

## APBI 200 - LAB 2 ASSIGNMENT

### Section 1 – soil texture

Please answer the following questions:

1. Assume that the density of quartz is  $2650 \text{ kg m}^{-3}$ . Showing all calculations determine:
  - a. What is the surface area - SA (in  $\text{m}^2$ ) of a cube of quartz 1 mm tall?
  - b. What is the weight of this cube? What is its volume (in  $\text{m}^3$ )?
  - c. Calculate the specific surface area - SSA ( $\text{m}^2 \text{ kg}^{-1}$ ) for cubes of quartz 1 mm tall.
  - d. 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.
  - e. Compare the two specific surface areas and draw conclusions. What does this simple calculation tell you about the specific surface area of sand as compared to the one of clay?

**[5 points]**

2. Using the Canadian Soil Texture Triangle (Figure 2 in your lab manual),
  - a. Classify the soil texture of each soil in the following table based on their sand and clay contents (expressed as weight percent of the fine earth fraction):

| Soil | % Sand | % Clay | Textural class |
|------|--------|--------|----------------|
| A    | 4      | 9      |                |
| B    | 25     | 20     |                |
| C    | 20     | 45     |                |
| D    | 84     | 10     |                |

- b. What is the lowest clay percentage allowed for a texture to be included in the clay loam textural class? In the sandy clay textural class?

**[3 points]**

3. Give an example and a brief explanation of a situation in which (a) hand-texturing method is more appropriate than the hydrometer method, and (b) hand-texturing method is less appropriate than the hydrometer method.

**[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. Don't forget to include a title and axes labels.
- Indicate the % sand, silt and clay and the soil textural class.

**[2 points]**

- The table regarding the soil texture of two “mystery” samples (determined by hand-texturing). Include a brief justification of your answer.

[3 points]

## Section 2 - Soil bulk density

4. Which would be more likely to change as a result of soil compaction, bulk density or particle density? Briefly explain your answer.

[2 points]

5. Use the data given below to answer the following questions:

|                                       | Soil A    | Soil B    | Soil C     |
|---------------------------------------|-----------|-----------|------------|
| bulk density (g/cm <sup>3</sup> )     | 1.5       | 1.4       | 1.6        |
| particle density (g/cm <sup>3</sup> ) | 2.79      | 2.84      | 2.65       |
| gravimetric moisture (%)              | 30        | 40        | 18         |
| textural class                        | Silt loam | Clay loam | Sandy loam |

- Which of the three soils in this question would have the highest porosity (f)?
- What data did you use to make your decision?

[2 points]

6. A team of forestry students excavated a pit in a gravelly soil. They lined the pit with a plastic tarp and filled it with water. It took 24 L of water to fill the pit. They also oven-dried and weighed the excavated soil. The oven-dried soil weighed 31 kg.
- Calculate the bulk density of the soil. Express your result in metric tonne/m<sup>3</sup>.
  - What would be the mass of 1 L of undisturbed dry soil? (Note that 1 L = 1 dm<sup>3</sup> = 10<sup>-3</sup> m<sup>3</sup>)
  - What would be the volume of one kg of undisturbed dry soil?

[3 points]

7. A soil has a bulk density of 840 kg m<sup>-3</sup> and the organic matter content of the soil is 0.13 kg of organic matter per kg of total solids. The average particle density of the organic matter is 1300 kg m<sup>-3</sup>, and the average particle density of the mineral (inorganic) solids is 2650 kg m<sup>-3</sup>.
- What is the volume occupied by organic solids, per m<sup>3</sup> of total soil volume?
  - What is the volume occupied by mineral solids, per m<sup>3</sup> of total soil volume?
  - What is the porosity of the soil (i.e. m<sup>3</sup> of pores / m<sup>3</sup> of total soil volume)?

[3 points]

### Required attachments:

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

[2 points]

*Total for lab 2 assignment*

[30 points]