CHAPTER 12

MINERAL NUTRITION

MULTIPLE CHOICE QUESTIONS

1. Which one of the following roles is not characteristic of an essential element?
   a. being a component of biomolecules
   b. changing the chemistry of soil
   c. being a structural component of energy related chemical compounds
   d. activation or inhibition of enzymes

2. Which one of the following statements can best explain the term critical concentration of an essential element?
   a. essential element concentration below which plant growth is retarded.
   b. essential element concentration below which plant growth becomes stunted.
   c. essential element concentration above which plant remains in the vegetative phase.
   d. none of the above

3. Deficiency symptoms of an element tend to appear first in young leaves. It indicates that the element is relatively immobile. Which one of the following elemental deficiency would show such symptoms?
   a. sulphur
   b. magnesium
   c. nitrogen
   d. potassium

4. Which one of the following symptoms is not due to manganese toxicity in plants?
   a. Calcium translocation in shoot apex is inhibited

b. Deficiency in both Iron and Nitrogen is induced
c. Appearance of brown spot surrounded by chlorotic veins
d. None of the above

5. Reaction carried out by N_2 fixing microbes include
   a. $2NH_3 + 3O_2 \longrightarrow 2NO_2^- + 2H^+ + 2H_2O$ (i)
   b. $2NO_2^- + O_2 \longrightarrow 2NO_3^-$ (ii)

   Which of the following statements about these equations is not true
   a. step (i) is carried out by *Nitrosomonas* or *Nitrococcus*
   b. step (ii) is carried out by *Nitrobacter*
   c. both steps (i) and (ii) can be called nitrification
   d. bacteria carrying out these steps are usually photoautotrophs

6. With regard to the Biological Nitrogen Fixation by *Rhizobium* in association with soybean, which one of the following statement/ statements does not hold true.
   a. Nitrogenase may require oxygen for its functioning.
   b. Nitrogenase is MO- Fe protein
   c. Leg-hemoglobin is a pink coloured pigment.
   d. Nitrogenase helps to convert N_2 gas into two molecules of ammonia.

7. Match the element with its associated functions/roles and choose the correct option among given below

A.	Boron	i.	splitting of H_2O to liberate O_2 during photosynthesis
B.	Manganese	ii.	needed for synthesis of auxins
C.	Molybdenum	iii.	component of nitrogenase
D.	Zinc	iv.	Pollen germination
E.	Iron	v.	component of ferredoxin

Options
   a. A-i, B-ii, C-iii, D-iv, E-v
   b. A-iv, B-i, C-iii, D-ii, E-v
   c. A-iii, B-ii, C-iv, D-v, E-i
   d. A-ii, B-iii, C-v, D-i, E-iv

8. Plants can be grown in (Tick the incorrect option)
   a. soil with essential nutrients.
   b. water with essential nutrients.
   c. either water or soil with essential nutrients.
   d. water or soil without essential nutrients.

VERY SHORT ANSWER TYPE QUESTIONS

1. Name a plant, which accumulate silicon.
2. Mycorrhiza is a mutualistic association. How do the organisms involved in this association benefit from each other?
3. Nitrogen fixation is shown by prokaryotes and not by eukaryotes. Comment.
4. Carnivorous plants like *Nepenthes* and Venus fly trap have nutritional adaptations. Which nutrient do they especially obtain and from where?
5. Name a plant which lacks chlorophyll. How will it obtain nutrition?
6. Name an insectivorous angiosperm.
7. A farmer adds *Azotobacter* culture to soil before sowing maize. Which mineral element is being replenished?
8. What is the function of leghaemoglobin in the root nodule of a legume?
9. What is common to *Nepenthes*, *Utricularia* and *Drosera* with regard to mode of nutrition?
10. Plants with zinc deficiency show reduced biosynthesis of _____.
11. Yellowish edges appear in leaves deficient in _____ mineral .
12. Name the macronutrient which is a component of all organic compounds but is not obtained from soil.
13. Name one non-symbiotic nitrogen fixing prokaryote.
14. Rice fields produce an important greenhouse gas. Name it.
15. Complete the equation for reductive amination

$$\underline{\quad ? \quad} + NH_4^+ + NADPH \xrightarrow[?]{} \text{glutamate} + H_2O + NADP$$

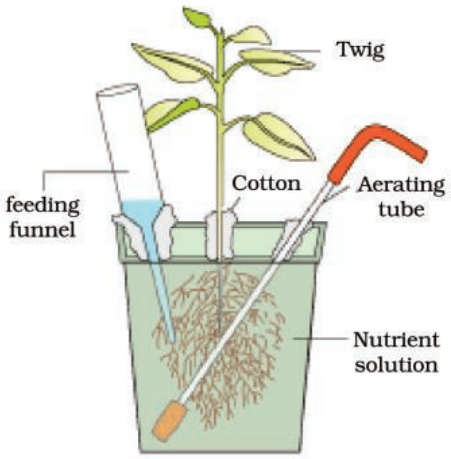
16. Excess of Mn in soil leads to defeciency of Ca, Mg and Fe. Explain.

SHORT ANSWER TYPE QUESTIONS

1. How is sulphur important for plants? Name the aminoacids in which it is present.

2. How are organisms like *Pseudomonas* and *Thiobacillus* of great significance in nitrogen cycle?

3. Carefully observe the following figure



   a. Name the technique shown in the figure and the scientist who demonstrated this technique for the first time.
   b. Name atleast three plants for which this technique can be employed for their commercial production.
   c. What is the significance of aerating tube and feeding funnel in this setup?

4. Name the most crucial enzyme found in root nodules for N_2 fixation? Does it require a special pink coloured pigment for its functioning? Elaborate.

5. How are the terms 'critical concentration' and 'deficient' different from each other in terms of concentration of an essential element in plants? How will you find the values of 'critical concentration' and 'deficient' for minerals – Fe & Zn?

6. Carnivorous plants exhibit nutritional adaptation. Citing an example explain this fact.

7. A farmer adds/ supplies Na, Ca, Mg and Fe regularly to his field and yet he observes that the plants show deficiency of Ca, Mg and Fe. Give a valid reason and suggest a way to help the farmer improve the growth of plants.

LONG ANSWER TYPE QUESTIONS

1. It is observed that deficiency of a particular element showed its symptoms initially in older leaves and then in younger leaves.
   a. Does it indicate that the element is actively mobilized or relatively immobile?
   b. Name two elements which are highly mobile and two which are relatively immobile.
   c. How is the aspect of mobility of elements important to horticulture and agriculture?

2. We find that *Rhizobium* forms nodules on the roots of leguminous plants. Also *Frankia* another microbe forms nitrogen fixing nodules on the roots of non-leguminous plant *Alnus*.
   a. Can we artificially induce the property of nitrogen fixation in a plant – leguminous or non-leguminous?
   b. What kind of relationship is observed between mycorrihiza and pine trees?
   c. Is it necessary for a microbe to be in close association with a plant to provide mineral nutrition? Explain with the help of one example.

3. What are essential elements for plants? Give the criteria of essentiality? How are minerals classifieds depending upon the amount in which they are needed by the plants?

4. With the help of examples describe the classification of essential elements based on the function they perform.

5. We know that plants require nutrients. If we supply these in excess, will it be beneficial to the plants? If yes, how/ If no, why?

6. Trace the events starting from the coming in contact of *Rhizobium* to a leguminous root till nodule formation. Add a note on importance of leg hemoglobin

7. Give the biochemical events occurring in the root nodule of a pulse plant. What is the end product? What is its fate?

8. Hydroponics have been shown to be a successful technique for growing of plants. Yet most of the crops are still grown on land. Why?