

## APBI 200 - LAB # 2 ANSWER KEY

### Section 1 – soil texture

Please answer the following questions:

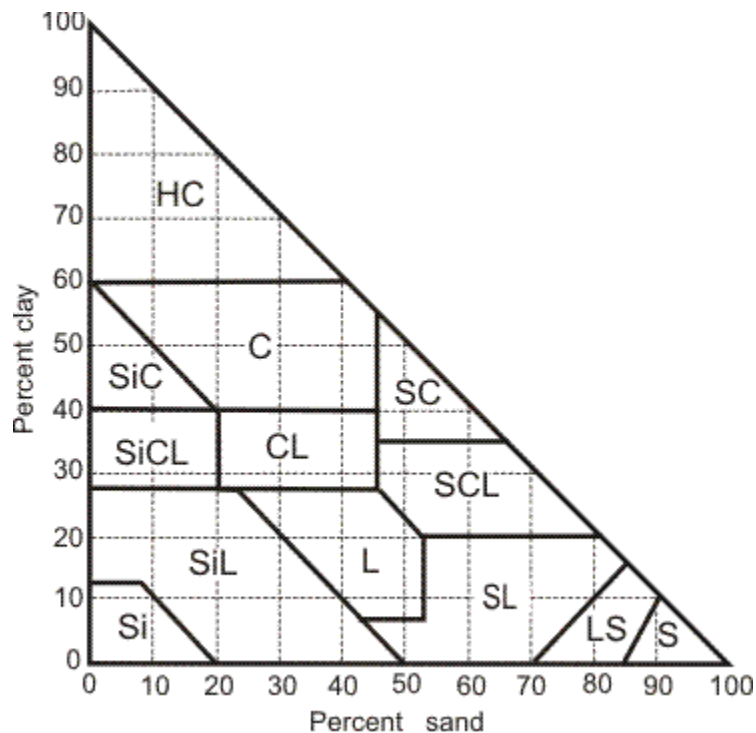
1. Which of the following is included when determining the soil texture class?
  - a) % sand
  - b) % organic matter
  - c) % gravel
  - d) % silt
  - e) % water
  - f) % clay

[1 point]

2. Using the Canadian Soil Texture Triangle (Figure 2 in your lab manual) and information in the table below:
  - a) Fill in all missing information in the table below.

Soil	% Sand	% Silt	% Clay	Textural class
A	33		33	
B		17	18	
C	10	48		
D		40	20	

- 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.



- c) Why do we consider a loam soil ideal?

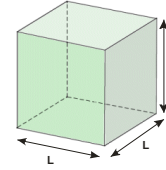
[4 points]

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

Assume that the density of quartz is  $2650 \text{ kg m}^{-3}$ .

Showing all calculations determine:



- What is the surface area - SA (in  $\text{m}^2$ ) of a cube of quartz 0.1 mm tall?
- What is its volume (in  $\text{m}^3$ )? What is the weight of this cube (in kg)?
- Calculate the specific surface area - SSA ( $\text{m}^2 \text{ kg}^{-1}$ ) for cubes of quartz 1 mm tall.
- Calculate the specific surface area - SSA ( $\text{m}^2 \text{ kg}^{-1}$ ) for cubes of quartz 1  $\mu\text{m}$  (1 micrometer =  $10^{-6}\text{m}$ ) tall.
- Compare the two specific surface areas. What does this simple calculation tell you about the specific surface area of sand as compared to clay? Why is this important?

[5 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.
- The particle-size distribution curve. Please do not forget to include a title and axes labels.
- Your answers regarding the soil texture of two “mystery” samples (determined by hand-texturing). Include a brief justification of your answer.

[3 points]

[2 points]

[4 points]

## Section 2 - Soil bulk density

Please answer the following questions:

- 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
- Which would be more likely to change as a result of soil compaction:
  - bulk density, or
  - particle density?

[1 point]

Briefly explain your answer.

[2 points]

7. A mineral soil has a bulk density of  $1.54 \text{ g/cm}^3$ . Showing all calculations answer the following:
- What would you assume particle density to be equal to in this soil?
  - Calculate the porosity ( $f$ ) in %.
  - What would be the volume of pores ( $V_f$ ) 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.

[3 points]

8. Consider the following soil characteristics:

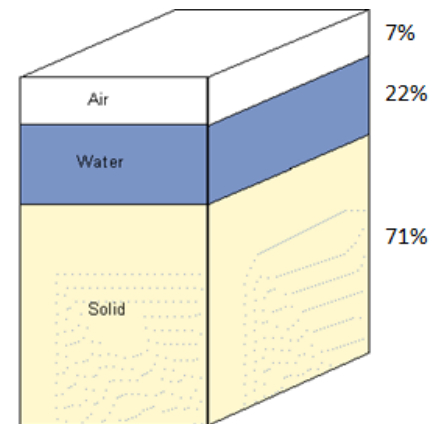
volume	$154 \text{ cm}^3$
organic matter content	7 %
mineral content (dry)	180 g
mineral particle density	$2.65 \text{ g/cm}^3$
Organic particle density	$1.30 \text{ g/cm}^3$

What is the bulk density of this soil in  $\text{g/cm}^3$ ?

[2 points]

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

- What is the porosity (in %) of this soil?
- Assuming a particle density of  $2.65 \text{ g cm}^{-3}$ , what is the bulk density of this soil in  $\text{g cm}^{-3}$ ?  
Give the equation you use, show your full calculation and units.



[2 points]

**Required attachments:**

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

Depth of sampling	Core height (cm)	Core diameter (cm)	Volume of core ( $\text{cm}^3$ )	Oven-dried wt. of soil (g)	Bulk density ( $\text{g/cm}^3$ )
0 – 7.5 cm	$h = 7.5 \text{ cm}$	$d = 7.3 \text{ cm}$		$M_s = 456.7\text{g}$	

[2 points]

**Total for lab 2 assignment [32 points]**