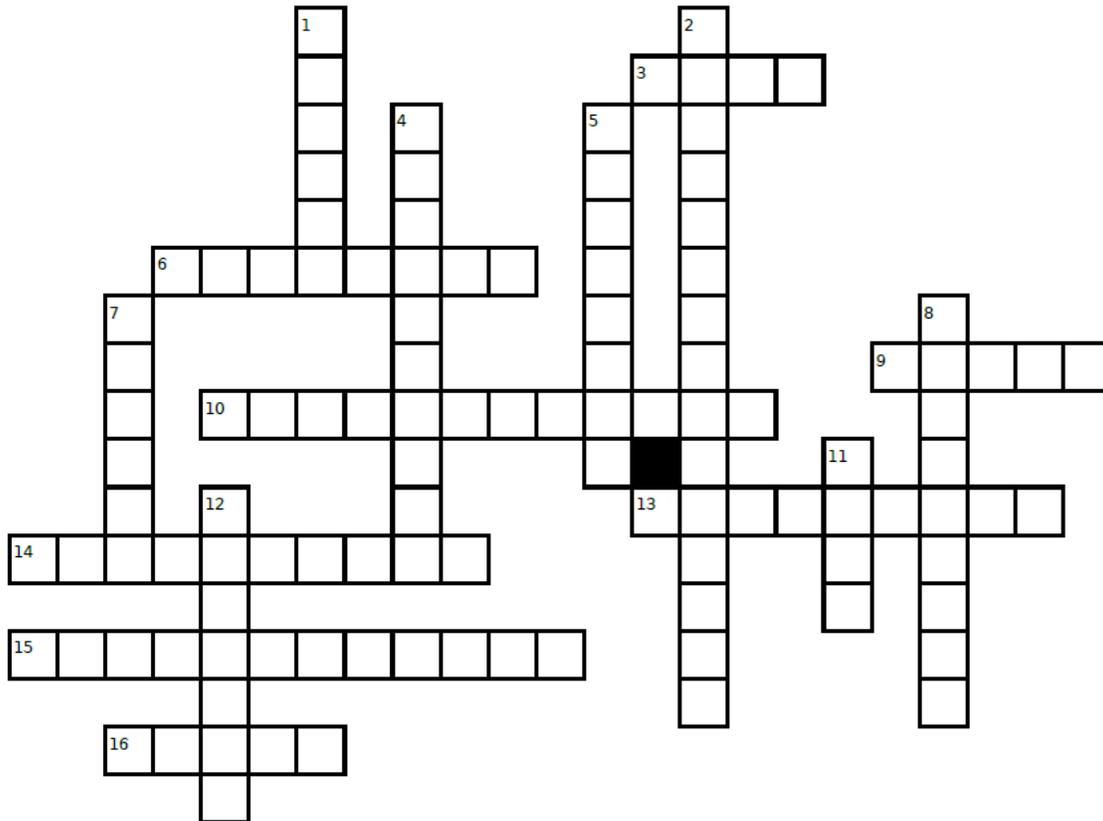


APBI 200 - Problem Set No. 2

Due: February 15, 2019 (by 5 pm)

1. Soil crossword puzzle



Down:

1. a soil with a high concentration of salts
2. a 2:1 phyllosilicate clay mineral with high specific surface area
4. thermal _____ describes how fast or slow surface temperature changes in a soil
5. a type of soil structure which commonly occurs in the A horizon of soils with high organic matter
7. when the soil pH is < 7
8. this type of clay is used in pottery because it does not shrink when dried
11. soil _____ density is the ratio of the mass of solids over volume of the soil
12. Fick's law helps explain how _____ moves in a soil

Across:

3. a soil with 40% sand, 40% silt and 20% clay
6. capillarity in soils is due to the forces of _____ and cohesion
9. Darcy's law helps explain how _____ moves in a soil
10. cations which are readily displaced by mass ion effect are _____
13. parent material transported downslope by gravity
14. large pores that occur between aggregates or between sand grains in a coarse textured soil
15. the capability of a soil to transmit water refers to its' hydraulic _____
16. the maximum soil water content which is available to plants is called _____ capacity

[8 points]

Note: you will need to write your answers on a separate sheet, as you will not have enough space

2. 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.

Granular structure & platy structure

[6 points]

3. The following measurements of soil water tension (T) were taken from Pacific Spirit Park at 3 depths.

a) Fill in the tables below using the following information:

- the soil solution contains no salts and the soil is well vented to atmosphere
- all three depths of observation are above the water table (or free water surface)
- the reference point is set at the soil surface

Hint: remember that $T = -\text{matric potential } (\psi_m)$

b) Indicate the direction of flow between points A & B; and B & C

Data table

Point	Depth in soil (m)	T (m)	ψ_g (m)	ψ_m (m)	ψ_o (m)	ψ_a (m)	ψ_s (m)	ψ_t (m)	Direction of flow (↓↑)
A	0	5.2							
B	-0.10	4.4							
C	-0.20	4.7							

Consider the following statement: “*water always moves downward in a soil*”.

c) Do you agree with this statement? Briefly explain your answer.

d) Can water move upwards in a soil? If yes, what force(s) are involved? Briefly explain the mechanism(s).

[8 marks]

4. A soil has the following properties:

pore volume	$f = 0.52 \text{ m}^3/\text{m}^3$
Volumetric water content	$\theta = 0.18 \text{ m}^3/\text{m}^3$
field capacity	$FC = 0.24 \text{ m}^3/\text{m}^3$
permanent wilting point	$PWP = 0.09 \text{ m}^3/\text{m}^3$
soil water tension corresponding to air intrusion value (AIV)	$T = 0.004 \text{ m}$

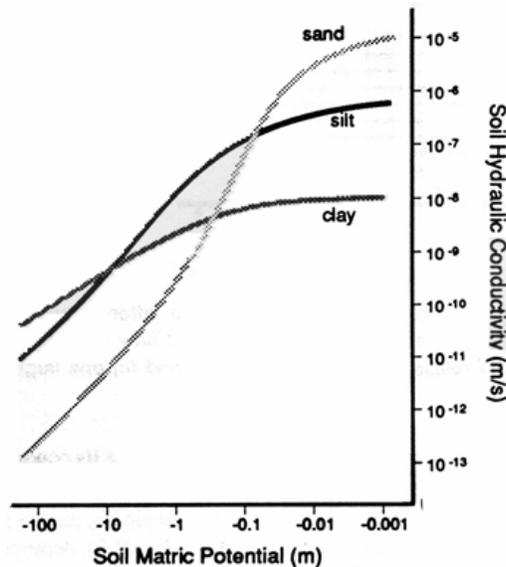
Note: values for FC, PWP, f and θ are given in 1 m^3 of soil

Show the entire calculation, including units for the following:

- Calculate the available water storage capacity (AWSC) in 1 m^3 of this soil
- Calculate the volume of soil air in 1 m^3 of this soil
- Calculate the saturated water content of this soil
- What is the radius of the most common pore size in this soil?

[4 points]

5. Consider the following graph of soil hydraulic conductivity.



- At a soil matric potential = -0.01 m , the sandy textured soil has a greater hydraulic conductivity than the clay textured soil. Why?
- At a soil matric potential = -10 m , the sandy textured soil has a lower hydraulic conductivity than the clay textured soil. Why?

[4 points]

6. On the UBC Campus, during winter, workers often place dried leaves loosely around the base of the trees along Main Mall. Using your knowledge of the thermal properties of mineral soil and organic matter answer the following questions:
- a) Briefly describe the climatic conditions in Vancouver during winter.
 - b) How do thermal properties in a mineral soil vary with soil moisture content? Briefly explain.
 - c) How would the addition of an organic mulch (loose, dry leaves in this example) modify the soil temperature of the underlying mineral soil in winter? Briefly explain.

[5 points]

Total for problem set no.2 [35 points]