Take Home Exam 2
Environmental Science 318
Applied Hydrogeology

1. Define porosity. Compute the porosity of a sample that has the following characteristics:

   The sample fills a cylinder of radius 2cm and length 10cm
   After the sample is soaked, approximately 1cc of water can be recovered from it.

2. Using the graph provided, find

   d_{60}: the grain size that is 60% finer by weight
   d_{10}: The effective grain size (the grain size that is 10% finer by weight)
   C_u: The uniformity coefficient

   What does it mean for a sample to be "well sorted" and how can you judge this from the shape of the grains size distribution curve.

3. Define Q and relate it to Darcy's Law. Use this relationship to find the Hydraulic conductivity for the following conditions taken from a constant head permeamter.

   Cylindrical sample has radius 10cm
   Difference in head is 2cm over a length of 1m
   Flow is 20cc in 30 s.

4. Using the information in 3, define the intrinsic permeability of the sample Take

   $\rho = 1g/cm^3$
   $\mu = 0.008$

   Is this a high or low intrinsic permeability.

5. Use the Hazen method and the information in 2, and 3 to find the shape factor for the sample. If this value is on the table, what kind of soil is this?

6. An unconfined aquifer loses $3\times10^7 m^3$ when its head falls by 0.4m. If the aquifer is circular and has a radius of 5km, what are the storativity and specify yield for this aquifer.

7. A confined aquifer has a skeleton compressibility of $3\times10^{-7} m^2/N$ and a porosity of 0.25. If the compressibility of water is $4.6\times10^{-10} m^2/N$:
   a) What is the specific storage of this aquifer?
   b) If the aquifer is 2m thick, what is the storativity?
   c) If the area of the aquifer is $1\times10^6 m^2$ and the head falls by 0.25 m, what volume of water is expelled?

8. Four layers in an aquifer have the following characteristics:

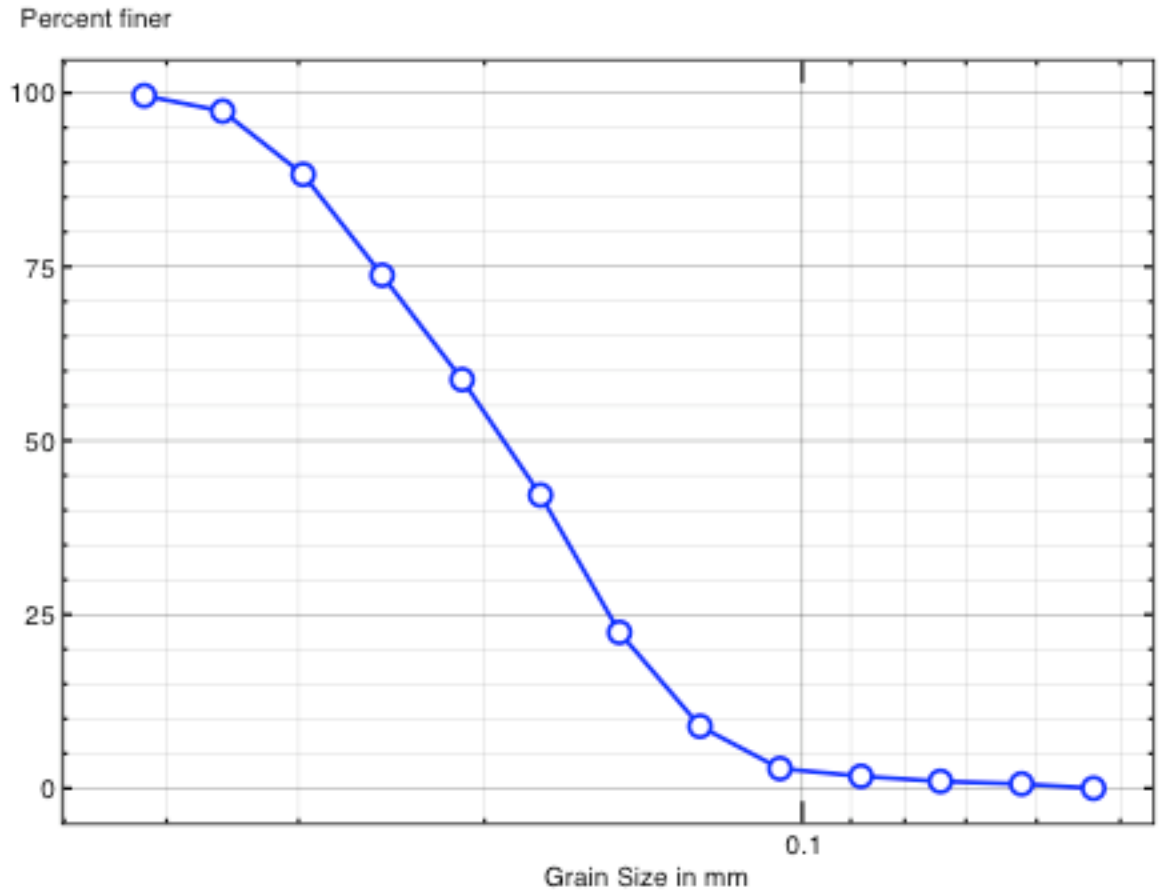
Hydraulic Conductivity(ft/day)	Layer thickness
K_A=10 ft/day	22 ft
K_B=20 ft/day	42 ft
K_C=5 ft/day	12 ft
K_D=25 ft/day	32 ft

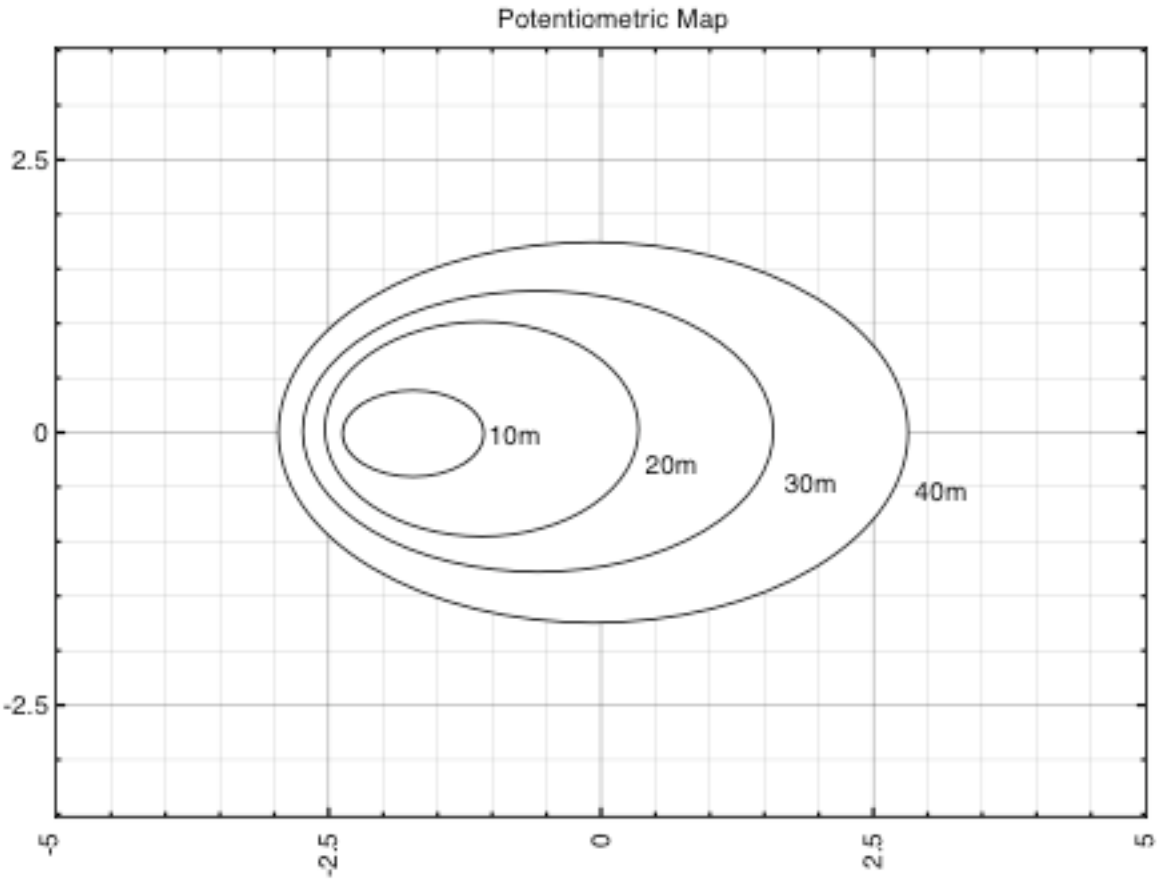
Compute the horizontal and vertical conductivity for this aquifer.

9. Consider the potentiometric map at the end of the test.
a) What is a potentiometric map and what does a map like this show.
b) Describe what might be happening in this map. What human activity could cause the depression in the potentiometric surface that is shown
c) What is the gradient of the potentiometric surface and why is the gradient important.
d) Draw in gradient arrows for the surface shown. Where is the gradient largest?

St. Peter Sandstone (quoted from http://www.cs.pdx.edu/~ian/geology2.5.html)

> "The St. Peter Sandstone has undergone an extensive multicyclic depositional history. It's last depositional episode was as a beach sand along a transgressing sea. During at least one of its previous depositional episodes the sand grains were eolian (wind transported) deposits. Consequently, the range of particle sizes is somewhat restricted owing to the narrow range of particle sizes that can be transported by wind. Due to its extensive depositional history the St. Peter Sandstone is texturally, and mineralogically very mature."




Potentiometric Map
2.5
0
-2.5
-5
-2.5
0
2.5
5
10m
20m
30m
40m