Exam Score: ____________

Be sure to show all calculations so that you can receive partial credit for your work!

1) List 8 of the plant essential micronutrients for plant growth. Provide the complete name of the element and one form taken up by plants. List one fertilizer source for four of them. Spelling and charge count! (10 points)

<table>
<thead>
<tr>
<th>Essential Micronutrient</th>
<th>Form taken up by plant including valence</th>
<th>List Fertilizer Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
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<td>2.</td>
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<td>7.</td>
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<td>8.</td>
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</table>

2) What nutrient deficiencies are shown in the pictures projected. (4 points)

a) _______________________________

b) _______________________________

c) _______________________________

d) _______________________________

3) Define or explain the following terms as they relate to soil fertility: (4 points)

WIN

Chelation

4) The primary function in the plant of each of these nutrients is
Nutrient | Primary Function in the Plant
--- | ---
Molybdenum | _____________________________
Phosphorus | _____________________________
Potassium | _____________________________

5) CEC Calculations - Use the following data for problems a through d **(8 points)**

<table>
<thead>
<tr>
<th>pH Index</th>
<th>Lime (%)</th>
<th>OM (%)</th>
<th>P (ppm)</th>
<th>K (ppm)</th>
<th>Mg</th>
<th>Ca</th>
<th>CEC (cmolc/kg)</th>
<th>% B.S. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>?</td>
<td>6.0</td>
<td>2.8</td>
<td>30</td>
<td>70</td>
<td>44</td>
<td>1000</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

a) Calculate the CEC of this soil. (Exch. Acidity = 12 cmolc/kg) ____________

b) Calculate the % Base Saturation of this soil. ____________

c) What is the estimated pH of this soil? ____________

d) If you were going turf (or wheat), would P or K be the more limiting nutrient based on the soil test above? ____________

6) Discuss the mechanism(s) by which sulfur coated urea releases nitrogen over time. Be specific, include information on the way these are manufactured and discuss how their physical, chemical, and/or biological release mechanisms work! **(3 points)**
7) Phosphorus in Soils

A. Label the four arrows shown on the diagram in Part B: (4 points)

1. _________________________ 3. _________________________
2. _________________________ 4. _________________________

B. Explain the chemistry of soil phosphorus in a Mollisol (from Indiana) for Boxes A and C shown below. List the forms of phosphorus found in each box, the relative amounts found in soil, and briefly explain how the four numbered processes affect availability of phosphorus to plants. Also, write the predominate available forms (Box B) of phosphorus (including valence) taken up by plants at pH 4.5 ________ and at pH 7.5 ________ (6 points)

C. What is the name of the mineral that is mined in Florida and is often referred to as “rock phosphate” and is the raw material for manufacturing phosphorus fertilizers? (2 points)
8) Briefly explain or diagram “fixed K” and “exchangeable K.” Explain how potassium in fertilizers can be fixed when added to soil. Which types of soils have the most fixing potential? (5 points)

9) List two minerals that naturally provide potassium in soils through the process of weathering? (2 points)

10) For each of the micronutrients listed, give the information requested. (9 points)

<table>
<thead>
<tr>
<th>Potential Soil Conditions Where Deficiency Might Occur</th>
<th>List the Most Susceptible Crop Found in Indiana</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2 conditions for each nutrient)</td>
<td></td>
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</table>

Iron

Manganese

Molybdenum
11) A. The mineral on the table in the front of the room provides which fertilizer material? (2 points)

B. Where is this mineral mined? (2 points)

12) List two situations when starter fertilizer should be used for corn production. (2 points)

1. 

2. 

13) You have just landed your first job as the head superintendent at White Sands Country Club. On your first day a salesman stops and claims that you need to purchase his newest complete micronutrient fertilizer to aid in greening-up your turf. Before buying this product you should…….. (2 points)

14) What micronutrient is MOST commonly deficient in turfgrasses? (2 points)

15) Briefly explain how each of these fertilizer materials is manufactured. Include the starting material(s) and the general process that produces the fertilizer. State which of the two processes involves the use of a pipe reactor. (4 points)

A. 0-44-0 

B. 10-34-0
Multiple Choice Questions (2 point each) – Record the best answer to each on the line provided.

_____ 1. If a fertilizer label reads 8-32-16, it contains:
   A. 8% soluble N
   B. 32% available P₂O₅
   C. 16% soluble K
   D. All of the above

_____ 2. Ureaform and IBDU differ in their method of N release because
   A. Ureaform is coated with sulfur and this coating must be broken down before the N is released whereas IBDU is water soluble and more readily available than ureaform.
   B. Ureaform is dependent on soil microorganisms for hydrolysis to available forms of N whereas IBDU is not dependent on soil microorganisms.
   C. IBDU is dependent on the breakdown of plastic coatings on the particles and ureaform is dependent on Thiobacillus to solubilize the fertilizer.

_____ 3. How many pounds of N would be supplied from 18-46-0 if it was used to supply 80 lb P₂O₅/A
   A. 31 lb  B. 45 lb  C. 174 lb  D. 333 lb  E. 422 lb

_____ 4. 6-24-12 fertilizer would most likely have its source of potassium in which chemical form:
   A. P₂O₅
   B. Dicalcium Phosphate
   C. KCl
   D. K₂O

_____ 5. The availability of Fe, Mn, Zn, and Cu increases as soil pH
   A. increases
   B. decreases
   C. exceeds 8.3

_____ 6. High P applications may induce this micronutrient deficiency on turf if it is found in marginal quantities in the soil.
   A. Mo
   B. B
   C. Cl
   D. Fe
   E. All of these
7. The ratio for N:P₂O₅:K₂O in turfgrass clippings is approximately:

A) 6:14   B) 4:1:3   C) 4:1:7   D) 8:1:3   E) 5:7:3

8. Of the three major fertilizer nutrients, which two are most likely to cause “salt injury” to turf or cause salt injury when using starter fertilizer on corn?

A. nitrogen and potassium
B. phosphorus and potassium
C. nitrogen and calcium
D. nitrogen and phosphorus

9. Most of the potassium and phosphorus reaching plant roots gets to the roots by:

A. root interception.
B. mass flow.
C. diffusion.
D. complimentary ion carriers.

10. Which of the three soils on display would most likely fix the most phosphorus and would have little potential to fix potassium?

A. Soil A   B. Soil B   C. Soil C

11. A tissue analysis for turf was found to contain 3.6% N, 0.38% P, 0.62% K, and 200 ppm Fe. Which element is most likely hindering growth?

A. N   B. P   C. K   D. Fe

12. Which extractant for soil phosphorus would give you the best results if you were analyzing a soil with a pH of 7.6?

A. Bray P1   B. Morgan   C. Olsen   D. Walker’s Special Extractant 2

13. Which nutrient is of great concern related to pollution, impacts lake eutrification, and is restricted in use for lawns in some states (e.g. Minnesota):

A) N   B) P   C) K   D) Fe   E) Mg