

Name _____

6 December 2002

(112 points total)

I. Single-Answer Multiple Choice (2 points each): Circle the **one** solution that correctly answers each question or completes each sentence.

1. The prominent characteristic of a oxic horizon is the accumulation of
 - a. humus, Fe, and Al.
 - b. sesquioxides.
 - c. silicate clays.
 - d. calcium carbonate.

2. Advantages of synthetic fertilizers include
 - a. their relative ease to apply.
 - b. their ability to increase crop yields.
 - c. their quick availability to plants once applied.
 - d. all of the above.
 - e. both a and b.

3. When looking at a response curve of wheat yield to nitrogen, the point on the curve where the yield is the greatest is called the
 - a. maximum yield.
 - b. optimum yield.
 - c. sufficient yield.
 - d. premium yield.

4. Which of the following is not a soil order in U.S. Soil Taxonomy?
 - a. Ultisols.
 - b. Alfisols.
 - c. Andisols.
 - d. Argisols.
 - e. None of the above.

5. With continued weathering and leaching, one soil order can become another. Which set of soil orders is in the order from younger soils to older soils?
 - a. Alfisols, Ultisols, Oxisols.
 - b. Inceptisols, Ultisols, Alfisols.
 - c. Aridisols, Andisols, Spodosols.
 - d. Entisols, Alfisols, Inceptisols.

6. Crop yields per unit of land area have dramatically increased over the past 60 years due to the development of
- improved pest management.
 - improved crop cultivars and varieties.
 - commercial fertilizers.
 - all of the above.
 - both b and c.
7. For the production of crops, which would likely be the most desirable?
- prime farmland
 - Mollisols
 - Alfisols
 - unique farmland
8. Compared to synthetic (inorganic) fertilizers, organic fertilizers
- generally have lower nutrient contents per unit weight than do chemical fertilizers.
 - generally contribute larger amounts of organic matter to the soil.
 - generally must be decomposed to inorganic nutrient ions before nutrient absorption can take place by plants.
 - all of the above.
 - both b and c.
9. If a bag of fertilizer is labeled "10-8-8", then it has
- 10% N, 8% P, and 8% S.
 - 10% N, 8% P_2O_5 , and 8% K_2O .
 - 10% N, 8% P_2O_5 , and 8% K_2O .
 - 10% N, 8% H_3PO_4 , and 8% K_2SO_4 .
 - none of the above.
10. Concerning macronutrients and micronutrients,
- both are equally essential for plants.
 - macronutrients are needed in larger quantities than micronutrients.
 - magnesium is a macronutrient and boron is a micronutrient.
 - all of the above.
 - both a and b.
11. Which statement about the USDA Land Capability Classification System is true?
- Classes I, II, and III are generally considered prime farmland.
 - Class III requires more conservation practices than Class IV.
 - Class II has fewer soil limitations than Class III.
 - There are nine classes of land: Class I through Class IX.

12. For plants to take up nutrients from the soil solution, they must provide energy which comes from
- transpiration.
 - evapotranspiration.
 - photosynthesis.
 - respiration.
13. When an organic fertilizer is added to a soil, the plants growing in that soil depend on what process to make the nutrients in the organic fertilizer available?
- nitrification.
 - immobilization.
 - mineralization.
 - nitrogen fixation.
14. Which of the following soil orders has the most highly weathered soils?
- Entisols
 - Ultisols
 - Alfisols
 - Vertisols
 - Inceptisols
15. Prime farmland
- can be defined based on land classification systems that use soil and climatic characteristics as their criteria.
 - is usually the best land on which to build houses.
 - is the best agricultural land.
 - all of the above.
 - both a and c.
16. Which of the following soil orders can be found in Washington State?
- Andisols
 - Oxisols
 - Mollisols
 - All of the above
 - Both a and c
17. A sample of a loam surface soil is taken from a farmer's field and analyzed in the lab. The lab results indicate a CEC of 20 cmol/kg soil and the following concentrations of exchangeable cations: $\text{Ca}^{+2} = 6 \text{ cmol}_c/\text{kg}$; $\text{Mg}^{+2} = 2 \text{ cmol}_c/\text{kg}$; $\text{Al}^{+3} = 6 \text{ cmol}_c/\text{kg}$; $\text{H}^+ = 4 \text{ cmol}_c/\text{kg}$; $\text{K}^+ = 2 \text{ cmol}_c/\text{kg}$. The percentage base saturation is
- 80%
 - 70%

- c. 50%
- d. 40%
- e. 30%

18. Shrink-swell clays are an important constituent of which soil order?

- a. Spodosols
- b. Aridisols
- c. Vertisols
- d. Andisols
- e. Alfisols

19. What amounts of 46-0-0 and 0-45-0 fertilizers are needed to meet the need for 150 kg/ha of N and 60 kg/ha of P₂O₅ on a 200 ha field

- a. 65,220 kg of 46-0-0 and 26,670 kg of 0-45-0
- b. 69 kg of 46-0-0 and 27 kg of 0-45-0
- c. 13,800 kg of 46-0-0 and 5,400 kg of 0-45-0
- d. 326 kg of 46-0-0 and 133 kg of 0-45-0

20. Large deposits of a phosphorous-containing mineral called _____ are located in Florida.

- a. sylvinite
- b. apatite
- c. sodium nitrate
- d. kaolin

21. Which diagnostic horizon is most similar to a Bw horizon?

- a. Oxic
- b. Cambic
- c. Argillic
- d. Ochric
- e. Spodic

22. In the general use of synthetic fertilizers, the highest expected fertilizer efficiency would be for

- a. nitrogen.
- b. phosphorus.
- c. potassium

23. Soils with more than 20 percent organic matter are classified as

- a. Histosols.
- b. Humusols.

- c. Spodosols.
- d. Vertisols.

24. The optimum pH range for soluble nutrients in the soil is between

- a. 5 and 7.
- b. 6 and 7.
- c. 6 and 8.
- d. 8 and 9.

25. A common inorganic fertilizer carrier is

- a. anhydrous ammonia.
- b. superphosphate.
- c. blood meal.
- d. all of the above.
- e. both a and b.

26. Essential nutrient ions for plant growth include

- a. NO_3^- .
- b. SO_4^{-2} .
- c. Al^{+3} .
- d. all of the above.
- e. both a and b.

II. **Multiple-Answer Multiple Choice** (1 point for each answer): Each problem set below consists of one problem with four possible answers. Each problem has at least one correct answer listed for its solution but may have two, three, or all four correct answers. Mark "T" (for true) for each answer that solves the problem correctly and "F" (for false) for each answer that answers the problem incorrectly.

27-30. Concerning fertilizers,

- ___ 27. organic fertilizers can improve soil structure.
- ___ 28. yearly applications of fertilizers to a field will progressively become larger.
- ___ 29. inorganic fertilizers are chemical compounds containing readily available plant nutrients.
- ___ 30. organic and inorganic fertilizers have similar effects on soil quality.

31-34. Mollisols

- ___ 31. are the dominant soil order in the Great Plains.
- ___ 32. represent the largest area of all soil orders in the world.
- ___ 33. are the most naturally productive agricultural soil.
- ___ 34. have to have an ochric epipedon.

35-38. Concerning soil fertility and plant nutrition,

___ 35. generally a small portion of the total amount of a nutrient present in the soil will be in forms available for plant uptake.

___ 36. there are 18 essential elements for plant growth.

___ 37. research has shown that each essential element must be present in a specific concentration range for optimum plant growth.

___ 38. nutrients are absorbed by plants primarily as organic molecules.

39-42. Available forms of nutrient elements for plants include those ions in

___ 39. primary minerals.

___ 40. the soil solution.

___ 41. large organic particles.

___ 42. adsorbed form on surfaces of clay minerals.

43-46. Nitrogen entering the groundwater can originate from

___ 43. soil organic matter.

___ 44. atmospheric nitrogen.

___ 45. animal manure.

___ 46. nitrogen fertilizer.

47-50. The Important Farmlands Classification System

___ 47. categorizes lands into eight classes.

___ 48. identifies unique farmland based more on crop than soil characteristics.

___ 49. defines prime farmland based on specific soil and climatic criteria.

___ 50. identifies statewide important farmlands.

51-54. Nutrient uptake by plants

___ 51. is basically ions passively soaking in root cells along with soil water.

___ 52. requires energy to move ions across a semipermeable membrane and release them in the interior of the root cell.

___ 53. can be explained by the cation-exchange hypothesis.

___ 54. is selective so that specific nutrients can be preferentially absorbed over others present in the soil solution.

55-58. Concerning percentage base saturation,

___ 55. it is optimal for plant growth at 50%.

- ___ 56. a soil with a clay loam texture can have a higher % B.S. than a soil with a sandy loam texture and have more exchangeable base-forming cations.
- ___ 57. two soils with the same textures and %B.S. will have the same CEC.
- ___ 58. generally the lower the pH in a soil, the lower the %B.S.
- 59-62. From the Bill Moyer film on genetically modified foods, we saw
- ___ 59. a field growing pharmaceutical soybeans to create a vaccine for cows.
- ___ 60. a field of roundup-ready soybeans, where farmers sprayed the herbicide roundup directly on soybeans and weeds and the roundup would kill the weeds but not affect the soybeans.
- ___ 61. that Bt-corn pollen had blown into the fields of a certified organic farmer contaminating her corn.
- ___ 62. that fields in a remote area of Argentina had become contaminated with Bt corn.

III. Fill-Ins (2 points each space, except where noted): Fill-in each space below with the correct word or words.

63. The soil order with the most land area in the U.S. is Mollisols , whereas the soil order with the most land area in the world is Entisols .
64. The microbial conversion of ammonia to nitrate is called nitrification .
65. The three ways in which nutrients are supplied to the root surface are (1) mass flow, (2) root interception and (3) diffusion .
66. The microbial conversion of nitrate to nitrous oxide is called. denitrification .
67. Nutrient enrichment of surface waters that leads to over-growth of aquatic weeds, algae, and bacteria is called eutrophication .
68. Nitrogen in the form of nitrate can be readily lost from the soil through leaching.
69. The production of synthetic nitrogen fertilizer by industrial fixation is based on the Haber-Bosch process, in which the gases N_2 and H_2 react to form ammonia (NH_3).
70. Phosphorus is transported to streams and lakes by the processes of runoff and erosion .
71. Taking the gene from one living thing and putting it in another creates a transgenic organism.