Volume of water, in cubic feet or cubic meters per second, passing a point in a given amount of time	
10. Diversion	oxygenate the water	
11. Feet	Vertical change in elevation	
12. Head	Using fish ladders or elevators	
13. Flow	Also known as run-of-river	
14. Penstock	water cycle	
15. Hydropower plants can cause low dissolved oxygen levels in the water	Can't produce electricity	



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