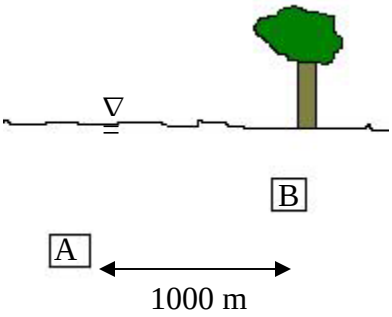
ATM 408/508 HW on Soil Hydrology **DUE Thursday Feb 28**
65 points

1. Use the soil textural triangle to determine the soil type for each of the soils listed in Table 1. (1 pt each, 4 pts total)

2. The most accurate way to get the bulk properties of a patch of soil is to use a sampling can whose volume is known, fill it, weigh it, oven dry it, compact it, and then weigh it again. A hydrologist used a sampling can that was 10 cm long with a 5 cm diameter to take 4 soil samples from different locations. The data are in Table 2. Fill in Table 2. (1 pt each, 16 pts total)

3. Box A is 10 m below the surface and has a pressure measured at 9.0×10^4 N/m^2. Box B is 5 m below the surface and has a pressure of 6.1×10^4 N/m^2. The soil is loamy sand (5% clay, 15% silt, 80% sand) and completely saturated. (5 pts each for a-b, 10 pts for c, 20 pts total)

a) Find the pressure head at A and B.
b) Find the total head at A and B.
c) Determine the specific discharge in m/s ($\vec{q}$) of water flowing between A and B. You must determine the components of $\vec{q}$ and the magnitude of $\vec{q}$ and indicate whether the water is flowing from A to B or B to A. Note: dh/dy = 0.



4. Evapotranspiration is difficult, sometimes impossible to measure, so hydrologists often resort to solving a simple water balance equation to estimate how much ET occurred in a control volume. Streamflow and precipitation are typically the only components of the hydrologic cycle that are measured regularly. Suppose your control volume (area = 2050.80 km^2) received 150.38 cm/yr of precipitation and 2.08×10^9 m^3/yr of streamflow. (5 pts each, 10 pts total)

a) What assumptions do you have to make to estimate ET from streamflow and precipitation if you start with $\Delta S = P - E \pm R \pm G \pm Q$?
b) How much ET in cm/yr occurred in this control volume?

5. After a heavy rainfall, a saturated silt loam field (1 km^2, 15% clay, 30% sand, 55% silt) is producing discharge into the local stream at a rate of 3.0 m^3/s. (5 pts each, 15 pts total)

a) Find the hydraulic head gradient, $\frac{\Delta h}{\Delta x}$.
b) A sandy loam field (1 km^2) on the other side of the stream is producing the same discharge into the local stream, but the hydraulic head gradient is only 20% of the hydraulic head gradient in the silt loam field. What is the sandy loam's saturated hydraulic conductivity?
c) Explain why a smaller hydraulic head gradient is required to drain the sandy loam field immediately after rainfall.

Table 1

% Sand	% Silt	% Clay	Texture Class
9	75	16	
81	16	3	
49	42	9	
14	55	31	

Table 2

Soil	Field Weight (g)	Oven Dry Weight (g)	Bulk Density (g/cm^3)	Porosity	θ_g	θ
A	312.5	282.5				
B	370.6	320.8				
C	425.6	402.3				
D	470.9	452.5				