Choose the best answer for each question. Questions are worth 3 points each.

1. Plants absorb sulfur as
   a) $\text{SO}_2^{2-}$.
   b) $\text{H}_2\text{S}_2$.
   c) $\text{SO}_4^{2-}$.
   d) $\text{SO}_4^{2+}$.

2. Boron is absorbed from soils by plants as
   a) $\text{H}_3\text{BO}_3$.
   b) $\text{H}_2\text{BO}_3$.
   c) $\text{HBO}_3^-$.
   d) $\text{BO}_3^{3-}$.

3. The most common reason we see micronutrient deficiencies in Iowa is
   a) the soil simply doesn’t contain enough for proper crop growth.
   b) some soil chemical property is making the micronutrient unavailable to the growing crop.
   c) the soil pH is too low.
   d) the phosphorus soil test is too high.

4. The metabolically active form of manganese is
   a) $\text{Mn}^+$. 
   b) $\text{Mn}^{2+}$. 
   c) $\text{Mn}^{3+}$. 
   d) $\text{Mn}^{4+}$.

5. Copper is absorbed from soils by plants as
   a) $\text{Cu}^+$. 
   b) $\text{Cu}^{2+}$. 
   c) $\text{CuS}_2$. 
   d) none of the above

6. The two most common micronutrient deficiencies observed in Iowa are
   a) manganese on soybean and iron on soybean.
   b) calcium on corn and magnesium on soybean.
   c) boron on soybean and chloride on corn.
   d) iron on soybean and zinc on corn.
7. Molybdenum is absorbed by plants as
   a) MoO$_4^-$.
   b) MoO$_4^+$. 
   c) MoO$_4^{2-}$. 
   d) MoO$_4^{2+}$. 

8. Copper deficiencies are often associated with
   a) low pH soils.
   b) low soil organic matter.
   c) high soil organic matter.
   d) soils that contain large amounts of kaolinite.

9. The metabolically active form of iron is
   a) Fe$_{3+}$. 
   b) Fe$_{3-}$. 
   c) Fe$_{2+}$. 
   d) Fe$_{2-}$. 

10. The micronutrient that becomes less plant available as soil pH decreases is
    a) manganese.
    b) magnesium.
    c) molybdenum.
    d) nickel.

11. The form of zinc absorbed by plants is
    a) Zn$_{2+}$. 
    b) Zn$_{+}$. 
    c) Zn$^-$. 
    d) Zn$_{2-}$. 

12. The micronutrient that is essential for nitrogen metabolism in plants is
    a) copper.
    b) nickel.
    c) manganese.
    d) zinc.

13. Changing soil pH from 5.0 to 6.0
    a) increases Fe$_{2+}$ solubility 100 fold.
    b) increases Fe$_{2+}$ solubility 1000 fold.
    c) decreases Fe$_{2+}$ solubility 100 fold.
    d) decreases Fe$_{2+}$ solubility 1000 fold.

14. All of the phosphorus in animal manure is available to plants in the year of application.
    a) true.
    b) false.
15. Application of micronutrients such as manganese, iron, copper and zinc to insure that you don't have deficiencies is a good idea.
   a) true
   b) false

Part 2.

16. Explain why it is common to see an early growth response of corn to applied sulfur but not a grain yield response to applied sulfur in Iowa. (5 points)