Agronomy 365 Final Exam Spring 2002

Name________________________

TA________________________

Lab________________________

Please keep your answers brief and to the point. DO NOT try to fill in all the space given unless you need it to answer the question. Where applicable, show your work for partial credit!!!

1) Please list all 17 plant essential elements. Provide the complete name of the element, the chemical symbol, and one form taken up by plants. **Spelling and charge count!**
(0.5 points each, 25 points total)

<table>
<thead>
<tr>
<th>Element</th>
<th>Symbol</th>
<th>Form taken up by plants</th>
</tr>
</thead>
</table>

Total points this page: 25 out of 100

2) Please define or explain the following terms as they relate to Soil Fertility:
(3 points each, 15 points total)

Soil Fertility:

Soil Productivity:

Soil test correlation:

Soil test calibration:

Cation exchange capacity:

3) Please list the soil pH (low, near neutral, high), temperature (cold, warm, hot), and moisture (dry, moist, saturated) conditions that would maximize the rates of the following N transformations. (3 points each, 12 points total)

Nitrification (assume N is currently present as NH$_4^+$):

Denitrification (assume N is currently present as NO$_3^-$):

Nitrate leaching (assume N is currently present as NO$_3^-$):

Volatilization (assume N will be surface-applied as urea):

Total points this page: 27 out of 100

4) Please provide the general formulae needed to calculate root nutrient contact via the following three mechanisms. (3 points each, 9 points)
5) Please list the three criteria used to determine the essentiality of an element for the growth of higher plants. (2 points each, 6 points)

6) What two factors control the differences in cation retention in soils (the lytropic series)? (2 points each, 4 points)

7) a. Does the cation exchange capacity of midwestern soils increase or decrease when soil pH increases? (1 point)
   
    b. Why? (3 points)

8) Given the following:

Total points this page: 23 out of 100
Conventionally tilled soil
Crop to be grown: Corn with 165 bu/acre yield potential
Previous crop: Corn (only corn and soybeans are planted to this field).
Subsoil pH is < 6.0.

**SOIL TEST REPORT**

<table>
<thead>
<tr>
<th>Buffer pH</th>
<th>pH</th>
<th>Organic matter (%)</th>
<th>Bray P&lt;sub&gt;1&lt;/sub&gt; ppm</th>
<th>K</th>
<th>Ca</th>
<th>Mg</th>
<th>CEC cmol(+) kg&lt;sup&gt;-1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.6</td>
<td>6.7</td>
<td>2.8</td>
<td>18</td>
<td>137</td>
<td>1320</td>
<td>175</td>
<td>12</td>
</tr>
</tbody>
</table>

**a.** What are the correct fertilizer recommendations for N, P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O for this crop? Show the equations you used. **(6 points)**

**b.** Calculate and list the cmol(+) kg<sup>-1</sup> for K, Ca, and Mg in this soil. **(6 points)**

[Atomic weights (g/mol): K = 39.1, Ca = 40.1, Mg = 24.3]

**c.** What is the percent base saturation of this soil? **(2 points)**

**d.** What was the [H<sup>+</sup>] of the soil:water extract that was used to determine pH for this soil? **Show units!** (3 points)

**Total points this page: 17 out of 100**

**e.** What is the recommended pH for this soil – crop combination? **(1 point)**
f. How much limestone (RNV = 54) should you apply to this soil? Show the equation(s) you used (4 points)

f. Why do we use buffer pH instead of water pH to determine lime requirement? (3 points)

Total points this page: 8 out of 100