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CE 4363/5363 Groundwater Hydrology Exam I March 7, 2017

Name___________________________

I. Verbal Questions (5 points each). CE 4363 students answer 6 of the following 10 questions briefly and concisely. CE 5363 students answer 7 of the 10 questions briefly and concisely. **Clearly mark the ones that are omitted. You must complete this part of this exam and put it away before starting the problems section.**

1. State three typical ethical issues that a hydrogeologist/environmental engineer might normally consider as s/he deals with clients and regulatory issues.

2. Distinguish between aquitard and aquifuge.

3. State two situations in which Darcy's Law might not apply.

4. List five of the assumptions made prior to derivation of the Theis solution for transient radial flow to a well in a confined aquifer (don't use anything stated already in this question).

5. Distinguish between homogeneity and isotropy for an aquifer.

6. Explain why the bottom of the aquifer is always used as the datum for head calculations when dealing with unconfined aquifers.

7. Explain why partial penetration of pumping wells can cause more drawdown near the pumping well than that seen for fully penetrating wells.

8. When a pumping well is turned on near an observation well in an unconfined aquifer, the drawdown at the observation well first increases quickly, then levels off, then increases more quickly again. Explain the flow conditions that cause these conditions.

9. List four different relatively complex aquifer conditions that we can represent using superposition.

10. Explain why pump tests for aquifer parameters are often preferred over lab tests for hydraulic conductivity.

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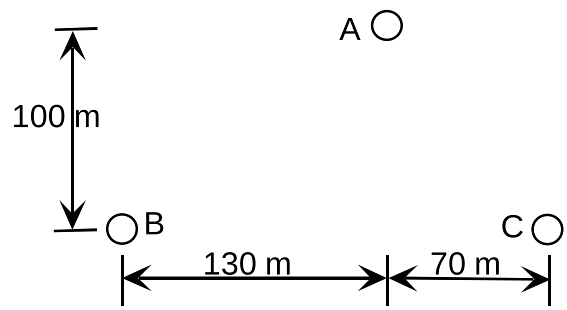
II. Problems. Show all work clearly with proper units for full credit. CE 4363 students work problems 1 through 3, then either 4 or 5. CE 5363 students work all five problems.

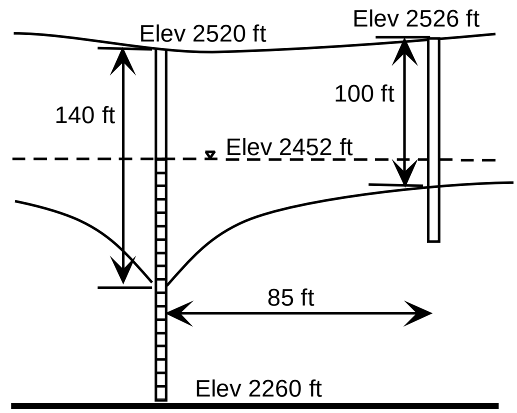
1. (15 total) Three wells are completed in an aquifer in the configuration shown below. Well C is directly east of Well B. The land surface elevations and depths to water are shown in the table. **Find the magnitude and direction of the hydraulic gradient.**



Well	Land Surface Elevation (m)	Depth to Water (m)
A	352.35	27.40
B	355.65	28.20
C	351.75	26.50

2. (15) A single well exists in an ideal unconfined aquifer. The pumping well has a flow rate of 200 gpm and an effective well radius of 0.60 ft. An observation well was placed 85 ft away from the centerline of the pumping well. The pumping well has been on long enough for equilibrium to be achieved, and drawdowns at the two wells were as shown in the figure below. **Please note the sketch is not to scale.**

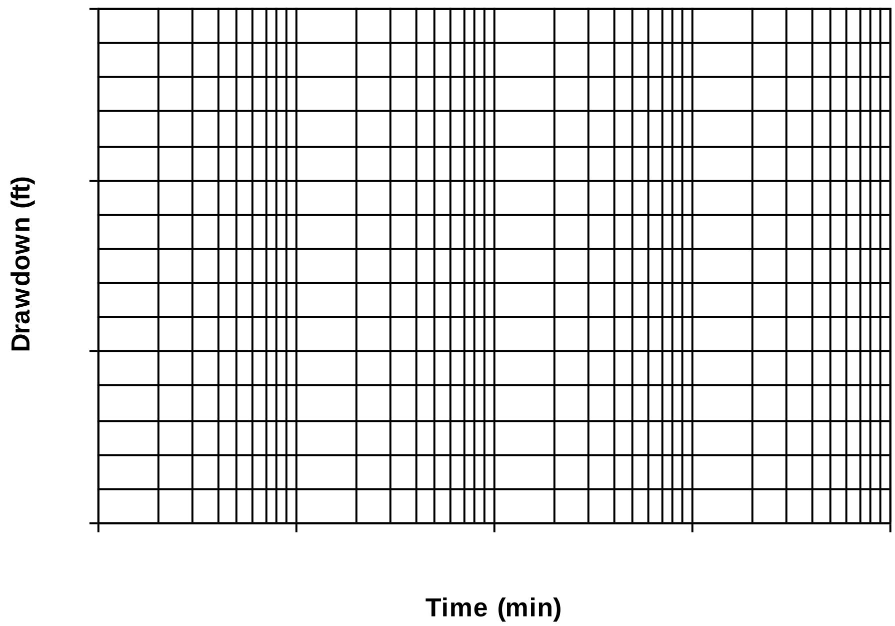
[a] (8) **Find the hydraulic conductivity of the aquifer in ft/d.**



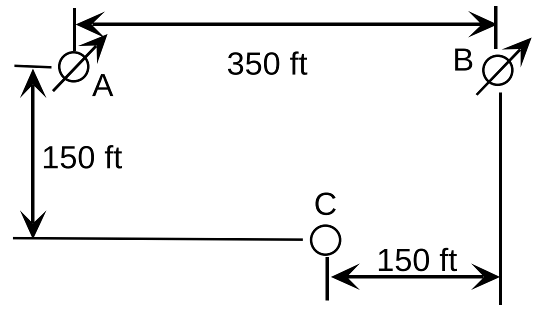
[b] (7) **Find the radius of influence for this pumping well in ft.**

3. (15) A conventional pumping test was performed in an ideal confined aquifer under all the proper conditions. The flow rate at the pumping well was 100 gpm, and the distance to the pumping well was 170 ft. The drawdown observed at the pumping well is shown in the table below. **Find the transmissivity in ft^2/d and storage coefficient for this aquifer. Label the axes as you use them.**

Time (min)	Drawdown (ft)
2	2.60
3	3.35
5	5.03
10	6.70
40	10.40
80	12.05
100	12.50
120	13.10



4. (30) The wells shown below are in a leaky confined aquifer. The aquifer has a hydraulic conductivity of 30 ft/d, saturated thickness of 45.0 ft, and storage coefficient of 0.00080. The aquitard above has a thickness of 8.0 ft and vertical conductivity of 0.45 ft/d. Well A was turned on at noon Sunday with a flow rate of 150 gpm. Well B was turned on at noon Tuesday with a flow rate of 200 gpm. **Find the total drawdown in ft at the observation well C at noon Thursday. You may continue your work on the next page.**



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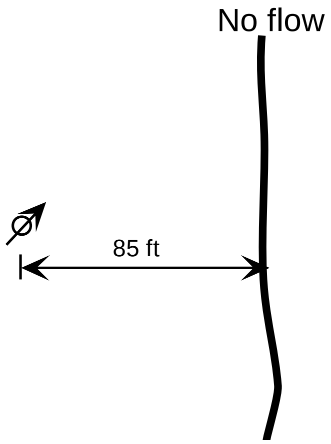
5. (30 total) A single pumping well exists in an ideal confined aquifer. The aquifer has a transmissivity of 4700 ft^2/d and storage coefficient of 0.00025. The well is 85 ft west of a no-flow boundary that runs north-south. The pumping well has an effective radius of 0.50 ft, and pumps at a flow rate of 200 gpm. **You may continue your work on the next page.**

[a] (26) **Find the total drawdown in ft at the pumping well at 6.0 hours after the well was turned on, ignoring characteristic well losses**. **Part b is on the next page!!!!!**



[b] (4) **What would be the drawdown at the pumping well if the boundary was constant head rather than no-flow?** You should be able to do this quickly and easily from your result in [a].