American University of Beirut
Department of Geology
Geol 330P Hydrogeologic Systems
Final Exam

NAME:_____ Fall 1999-2000

(25 points) 1.
(12 points) 1A. Fill in the blanks below.

1) In arid and semi-arid regions, _____ is the process that concentrates Cl^- in groundwater. If the ratio of Cl^- concentration in groundwater to that in precipitation is 5: 1, then the percentage of precipitation that becomes groundwater recharge is _____ .

2) Consolidation tests are used to determine _____ .

3) The casing diameter should be selected to meet two requirements:
_____ and
_____ .

4) The instrument used to measure the stable isotopes of hydrogen and oxygen in water is called _____ .

5) _____ are formed by radioactive decay but do not themselves decay.

6) A confined aquifer is 10 m thick. The appropriate screen length for this aquifer is _____ meters.

(13 points) 1B. Refer to the attached grain-size distribution curve to determine:
a) the effective size
b) the slope
c) the mean particle size

(15 points) 2.
(7.5 points) 2A. What are the limitations of the dispersion model in its lumped-parameter form?
(7.5 points) 2B. List and briefly discuss the methods used to delineate regional groundwater flow systems.

(15 points) 3. Explain how monitoring wells are used to investigate contaminant plumes in aquifers.

(15 points) 4.
(5 points) 4A.
The mean transit time of nonsteady groundwater flow in an aquifer is calculated by the lumped parameter approach. Write a mathematical expression for the mean transit time of water in this aquifer.

(5 points) 4B.
A regional sandstone aquifer is to be characterized by environmental radioisotopes to determine (a) whether recharge is old or recent, and (b) to quantify the mean residence time of water in the aquifer. What radioisotope do you recommend for (a) and (b)? Justify your answer.

(5 points) 4C.
A regional aquifer is recharged at a constant rate of X m/year. The area through which recharge occurs is Y m^2, and flow in the aquifer is steady. Show how the effective porosity of this aquifer can be determined by the lumped parameter approach using environmental radioisotopes.

(15 points) 5.
(5 points) 5A. Explain why flowlines form 90° with equipotential lines in homogeneous and isotropic aquifers.
(10 points) 5B.
The volume of groundwater that can be yielded by pumping (V_w), is given by:

$$V_w = AbS \qquad (1)$$

where A, b, and S are the surface area, thickness, and storativity of the aquifer, respectively. Explain why it is not possible to use the porosity (n) instead of the storativity (S) in equation (1). Your explanation should be for the case of (1) confined aquifers, and (2) unconfined aquifers.

(15 points) 6. Describe how hydrogeologic reports are prepared.

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