Final Exam - Environmental Hydrogeology Fall 2000

Name _____

Part 1. Answer three of the following four questions (10 pts. each).

1 - Discuss the nitrogen cycle and the role of various nitrogen compounds in water contamination. Be sure to include a discussion of point source and non-point source pollution.

2 - Discuss the various chemical, biological and physical factors that need to be taken into account when modeling plume migration. Be sure to illustrate your discussion with diagrams and equations.

3 - Describe how tritium can be used to esimate the age of groundwater.

4 - Discuss how stable istotopes of oxygen and and hydrogen can be applied to our understanding of geochemical processes.

Part 2. Define ten (10) of the following and point out their hydrogeologic significance (2 pts. each).

1 - The Texas study

2 - BTEX

3 - RCRA

4 - Ogallala (High Plains) aquifer

5 - Fick's law

6 - chemical water facies

7 - noble gases

8 - mcl's

9 - leachate

10 - CERCLA

11 - rhodamine

12 - fractionation

13 - global meteoric water line

14 - Freshkills landfill

Part 3. Answer both of the following questions, note that they both have multiple parts. (25 pts.)

3a. Annotate and calculate.

1 - Draw some equipotential lines at 2 foot contour interval starting with 92 feet. Clearly show the recharge and discharge areas. Assume the left and right sides are hydraulic no-flow boundaries and the bottom is a geologic no flow.

2. Piezometers are installed at three loactions and pressure head is measured in them by transducers *placed at their bottoms*. Pressure head is in feet of water. Draw arrows showing the *vertical* direction of water flow.

3.. Draw in contour lines at 2 foot intervals. Draw in a flow path from point A to where it ends. Show by arrows where you would expect water at the bottom of the aquifer to move upward, horizontally and downward.

c - Calculate the following from the two figures above.

- The Q (discharge) across a cross-sectional area of 1 ft2 _____

• The average linear velocity from A to the end of the flow path _____

• How long it takes (in years for water to mover from A to the end of the flow path? _____

Show your work. The relationships Q = KIA and V = KI/n_e with n_e assumed to be 0.2 should help.

3b. Geochemical analyses of groundwaters.(15 pts.)

a - Name the Aquifer based on the geochemistry of the waters and justify your choice:

TABLE 1. Major ions of water samples.

Ca	74	8.5	140	65	0
Mg	10	0.4	41	6.8	0
Na	24	310	31	374	0
HCO3	42	580	236	378	0.1
SO4	19	2.0	315	85	0
Cl	24	142	42	442	0
SiO2	55	13	12	58	0
pH	7.0	8.2	7.6	7.6	4.9
TDS	450	1080	823	1440	21
aquifer type (letter)	___	___	___	___	___

A = Sandstone, TX
B = Limestone, TX
C = Gypsiferous Limestone, NM
D = Shale, WY
E = Water table (soil)

b - Use the potentiometric map and the Piper diagram of water analyses to answer the following questions.

1 - Draw a series of flowlines on the map to get the overall picture of flow paths.

2 - Group the water analyses on the Piper diagram (draw a circle around groups) according to water type.

3 - Based on the plotted chemical analyses on the Piper diagram and your flow net - what can you say about the types of groundwaters present in the region?

BONUS: For a possible extra five points answer the following:

What is the direction of vertical groundwater flow?