Station 1 Test 1

Match the following terms to the correct explanation.
Not all will be used. None will be used more than one time.
Be sure to copy ALL answers to the Answer/Score Sheet

Answer	Term	Explanation
	1. subsidence	A. the component of a flow regime that represents normal flow conditions between precipitation events.
		B. water which is soft and acidic and can corrode plumbing, piping, and appliances
	2. Return flow	C. the formation of an erosion-resistant layer of relatively large particles on a streambed or bank resulting from removal of finer particles by erosion.
	3. Recharge rate	D. a tank used to collect rainwater runoff from the roof of a house or building
	4. outwash	E. a tank in which solids settle to the bottom and are subsequently removed as sludge
	5. Infiltration rate	F. water trapped in the pore spaces of a sedimentary rock at the time it was deposited
	6. Hard water	G. removal of mud from the bottom of water bodies
	7. Connate water	H. a measure of a river or stream's tendency to carry a high percentage of its flow volume in large, infrequent events rather than more moderate flows that occur frequently
	8. dredging	I. water containing a high level of calcium, magnesium, and other minerals
	9. flashiness	J. the quantity of water that can enter the soil in a specified time interval
	10. Aggressive water	K. a deposit of sand and gravel formed by streams of meltwater flowing from a glacier
		L. the quantity of water per unit of time that replenishes or refills an aquifer
	11. armoring	M. surface water that returns to the natural environment after diversion for beneficial uses, such as for irrigation
	12. Base flow	N. surface water entering rivers, freshwater lakes, or reservoirs
	13. clarifier	O. the movement of oil, gas, contaminants, water, or other liquids through porous and permeable rock.
	14. interface	P. any water that does not contain a significant amount of dissolved minerals such as salts of calcium or magnesium
	15. migration	Q. sinking down of part of the earth's crust due to underground excavation, such as removal groundwater
		R. soil particles, sand, and minerals washed from the land into aquatic systems as a result of natural and human activities
		S. the common boundary between two substances such as water and a solid

Station 1 Test 1 KEY

Match the following terms to the correct explanation.
Not all will be used. None will be used more than one time.

Answer	Term	Explanation
Q	1. subsidence	A. the component of a flow regime that represents normal flow conditions between precipitation events.
		B. water which is soft and acidic and can corrode plumbing, piping, and appliances
M	2. Return flow	C. the formation of an erosion-resistant layer of relatively large particles on a streambed or bank resulting from removal of finer particles by erosion.
L	3. Recharge rate	D. a tank used to collect rainwater runoff from the roof of a house or building
K	4. outwash	E. a tank in which solids settle to the bottom and are subsequently removed as sludge
J	5. Infiltration rate	F. water trapped in the pore spaces of a sedimentary rock at the time it was deposited
I	6. Hard water	G. removal of mud from the bottom of water bodies
F	7. Connate water	H. a measure of a river or stream's tendency to carry a high percentage of its flow volume in large, infrequent events rather than more moderate flows that occur frequently
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C	11. armoring	M. surface water that returns to the natural environment after diversion for beneficial uses, such as for irrigation
A	12. Base flow	N. surface water entering rivers, freshwater lakes, or reservoirs
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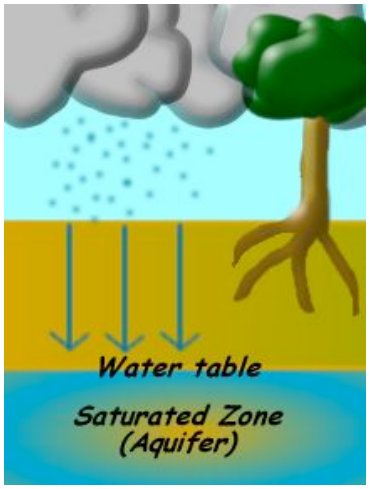
		S. the common boundary between two substances such as water and a solid

http://www.edwardsaquifer.net/glossary.html

Station 2 Test

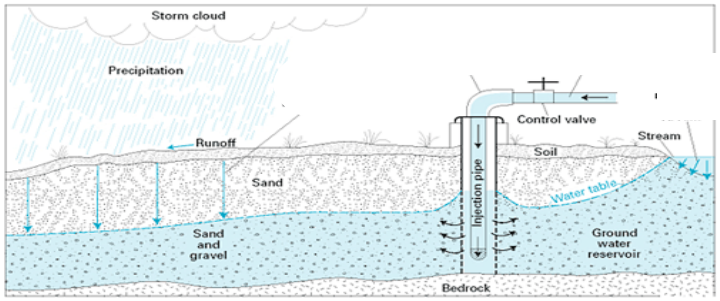
Answer the questions about the diagrams.

All answers must be written on the answer sheet.

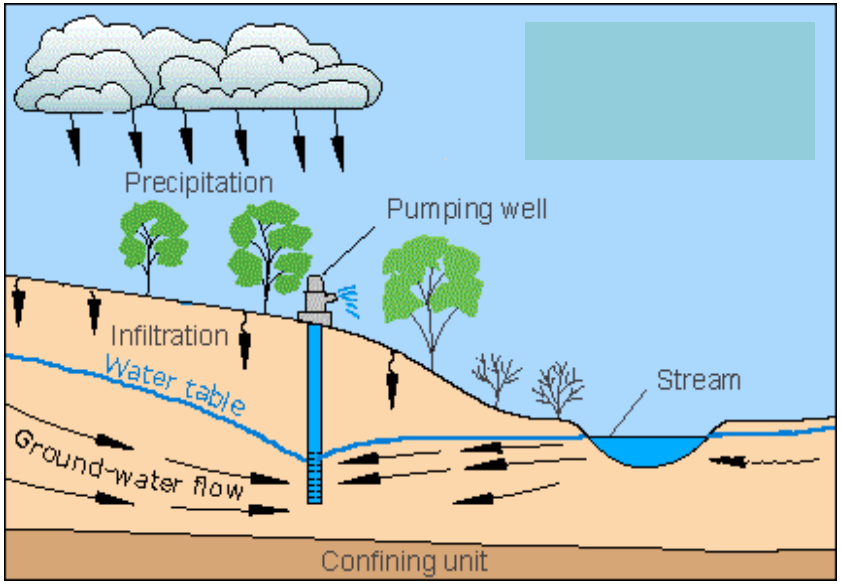


1. What is the process, indicated by the arrows, of water moving from the land surface through the pores of the unsaturated zone?

2. What is the name for the addition of water to the saturated zone by the process in question 1?



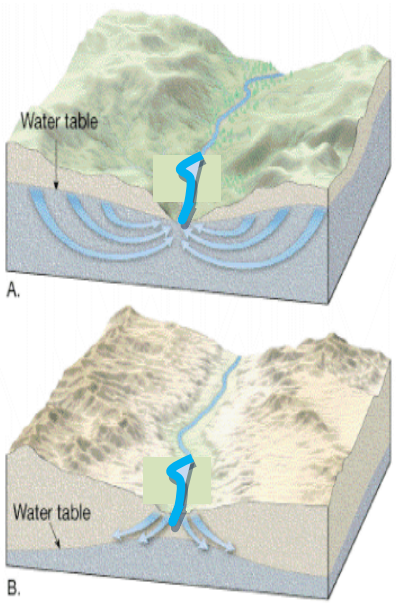
3, 4, & 5. From the diagram, list three sources of water entering the groundwater system.



6. What is the name for the “dip” in the water table in this diagram?

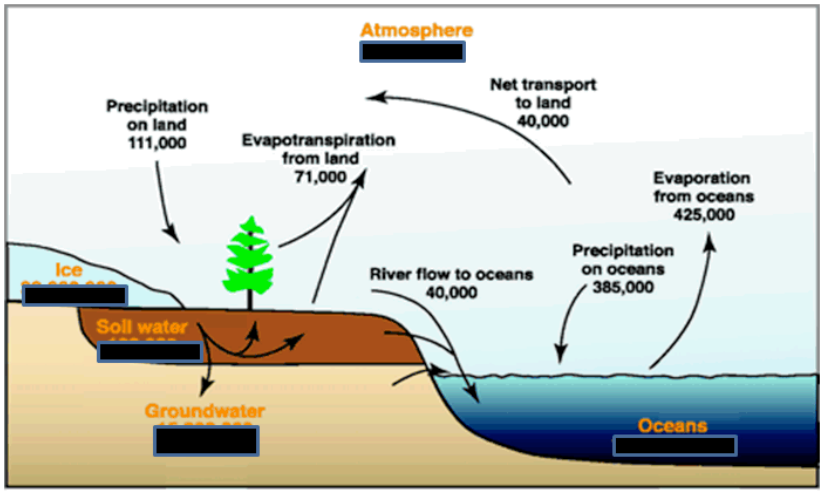
7. What do we call it when pumping removes water from pore spaces, allowing the aquifer to compact?

8. Even during dry weather conditions water can enter streams from the aquifer, as indicated by the diagram. What is the term for this continual level of discharge?



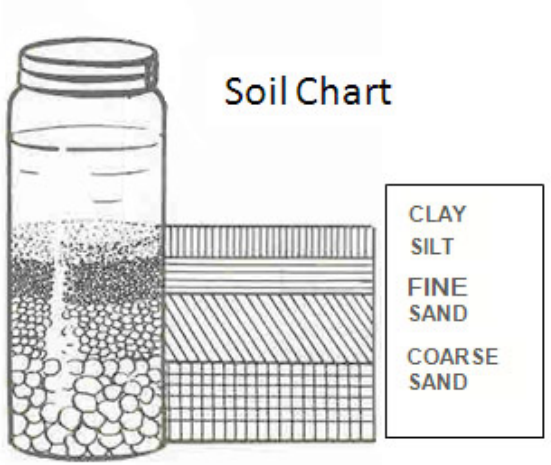
9. In diagram "A" above describe the relationship between the water table and the stream (9a), how that impacts the direction of groundwater flow (9b); and the downstream stream discharge (9c).

10a/10b. For the two diagrams above provide the name of the type of stream that exists in these conditions.



Rank the global water reservoirs in order of size from largest (1) to smallest (5)

11a. Atmosphere 11b. Ice 11c. Soil Water 11d. Groundwater 11e. Oceans



12, 13, 14 & 15. Rank the soil types from most to least permeable.

Tiebreaker: Do the higher permeability soils have a higher porosity? If not, why?

Note: This is just one example of information that may be included on an exam. Information on future exams is not limited to the scope or topics covered here.

Station 2 Test Answer Key

1. Infiltration
2. Recharge
3. Precipitation
4. Injection well
5. Stream
6. Cone of depression
7. Subsidence
8. Base flow

9a. Water Table is above the bed of the stream
9b. Water flows from the groundwater into the stream
9c. Stream discharge increases.

10a: Effluent Stream
10b: Influent Stream

11a. 5
11b. 2
11c. 4
11d. 3
11e. 1

12. Coarse Sand
13. Fine Sand
14. Silt
15. Clay

Tiebreaker: 1 point for each:

*** Soils made of larger particles have more space between the particles.**
*** Soils made of larger particles are highly permeable**
*** Fine materials are highly porous**
*** The small spaces in fine materials restrict flow.**

Team Number:

School:

Station 3: Build an Aquifer Model
Be prepared to demonstrate the following concepts:

1. **Describe the structure of your aquifer model:**

How does ***the composition of the geology*** (properties such as porosity and permeability) and their arrangement help or hinder the ***storage and movement of water***, including connections to surface water.

2. **Describe the considerations for locating wells** for water ***recovery*** or ***injection***,

   AND

The influence of well pumping or injection *on water movement and availability*, including potential ***impacts on surface waters***

3. How does **well pumping** influence the potential for **contaminants to enter the well**,

   AND

How that should be considered in locating wells.

4. What are ***some consequences of long-term pumping*** from wells?

Team Number: **Station 4: Presentation Score Sheet** **Score:**

School:

Use this rubric for assessing presentation of the concepts:

KNOWLEDGE LEVEL DEMONSTRATED	POINT AWARD
Response to concept demonstrates GENERAL knowledge	**2**
Response is COMPLETE : includes specific elements of the concept, including technical terms	**4**
Response is COMPLETE : includes specific elements of the concept, including technical terms AND makes reference to the model to explain or demonstrate concept	**6**

Concept to Be Demonstrated	Concept Elements circle points awarded, according to the rubric above, for any element explained
Describe the structure of your aquifer model How do ***the composition of the geology*** (properties such as porosity and permeability) and their arrangement help or hinder the ***storage and movement of water***, including connections to surface water.	**2 4 6 Identify aquifers** *Confined Unconfined Perched* **2 4 6 Discuss geologic materials represented** *Sand Gravel Rock Clay* **2 4 6 Define hydraulic properties** *Permeability Porosity* **2 4 6 Discuss how hydraulic properties vary with materials** **2 4 6 Discuss how materials and structures define ability of aquifers to hold water and pathways for water movement.** **2 4 6 Discuss connections and pathways between groundwater units and surface water**
Describe: The considerations for **locating wells** for ***water recovery*** or ***injection*** The influence of well **pumping or injection** on ***water movement and availability,*** including potential ***impacts on surface waters***	**2 4 6 Identify structural factors**: ***confined aquifers*** **are less subject to** pollution short-term changes in water availability **2 4 6 Identify aquifer properties** (*capacity* and *permeability*) **that facilitate removal or injection** **2 4 6 Discuss depth of well** into confined aquifer or well below water table **2 4 6 Pumping-**May lead to: Draw-down of water table (unconfined aquifer) Induced flow towards well- decreases flow toward surface water bodies **2 4 6 Injection-**May lead to: Raising of water table (confined aquifer) Induced flow away from well- increases flow toward surface water bodies

Total Points Side 1

Note: This is just one example of information that may be included on an exam. Information on future exams is not limited to the scope or topics covered here.

Explain: How does well **pumping** influence the potential for **contaminants** to enter the well**,** How that should be considered when **locating wells.**	**2 4 6 Location far from sources of contaminants** "far" reflects **distance** (unconfined aquifers) **and hydraulic connection** (confined aquifers are more remote) **2 4 6 Diversity of pollution sources** *(point, nonpoint)* **or entry points of pollution sources** - *surface* *direct to groundwater* *lakes and streams* ***consequences***
Explain: What are ***some consequences of long-term pumping*** from wells? • **Bonus Opportunity For Response Below**	**2 4 6 Decreased yield** *Well failure* **2 4 6 Subsidence** susceptibility to subsidence depends on *"compressibility"* or material properties of aquifer

A decrease in water table height can impact :

(Judge may award 1 Bonus Point for each of the following if explained as part of the answer given to the last concept)

1 vegetation
1 surface water levels
1 discharge
1 It can shut off "springs" and
1 require more effort to recover water.

# of Bonus Points Earned

Total Points Side 2 including any Bonus

Side 1 Points	
Side 2 Points	
TOTAL POINTS	

Awesome Aquifers Team Answer/Score Sheet

Total Score:

Rank:

School _____

Team Name and Number_____

Student Name (s)

_____

_____

Point Totals

Station and Possible Points		Points Earned
Station 1: Test 1	Up to 45	
Station 2: Test 2	Up to 45	
Station 4: Demonstration	Up to 90	
Presentation Bonus	Up to 5	
Total Score		

Test 2 Tiebreaker Answer:

_____

_____

_____

_____

_____

_____

Tiebreaker: _____/4 point

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Test 1 Answers 3 Points Each	Test 2 Points Per question	Test 2 Answers
1.	3	1.
2.	3	2.
3.	3	3.
4.	3	4.
5.	3	5.
6.	3	6.
7.	3	7.
8.	3	8.
9.	1 point Each or 3 points total if all 3 correct	9a.
10.		9b.
11.		9c.
12.	1.50 Each or 3 points total if both correct	10a.
13.		10b.
14.	0.6 Each or 3 points total if all 5 correct	11a.
15.		11b.
		11c.
		11d.
		11e.
	3	12.
	3	13.
	3	14.
	3	15.
TOTAL Points Test 1: /45		TOTAL Points Test 2: /45