Short Answer Type Questions-II

Q. 1. Complete the blank spaces in the table given below :

Minerals	Absorbed in the form of ions	Functions
(i) Zinc	……..	Needed for synthesis of auxins.
(ii) ……	……..	Is central atom in chlorophyll molecule.
(iii) Nitrogen	……..	Major constituent of proteins, vitamins, enzymes & nucleic acids.

Ans. (i) Zn^{2+}

(ii) Mg, Mg^{2+}

(iii) NO_3^-

Q. 2 What do you understand by solution culture ? How is it used to study the mineral requirements of plants.

Ans. Solution culture : It is a method in which plants are grown in solutions.

(i) In this method a set of waterproof earthern vessels or troughs are taken. These are filled with nutrient solution.

(ii) In one vessel, normal nutrient solution is taken while in other, the same nutrient solution minus one of the elements (whose effect you want to study is taken).

(iii) In these seedlings of same size, species are now grown. The growth, appearance and symptoms displayed by the seedlings are then noted.

Q. 3. What is hydroponics ? Give an application of this technique.

Ans. Hydroponics is the technique of growing plants with their roots are immersed in the nutrient solution without soil.

(i) It is useful in areas having infertile and dry soils.

(ii) It is useful to cultivate plants in the areas deficient in one or more nutrient.

Q. 4. In what form do plants absorb phosphorus from the soil ? Name one cell organelle and one organic molecule that require phosphorus in the cell. List any two phosphorus deficiency symptoms in leaves.

Ans. (i) Plants absorb phosphorus from the soil in the form of phosphate ions (either as $H_2PO^-_4$ or as $H_2PO_2^{-4}$).

(ii) Phosphorus is a constituent of cell membrane.

(iii) It is a constituent of nucleic acids, proteins and the nucleotides.

(iv) Two phosphorus deficiency symptoms are :

(a) Delay in seed germination.

(b) Purple spots on the leaves of the plants.

Q. 5. Give the classification of mineral needed by plants on the basis of their diverse function.

Ans. Essential elements are grouped into the following categories on the basis of their functions :

(i) Structural Elements : Carbon (C), hydrogen (H), oxygen (O) and nitrogen (N), sulphur (S), phosphorus (P) and magnesium (Mg).

(ii) Bio-catalytical Elements : They form part of biocatalysts e.g., iron (Fe), copper (Cu), manganese (Mn) and cobalt (Co).

(iii) Indispensable Elements : They are potassium, calcium, boron and molybdenum.

(iv) Stimulating Elements : Sodium, arsenic, titanium, nickel, bromine, rubidium, chlorine, cobalt and iodine are examples of these.

Q. 6. Write one function of sulphur, potassium and iron? [KVS Agra 2016]

Ans. Functions of sulphur, potassium and iron are:

(i) Sulphur : Chlorophyll formation and nodule formation in legumes.

(ii) Potassium : It plays important role in energy transfer and cell division.

(iii) Iron : It is involved in development of chloroplast, chlorophyll and other pigments.

Q. 7. The ammonia that is absorbed by the plants is used to synthesize various amino acids. Explain the main two ways by which this is done. [KVS Silchar 2017]

Ans. At physiological pH, the ammonia is protonated to form NH_4^+ (ammonium) ion while most of the plants can assimilate nitrate as well as ammonium ions, the latter is quite toxic to plants and hence cannot accumulate in them.
There are two main ways by which this can take place :

(i) Reductive amination : In these processes, ammonia reacts with α-ketoglutaric acid and The two most important amides - asparagine and glutamine - found in plants are a structural part of proteins. They are formed from two amino acids, namely aspartic acid and glutamic acid, respectively, by addition of another amino group to each. The hydroxyl part of the acid is replaced by another NH_2-radicle.

Q. 8. What is non-symbiotic N_2 fixation? Give examples of some microorganism. [KVS Guwahati 2016]

Ans. When atmospheric nitrogen fixation takes place by free living bacteria or cyanobacteria without showing any mutual relationship with any other species is called non-symbiotic

nitrogen fixation. E.g. *Azotobacter*, *Anabaena*, *Nostoc*.

Q. 9. (i) Name the enzyme involved in nitrogen fixation by *Rhizobium*.

(ii) Name the pigment seen in root nodules of leguminous plants and explain its role in nitrogen fixation.

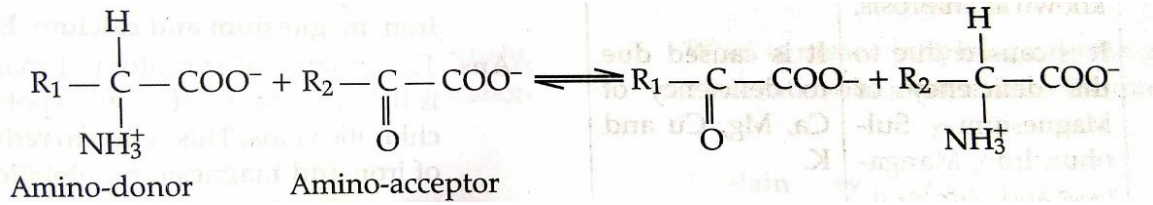
(iii) Explain the two ways by which NH_4^+ is used to synthesise amino acids in plants.
[KVS Mumbai 2016]

forms glutamic acid as indicated in the equation given below:

***a*-ketoglutaric acid + NH_4^+ + NAD**

$$\xrightarrow[\text{Dehydrogenase}]{\text{Glutamate}} \text{Glutamate} + H_2O + \text{NADP}$$

(ii) Transamination: It involves the transfer of amino group from one amino acid to the keto group of a keto acid. Glutamic acid is the main amino acid from which the transfer of NH_2, the amino group takes place and other amino acids are formed through transamination. The enzyme transaminase catalyses all such reactions.
For example,



Ans. (i) Nitrogenase

(ii) Leghaemoglobin : Leghaemoglobin is pinkish pigment found around bacteroides of *Rhizobium* inside the cells of legume roots that protects the nitrogenase from oxygen. Leghaemoglobin absorbs oxygen and thus it creates anaerobic conditions inside the root nodule. The enzyme nitrogenase is functional only under anaerobic conditions.

(iii) Ammonium ion is converted into amino acids by two methods : Reductive amination and Transamination.

Q. 10. What is nitrification Name two nitrifying bacteria of soil.

Ans. Nitrification refers to the phenomenon of conversion of ammonia into NO_2^- (nitrite) and then into NO_3^- (nitrates).
Two nitrifying bacteria are :

(i) *Nitrosomoras*: It converts ammonía (NH_3) into nitrites (NO_2^-).

$2NH_3 + 3O_2 \rightarrow 2H^+ 2H_2O + 2NO_2^-$

(ii) *Nitrobucter* : It converts nitrites into nitrates.

$2NO_2^- + O_2 \rightarrow 2NO_3$

Q. 11. What do you understand by reduction of nitrite?

Ans. (i) Reduction of nitrite to ammonia is carried out by an enzyme called nitrite reductase.

(ii) This enzyme does not contain molybdenum but requires copper and iron as activators. It requires a reducing power, which is NADPH.

(iii) The process of reduction also requires ferredoxin which occurs in the higher plants mostly in the leaves and hence this step is carried out in the leaves.

Q. 12. In the root nodules of leguminous plants, what is the role of nitrogenase and leghaemoglobin?

Ans. (i) The enzyme nitrogenase in root nodules of legume plants catalyses the conversion of atmospheric N_2 to ammonia (NH_3).

$N_2 + 8e^- + 8H^+ + 16ATP \rightarrow 2NH_3 + H_2 + 16ADP + 16Pi$

(Nitrogen) (Ammonia)

(ii) Leghaemoglobin is an oxygen scavenger. It protects nitrogenase from oxygen.

Q. 13. Differentiate between: (i) Chlorosis and Necrosis, (ii) Mottling and Interveinal chlorosis, (iii) Haemoglobin and Leghaemoglobin.

Ans. (i)

S. No.	Chlorosis	Necrosis
(i)	The yellowing of leaves due to reduction of chlorophyll content in a green part is known as chlorosis.	The death of a cell or a group of cells in a living plant is known as necrosis.
(ii)	It is caused due to the deficiency of Magnesium, Sulphur, Iron, Manganese and Nitrogen.	It is caused due to deficiency of Ca, Mg, Cu and K.

(ii)

S.No.	Mottling	Interveinal chlorosis
(i)	It is the patchy appearance of green and non-green areas of a leaf.	The yellowing of leaf between the veins is called interveinal chlorosis.
(ii)	It is caused due to the deficiency of zinc and molybdenum.	It is caused due to the deficiency of iron and molybdenum.

(iii)

S.No.	Haemoglobin	Leghaemoglobin
(i)	It is found in animals.	It is found in root nodules of leguminous plants.
(ii)	It is bright red in colour.	It is reddish pink in colour.

(iii)	It acts as an oxygen carrier.	It acts as an oxygen scavenger.
(iv)	It transports oxygen in the bodies of animals.	It protects the enzyme nitrogenase.

Q. 14. Describe the process of progressive reduction of one molecule of nitrogen during fixation in leguminous plants.

Ans. Process of progressive reduction of one molecule of nitrogen during fixation in leguminous plants:

(i) The nodules are the sites of nitrogen fixation in leguminous plants. Nodules contain leghaemoglobin (Lb) and the enzymenitrogenase.

(ii) Leghaemoglobin is a pink colour pigment similar to haemoglobin of vertebrates and functions as an oxygen-scavenger and protects the nitrogenase from oxygen.

(iii) During this process, a dinitrogen ($N \equiv N$) molecule is reduced by the addition of hydrogen atoms into two molecules of ammonia catalysed by the nitrogenase enzyme.

(iv) It requires (a) a strong reducing agent, (b) energy in the form of ATP to transfer the hydrogen atom and (c) the enzyme systems. The reaction is as follows:

$N_2 + 8e^- + 8H^+ + 16\ ATP \rightarrow 2NH_3 + H_2 + 16\ ADP + 16\ Pi$

Q. 15. The toxicity symptoms of manganese are actually the combined deficiency symptoms of iron, magnesium and calcium. Explain.

Ans. The prominent symptom of manganese toxicity is the appearance of brown spots surrounded by chlorotic veins. This is due to reduction in uptake of iron and magnesium, inhibition of binding of magnesium to specific enzymes and inhibition of calcium translocation in shoot apex. Therefore, excess of manganese causes deficiency of iron, magnesium and calcium. Thus the toxicity symptoms of Mn are actually the combined deficiency symptoms of Fe, Mg and Ca.

Q. 16. Describe two important functions of each of the element P Fe and Zn in green plants. Mention deficiency symptoms of any two of these elements.

Ans. Phosphorus (P) : It forms the constituent of cell membrane protein, nucleic acids, ATP, NADP and energy rich compounds. **Deficiency symptoms :** It causes poor growth, leaves become dull green and chlorosis occurs. **Iron (Fe):** It helps in the synthesis cytochrome and ferredoxin. It activates enzyme catalase. **Deficiency symptoms :** It results in chlorosis. **Zine (Zn) :** It activates enzyme synthesis. It is a constituent of carbonic anhydrase. This is a also cnstituent of dehydrogenase. **Deficiency symptoms :** Leaves are not properly formed.