2013 California Envirothon

Aquatics Station Test 1

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 in 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 and show all work, as you may receive partial credit where possible.

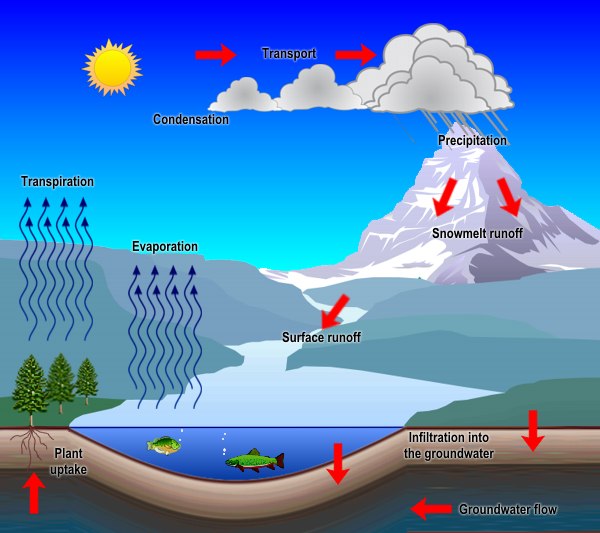
C

**B.**

**A.**

**Figure 1**.

**D.**



Fill in the four blanks on figure 1 using options from the word bank on page 2. The blanks define processes (4 pts).

The next five questions apply to Figure 1. Use the Word Bank on page 2 to help answer questions 1 to 5 below.

1. This figure 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? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (2 pts.)
2. Evaporation is the change of state in a substance from

**Word Bank for Questions 2-6.**

Runoff

Percolation

Precipitation

Infiltration

Evaporation

Transpiration

Atmosphere

Saturated

Perspiration

Evaporate

Interception

Liquid

a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to a gas? (1 pt)

1. 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

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(1pt)

1. Runoff occurs when there is excessive precipitation and the ground is

\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(1 pt)

1. A portion of precipitation never reaches the ground because of vegetation, forest floors, or other surfaces. What is this process called?

\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_(1 pt)

1. Impervious surfaces such as pavement and rooftops generate \_\_ more runoff than a woodland area of the same size. (1 pt) (Answer at [*http://www.epa.gov/owow/nps/facts/point7.htm*](http://www.epa.gov/owow/nps/facts/point7.htm)*)*
   1. 3-4 times b. 5- 6 times c. 9-12 times d. 100 times

**True and False (1 pt each, 3 total points)**

1. The best crop for the environment would protect the soil from wind and water erosion; catch the most rainfall possible to recharge the underground water system; hold, capture, and use nutrients applied in the form of manure and fertilizer; and provide a valuable product for human society regardless of how the pasture is managed. True or False (circle one)

[*http://www.envirothon.org/pdf/2013/Pasture\_Grazing\_ABC.pdf*](http://www.envirothon.org/pdf/2013/Pasture_Grazing_ABC.pdf)

1. Range plants have not evolved to withstand grazing and, therefore, cannot withstand a heavy grazing event even if done in the right season and if plants are given enough time to recover after grazing. True or False (circle one) [*http://www.envirothon.org/files/Rangeland\_Ecology.pdf*](http://www.envirothon.org/files/Rangeland_Ecology.pdf%20)
2. Rangeland agriculture is grazing, and when properly managed, rangeland agriculture is fully sustainable having gone on long before the discovery of fossil fuels and will, without doubt, go on long after the depletion of fossil fuels. True or False (circle one) [*http://www.envirothon.org/files/heitschmidt\_energy2.pdf*](http://www.envirothon.org/files/heitschmidt_energy2.pdf%20)

**Fill in the Blank (2 pts each, 10 points total)**

Using some of the words below, fill in the blanks to the following statements:

|  |  |  |  |
| --- | --- | --- | --- |
| 25 percent | Riparian Corridor | Fecal Matter | Recreation |
| Land Management | 50 percent | Decision Tree | Cows |
| Best Management Practices | Nitrates | 33 percent | Temperature |
| pH | Sediment | Roads | 66 percent |
| Dissolved Oxygen | Trails | 100 percent | Proper Management |
| People | Livestock | Alkalinity | Stream flow |

1. More than \_\_\_\_\_\_\_\_\_\_\_ of California’s drinking-water supply passes through or is stored in oak woodlands. (2pts) [*http://rangelandwatersheds.ucdavis.edu/publication%20list%20and%20files/Ogeen%20et%20al\_Cag\_2010.pdf*](http://rangelandwatersheds.ucdavis.edu/publication%20list%20and%20files/Ogeen%20et%20al_Cag_2010.pdf)
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ “is a practice or combination of practices that is determined by a state to be the most effective means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals" (Federal Clean Water Act, 1977). (2pts)
3. According to a study titled *Evaluation of California’s Rangeland Water Quality Education Program*, the number one non-source pollutant identified during self-assessments by land owners was \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. (2pts) <http://www.carangeland.org/images/Evulation_of_CA_Rangeland_Water_Quality_Education_Program.pdf>
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are critical variables in determining habitat quality for cold-water fisheries and stream macroinvertebrates. (2pts) <http://www.carangeland.org/images/Monitoring_Helps_Reduce_Water-Quality_Impacts_in_Flood-Irrigated_Pasture.pdf>
5. A study in Northern California’s watersheds and rangelands, where Total Maximum Daily Load (TMDL) are large concerns for streams, found that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are the largest cause of sediment issues. (2pts) <http://www.carangeland.org/images/Survey_Identifies_Sediment_Sources_in_North_Coast_Rangelands.pdf>

Short Answers (5 pts each. 10 total)

1. A landowner has inherited the family’s ranch located in the foothills of California. He has no idea how to run livestock properly, but is willing to learn. He has hired others to help him with various tasks on the ranch and wants you, as a hydrologist, to help him maintain and improve the water quality. You come up with two general plans. What are they are what will they accomplish? (5 pts)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. As a hydrologist, think about livestock use and their potential impacts to streams. What are the two biggest concerns and, if they are occurring, what could happen? (5 pts) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Water Chemistry**

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

|  |  |  |  |
| --- | --- | --- | --- |
| Location | Your Results | Foothills (Campground) | Foothills(Grazing) |
| Time/Date | (2) | N/A | N/A |
| Air Temperature | (2) | N/A | N/A |
| Water Temperature | (2) | 9 | 7 |
| pH | (2) | 6.5 | 7.5 |
| Dissolved Oxygen  (DO) | (2) | 9 | 11 |
| Total Alkalinity | (2) | 175 | 72 |

Using the water quality data you collected above, answer the following questions. (6pts total)

1. The majority of your data fits with (2pts)
   1. Foothills (Campground)
   2. Foothills (Grazing)
   3. Neither A or B
   4. Both A and B
2. Between all three data sets from the table above (your data, grazing, and campground), what are at least two observations you can make? (2pts) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Although the results you collected are part of water quality sampling, what is one valuable piece of data missing that should be collected with regards to grazing? (2pts)
   1. Citric Acid
   2. Nitrates
   3. Fecal matter tallying
   4. Nickel Metal Hydride concentrations

**Fluvial Geomorphology (10 pts total)**

1. We know adding an overabundance of nutrients to streams from land uses can impact water quality. There is a natural resource that is far more abundant and can be just as damaging to the water quality and stream channel stability. What is this resource? (2 pts)
   1. Vegetation
   2. Roads
   3. Soil
   4. Waste
2. If not properly managed, livestock use during the dry and hotter times of year could increase damage to a resource. If water access is limited to stream channels, livestock use on a particular portion of the stream channel could become concentrated, which increases the likelihood of a negative impact in that area. Besides increasing fecal matter, what are two other problems that could occur to the stream corridor as a result? (4 pts)

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1. In order to reduce the likelihood of livestock from concentrating around stream channels, what could a rancher do? Write down three things for the rancher and briefly describe how each of these feasible and practical ways will influence livestock away from stream channels? (6 pts).

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. A disturbance to a stream can cause instability; one of those being the stream channel over widening. As a stream over widens, one thing that occurs is an increase in surface area which water passes over as it flows downstream. Besides a larger surface area affecting water temperature and supply, an over widening stream will also (2 pts)

<http://water.epa.gov/scitech/datait/tools/warsss/enlarge.cfm>

* 1. provide better aquatic habitat as there is more water over a greater area
  2. increase sediment supplied to the system due to increased surface area
  3. decrease the chances of flooding as it the stream can hold more water
  4. promote better stream crossing for terrestrial species

1. Past studies set out to determine where most of the excess sediment originates from in a river system. Results found that a majority of the excess sediment was coming from (2 pts)

<http://water.epa.gov/scitech/datait/tools/warsss/streamero.cfm>

* 1. Bedrock
  2. Active Channel
  3. Stream Banks
  4. Runoff

1. In order to reduce the likelihood of bank erosion within a low gradient stream channel, there are several solutions with regards to grazing. One of those solutions is having enough vegetation. Why is vegetation so important to a low gradient stream’s stability and water quality? (4 pts) <http://water.epa.gov/scitech/datait/tools/warsss/type.cfm>

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**Short Essay Question (30 pts total)**

1. You work for an environmental consultant group as their hydrologist. A rancher wants to change how things are managed on his property and has hired you and your company creates a management plan. As a hydrologist you want to help him reduce, if not eliminate, water quality concerns and protect the streams/springs he has on his 10,000 acre property located in the foothills of the Sierra Nevada mountains. Using what you know on the subject and the information provide below, write short essay stating the problems with the ranchers current setup, what you propose to change, how you will monitor for change, and what you expect the results would be from a hydrology perspective. If you need more room, you can write on the back of the test. (30 Points)

Current Conditions on the ranch.

* One perennial stream and several intermittent streams as tributaries to the perennial stream
* Livestock obtain water from a few developed springs that feed into the intermittent streams. Otherwise they drink where ever water is in a stream and focus on perennial flows during hotter and dryer months.
* Livestock graze all year long all the time and livestock are moved throughout the ranch at set intervals (i.e. once every other week).

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