APBI 200
Midterm Exam No.2
March 11, 2019

- Please read the questions carefully & attempt each question.
- This exam contains 5 sections; shown on 5 pages.
- Total time of the exam is 50 minutes.
- Write all answer in your *exam booklet*

Section I - Explanation questions (*estimated time = 20 minutes*)

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

   a) Cation exchange capacity and base saturation

   b) Mineralization and immobilization

[12 points]

2. Soil organisms:

For each of the following soil organisms briefly indicate its importance in the soil.

a) Earthworm
b) Tardigrade (water bear)
c) Mycorrhizal fungi
d) Bacteria
e) Nematode
f) Algae

[6 marks]

Section II – Data interpretation (*estimated time = 10 minutes*)

3. Farmer Bill is looking to expand his farm, but needs to carefully consider the quality of the soil on the land he is considering to buy. He narrowed down his choices to two farms and soil properties of those farms are shown in the table below.

Based on the soil properties of the two farms, what can farmer Bill infer about the soil capabilities for:

a) Nutrient retention and supply

b) Water retention

c) Drainage (i.e., water movement through the soil profile)

Soil property	**Farm 1**	**Farm 2**
% sand	70	40
% clay	10	20
% organic matter (by weight)	4	7
Bulk density (g/cm^3)	1.25	1.03
Soil pH	4.4	6.1
CEC ($cmol_c/kg$)	15	30
Parent material type	basal till	alluvium

[Hint: Create a table in your exam booklet (similar to the one below), and for each category indicate the relative capability of each soil and briefly explain your rationale].

	Farm 1	Farm 2
a) Nutrient retention & supply		
b) Water retention		
c) Drainage		

d) Based on your rationale above, which farm (1 or 2) would you recommend Bill purchase?

[7 points]

Section III - Multiple choice questions, indicate ONE correct answer (*estimated time = 5 minutes*)

Note – you should write your answers for these questions in the exam booklet

4. Exchangeable acidity is:
   a) due to H^+ and Al^{3+} ions in soil solution
   b) associated with H^+ and Al^{3+} ions which are easily exchanged by other cations in soil solution
   c) associated with H^+ and Al^{3+} ions which are tightly bound on soil particles
   d) due to leaching

[1 point]

5. Soil salinity is an issue in soils because it:
   a) increases osmotic potential and requiring plants to exert more energy to uptake water from the soil
   b) causes dispersion of soil aggregates
   c) reduces soil pH
   d) results in a loss of soil nutrients

[1 point]

6. Denitrification is:
   a) a biochemical reduction of atmospheric nitrogen (N_2) to ammonia (NH_3), carried out by certain bacteria
   b) release of inorganic forms of nitrogen through decomposition of organic compounds
   c) plant uptake of nitrogen
   d) biological reduction of NO_3^- to gaseous N-compounds

[1 point]

7. In organic horizons on well drained sites, the H horizon corresponds to:
   a) accumulation of relatively fresh undecomposed residues
   b) accumulation of partially decomposed residues
   c) accumulation of decomposed organic matter, where structures are unrecognizable
   d) the upper mineral horizon which is enriched in soil organic matter

[1 point]

8. Heterotrophic organisms are:
   a) primary producers
   b) decomposers
   c) higher plants
   d) Cyanobacteria

[1 point]

Section IV - Multiple answer questions, indicate ALL answers that apply (*estimated time = 5 minutes*)

Note – you should write your answers for these questions in the exam booklet

9. Humic substances:

a) are inherited from plant and animal residues entering the soil
b) are formed within the soil by the breakdown of organic structures and synthesis of new organic compounds
c) include fulvic acid and humic acid
d) include proteins, carbohydrates and lignin
e) have numerous carboxyl (COOH) groups which dissociate over a range of pH

[1 point]

10. Acidic soils:

a) Have a high pH
b) Have a low pH
c) Are low in hydrogen ions
d) Are high in hydrogen ions
e) Generally found under humid climates
f) Generally found under dry climates

[1 point]

11. A plant residue with a C:N ratio of 15:1 will:

a) Decompose slowly
b) Decompose rapidly
c) Provide excess N for plants
d) Immobilize N within microbial biomass
e) Be a good source of available N for vegetable gardens

[1 point]

12. The rhizosphere is the region in the soil:

a) influenced by plant roots
b) influenced by root exudates
c) with a low concentration of soil organisms
d) with a high concentration of soil organisms
e) no different than the bulk soil

[1 point]

13. Ion exchange reactions are:

a) irreversible
b) rapid
c) charge for charge
d) reversible
e) due to isomorphic substitution

[1 point]

Section V - Fill in the blank questions (*estimated time = 5 minutes)*

Note – you should write your answers for these questions in the exam booklet

14. List three processes in the nitrogen cycle mediated by soil organisms:

_____, _____, and _____ .

[1 point]

15. _____ water-filled pores are better conductors of water than many small water-filled pores totaling the same cross section.

[1 point]

16. The three types of forest floor humus forms are: _____, _____ and _____.

[1 point]

17. Long, threadlike filaments of fungi are called _____.

[1 point]

18. Glacio-lacustrine deposits were formed material transported by _____ and deposited _____

[1 point]

Total number of points = 40