Situation: You are going to grow corn grain with a yield potential of 145 bu acre$^{-1}$. Your crop last year was wheat with a yield of 65 bu/acre. Your field is conventionally tilled and corn, wheat, and soybean are the only crops grown on this field.

<table>
<thead>
<tr>
<th></th>
<th>Buffer pH</th>
<th>Organic matter (%)</th>
<th>Bray P$_i$</th>
<th>K</th>
<th>Ca</th>
<th>Mg</th>
<th>CEC cmol$^+$ kg$^{-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsoil</td>
<td>5.6</td>
<td>6.6</td>
<td>2.3</td>
<td>12</td>
<td>124</td>
<td>1530</td>
<td>247</td>
</tr>
</tbody>
</table>

Subsoil pH is > 6.0 (This field is in Tippecanoe County IN).

1. According to the Tri-state Fertilizer Recommendations, how many pounds of nitrogen per acre should you apply for this corn crop? (4 points)

2. How many pounds of 82-0-0 per acre should you apply to achieve the nitrogen rate you calculated in Question 1? (3 points)

3. What is the critical soil test P level for this soil in mg P kg$^{-1}$ soil? (2 points)

4. What is the soil test P maintenance limit for this soil in mg P kg$^{-1}$ soil? (2 points)

5. What is the lowest soil test P level in mg P kg$^{-1}$ soil you can have to get a fertilizer P recommendation of 0 lb acre$^{-1}$ in this soil? (2 points)

6. According to the Tri-state Fertilizer Recommendations, how many pounds of P$_2$O$_5$ per acre should be applied this corn crop? (4 points)

Total points this page = 17 out of 100.
7. Your answer to Question 6 is equivalent to how many pounds of P per acre? (atomic wt of P = 31 g mole\(^{-1}\); atomic wt. of O = 16 g mole\(^{-1}\)) (3 points)

8. How many pounds of P\(_2\)O\(_5\) per acre in excess of crop removal does it take to increase soil test P level by 1 mg P kg\(^{-1}\)? (2 points)

9. How many pounds of P\(_2\)O\(_5\) per acre in excess of crop removal do you need to apply to raise your soil test P level to the critical level for this soil? (3 points)

10. What is the predominant form of P that plants will take up from the soil solution at this soil pH? (2 points)

11. What is the critical soil test K level for this soil in mg K kg\(^{-1}\) soil? (3 points)

12. What is the soil test K maintenance limit for this soil in mg K kg\(^{-1}\) soil? (2 points)

13. What is the lowest soil test K level in mg K kg\(^{-1}\) soil you can have to get a fertilizer K\(_2\)O recommendation of 0 lb acre\(^{-1}\) in this soil? (2 points)

14. According to the Tri-state Fertilizer Recommendations, how many pounds of K\(_2\)O per acre should be applied this corn crop? (4 points)

15. What is the equation used to determine the amount of K\(_2\)O it takes to increase soil test K by 1 mg K kg\(^{-1}\) soil? (3 points)

16. How many cmoles\(^{(+)}\) kg\(^{-1}\) are coming from exchangeable Ca in this soil? (atomic wt of Ca = 40.08 g mole\(^{-1}\)) (5 points)

17. What is the soil solution H\(^{+}\) activity/concentration of this soil in moles H\(^{+}\) L\(^{-1}\)? (3 points)

Total points this page = 32 out of 100.
18. What is the recommended pH for this soil if you are growing only corn, wheat, and soybean? (2 points)

19. If your limestone has a relative neutralizing value (RNV) of 65, how many tons per acre should be applied to this field? (4 points)

20. If your limestone has a relative neutralizing value (RNV) of 60, how many tons per acre should be applied to this field? (3 points)

21. What is the critical soil test level for Mg in mg Mg kg$^{-1}$ for this soil? (2 points)

22. I am growing a corn crop with 160 bu acre$^{-1}$ yield potential. I applied 50 pounds of 46-0-0 per acre in my starter fertilizer. My PSNT is 17 ppm NO$_3$-N. How many lb N acre$^{-1}$ should I apply? (Use the PSNT Table provided with your other equations) (5 points)

23. There are two situations where nitrogen should always be added to starter fertilizer in corn production. Please list them. (3 points)

24. Please fill in the blanks (1.5 points each, 6 points)

The maximum rate of N + K$_2$O to apply when we are using starter fertilizers in a 2 x 2 placement for corn is __________ lbs/acre. Because soybeans are more salt sensitive, the maximum rate of N + K$_2$O to apply when we are using starter fertilizers in a 2 x 2 placement for 30 inch row soybean is _______________ lbs/acre. If we are using ammonium phosphates in our starter fertilizer, again in a 2 x 2 placement, we do not want the N rate in the starter fertilizer material to exceed ________ lbs N /acre for corn. We would not expect a yield response to adding phosphorus in starter fertilizer for a field where only corn and soybean are grown unless soil test P is at or below _________________ mg K kg$^{-1}$ soil.

Total points this page = 25 out of 100.
25. Please discuss the fate of fertilizer P when it is applied in a band. Include in your discussion what happens to pH, solution P levels, Fe and Al concentrations and solubility, and the reactions that change P availability with time. Feel free to include a diagram if it will help you in your discussion. (8 points)

26. Briefly explain or diagram fixed K, exchangeable K, and soil solution K. Feel free to include a diagram if it will help you in your discussion. (6 points)

30. In forested ecosystems of the Midwestern US, approximately what percent of total soil P is in the organic form? (2 points)

20. Please complete the table below (1 point each, 10 points)

<table>
<thead>
<tr>
<th>Nutrient Element</th>
<th>Mobility in plants</th>
<th>One physiological role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphorus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnesium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfur</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total points this page = 26 out of 100.