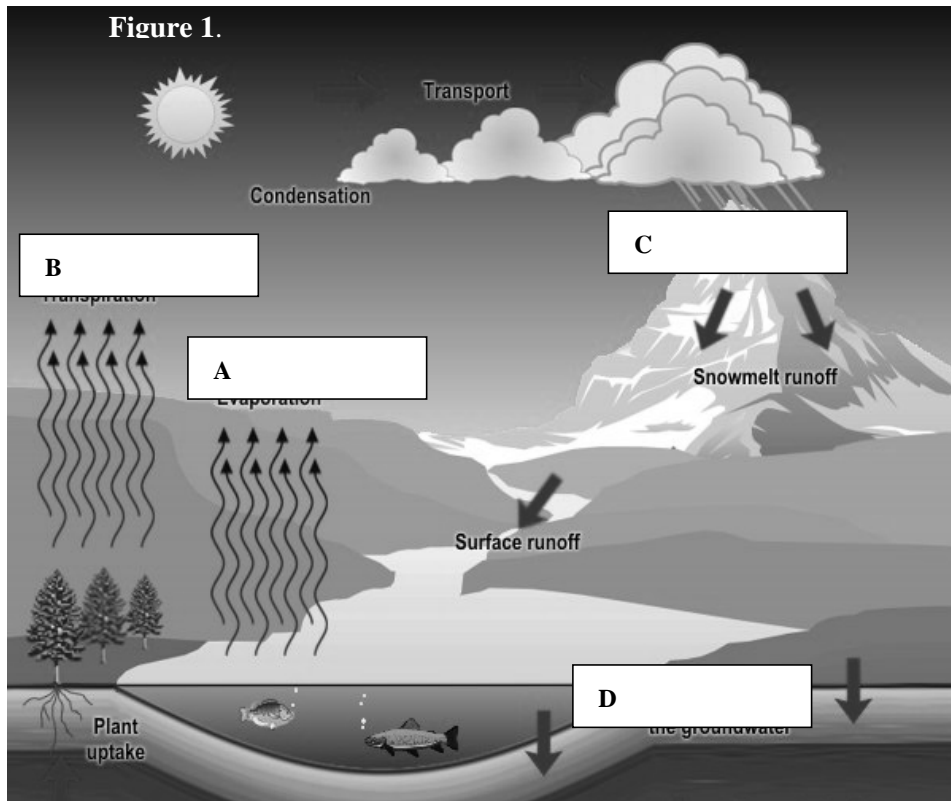


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2010 Canon Envirothon
 Hydrology-Aquatics Station Test 1
 Total = 100 points

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



The next five questions apply to Figure 1. (Answers to 1-5 can be found at: <http://www.srh.noaa.gov/srh/jetstream/atmos/hydro.htm>)

1. This figure is an illustration of the transfer of water from **atmospheric** precipitation to surface water and ground water, to storage and runoff, and eventually back to the atmosphere. What is this cycle called _____ (1 pt.)

2. Fill in the four blanks on Figure 1. The blanks define processes. (4 pts.)

3. Evaporation is the change of state in a substance from a _____ to a gas. (1 pt.)

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4. Of the transpired water passing through a plant, only 1% is used in the growth process of the plant. The remaining 99% is passed into the _____. (1 pt.)
5. Runoff occurs when there is excessive precipitation and the ground is _____. (1 pt.)
6. A portion of precipitation never reaches the ground because of vegetation, forest floors, or other surfaces. What is this process called? _____ (1 pt.)
7. Impervious surfaces such as pavement and rooftops generate how much more runoff than a woodland area of the same size? (2 pts.) (Circle answer below)
<http://www.epa.gov/owow/nps/facts/point7.htm>
 - a. 3-4 times
 - b. 5- 6 times
 - c. 9-12 times
 - d. 100 times

Short Answer

8. The following table shows discharge measurements for a stream in a desert environment. Discharge (measured in cubic feet/second) is the amount of volume of water flowing past a given point in a given amount of time. Based on the data (and your knowledge of how ground water interacts with streams), what type of stream is this? Explain your answer (3 pts.) Pages 9-13
http://water.usgs.gov/pubs/circ/circ1139/hdocs/natural_processes_of_ground.htm

Station Reading	Discharge Measurement (cubic feet/second)
(upstream) Cross-section #1	235 cfs
(mid-stream) Cross-section #2	189 cfs
(downstream) Cross-section #3	98 cfs

9. What are three basic ways that streams interact with ground water? (3 pts.) pages 9-13
http://water.usgs.gov/pubs/circ/circ1139/hdocs/natural_processes_of_ground.htm

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10. How can “bank storage” affect flood peaks? (3 pts.) Pages 9-11

http://water.usgs.gov/pubs/circ/circ1139/htdocs/natural_processes_of_ground.htm

<http://www.s-cool.co.uk/alevel/geography/river-profiles/storm-hydrographs-and-river-discharge.html>

Use Figure 2 to answer questions 11-15.

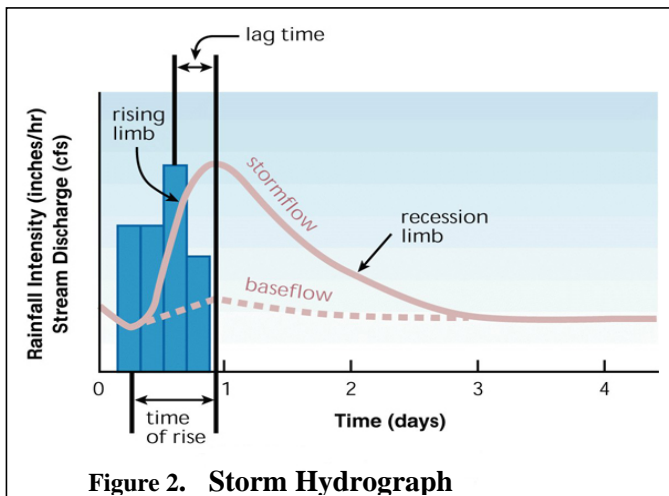


Figure 2 is a Storm Hydrograph. It shows how stream discharge changes over time in response to a storm event. The area under the curve is the amount of water and the rate it flows down the creek after a storm. The bar graph represents the intensity of rainfall. Use this figure to answer the following questions:

11. How long did it take the river to peak (reach its highest discharge) after the highest rainfall intensity? (1 pt.)

12. Explain what the term “lag time” means in Figure 2. (2 pts.)

13. If the hydrograph in Figure 2 represents a rainfall-discharge relationship in a forested watershed, how would the shape of the hydrograph change if the watershed were converted to an area of low permeability like a parking lot? Draw the new curve on Figure 2 and explain your reasoning for drawing it as you do. (2 pts.) (1 pt.) Correct sketch (2 pts. Full credit for correct sketch and explanation).

14. Describe how the “lag time” might be affected if the watershed changed to a more urban setting (i.e., became less permeable). (2 pts.)

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15. What three management practices could be used to help restore the runoff (discharge) response of an urban watershed to a more forest-like watershed? (3 pts.)

Field Application of Aquatics-Hydrology

The following questions relate to the hydrograph figure (figure 3) on page 5 below:

<http://geology.com/articles/hydrograph.shtml>

16. From the hydrograph (Figure 3) determine: (3 pts. each)

- I. Approximate maximum discharge for the period of record _____ cfs
- II. Approximate minimum discharge for the period of record _____ cfs
- III. What was the top month for maximum water flow? _____

17. When contribution from surface runoff (i.e., snow melt and/or rain) stops, rivers receive water as “base flow” primarily from ground water. As the season becomes drier, and less ground water is available to the river, the discharge (cfs) will decrease. This is called “Base Flow Recession.” This can be seen on Figure 3 from the last high cfs “peak” to the lowest cfs “trough.” The following questions relate to base flow recession: (3 pts. each)

- a. How many months did the base flow recession last? _____
- b. How many small storm events occurred during this time? _____
- c. When did the last of these small storm events occur? _____
- d. What was the discharge of the storm event that occurred on July 15th? _____

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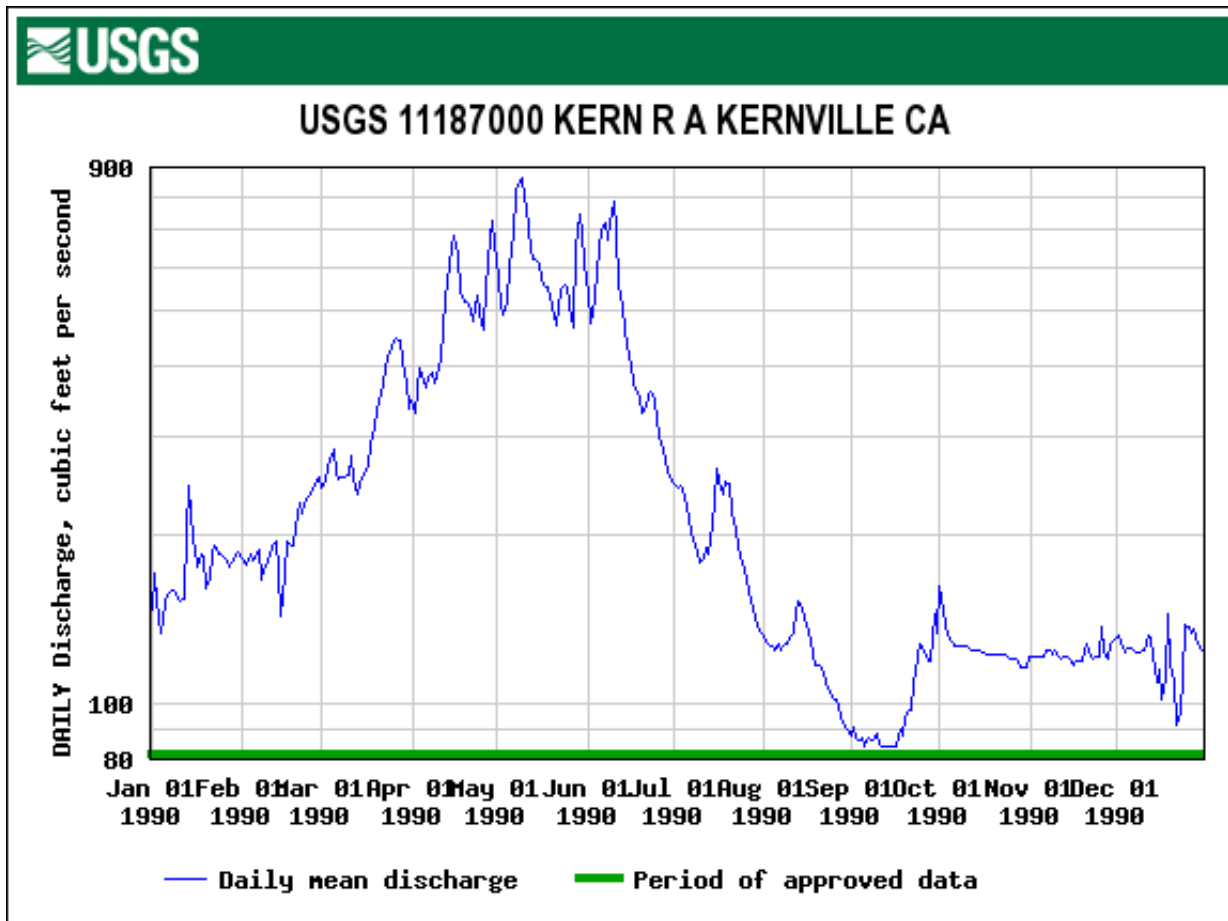


Figure 3: This is a typical Log-Linear hydrograph of a river that flows through arid terrain. The Y axis shows discharge in cubic feet per second (cfs) and the X axis shows time in months. The X axis starts on January 1st and goes through December 31st.

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Water Chemistry

18. Fill out the following table using the water quality testing equipment available at the station. (12 pts.)

Measurement	Water Source 1	Water Source 2
Water Temperature	(3pts.)	Given
pH	(3pts.)	Given
Alkalinity	(3pts.)	Given
Dissolved Oxygen	(3pts.)	Given

19. Based on your measurements and the data provided in the table, describe the similarities or differences in the physical properties between the two waters. (2pts.)

20. Scout Island Creek is an artificial creek created by pumping ground water that is within ¼ mile of the San Joaquin River. Give two reasons why water samples may be similar or different. (2pts.)

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Aquatic Ecology

21. On the table you will observe various aquatic insects that have been collected from creeks and tributaries that flow into the San Joaquin River. Using the identification cards, write the common name of the insects and identify their level of environmental sensitivity; (2 pts. for the correct common name and 2 pts. for the correct environmental sensitivity. 4 pts total/specimen)

Common Name	Environmental Sensitivity
	Most Sensitive Sensitive Tolerant Very Tolerant
	Most Sensitive Sensitive Tolerant Very Tolerant
	Most Sensitive Sensitive Tolerant Very Tolerant

22. Explain why aquatic insects can be biological indicators of a watershed’s health. (6 pts)

23. What are five potential land use activities that could affect ground water and hence the ecological health of the San Joaquin River watershed? (10 Points)

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¶

24. List five Best Management Practices (BMPs) that can help protect groundwater from agricultural activities, including livestock management (5 points).

(<http://www.watersystemscouncil.org/documents/AgriculturalBMPOverview.pdf>)

Team Name _____ Team Number _____