Hydrogeology Homework Set # 1
Storage & Basic Definitions

Date: Wednesday, 20 Esfand, 1392   ✍ **Due Date:** Wednesday, 27 Farvardin, 1393, 10:00

Note: g: 9.8 m/sec

1. What is the weight, in Newton's, of an object with a mass of 32.1 kg?

2. Calculate the weight of sea water in a cylindrical tank that has a diameter of 150 cm and height of 60 cm. Give your answer in Newton's?

3. If the object in problem 1 has volume of 0.23 cubic meters:
a: What is its density?
b: What is its specific weight?

4. A sample of silty sand has a volume of 70 cm^3. At the moisture content it weights 150.7 grams. The sample was then saturated with water and reweighted to a weight of 169.7 grams .The sample was derined by gravity until it reached a constant weight of 146.2 grams. The sample was then oven_ dried at 105 C until it reached a constant weight of 139.7 grams. Assume the unit weight of water is 1 gr/cm?
Compute the following:

   a. Gravimetric water content under natural conditions

   b: Volumetric water content under natural condition

   c: Saturation ratio under natural condition

   d: Porosity &specific yield

   e: Specific retention &water content at saturation

5.An aquifer has specific yield of 0.19 .During a drought period the following declines in the water table is noted:

| Area	Size	Decline	
A	14 mi^2	2.75 feet	What was the tota
B	7 mi^2	3.56 feet	
C	28 mi^2	5.42 feet	
D	33mi ^{2}	7.78 feet	

l volume of water represented by decline in water table?

6. Imagine a confined aquifer with 25 m thickness and porosity of 0.3.This aquifer is exploited by a municipal well field that draws water from an area approximately 5 km^2.
What volume of water will be produced by the aquifer if the average hydraulic head drawdown &compressibility of this aquifer are 2m & a=5×10^{-9}

7. A sample of sandy silt retrieved from the sub surface, it was cylinder shaped, with diameter of 8.0 cm and length of 30.0 cm, the moist mass measured right after retrieved was 3265 g, and after oven drying to remove all water, the mass was 2931 g. Examination of the sample revealed that the composition was 0.75 quartz and 0.25 feldspar, from this information: calculate n,θ,ρb?(Fitts,2002)
(ρs quartz: 2.65 (g/cm^3),feldspar 2.54 (g/cm^3))

8. Imagine aquifer with specific yield of 0.2, located near farm .If we start to pomp this aquifer in constant speed and water table declines in part A,B&C of this aquifer 0.5 m,1m,0.5m .How much water will be with drawn from this aquifer after these declines ?

A+B+C=65km^2

A+B=35km^2

A=15km^2
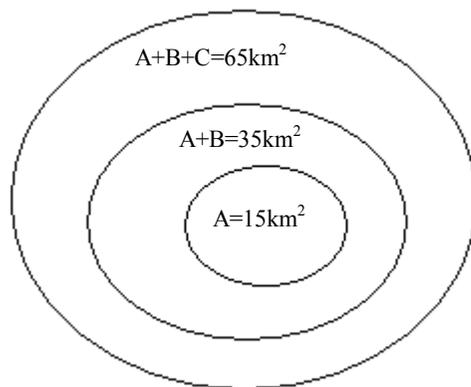
9. A horizontal aquifer is over lain by 20 m of feldspars, density of feldspar is about 2540 kg/m3 and its porosity is 0.2 .Use density of water of 1000 kg/m3.

   a. Calculate total stress on the aquifer in N/m^2?

   b. Calculate the effective stress in the aquifer if the pressure head is 30 m?

   c. Imagine the hydraulic head is reduced by 6 m, How much compaction will be under go during this reduction? (thickness of aquifer is 9 m &the compressibility of aquifer is 4.5 E-6 m^2/N)

10. How much water will be withdrawn from unconfined aquifer with area of 36 hector if the water table reduces 2 m during summer .Specific yield and porosity of this aquifer are 0.15 & 0.2?

11. Imagine unconfined aquifer with area of 30 km^2, specific retention of 0.1 and porosity of 0.35, if spring rain with the elevation of 20 cm penetrates the soil completely ,what will be the increase in water table elevation ?

12. The area and thickness of a confined aquifer are 10 km^2 and 40 m. A well discharge from this aquifer at a constant rate of 300 lit/sec for period of 45 hours. Therefore the pizometric surface declines 30 m in well .Calculate the storage coefficent (s) ,if the aquifer hasn't been recharged from any sources during the pumping of aquifer?

13. A horizontal aquifer is overlain by 15m of saturated clay. The (dry) bulk density of the clay is 1422 kg/m^3 and its porosity is 0.48. use density of water 1005 kg/m^3.

    a. calculate the total stress on the aquifer in N/m^2?

    b. if the pressure head in the aquifer is 30m, . calculate the effective stress in the aquifer in N/m^2?

    c. If the aquifer is pumped and hydraulic head is reduced by 3m, what will be the resulting changes in the pressure head, the fluid pressure, the effective stress and total stress?

    d. If the compressibility of the aquifer is 2.373 e-7 m^2/N and its thickness is 7.6m, how much compaction will the aquifer undergo during the hydraulic reduction in part b?

    e. If the hydraulic conductivity of the aquifer is 4.27 e-6 m/s, calculate the transmissivity and storativity for the aquifer. The compresstivity of water ()is 4.4 e-10 m^2/N?