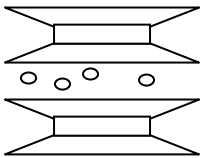
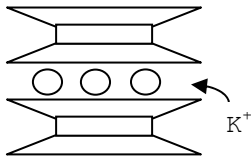
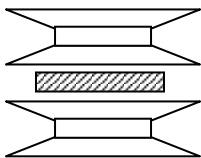
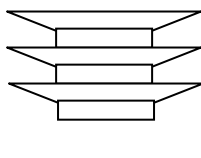
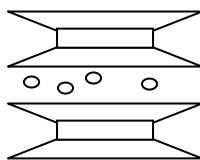


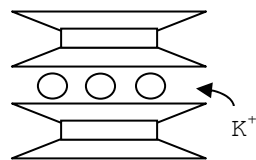
**Single-answer multiple choice**

Circle the one answer that best answers each question or completes each sentence. [3 points each]

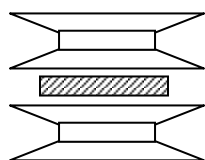
- Which of the following is the correct representation of the Revised Universal Soil Loss Equation (RUSLE)?
  - $T = R \times K \times L \times S \times C \times P$
  - $A = R \times K \times L \times S \times C \times P$
  - $T = R + K + LS + C + P$
  - $A = (R + K + LS + C + P) / T$
- Which of the following is not a term used to describe a water erosion process or feature?
  - rill
  - gully
  - saltation
  - raindrop impact
- A 1:1 mineral having little isomorphous substitution and a low cation exchange capacity is \_\_\_\_.
  - montmorillonite
  - gibbsite
  - illite
  - kaolinite
  - vermiculite
- Of the following minerals, which has the highest cation exchange capacity?
  - montmorillonite
  - illite
  - gibbsite
  - kaolinite
  - vermiculite
- You recently installed a cement driveway on a clay soil. During a recent dry period in the weather you noticed considerable cracking in the driveway as well as in the surrounding soil. The clay in the soil would most likely have which of the following crystalline structures?
  - 
  - 
  - 
  - 



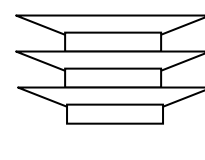
a)



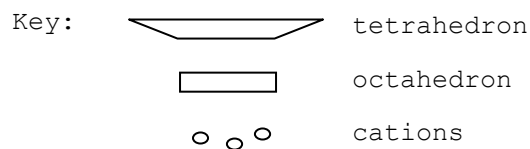
b)



c)



d)



- Which of the following cations is considered an 'acidic' or 'acid-forming' cation?
  - $Al^{3+}$
  - $Mg^{2+}$
  - $Ca^{2+}$
  - $K^+$

- 7) Isomorphic substitution is the substitution of one ion by another of *similar / dissimilar* (circle one) charge.
- 8) A measurement of soil solution pH indicates:
- the active acidity of the soil
  - the quantity of exchangeable acidity
  - the active plus the exchangeable acidity
  - the amount of lime to add to neutralize the soil
- 9) Processes or history that tends to promote an acid soil include:
- decomposition of organic matter
  - reactions of CO<sub>2</sub> and water
  - high rates of soil weathering
  - application of ammonia-based fertilizers
  - all of the above
- 10) The addition of organic matter to a soil usually \_\_\_ of that soil.
- changes the textural classification
  - inhibits soil structure formation
  - decreases the bulk density
  - lightens the color
- 11) In a symbiotic relationship between two organisms,
- the parasite kills the host.
  - the parasite weakens but does not kill the host.
  - both are equally matched and there is no winner in the competition.
  - both benefit.
  - the second organism finishes the job that the first organisms started.
- 12) Of all the soil microorganisms, the \_\_\_ are the most versatile and can develop vigorously in acid, neutral, or alkaline soils.
- fungi
  - actinomycetes
  - bacteria
  - protozoa
  - algae
- 13) Which of the following sequences ranking global pools of carbon from largest to smallest is most correct?
- LARGEST >>> SMALLEST
- oceans > fossil fuels > soils > atmosphere > standing vegetation
  - oceans > fossil fuels > standing vegetation > oceans > atmosphere > soils
  - fossil fuels > standing vegetation > oceans > atmosphere > soils
  - fossil fuels > atmosphere > fossil fuels > oceans > soils
  - soils > fossil fuels > oceans > standing vegetation > atmosphere
- 14) Organic compounds vary greatly in their rate of decomposition. Which of the following sequences of organic compounds are listed correctly in order from the most rapidly decomposed to the most slowly decomposed?
- MOST RAPID >>> SLOWEST
- lignins > sugars > proteins > cellulose
  - sugars > proteins > cellulose > lignins
  - proteins > sugars > cellulose > lignins
  - cellulose > lignins > proteins > sugars
  - sugars > lignins > proteins > cellulose

**Multiple-Answer true/false [2 points each].**

Each question below has four possible answers. Mark 'T' (true) for each answer that solves the problem correctly and 'F' (false) for each answer that is incorrect.

- 15) [4 points] The cation exchange capacity of a soil would likely increase as  
\_\_\_\_ a) vermiculite was replaced by iron oxides.  
\_\_\_\_ b) the pH increased from 5.0 to 6.8.  
\_\_\_\_ c) the amount of clay decreased.  
\_\_\_\_ d) the amount of organic matter increased.
- 16) [3 pts] An organic residue which has a C/N ratio of 60/1 that is added to soil will \_\_\_\_ compared to an organic residue added to soil that has a C/N ratio of 15/1.  
\_\_\_ a) remove available-nitrogen from the soil in the short term  
\_\_\_ b) decompose more quickly  
\_\_\_ c) have a lower nitrogen content relative to carbon content

**Short answer**

- 17) Regarding the RUSLE used to predict water erosion
- [2 pts] Which 2 of the RUSLE factors (R, K, LS, C and P) are factors that can be changed in the short term by human activities?
  - [2 pts] What are the names of these two factors (what do the letters mean)?
  - [2 pts] Give an example of one change in one of them that, if implemented, would decrease water erosion rate?
- 18) [2 points] We talk about silicate clay minerals as 1:1 or 2:1 or 2:1:1 minerals. What do the numbers refer to?
- 19) [2 points] List four cations that are considered to be non-acid (previously called 'basic') cations  
\_\_\_\_
- 20) [3 points] Explain why clay minerals in temperate regions typically have net negative charge (what makes the negative charge?)
- 21) [4 pts] Describe the general process that happens in soil when lime is added (what happens to the lime and why is the acidity neutralized)?
- 22) [3 pts] Use the following two terms in a (factually correct) sentence related to soil organisms that helps explain their meanings .  
*primary consumers, secondary consumers*

23) [6 points] One way of determining the importance of organisms is to compare their relative abundance, biomass, and metabolic activity. Using these criteria, earthworms are often considered the most important *macroorganism* in soil. List three groups of *microorganisms* that are considered to be among the most important in soils.

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24) One class of symbiotic relationships we talked about in class was mycorrhizae.

a) [2 pts] What general classes of organisms does this relationship occur between?

b) [2 pts] What is the difference between endomycorrhizae and ectomycorrhizae?

25) [2 points ] One of the important roles of microorganisms in soil is mineralization. Define this term.

26) A soil has been tested in the lab and found to have the following exchangeable cations:

2 cmol<sub>c</sub>/kg Ca<sup>2+</sup>, 2 cmol<sub>c</sub>/kg Mg<sup>2+</sup>, 2 cmol<sub>c</sub>/kg H<sup>+</sup>, 3 cmol<sub>c</sub>/kg K<sup>+</sup>, 1 cmol<sub>c</sub>/kg Al<sup>3+</sup>

a) [4 pts] What is the cation exchange capacity of this soil? (*show your work!*)

b) [4 pts] What is the % non-acid cation saturation (base saturation)? (*show your work!*)

### Extra Credit

A. [5 points] Coarse-textured soils generally have a lower organic matter content than finer textured soils. From your knowledge of soil organic matter, discuss likely reasons for why this pattern occurs.

B. [2 pts] Which class of microorganisms typically is the most abundant in soils – whether measuring by biomass (kg/ha) or numbers of organisms?