28-01-2020

# APBI 200 LAB # 4, Soil Water Retention

**Please answer the following questions:**

1. At permanent wilting point, the highest water content is found in:
   a) clay soils
   b) loam soils
   c) sandy soils

[1 point]

2. Available water storage capacity is smallest in:
   a) clay soils
   b) loam soils
   c) sandy soils
   d) organic soils

[1 point]

3. Field capacity: [select all that apply]
   a) is the amount of water retained in the soil after rapid drainage
   b) is the soil water content at which plants begin to wilt
   c) corresponds to a matric potential of -100 kPa
   d) is measured either -10 or -33 Kpa depending on soil texture

[1 point]

4. Two soil samples A and B, at different soil moisture levels are placed in contact with each other. Water will more likely move from soil A to soil B if their water potentials are:
   a) A = -5 kPa; B = -5 kPa
   b) A = -5 kPa; B = +5 kPa
   c) A = -100 kPa; B = -50 kPa
   d) A = -20 kPa; B = -10 kPa
   e) A = -30 kPa; B = -40 kPa

[1 point]

5. Define the paired terms shown below. Identify important distinctions between the paired terms. Explain how they differently affect what goes on in the soil and/or how plants grow on that soil.

Permanent wilting point and Field Capacity

[6 points]

6. Pore size differences: fine versus medium sand

   a) How do you determine the dominant pore size?

Consider the data you collected during the lab #4 and the data shown in the appendix of the lab manual:

   b) Which of the two samples (i.e. medium or fine sand) has the smaller dominant pore size? Show your calculations, units and briefly explain your answer for both the medium and fine sand.

   c) How would you determine the largest pore size in a sample?

Consider the data you collected during the lab #4 and the data shown in the appendix of the lab manual:

   d) Which of the two samples (i.e. medium or fine sand) has the largest pore size? Show your calculations including units. Briefly explain your answer.

[4 points]

7. The partial water retention curves obtained in lab #4 are representative of sand fractions, with uniform particle sizes. Consider a loam soil with 7% organic matter.
   How would you expect the partial water retention characteristics of a loam soil (with 7% soil organic matter) to differ from your graph and why?

   Hint: consider the influence of structure and pore size on the water retention curve.

[2 points]

8. For good plant growth, it is important to know what portion of total soil volume is occupied by air. Aeration porosity (Va/Vt) represents the portion of total soil volume which is occupied by air.

   a) Calculate aeration porosity at a tension of 60 cm for the two soil samples analyzed during the lab #4 (i.e., medium sand and fine sand). Show complete calculations.
   Note that you will have collected data for one sample; data for the 2nd sample is provided in the appendix of the lab manual.

   b. Compare aeration porosity values for the medium and fine sand samples. Indicate which sand (medium or fine) has the highest aeration porosity. Briefly explain why?

[4 points]

**Required attachments:**

- Your data collection sheet with calculations written out for both samples parameters (lines a through k), and for the first 2 tension values.
  Be sure to include units when you enter your data and to keep track of units when making your calculations.

[7 points]

- The water retention curves for medium and fine sand samples indicating air entry value (AEV) and air intrusion value (AIV) on the graph. Hint: don't forget to include a title, axis labels, and label your curves indicating which curve is for fine sand and which curve is for medium sand. Clearly indicate on your graph the tensions which correspond to AEV and AIV.

[3 points]

**Total for lab 4 assignment [30 points]**