

**APBI 200 - LAB # 2**

**Section 1 – soil texture**

Please answer the following questions:

1. Which of the following components are part of soil texture (select all that apply):
  - a) % silt
  - b) % organic matter
  - c) % soil water
  - d) % sand
  - e) % clay

[1 point]

2. Using the Canadian Soil Texture Triangle (shown below) and information in the table below:
  - a) Fill in all missing information in the table below.
  - b) Plot each of the 4 soils on the soil texture triangle given below, using information about their relative percentages of sand, silt, and clay.

Soil	% Sand	% Silt	% Clay	Textural class
A	10		22	
B		55	8	
C	52	8		
D	65		15	



- c) What is the name of a soil texture class that comes the closest to being a mixture of equal proportions of sand, silt and clay?

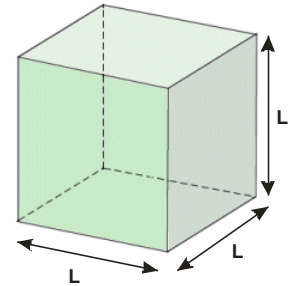
[4 points]

3. Specific surface area of soil mineral particles is an important property to understand. Remember the diameters of mineral soil particles, as mentioned in the lectures, are:

Coarse fragments	Fine earth fraction		
	Sand	Silt	Clay
>2mm	0.05 – 2 mm	0.002 – 0.05 mm	<0.002 mm

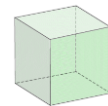
Consider a sand grain (or particle), which is cubic in shape and has sides of length “L”.

- What is the formula to determine the surface area of a cube?
- If  $L = 1 \text{ mm}$  what is the specific area of this cube (in  $\text{cm}^2$ )?
- Assuming that this cube is a sand grain made of quartz and the density of quartz is  $2.65 \text{ g cm}^{-3}$ , what is the weight of this sand grain in grams?
- Calculate the specific surface area (SSA) in  $\text{m}^2/\text{g}^{-1}$ .



Consider a clay particle, which is cube with sides of length “L”

- If  $L = 0.001 \text{ mm}$  what is the specific surface area (SSA) of this cubic clay particle in  $\text{m}^2 \text{ g}^{-1}$ ? Show ALL your steps including formulas and units.
- Compare your calculations for the specific surface area (SSA) of the sand and the clay particles, and briefly comment what these calculations tell you about the SSA of sand versus clay.
- If this clay sized particle were a rectangular cuboid with sides  $L = 0.001 \text{ mm}$  and thickness =  $0.00001 \text{ mm}$ , indicate how would this impact the SSA of this clay sized particle? Note you are not expected to calculate a numeric value, but should briefly explain how the SSA would change.



[7 points]

4. You get a summer job working in the field for a forestry company. One of your tasks is to determine soil texture. Your supervisor tells you to do hand-texturing. What are the advantages and challenges with this method? Briefly explain.

[2 points]

#### Required attachments:

- Your hydrometer data sheet with sample calculations written out for at least one line. [3 points]
- The particle-size distribution curve. Please do not forget to include a title and axes labels. [2 points]
- Your answers regarding the soil texture of two “mystery” samples (determined by hand-texturing). Include a brief justification of your answer. [4 points]

## Section 2 - Soil bulk density

Please answer the following questions:

5. The bulk density of a soil is the:
- mass of solids / volume of solids
  - mass of solids / total soil volume
  - volume of voids / total soil volume
  - 1 - volume of voids / total soil volume

[1 point]

6. What is the bulk density of a mineral soil sample that weighs 286 g when dry and occupies 220 cm<sup>3</sup>? What is the porosity of this sample? Show all formulas used, full calculations and units.

[2 points]

7. Which would be more likely to change as a result of soil compaction:

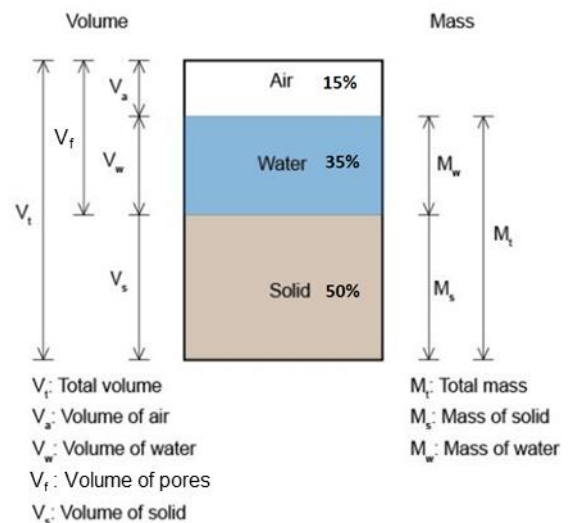
- bulk density, or
- particle density?

Briefly explain your answer.

[2 points]

8. Consider the following mineral soil as shown on a diagram below:

- What is the porosity (in %) of this soil?
- Assuming a particle density of 2.65 g cm<sup>-3</sup>, what is the bulk density of this soil in g cm<sup>-3</sup>?  
Give the equation you use, show your full calculation and units.
- Which component is most impacted by compaction:  $V_s$  or  $V_f$ ?



[3 points]

9. A team of students is given the task to determine the bulk density of the soil at a site in the Pacific Spirit Park. Because this forested site is quite rocky, they decide to use the excavation method described in your lab manual. They excavate a pit in this rocky soil, line the pit with plastic and fill it with water. It took 24 L of water to fill the pit. The total weight of the air dried, excavated soil (fine and coarse fragments) was 40 kg; the coarse fragments weighed 9 kg. They oven dried and weighed the excavated soil (fine fraction); this oven-dried soil weighed 30.5 kg. Assume a particle density of 2650 kg m<sup>-3</sup>.

- Calculate the volume of the coarse fragments in this sample (in m<sup>3</sup>).
- Calculate the volume of the fine earth fraction in this sample (in m<sup>3</sup>).
- Calculate the bulk density of the soil. Express your result in metric kg m<sup>-3</sup>.

[3 points]

10. A mineral soil has a bulk density of  $1.43 \text{ g/cm}^3$ . Showing all calculations answer the following:

- a) What would you assume particle density to be equal to in this soil?
- b) Calculate the porosity ( $f$ )
- c) What would be the pore volume ( $V_f$ ) in  $1 \text{ m}^3$  of this undisturbed soil? Give the formula you use to determine the pore volume ( $V_f$ ) and show your calculation.
- d) What would be the pore volume (in  $\text{m}^3$ ) in 500 kg of this undisturbed dry soil?

[4 points]

**Required attachments:**

- The bulk density calculation table with all calculations written out. Include all the units.

[2 points]

**Total for lab 2 assignment [40 points]**