MINERAL NUTRITION

BIOLOGY

Single Correct Answer Type

1. Enzyme nitrogenase is responsible for
   a) Nitrification b) Nitrogen fixation c) Nitrite reduction d) Nitrate reduction
2. Nitrifying bacteria
   a) Liberate ammonia b) Change ammonia into ionic form
   c) Oxidise ammonia to nitrate d) Oxidise ammonia to nitrite
3. Plants growing near the nuclear test sites take up and accumulate which of the following elements?
   a) Gold b) Selenium c) Strontium d) All of these
4. Name the minerals responsible for maintaining cation-anion balance in the plant cells
   a) K^+ and Fe^{+3} b) Cl^- and K^+ c) Ca^{+2} and Mg^{+2} d) Cl^- and Mg^{+2}
5. What is the major function of air stone?
   a) Remove CO_2 content from the nutrient solution b) Dissolves O_2 in the nutrient solution
   c) Increases the level of N_2 in the nutrient solutions d) Removes O_2 from the nutrient solution
6. In hydroponic vegetables, the pH preferred by most vegetable is slightly
   a) Alkaline b) Neutral c) Acidic d) Basic
7. Which of the following are considered as the roles of iron (Fe) in plants?
   I. Important constituent of cytochrome
   II. Activator of catalase
   III. Essential for chlorophyll synthesis
   Choose the correct option
   a) Only I b) Only III c) Only II d) All of these
8. By applying which of the following practices, contamination of hydroponics plants can be reduced?
   a) Change the medium every week b) Do not use tools from the outdoor garden
   c) Complete aeration in hydroponic tank d) All of the above
9. An essential element is that which
   a) Improves health of the plant b) Is irreplaceable and indispensable for growth of plants
   c) Is found in plant ash d) Is available in the soil
10. Essential elements perform many functions which includes
    I. Permeability of the cell membrane
    II. Maintenance of osmotic concentration of the cell sap
    III. Major constituents of macromolecules and coenzymes
    IV. Buffering action
    Choose the correct option
    a) Only III b) I and III c) Only I d) I, II and III
11. Which of the following metals causes harmful effects?
    a) Lead b) Cobalt c) Uranium d) All of these
12. Nitrogen is mainly absorbed in the form of
    a) Nitrate b) Nitrite c) Ammonium d) All of these
13. In the initial phase of minerals absorption ions are taken up
    a) Slowly b) Rapidly c) Fluently d) Simultaneously
14. Which of the following is true regarding manganese toxicity in plants?
    a) Induction deficiencies of iron, magnesium and calcium

b) Appearance of brown spots surrounded by chlorotic veins
c) Inhibition of Ca^{2+} ions translocation in the shoot apex
d) All of the above

15. Sulphur is found as a constituent in which of the following amino acids?
a) Cysteine b) Methionine c) Both (a) and (b) d) None of above

16. What is the key principle of the EBB and flow system in hydroponics?
a) It floods and drains periodically
b) It makes a tide flowing over the roots
c) It sprays a mist of nutrients on the roots
d) None of the above

17. Hydroponics has been successfully employed as a technique for which of the following vegetables?
a) Seedless cucumber b) Tomato c) Lettuce d) All of these

18. For the uptake of ions in the second phase of absorption of minerals, the pathway followed is called
a) Passive uptake b) Active uptake c) Neutral d) None of these

19. How many essential mineral elements have been discovered yet?
a) 17 b) 107 c) 110 d) 150

20. Which of the following is a rootless aquatic plant in which a portion of the leaf forms a tiny sac for trapping insects?
a) Nepenthes b) Drosera c) Utricularia d) Dionaea

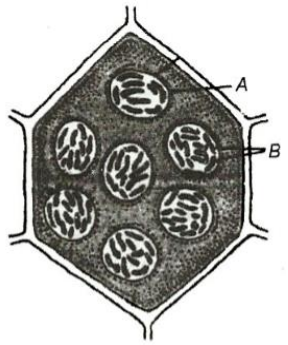
21. Which of the given options are correct for hydroponics? Select the correct pair
I. Hydroponics technique is useful in areas having infertile and dry soils
II. Hydroponics can regulate pH optimum for a particular crop
III. It increases the labour cost
IV. It increases the problem of weeding
a) I and IV b) I and II c) I and III d) Only I

22. Phosphorus is absorbed by the plants as
I. $H_2PO_4^-$ II. HPO_4
III. HPO_4^{2-} IV. H_2PO^-
a) Only I b) Only III c) I and III d) Only II

23. Insectivorous plants eats the insect for
a) Na-K b) Nitrogen c) Chlorine d) Phosphorus

24. Aeroponics are
a) Aerial plants b) Aerated plants
c) Soilers cultivated plants d) None of these

25. Given diagram belongs to bacteroids in nodule. Identify A and B and choose the correct option accordingly



a) A-Bacteria; B-Bacteroids b) A-Leghaemoglobin; B-Bacteroides
c) A-Bacteroids; B-Bacteria d) A-Bacteroids; B-Leghaemoglobin

26. Insectivorous plants eats insects for their requirement of
a) Sodium-potassium b) Nitrogen c) Chlorine d) Phosphorus

27. Molybdenum is the essential constituent of
a) Nitrogenase b) Respiratory chain c) Growth regulators d) Chlorophyll

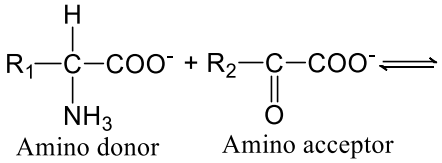
28. Select the correct statement.
    a) Legumes are incapable of fixing nitrogen
    b) Legumes fix nitrogen through bacteria living in fruits
    c) Legumes fix nitrogen only by bacteria present in root nodules
    d) None of the above
29. Which among the following are used as media for hydroponics?
    a) Coco air b) Rock cool c) Gravel d) All of these
30. The core metal of chlorophyll is
    a) Fe b) Mg c) Ni d) Cu
31. Identify the elements which functions as the components of biomolecules
    I. Hydrogen II. Magnesium
    III. Oxygen IV. Nitrogen
    a) Only IV b) Only II c) I, II, III and IV d) All except II
32. Potassium is required by which of the following regions of plants
    I. Meristematic tissues II. Buds
    III. Leaves IV. Root tips
    a) Only I b) I and IV c) II and IV d) All of these
33. In root nodules of legumes, leghaemoglobin is important because it
    a) Transports oxygen to the root nodule
    b) Acts as an oxygen scavenger
    c) Provides energy to the nitrogen fixing bacterium
    d) Acts as a catalyst in transamination
34. The number of essential elements known for the growth and reproduction of plants is
    a) 27 b) 15 c) 17 d) 9
35. Which of the following minerals activate the enzymes involved in respiration?
    a) Nitrogen and phosphorus b) Magnesium and manganese
    c) Potassium and calcium d) Suluur and iron
36. Which of the following is not caused by deficiency of mineral?
    a) Chlorosis b) Etiolation
    c) Shortening of intermodes d) Necrosis
37. Crop rotation is used by farmers to increase
    a) Soil fertility b) Community area
    c) Organic content of soil d) Nitrogenous content in the soil
38. The enzyme responsible for the reduction of molecular nitrogen to the level of ammonia in leguminous root nodule is
    a) Nitrogenase b) Nitrate reductase c) Nitrite reductase d) hydrogenase
39. Soil is able to maintain a regular supply of minerals by the help of which of the following?
    I. Slow vegetation
    II. Activity of decomposers
    III. Soil erosion
    IV. Weathering of rocks
    a) Only IV b) Only I c) IV and II d) All of the above
40. Select the match ones.
    I Nitrosomonas – Nitrite to nitrate
    II Thiobacillus - Denitrification
    III Nostoc - Free-living nitrogen-fixer
    IV Azotobacter - Anaerobic nitrogen-fixer
    a) I and II b) III and IV c) II and III d) II and IV

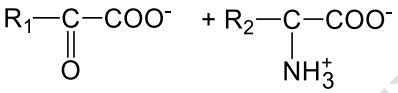
41. Which of the following option shows correct co-relation between column I, II and III?

Column I	Column II	Column III
A. Calcium	I. Required for ionic balance	(i)Grey blot on leaves
B. Boron	II. Essential for constitution of nucleic acid	(ii)Fruit-yield decreases
C. Phosphorus	III. Required for absorption of calcium	(iii)Red blot on leaves
D. Chlorine	IV. Required to active respiratory enzyme	(iv)Fruit-size diminishes
E. Manganese	V. Required for synthesis of mitotic spindle	(v)Young root tip begin to die

a) A-V-v, B-IV-iv, C-III-I, D-II-iii, E-I-ii
b) A-V-v, B-III-iii, C-II-iii, D-I-ii, E-IV-i
c) A-I-iv, B-II-v, C-III-iii, D-IV-I, E-V-ii
d) A-IV-iii, B-I-iv, C-V-v, D-III-ii, E-II-i

42. What does the given reaction shows?





Choose the correct option
a) Oxidative deamination
b) Reductive amination
c) Transamination
d) Deamination

43. In hydroponics, chelating agent is used to
a) Chelate metals
b) Provide nutrition
c) Provide non-stream conditions
d) All of the above

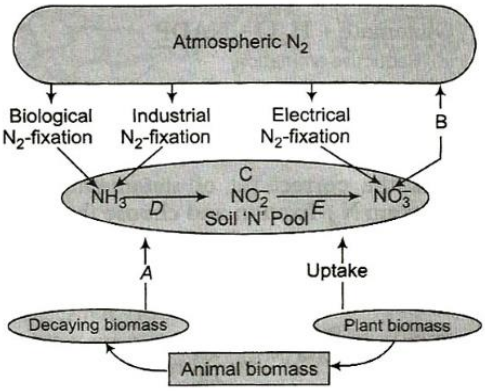
44. The term 'outer space' represents …A…, while 'inner space' represents …B… with reference to absorption of minerals
Identify A and B to complete the given statement
a) A-cytoplasm and vacuole, B-intercellular space and cell
b) A- intercellular space and cell wall, B- cytoplasm and vacuole
c) A-cytoplasm, B-vacuole
d) A-intercellular space, B-vacuole

45. Hydroponic tomatoes may not taste so fresh. Why?
a) The tomatoes are really potatoes in disguise
b) The tomatoes are supposed to be green and sour, it makes them healthier for humans
c) They are picked too soon
d) They are not picked soon enough

46. Which of the following is used as a chelating agent in hydroponics?
a) EDTA
b) Iron
c) Nitrogen
d) Copper

47. Identify the labels in the given flow diagram which links the major nitrogen pools

Choose the correct combination from the options given below



a) A-Nitrification, B-Ammonification, C-*Nitrobacter*, D-*Nitrosomonas*
b) A-Ammonification, B-Denitrification, C-Nitrification, D-*Nitrosomonas*, E-*Nitrobacter*
c) A-Denitrification, B-*Nitrobacter,* C-Nitrification, D-*Nitrosomonas,* E-Ammonification
d) A-*Nitrobacter,* B-Denitrification, C-*Nitrosomonas,* D-Ammonification

48. Sulphur is an important nutrient for optimum growth and productivity in
a) Pulse crops b) Cereals c) Fibre crops d) Oilseed crops

49. Which of the following are reservoirs for phosphorus and nitrogen cycle respectively?
a) Atmosphere and bedrocks b) Bedrocks and atmosphere
c) Consumers d) Atmosphere and producers

50. The organ in *Viscum* that absorb nutrients is known
a) Haustoria b) Rhizophore c) Roots d) None of these

51. Insectivorous plants live in a soil that is usually deficient in
a) Nitrate b) Chloride c) Potassium d) Magnesium

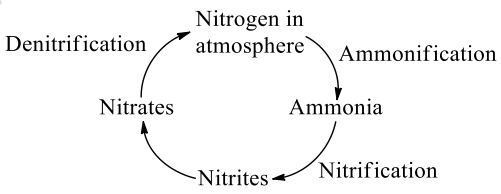
52. Humans is essential for plant growth because
a) It is rich in nutrients and increases the water holding capacity of soil
b) It increases aeration of soil
c) It increases porocity of soil
d) All of the above

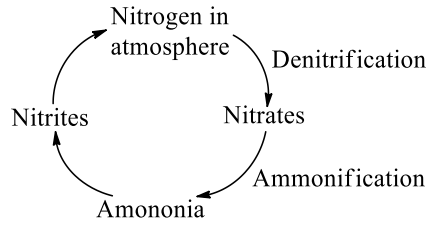
53. Read the functions given below and identify the concerned nutrient
I. Activator of catalase
II. Important constituent of cytochrome
III. Important constituent of proteins involved in ETS
IV. Essential for chlorophyll synthesis
a) Mo b) Fe c) Cu d) Ca

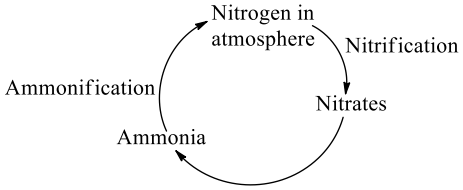
54. Nitrogen is present in the soil in the form of
I. Nitrates II. Ammonical salts
II. Nitrite IV. None of these
a) Only I b) Only III c) I and II d) Only IV

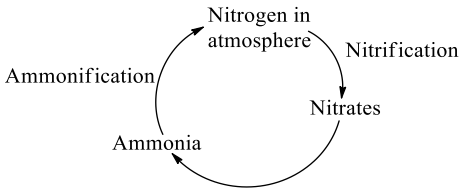
55. Which of the following diagram correctly depicts N_2-cycle?

a)



b) 

c) 

d) 

56. The deficiencies of micronutrients not only affects growth of plants but also vital functions, such as photosynthetic and mitochondrial electron flow. Among the list given below, which group of three elements shall affect most, both photosynthetic and mitochondrial electron transport?
a) Cu, Mn and Fe b) Co, Ni and Mo c) Mn, Co and Ca d) Ca, K and Na
57. Which of the following is a bacterium involved in denitrification?
a) Nitrococcus b) Nitosomonas c) Pseudomonas d) Nitrobacter
58. The major role of minor elements inside living organisms is to act as
a) Constituents b) Binder of cell structure
c) Cofactors of enzymes d) Building blocks of important amino acids
59. Which of the following is one of the component of ATP?
a) Potassium b) Phosphorus c) Magnesium d) Manganese
60. Hydroponics is a technique of growing plants in a
a) Soil solution b) Nutrient solution c) Both (a) and (b) d) None of the above
61. Which of the following is an example of nutrient in its reduced form?
a) Hydrogen in H_2O b) Carbon in CO_2 c) Nitrogen in NH_3 d) Sulphur in SO_2
62. The source of energy for non-biological nitrogen fixation is
a) By ionizing events such as lightning and effect of cosmic rays
b) Ferredoxin enzyme and nitrogenase
c) By reduction of proteins to ammonia
d) By oxidation of ammonia to protein
63. What effect can be seen on the plant growth and reproduction in the absence of essential mineral element?
a) Plants will complete their life cycle normally
b) Plants will complete their life cycle
c) There will be no effect on the normal growth but reproduction in plants will suffer
d) Only growth will get effected not the reproduction
64. 'mottled chlorosis' on the leaves occurs due to the deficiency of
a) Nitrogen b) Phosphorus c) Potassium d) Sulphur
65. Maximum percentage of which element occurs in plant ash?
a) Magnesium b) Zinc c) Potassium d) Calcium
66. Which one of the following is an amide involved in nitrogen assimilitaion by plants?
a) Glutamate b) Alanine c) Asparagine d) Serine
67. Which of the following is considered as partial mineral elements in plants?
a) Potassium b) Phosphorus c) Nitrogen d) Iron

68. Hydroponics is the growth of plants in
a) Pure water b) Air
c) Water containing essential nutrients d) Soil
69. The major characteristics of colloids is/are
a) Charged surface b) Large surface area c) Brittle d) Both (a) and (c)
70. The enzyme responsible for the reduction of molecular nitrogen to the level of ammonia in the leguminous root nodules is
a) Amminase b) Nitrogenase c) Nitrate reductase d) Nitrite reductase
71. Mark the statements as true/ false by choosing the correct option from the set (I-IV) given below
I. Magnesium is a constituent of chlorophyll and helps to maintain the ribosome structure
II. Calcium is needed during the formation of mitotic spindle
III. Magnesium is essential for the photolysis of water
IV. Zinc helps in sugar translocation
a) I-True, II-True, III-False, IV-False b) I-False, II-True, III-False, IV-True
c) I-True, II-False, III-True, IV-False d) I-False, II-False, III-True, IV-True
72. Free living nitrogen fixing bacteria are
a) *Bacillus polymixa* b) *Rhodoseudomonas* c) *E. coli* d) *Anabaena*
73. In case of *Nitella*, H_2O, O_2, CO_2 and Na follows
a) Passive diffusion b) Facilitated diffusion
c) Mass flow d) Ionic exchange
74. Name the essential element that is considered as the component of energy related to chemical compound like chlorophyll
a) Magnesium b) Phosphorus c) Manganese d) Potassium
75. What is the correct unit for measuring nutrients in hydroponics nutrient solution?
a) Parts per million b) Parts per thousand c) Parts per trillion d) Parts per gazillion
76. Which of the following reaction shows nitrogen fixation?
a) $2NH_4 + 2O_2 + 8e^- \rightarrow N_2 + 4H_2O$ b) $2NH_3 \rightarrow N_2 + 3H_2$
c) $N_2 + 4H_2 \rightarrow 2NH_3$ d) $2N_2 + \text{Glucose} \rightarrow 2$ Amino acids
77. For the limited nitrogen that is present in the soil, microbes compete with
a) Animals b) Plants c) Both (a) and (b) d) None of these
78. Julius Von Sachs, who demonstrated hydroponics for the first time, was a German
a) Zoologist b) Mathematician c) Botanist d) Physicist
79. Farmers in a particular region were concentrated that pre-mature yellowing of leaves of a pulse crop might cause decrease in the yield. Which treatment could be most beneficial to obtain maximum seed yield?
a) Frequent irrigation of the crop
b) Treatment of the plants with cytokinins along with a small dose of nitrogenous fertilizer
c) Removal of all yellow leaves and spraying the remaining green leaves with 2, 4,5-trichlorophenoxy acetic acid
d) Application of iron and magnesium to promote synthesis of chlorophyll
80. In the hydroponics plant production technique, in order to obtain the optimum growth, nutrient solutions must be
a) Poorly aerated b) Adequately aerated
c) Diluted d) None of these
81. Based on the quantitative requirement of elements by the plants, these elements are called
a) Macronutrients b) Micronutrients c) Both (a) and (b) d) None of these
82. The number of essential nutrients needed in plants is
a) 16 b) 5 c) 4 d) 8
83. One of the following is called pitcher plant

a) *Nepenthes* b) *Aristolochia* c) *Drosera* d) *Uticularia*

84. Minerals involved in redox reactions in plant cells are
a) N, Cu b) Fe, Cu c) Ca, Fe d) Na, Cu

85. The conversion of nitrate to nitrogen is called
a) Nitrification b) Denitrification c) Ammonification d) Nitrogen fixation

86. Enzyme required for nitrogen fixation is
a) Nitrogenase b) Nitroreductase c) transaminase d) Transferase

87. For the proper management of diseased conditions in hydroponics, it is important to
a) Change and replace the nutrient solution daily
b) Change and replace the media daily
c) Remove dead leaves from the media daily
d) Both (a) and (b)

88. Which of the following statements are not correct in reference to hydroponics?
I. It determines the mineral nutrients essential for the plants
II. The hydroponics involves the culture of plants in a soil with, defined mineral solution
III. Hydroponics requires purified water with non-defined mineral nutrient salts
IV. In the hydroponics technique, plants are grown in sandy soil with nutrient solution
V. By this method, essential elements required for the growth of plants can be identified and their deficiency symptoms can also be discovered
Choose the correct options
a) Only IV b) Only V c) Only III d) None of these

89. Quantity of macronutrients that is generally found in plant is
a) Very small b) Large c) Varying d) None of these

90. Who proved for the first time that the plants contain a large number of minerals and microelements?
a) De Saussure (1804) b) Leibeg (1840)
c) Glauber and Mayhon (1650) d) Arnon and Stout (1939)

91. $N_2 + 8e^- + 8H^+ + 16ATP \rightarrow 2NH_3 + 2H^+ + 16ADP + 16Pi$
The above equation refers to
a) Ammonification b) Nitrification
c) Nitrogen fixation d) Denitrification

92. The optimum temperature preferred for the plant growth is
a) Less than 15°C b) Between 15°C and 30°C
c) Less than 10°C d) More than 30°C

93. Which of the following elements is not an essential micronutrient for plant growth?
a) Mn b) Zn c) Ni d) Ca

94. Which of the following gene is responsible for biological nitrogen fixation?
a) Nitrogenase b) *Nif* gene
c) Yeast alanine tRNA synthetase d) RNA synthetase

95. Hydroponics are of three types ...A..., a film system and ...B...
Choose the correct pair from the option given below
a) A-*in vitro*; B-tube system b) A-tube system; B-tank system
c) A-tank system; B-aeroponics d) A-plant tissue culture; B-tube system

96. Deficiency of which to the following can cause yellowing of intravenous regions of leaves?
a) Calcium b) Potassium c) Copper d) Phosphorus

97. The technique of growing plants in a nutrient solution in the complete absence of soil is called
a) Plant tissue culture b) Hydroponics c) Both (a) and (b) d) None of these

98. Who demonstrated the concept of hydroponics for the first time?
a) Hewitt b) Julius von Sachs c) Dalton d) None of these

99. Appearance of yellowish edges in the leaves is due to deficiency of
a) Calcium b) Magnesium c) Phosphorus d) Potassium

100. VAM is
a) Ectomycorrhizae b) Endomycorrhizae
c) Both (a) and (b) d) Ectoendomycorrhizae

101. Nitrogen is required mainly by which of the following parts of the plants?
I. Meristematic tissues
II. Differentiating tissues
III. Apical tissues
IV. Metabolically active cell
Choose the correct option
a) Only II b) Only I c) I and II d) I and IV

102. Choose the correct options
a) Amides are the transported forms of nitrogen as they have more nitrogen
b) Legumes of tropical origin (*e. g.*, soyabean) transport ureides
The host produces globin part and bacterial
c) symbiont produces heam part of leghaemoglobin (N_2-fixing pigment)
d) All of the above

103. Macronutrients like carbon, hydrogen and oxygen are obtained mainly from
a) CO_2 b) H_2O c) Both (a) and (b) d) Soil

104. For a seed to germinate, the most important thing needed is
a) Phosphate fertiliser b) Nitrogen
c) Water d) None of these

105. The entry and exit of ions to and from the symplast requires the expenditure of
a) Photosynthetic energy
b) Metabolic energy
c) Energy derived from ions
d) Zero amount of energy

106. A plant requires magnesium for
a) Holding cells together b) Protein synthesis
c) Chlorophyll synthesis d) Cell wall development

107. Which element is required for the germination of pollen grains?
a) Boron b) Calcium c) Chlorine d) Potassium

108. The area around the plant roots is called
a) Phyllosphere b) Rhizoplane c) Both (a) and (b) d) None of these

109. Mg^{2+} is an activator of
I. alcohol dehydrogenase
II. nitrogenase
III. ribulose bisphosphate carboxylase oxygenase
IV. phosphoenol pyruvate carboxylase
Choose the correct option
a) Only III b) Only I c) Only IV d) III and IV

110. The ultimate source of nitrogen is
a) Atmospheric nitrogen
b) Nitrogen present in soil
c) Nitrogen that comes from water
d) Nitrogen fixed by the process of photosynthesis

111. Select from the given options, which is the most commonly obtained commercial flower crop in hydroponics?
a) Daisy b) Rose c) Lily d) Carnation

112. Which one of the following elements in plants is not remobilised?
a) Calcium b) Potassium c) Sulphur d) Phosphorus
113. The plant ash indicates
a) Organic matter of plant
b) Mineral salts absorbed by plants
c) Both mineral salts and organic matter
d) Silica absorbed by plants
114. The full form of CEA is
a) Common Environment Analysis
b) Centrally Expanded Atmosphere
c) Controlled Environment Agriculture
d) Commercial Expansion Advancement
115. In the final phase of mineral absorption, ions are taken up into the …… space of cells
a) Outer
b) Inner
c) Extra inner membrane
d) None of these
116. Major disadvantages of hydroponics include
a) Expense to set up
b) High technical knowledge
c) Both (a) and (b)
d) None of the above
117. The nutrient solution in flowering culture hydroponics
a) Is constantly recycled using a pump
b) Flows back into the loam soil in which the plant grows
c) Drains into a bucket for disposal
d) None of the above
118. Which of the following elements can be considered as macronutrients for plants?
a) Zinc b) Boron c) Nickel d) Phosphorus
119. The process of decay of dead organic matter is known as
a) Denitrification b) Nitrification c) Nitrogen fixation d) Ammonification
120. Nitrogen is absorbed by the plants in the form of
a) NO_3^- b) NH_4^+ c) Both (a) and (b) d) None of these
121. Grey spots of oat are caused by deficiency of
a) Mangenese b) Iron c) Copper d) Zinc
122. A nutritionally wild type organism, which does not require any additional growth supplement is known as
a) Phenotype b) Holotype c) Auxotroph d) Prototroph
123. Which of the following elements is considered as beneficial elements in higher plants?
a) Sodium and iron b) Silicon and potassium c) Cobalt and selenium d) All of these
124. Which of the following is limiting nutrient for both natural and agricultural ecosystems?
a) Nitrogen oxides b) Nitrogen c) Ammonia d) Hydrogen
125. Plant deficient of element zinc, shows its effects on the biosynthesis of plant growth hormone
a) Ethylene b) Abscisic acid c) Auxin d) Cytokinin
126. Julius Von Sachs, who demonstrated hydroponics first, was from
a) Germany b) Greece c) Egypt d) United States
127. Which of the following is not considered as a trace element (micronutrient) in the plant?
a) Mo O_2^{-2} b) Cu^{+2} c) Mn^{+2} d) K^+
128. Maximum amount of macronutrients that are generally present in plant tissue is
a) 10.5 m mole kg^{-1} of dry matter
b) 9.5 m mole kg^{-1} of dry matter
c) 1.0 m mole kg^{-1} of dry matter
d) 10 m mole kg^{-1} of dry matter
129. Which of the following shows the deficiency symptoms of nitrogen in plants?
a) Delaying of flowering
b) Inhibits protein synthesis

c) Inhibition of chloroplast formation
d) Dormancy of lateral buds

130. Which of the following is a macronutrient?
a) Molybdenum b) Calcium c) Zinc d) Manganese

131. Which of the following statements are correct about mineral absorption in plants?
a) In the initial phase, ions are taken up into the outer space of cells, the apoplast. It is a passive process
b) In the final phase, ions are taken slowly into the inner space, the symplast of cells and it is an active process
c) Passive movement of the ions into the apoplast occurs through ion channels, transmembrane proteins, which acts as selective pores
d) All of the above

132. For the uptake of ions in the first phase of absorption of minerals, the pathway followed is called
a) Active uptake b) Passive uptake c) Neutral d) None of these

133. Necrosis is the term used for the
a) Falling of leaves
b) Delay in flowering
c) Death of plant tissues
d) Inhibition of cell division in plants

134. Monovalent ions ($e.g.$, Na^+, K^+) …A… the membrane permeability while, the divalents ions (Ca^{2+}) …B… the same
Complete the given statement by filling appropriate option in the given below (A and B)
a) Decrease; increase b) Increase; increase c) Decrease; decrease d) Increase; decrease

135. *Cuscuta* is a
a) Parasitic plant b) Symbiotic plant c) Predator d) Decomposer

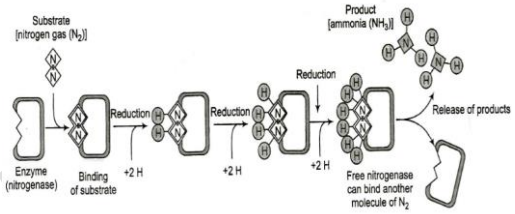
136. Which form of nitrogen enters in the plants
a) Free form b) Fixed form c) Reduced form d) Oxidised form

137. Manganese is required in
a) Nucleic acid synthesis
b) Plant cell wall information
c) Photolysis of water during photosynthesis
d) Chlorophyll synthesis

138. Nitrite is coverted to nitrate by
a) *Nitrosomonas* b) *Nitrobacter* c) *Pseudomonas* d) *Clostridium*

139. Molybdenum causes
a) Mottling b) Wilting c) Reclamation d) Chlorosis

140. Pick the correct set of statements for the given diagram N_2-fixation and choose the correct option accordingly



I. Nitrogenase catalyses the reaction
II. The formation of ammonia is a reductive process
III. One molecule of nitrogen produces two molecules of ammonia
IV. Nitrate reductase catalyse the reaction
V. Formation of ammonia is an oxidative reductive process
VI. One molecule of nitrogen produces one molecule of ammonia
Which is the correct option?
a) I, II and III
b) IV, V and VI

c) I, V and VI
d) III, IV and V

141. Nitrogen is a constituent of
a) Chlorophyll
b) Hormones
c) Vitamins and amino acids
d) All of these

142. Necrosis or death if tissue particularly leaf tissue, is due to the deficiency of
a) N, K, and S
b) N, K, Mg and Fe
c) Mn, Zn and Mo
d) Ca, Mg, Cu and K

143. The function of leghaemoglobin during biological nitrogen fixation in root nodules of legumes is to
a) Convert atmospheric nitrogen to ammonia
b) Convert ammonia to nitrite
c) Transport oxygen for activity of nitrogenase
d) Protect nitrogenase from oxygen

144. The macronutrient which is an essential component of all organic compounds, yet not obtained by plants from soil is
a) Nitrogen
b) Carbon
c) Phosphorus
d) Magnesium

145. The process of transfer of amino group from one amino acid to the keto group of a keto acid is called
a) Oxidative amination
b) Reductive amination
c) Transamination
d) Deamination

146. Name the fungus that helps in N_2-fixation
a) *Rhizopus*
b) *Albugo*
c) *Puccinia*
d) *Pullularia*

147. What is the correct order of nitrogen assimilation?
a) $N_2 \rightarrow NO_2 \rightarrow NO_3 \rightarrow NH_2OH \rightarrow NH_3$
b) $N_2 \rightarrow NO_3 \rightarrow NO_2 \rightarrow NH_2OH \rightarrow NH_3$
c) $N_2 \rightarrow NO_2 \rightarrow NO_3 \rightarrow NH_3 \rightarrow NH_2OH$
d) $N_2 \rightarrow NO_3 \rightarrow NO_2 \rightarrow NH_3 \rightarrow NH_2OH$

148. Nitrification is the process of conversion of
a) Ammonia
b) Nitrite
c) Nitrate
d) All of these

149. Which of the following is a nitrogen-fixing organism?
a) BGA
b) *Rhizobium*
c) Both (A) and (B)
d) *Aspergillus*

150. Media, which is used most commonly in hydroponics is
a) Loam and clay
b) Only clay
c) Sand and soil
d) Perlite and vermiculite

151. Which of the following gene clusters in bacteria is responsible for nitrogen fixtion?
a) *Nod, nif, fix*
b) *Nod, ndf, nfx*
c) *Nod, nix, nfx*
d) *Ndx, nif, fix*

152. *Anabaena*, which is extensively used in rice cultivation, forms symbiotic association with
a) *Cycas* roots
b) *Azolla*
c) *Anthoceros*
d) *Alnus*

153. Nitrates are converted into nitrogen by
a) Nitrogen fixing bacteria
b) Sulphur fixing bacteria
c) Denitrifying bacteria
d) None of the above

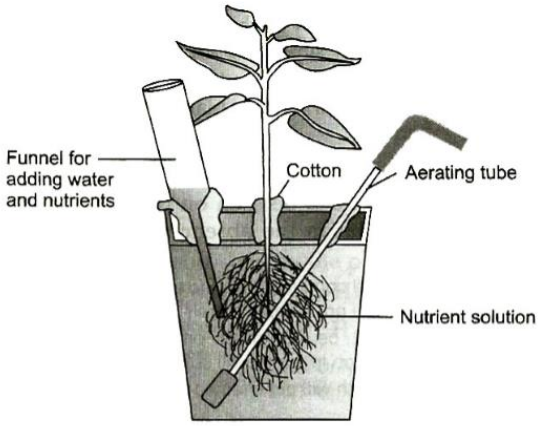
154. The appearance of yellow edges in leaves is due to the deficiency of this mineral element.
a) Calcium
b) Magnesium
c) Potassium
d) Sulphur

155. Minerals are absorbed by plants in
a) Colloidal form
b) ionic form
c) Precipitated form
d) None of these

156. Which of the following is not an insectivorous plant?
a) Drosera
b) Nepenthes
c) Monotropa
d) Utricularia

157. An element playing important role in nitrogen fixation is
a) Molybdenum
b) Copper
c) Manganese
d) Zinc

158. What does the given experimental set-up to depicts?



Choose the correct option accordingly

a) O_2 evolves during photosynthesis
b) CO_2 is required during photosynthesis
c) Measurement of the growth of a plant
d) Nutrient solution culture

159. The following reaction represents

$$\alpha\text{-ketogulataric acid} + NH_4^+ + NADPH \xrightarrow[\text{dehydrogenose}]{\text{Glutamate}} \text{Glutamate} + H_2O + NADP$$

a) Reductive amination b) Transamination c) Amination d) Nitrification

160. Copper is present in

a) Plasmalemma b) Plastoquinone c) Plastocyanin d) Ferredoxin

161. Which of the following is used as an alternative for minerals?

a) Rubber b) Polythene c) Decron d) Cement

162. The function of leghaemoglobin in the root nodules of legumes is

a) Oxygen removal
b) Nodule differentiation
c) Expression of *nif* gene
d) Inhibibition of nitrogenase activity

163. The molecular nitrogen is correctly termed as

a) Trinitrogen b) Nitrogen c) Dinitrogen d) Nitrogen oxide

164. The deficiency of this micronutrient results in little leaf disease.

a) Copper b) Zinc c) Boron d) Iron

165. Zn, Mo, Fe, Cu are

a) Trace elements b) Non-essentials c) Macronutrients d) None of these

166. Name the technique used by researchers to explore the plant nutrient deficiencies

a) Sun exposure
b) Hyperbasic chambers
c) Crop rotation
d) Hydroponics

167. Bacteria and fungi developing on dead decaying organisms are

a) Parasites b) Commensals c) Saprophytes d) Symbionts

168. Name the elements, which occur in nucleic acid macromolecule?

a) C, H, O, N, S b) C, O, N, S c) C, O, P, S d) C, H, O, N, P

169. Enzymes involved in nitrogen metabolism is

a) Phosphoenol pyruvate carboxylase
b) Ribulose bisphosphate carboxylase oxygenase
c) Nitrogenase
d) Alcohol dehydrogenase

170. Select the incorrect statement

a) *Anabaena* and *Nostoc* are not capable of fixing nitrogen in free living state
b) Phosphorus is a constituent of cell membranes, certain nucleic acid and cell proteins
c) Root nodule forming nitrogen fixers live as aerobes under free-living conditions
d) *Nitrosomonas* and *Nitrobacter* are chemoautotrophs

171. Two nitrogen atoms are joined by

a) The double covalent bond
b) Ionic bond
c) The triple covalent bond
d) None of these

172. Which of the following is considered to be the best chemical method of fixing atmospheric nitrogen?
a) Fisher method
b) Decan method
c) Haber-Bosch method
d) Parnas-Meyerhoff method

173. Which of the following elements play a major role in nitrogen metabolism by activating the enzyme, nitrogenase?
a) Cu^{+2} b) Zn^{+2} c) Mg^{+2} d) Mn^{+2}

174. Chlorosis is
a) Loss of chlorophyll
b) Yellowing of leaves
c) Death of blant tissue
d) Blackening of the leaves

175. Ca^{2+} is an essential elements in plants. The major function it performs is
a) Selective permeability of the cell membrane
b) Maintenance of the cell turgidity
c) Energy transfer
d) Increases hardness of the cell wall

176. On the basis of symptoms of chlorosis in leaves, a student inferred that this was due to the deficiency of nitrogen. This inference could be correct only if we assume that yellowing of leaves appeared first in
a) Old leaves
b) Young leaves
c) Young leaves followed by mature leaves
d) Young leaves followed by young leaves

177. Choose a true statement regarding essential mineral elements of plants
a) Minerals present in the soil cannot enter the plants
b) Gold is the only element which cannot be accumulated by the plants
c) Plants growing near the nuclear test sites takes up the radioactive strontium
d) Minerals present in very low concentration cannot be detected and, hence they remain undiscovered

178. The insectivorous plants are
a) Autotrophic b) Heterotrophic c) Both (a) and (b) d) None of the above

179. In the initial phase of mineral absorption, ions are taken up into the …… space of cells
a) Outer b) Inner c) Semiouter d) None of these

180. Absorption of minerals takes place in the form of
a) Molecules b) Compounds c) Ions d) Mixtures

181. A metal ion involved in stomatal regulation is
a) Iron b) Potassium c) Zinc d) Magnesium

182. Find out odd one form the following options by considering its role in nitrogen cycle.
a) *Clostridium* b) *Nostoc* c) *Pseudomonas* d) *Rhizobium*

183. While producing hydroponic plants, which of the following metal is added along with EDTA?
a) Nitrogen b) Copper c) Iron d) None of these

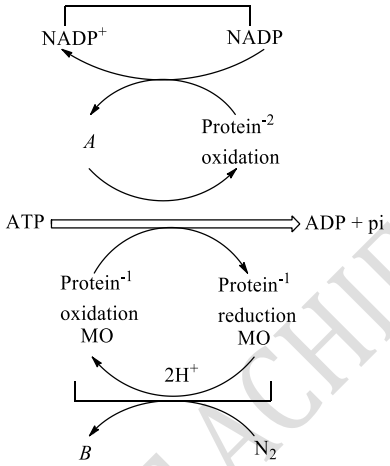
184. Which one of the following is not a micronutrient?
a) Molybdenum b) Magnesium c) Zinc d) Boron

185. About 98% of the mass of every living organism is composed of just six element including carbon, hydrogen, nitrogen, oxygen and
a) Phosphorus and sulphur
b) Sulphur and magnesium
c) Magn0esium and sodium
d) Calcium and phosphorus

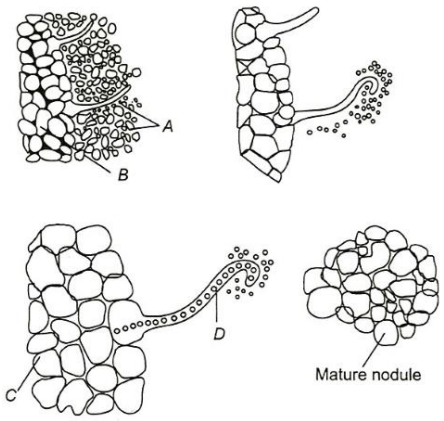
186. The bladder serving as floats for trapping insects is found in
a) *Zizyphus* b) *Utricularia* c) *Nephenthes* d) *Acacia*

187. Which of the following method is close to hydroponics and has the same principle?
a) Aeroponics b) Geoponics c) Planting d) None of these

188. Plants uptake minerals present in the soil, mostly through
a) Shoot b) Photosynthesis c) Roots d) None of these
189. Boron in green plants assists in
a) Photosynthesis b) Sugar transport
c) Activation of enzymes d) Acting as enzyme cofactor
190. Separation of amino acid and carboxylic groups is called
a) Deamination b) Exertion c) Egestion d) Transamination
191. Addition of chelating agent to hydroponics is necessary for
a) Healthy plants b) Nutrition of plants
c) Promote plant growth d) All of the above
192. Which of the following mineral deficiencies will cause death of stem and root tips?
a) Mo b) Ca c) S d) Fe
193. Which among the following is the major constituent of proteins, nucleic acids, vitamins and hormones?
a) K b) N c) P d) S
194. Which of the following is a flowering plant with nodules containing filamentous nitrogen-fixing microorganism?
a) Casuarinas equisetifolia b) Crotalaria juncea
c) Cycus revolute d) Cicer arietinum
195. 'Khaira disease of rice' is due to
a) Fungus b) Bacteria c) Zn deficiency d) Mo deficiency
196. Which one of the following is a micronutrient in plants?
a) Magnesium b) Zinc c) Potassium d) Calcium
197. The diagram represents a mechanism of symbiotic N_2-fixation. Here A and B stands for



a) A-Protein^{-1} reduction; B$-2NH_3$ b) A-Protein^{-2} reduction; B$-2NH_3$
c) A-Protein^{-2} oxidation; B$-2NH_2$ d) A-Protein^{-2} reduction; B$-2N_2$
198. In which of the following conditions, plants cannot be grown?
a) Soil without microelements b) Soil without macroelements
c) Both (a) and (b) d) None of these
199. One of the major function of essential elements is
a) Activation of enzymes b) Inhibition of enzymes
c) Both (a) and (b) d) No effect on enzymes
200. Identify the A t D correctly in the given diagram of root nodule development and choose the correct option accordingly



a) A-Rhizobial bacteria, B-Cortex cell, C-Outer cortex, D-Infection thread
b) A-Rhizobial bacteria, B-Cortex cell, , C-Inner cortex, D-Infection thread
c) A-Rhizobial bacteria, B-Endodermal cell, C- Inner endodermis, D-Infection thread
d) A-*Nitrosomonas* bacteria, B-Cortex cell, C- Inner cortex, D-Infection thread

201. Efflux is the movement of ions
a) From one cell to another
b) Within the cell
c) Into the cell
d) Out of the cell

202. If by radiation all nitrogenase enzymes are inactivated, then there will be no
a) Fixation of nitrogen in legumes
b) Fixation of atmospheric nitrogen
c) Conversion from nitrate to nitrite in legumes
d) Conversion from ammonium to nitrate in soil

203. The process of conversion of nitrogen to ammonia is termed as
a) Ammonification b) Nitrification c) Denitrification d) Nitrogen fixation

204. Identify the non-leguminous plants that forms nodules to fix nitrogen
a) *Alnus* b) *Casuarina* c) *Xanthomonas* d) All of these

205. The minerals involved in water-splitting reaction during photosynthesis are
a) Magnesium and chlorine b) Potassium and manganese
c) Manganese and chlorine d) Molybdenum and manganese

206. Nitrifying bacteria
a) Convert free nitrogen to nitrogen compounds
b) Convert proteins into ammonia
c) Reduce nitrates to free nitrogen
d) Oxidize ammonia to nitrates

207. Micronutrients are
a) As important as macronutrients but are required in small amount
b) Less important than macronutrients
c) Called micro as they play only a minor role in plant nutrition
d) None of the above

208. A small aquatic plant was put in each of the petri dishes- X, Y and Z, containing different culture solutions. After six weeks, the plant in dish-X had the same number of leaves as it had previously and were all small and yellowish. Plant in dish-Y had more leaves of normal size and dark green colour. Plants in dish-Z had more leaves of normal size but very pale. Which of the following show the elements missing the culture?
a) Magnesium Phosphorus b) Phosphorus Magnesium

Nitrogen

c) Phosphorus Nitrogen Magnesium d) Magnesium Nitrogen Phosphorus

209. Essential ions are absorbed in different amounts by
a) Root hairs b) Shoots c) Phloem d) None of these

210. Which of the following is/are not an essential micro nutrient?
a) Boron b) Nickel and cadmium
c) Molybdenum d) Zinc

211. For the existence of nitrogen, how many nitrogen atoms are required?
a) Three b) Two c) Four d) One

212. In the final phase of mineral absorption ions are taken up
a) Slowly b) Rapidly c) Very fastly d) Fluently

213. Which of the following statement is true about the passive uptake of ions?
a) Passive uptake may be non-mediated or mediated
b) Passive uptake is always mediated
c) Passive uptake is always non-mediated
d) None of the above

214. Active transport of ions by the cell requires
a) Alkaline pH b) Salts c) High temperature d) ATP

215. If the size of fruits diminishes in plants, which mineral ion should be added to soil?
a) Calcium b) Chlorine c) Copper d) Boron

216. Mineral element required by plants in the greatest amount is
a) Nitrogen b) Potassium c) Phosphorus d) Zinc

217. Premature leaf fall is due to deficiency of
a) Phosphorus b) Nitrogen c) Calcium d) Potassium

218. An element must be considered essential, when
I. the element is necessary for supporting normal growth and reproduction of the plants
II. the deficiency of that particular element can not be met by supplying some other element
III. the element is directly involved in the metabolism of the plants. Choose the correct pair
a) I and III b) Only II c) II and III d) I, II and III

219. Soilless culture helps in knowing
a) Toxicity caused by an element b) Deficiency symptoms caused by an element
c) Essentially of an element d) All of the above

220. Chlorosis is caused due to deficiency of
a) Magnesium b) Calcium c) Boron d) Manganese

221. I. The practice of growing plants in nutrient enriched water without soil is called ….
II. The system of growing plants with their roots bathed in nutrient mist (a cloud of moisture in air) is called…..
Complete the given statement (I and II) with the correct pair of options given below
a) Hydroponics and aeroponics b) Aeroponics and hydroponics
c) Hydroponics and fogponics d) Agroponics and hydroponics

222. A plant which lives on another plant but do not take food or anything from plant is called
a) Endophyte b) Epiphyte c) Parasite d) Host

223. In addition to known essential elements, there are some beneficial elements. These are required by the
a) Small plants b) Very small plants c) Higher plants d) All of the above

224. For nitrogen fixation, useful pigment is
a) Nitrogenase b) Haemoglobin c) Myoglobin d) Leghaemglobin

225. Fe can be taken by plants in the form of
a) Ferrous ion b) Ferrous sulphate c) Ferric ions d) Either (a) or (c)

226. Necrosis in crops is due to the deficiency of
a) Ca, K, S, and Mo b) N, K, S and Mo c) N, S, Fe and Zn d) Mg, S, Mn and Ca

227. Hydroponics were first time demonstrated in the year
a) 1860 b) 1866 c) 1859 d) 1886

228. Which element is located at the centre of the porphyryin ring in chlorophyll?
a) Potassium b) Manganese c) Calcium d) Magnesium

229. The structure present in cynobacteria (BGA) that helping in nitrogen fixation is
a) Haplosperm b) Holostrum c) Holotrema d) Heterocyst

MINERAL NUTRITION

BIOLOGY

: ANSWER KEY :

1)	b	2)	c	3)	c	4)	b	173)	a	174)	b	175)	d	176)	a
5)	b	6)	c	7)	d	8)	d	177)	c	178)	a	179)	a	180)	c
9)	b	10)	d	11)	d	12)	a	181)	b	182)	c	183)	c	184)	b
13)	b	14)	d	15)	c	16)	a	185)	a	186)	b	187)	a	188)	c
17)	d	18)	b	19)	a	20)	c	189)	b	190)	a	191)	d	192)	b
21)	b	22)	c	23)	b	24)	c	193)	b	194)	a	195)	c	196)	b
25)	c	26)	b	27)	a	28)	c	197)	b	198)	c	199)	c	200)	b
29)	c	30)	b	31)	d	32)	d	201)	b	202)	a	203)	a	204)	d
33)	b	34)	c	35)	b	36)	b	205)	c	206)	d	207)	a	208)	a
37)	a	38)	a	39)	b	40)	c	209)	a	210)	b	211)	b	212)	a
41)	b	42)	c	43)	a	44)	b	213)	a	214)	d	215)	d	216)	a
45)	c	46)	a	47)	b	48)	a	217)	a	218)	d	219)	d	220)	a
49)	b	50)	a	51)	a	52)	d	221)	a	222)	b	223)	d	224)	d
53)	b	54)	c	55)	a	56)	a	225)	c	226)	a	227)	a	228)	d
57)	c	58)	c	59)	b	60)	b	229)	d						
61)	c	62)	a	63)	b	64)	c								
65)	d	66)	c	67)	c	68)	c								
69)	d	70)	b	71)	a	72)	a								
73)	a	74)	a	75)	a	76)	c								
77)	b	78)	c	79)	d	80)	b								
81)	b	82)	a	83)	a	84)	b								
85)	b	86)	a	87)	d	88)	c								
89)	b	90)	b	91)	c	92)	b								
93)	c	94)	b	95)	c	96)	b								
97)	c	98)	b	99)	d	100)	b								
101)	d	102)	a	103)	c	104)	c								
105)	b	106)	c	107)	a	108)	b								
109)	d	110)	a	111)	d	112)	a								
113)	b	114)	c	115)	b	116)	c								
117)	a	118)	d	119)	d	120)	c								
121)	a	122)	d	123)	c	124)	b								
125)	c	126)	a	127)	d	128)	d								
129)	a	130)	b	131)	d	132)	b								
133)	c	134)	d	135)	a	136)	d								
137)	c	138)	b	139)	a	140)	a								
141)	d	142)	d	143)	c	144)	b								
145)	c	146)	d	147)	b	148)	d								
149)	d	150)	d	151)	a	152)	b								
153)	c	154)	c	155)	b	156)	c								
157)	a	158)	d	159)	a	160)	c								
161)	c	162)	a	163)	c	164)	b								
165)	a	166)	d	167)	c	168)	d								
169)	c	170)	b	171)	c	172)	c								

MINERAL NUTRITION

BIOLOGY

: HINTS AND SOLUTIONS :

1 **(b)**
The fixation of nitrogen in root nodules of legumes takes place in the presence of the enzyme 'nitrogenase'. This enzyme is an enzyme complex consisting of two components called as protein-1 and protein-2. The active nitrogenase complex contain protein-1 and protein-2 components in the ratio of 1:2.

2 **(c)**
Ammonia produced by the degradation of manures and organic matter may not be available to plants because it is readily leached from soil. It is converted to nitrate with the help of certain microorganisms, i.e., called nitrification (the used bacteria, nitrifying bacteria).

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

Ammonia is first oxidized to nitrite by the bacteria *Nitrosomonas* and/or *Nitrosococcus*. The nitrite is further oxidized to nitrate with the help of bacterium *Nitrobacter.*

3 **(c)**
Some plant species accumulate selenium, some others gold, while some plants growing near nuclear test sites take up radioactive strontium

4 **(b)**
Functions of Cl^- It helps photolysis of water, maintenance of solute concentration and ionic balance.
Function of K Potassium plays an important role in the opening and closing of stomata. These both can alter the osmotic potential of a cell

5 **(b)**
An air pump used in conjunction with an air stone is an excellent way to dissolve oxygen in the nutrient solution

6 **(c)**
An ideal pH range for most hydroponic crops is between 5.5 and 6.5.
It is important because it affects the availability and absorption of several of the 16 atomic elements needed for the plant growth

7 **(d)**
Functions of Fe It is involved in the transfer of electrons like ferredoxin and cytochromes. It is reversibly oxidised from Fe^{2+} and Fe^{3+}during electron transfer. It activates catalase enzymes and is essential for the formation of chlorophyll

8 **(d)**
All of the above

9 **(b)**
Essential element has following features:
1.It is indispensable for the growth of plants.

2.Cannot be replaced by any other element.

3.Absence/deficiency produces disorders.

4.Has nutritive value.

5.Necessary for completion of vegetative or reproductive phase.

6.These are- C, H, O, N, P, K, S, Mg, Ca, Fe, B, Mn, Cu, Zn, Mo and Cl.

10 **(d)**
Essential elements performs several functions. They participate in various metabolic processes in the plant cells, such as permeability of the cell membrane, maintenance of osmotic concentration of the cell sap, electron transport systems, buffering action, enzymatic activities and acts as a major constituents of macromolecules and coenzymes

11 **(d)**
All **lead, cobalt** and **uranium** causes harmful effects.

12 **(a)**
Nitrogen is mainly absorbed in the form of nitrate from soil

13 **(b)**
In the initial phase, ions are taken up rapidly

14 **(d)**

The prominent symptoms of manganese toxicity is the appearance of brown spots surrounded by chlorotic veins.
It is important to know that manganese competes with iron and magnesium for its uptake by the plants and with magnesium for its binding with enzymes. Manganese also inhibits calcium translocation in shoot apex. Therefore, excess of manganese may induce deficiencies of iron, magnesium and calcium

15 **(c)**
Plant obtains sulphur in the form of sulphate (SO_4^{2-}). Sulphur is present in two amino acids-cysteine and methionine and is the main constituent of several coenzymes, vitamins and ferredoxin

16 **(a)**
The EBB and flow system work by temporarily flooding the grown tray with nutrition solution and then draining the solution back into the reservoir

17 **(d)**
Hydroponics has been successfully employed as a technique for the commercial production vegetables such as tomato, seed less cucumber and lettuce

18 **(b)**
For the uptake of ions in the second phase, the pathway followed is called active uptake

19 **(a)**
17 element are essential for the plant growth

20 **(c)**
Utricularia or bladderwort is an insectivorous submerged aquatic plant. In which the rootless floating stem bears highly dissected leaves. A portion of leaf is modified into sac, like bladders of about 1.3 mm in diameter. Each bladder is guarded by a small valve which opens inwardly. Small insects flow into the bladder with water, but cannot come out due to the volve.

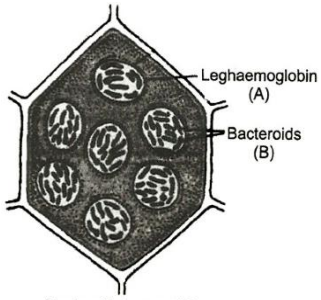
21 **(b)**
Hydroponics technique is useful in areas having infertile and dry soils and can regulate pH optimum for a particular crop

22 **(c)**
Phosphorus is absorbed by the plants from soil in the form of phosphate ions either as $H_2PO_4^-$ or HPO_4^{2-}

23 **(b)**
Insectivorous plants are autotrophic in their mode of nutrition but they grow in marshy or muddy soils, which are generally deficient in **nitrogen** and in other to fulfil their nitrogen requirements, these plants catch and digest small insects.

24 **(c)**
Aeroponics are soilless cultivated of plants

25 **(c)**
A-leghaemoglobin, B-bacteroids



Bacteroids in a nodule

26 **(b)**
Insectivorous plants eats insects for nitrogen

27 **(a)**
Enzyme nitrogenase is required for biological nitrogen fixation. It is a metal protein. The metal present in nitrogenase enzyme is molybdenum. Hence, molybdenum is an important element for nitrogen fixation.

28 **(c)**
The legumes (papilionacous plants) are itself incapable of nitrogen fixation. The *Rhizobium* bacteria are present symbiotically in the root nodules of these plants which have the capability of nitrogen fixation.

29 **(c)**
Coco air, perlite, rock cool, gravel all are used as media for hydroponics

30 **(b)**
In the centre of each chlorophyll molecule is found a magnesium metal.

31 **(d)**
Essential elements can be grouped into four broad categories on the basis of their diverse functions.
(i) Essential elements that acts as a components of biomolecules and hence, structural elements of cells (*e*. *g*., carbon, hydrogen, oxygen and nitrogen)
(ii) Essential elements that are components of energy-related chemical compounds in plants
(iii) Essential elements that activates or inhibits

enzymes
(iv) Some essential elements can alter the osmotic potential of a cell

32 **(d)**
Potassium is absorbed as K^+ ions. In plants, this is required in more abundant quantities in the meristematic tissues, buds, leaves and root lips

33 **(b)**
The root nodules in leguminous plants are pinkish due to presence of pigment leghaemoglobin. The cells of root nodules contain irregular polyhedral bacteria called bacteroids. Leghaemoglobin is located between bacteroids and surrounding host membrane. Leghaemoglobin is an oxygen scavenger and protect the nitrogen fixing enzyme nitrogenase.

34 **(c)**
The number of essential elements known for the growth and reproduction of plants is 17

35 **(b)**
Magnesium activates the enzymes of respiration, photosynthesis and is involved in the synthesis of DNA and RNA. Manganese activates many enzymes involved in photosynthesis, respiration and nitrogen metabolism.

36 **(b)**
Etiolation is the symptom developed in plants when grown in the dark. Examples include pale yellow or white colour due to lack of chlorophyll, long internodes, small and rudimentary leaves, poor development of lignificant tissue.

37 **(a)**
Crop rotation is the growing of alternate crops in the successive seasons on the same field. Crop rotation increases the soil fertility because different crops have different nutritional requirements.

38 **(a)**
The enzyme responsible for nitrogen fixation is known as **nitrogenase**. Nitrogenase enzyme complex consists of two components, i.e., Fe-protein and Mo-Fe protein. The subunits of Fe-protein contain iron-sulphur cluster (4 Fe and 4S) that participates in the redox reactions involved in the conversion of nitrogen to ammonia.

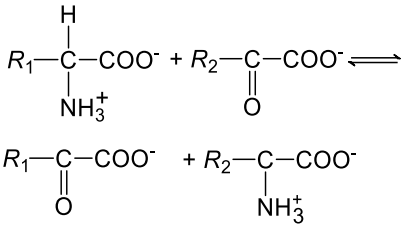
39 **(b)**
Soil is able to maintain a regular supply of minerals by the help of slow vegetation

40 **(c)**
Nitrate present in the soil is reduced to nitrogen by the process of denitrification. Denitrification is carried by bacteria *Pseudomonas* and *Thiobacillus*.
A number of cyanobacteria such as *Anabaena* and *Nostoc* are free-living nitrogen-fixers. *Azotobacter* and *Beijernickia* are free-living nitrogen fixing aerobic microbes.
Nitrosomonas and/or *Nitrosococcus* oxidise NH_3 to nitrite.
The nitrite is further oxidised to nitrate with the help of *Nitrobacter* and *Nitrocystis.*

41 **(b)**

Column I	Column II	Column III
Calcium	Required for synthesis of mitotic spindle	Young root tip begin to die
Boron	Required for absorption of calcium	Fruit size diminishes
Phosphor-ous	Essential for constitution of nucleic acid	Red blots on leaves
Chlorine	Required for ionic balance	Fruit yield decreases
Mangane-se	Required to activate respiratory enzyme	Grey blot on leaves

42 **(c)**
Once the glutamic acid is synthesised by reductive amination, other amino acids are synthesised by the transfer of its amino group to other carbon skeletons. Therefore, glutamic acid is used as a starting material for the synthesis of other amino acids.
Such a transfer of amino group ($-NH_2$) from an amino donor compound to the carbonyl position ($= CO$) of an amino acceptor compound is called transamination



43 **(a)**
Chelating agent is used to chelate metals like iron

44 **(b)**
The term outer space represents intercellular space and cell wall, while inner space represents cytoplasm and vacuole with reference to absorption of minerals

45 **(c)**
As hydroponic tomatoes are picked too soon, therefore, they may not taste so fresh

46 **(a)**
EDTA is used to chelate metal ions. It is ethyldiamenetetracetic acid

48 **(a)**
Sulphur is constituent of certain amino acids. The amino acids form the protein by polymerization. The pulses are rich in protein.

49 **(b)**
The atmosphere has about 78% of nitrogen. It is used by organisms in the synthesis of proteins, nucleic acid and other nitrogenous compounds. Basic source and the great reservoir of phosphorus are rocks or other deposits, which have been formed in the past geological ages.

50 **(a)**
Haustoria is found in *Viscum* that absorbs nutrient

51 **(a)**
Insectivorous plants grows in the soil, which have poor amount of nitrogen contents (nitrate). Nitrogen is very essential for metabolism. To solve this problem, these plants kill and digest insects for their nitrogen contents, *e.g., Nepenthes*.

52 **(d)**
Humus is the dark-colored amorphous colloidal material that constitutes the organic component of soil. It is formed by the decomposition of plant and animal remains and excrement and has a complex and variable chemical composition. Being a colloid, it can hold water therefore improves the water retaining properties of soil. It also enhance soil fertility and workability.

53 **(b)**
Iron (Fe).
Functions of Fe It is involved in the transfer of electrons like ferredoxin and cytochromes. It is reversibly oxidised from Fe^{2+} to Fe^{3+}during electron transfer. It activates catalase enzymes and is essential for the formation of chlorophyll

54 **(c)**
The ultimate source of nitrogen is atmosphere. It is fixed in usable forms by several biological and non-biological agencies. Nitrogen is also present in the soil in the form of nitrates and ammonical salts

56 **(a)**
Copper, magnesium and iron affect photosynthetic and mitochondrial electron transport path.

57 **(c)**
Nitrate or death of issue, particularly leaf tissue, occurs due to deficiency of Ca, Mg, Cu, K.

58 **(c)**
Through trace elements are required for various functions, most of these have a significant role in enzyme activities (e.g., zinc activities carboxylases, carbonic anhydrase and various dehydrogenases).

59 **(b)**
Phosphorus.
Essential elements can be grouped into four broad categories on the basis of their diverse functions
(i) Essential elements that acts as a components of biomolecules and hence, structural elements of cells (*e*. *g*., carbon, hydrogen, oxygen and nitrogen)
(ii) Essential elements that are components of energy-related chemical compounds in plants
(iii) Essential elements that activates or inhibits enzymes
(iv) Some essential elements can alter the osmotic potential of a cell

60 **(b)**
Hydroponics is a technique of growing plants in a nutrient solution and this technique also helps in determination of mineral nutrients essential for

the growth of blank

61 **(c)**
Nitrogen in NH_3 is an example of a nutrient in its reduced form

63 **(b)**
In the absence of essential mineral elements, plants do not complete their life cycle or set the seeds

64 **(c)**
Potassium is macroelement of plants. Deficiency symptoms of potassium are; mottled inter-veinal chlorosis appears first in older leaves, marginal or apical yellowing or scorch and curling, die back, bushy habit, shorter internodes, loss of apical dominance, cereals may show lodging, loss of cambial activity, plastid disintegration and increase in rate of respiration.

65 **(d)**
Calcium is the constituent of middle lamella of cell walls. It is required as cofactor by some enzymes involved in the hydrolysis of ATP and phospholipids. It also acts as a second messenger in metabolic regulation.

66 **(c)**
Asparagine is the primary assimilation product from nitrogen fixation in temperature legumes and the predominant nitrogen transport product in many plant species. It is synthesised via asparagines synthetase and has carboxamide as side chain functional group.

67 **(c)**
Nitrogen is considered as a partial mineral element. Its approximate amount in the whole plant is 1-3%. It is present in almost all the living matter; chiefly macromolecules like proteins, nucleic acids and thus, it is an important element in various metabolic processes

68 **(c)**
Hydroponics is the soil less culture of plants. Plants are raised in small tanks filled with water solution containing appropriate quantities of all mineral elements along with concrete and metal. Hydroponics is being used for flower and vegetable culture.

69 **(d)**
The colloids carry a large member of charges on their surface as well as they have large surface area

70 **(b)**
Rhizobium leguminosarum causes biological nitrogen fixation in root nodules of leguminous plants. A pigment leghaemoglobin is present in the root nodules, which is a oxygen scavenger, i.e., protect the enzyme nitrogenase from oxygen. **Nitrogen enzyme complex** consists of two components, i.e., the **Fe-protein** and **Mo-Fe protein**.

71 **(a)**
Magnesium is present in tetrapyrrolic chlorophyll. It is essential for continued growth of the apical meristem. Calcium in small amounts is necessary for normal mitosis as it is important in chromatin or mitotic spindle organisation. Zinc is needed for the synthesis of auxin

72 **(a)**
Bacillus polymixa is a free-living nitrogen fixing bacteria

73 **(a)**
In case of *Nitella*, H_2O, O_2, CO_2 and Na follows passive diffusion

74 **(a)**
Essential elements that are the components of energy-related chemical compounds in plants, ($e.g.$, magnesium in chlorophyll and phosphorus in ATP)

75 **(a)**
ppm is a common unit for measuring the concentrations of elements in the nutrient solution. One ppm is one part by weight of the mineral in one million parts of solution. It is also equivalent to 1 mg of something per litre of water

76 **(c)**
During the conversion of nitrogen, cyanobacteria first converts nitrogen into ammonia and ammonium. Plants can use ammonia as a nitrogen source
$N_2 + 4H_2 \rightarrow 2NH_3$

77 **(b)**
It is the microbes, which competes with plants in the soil for the limited nitrogen

78 **(c)**
Botanist.
Julius Von Sachs was German botanist

79 **(d)**
If a pulse crop possesses premature yellowing

of leaves and decrease in yield then application of **magnesium** and **iron** to promote synthesis of chlorophyll may become most beneficial to overcome the problem and to obtain maximum seed yield.

80 **(b)**
In the hydroponic plant production technique, to obtain the optimum growth, nutrient solutions must be adequately aerated

81 **(b)**
It was observed that only a few elements have been found to be absolutely essential for the plant growth and metabolism.
These elements are further divided into two broad categories based on their quantitative requirements
(i) Macronutrients (ii) Micronutrients

82 **(a)**
The essential nutrients (16) are divided into two categories;
1.Major nutrients: (Plants require in large quantities), e.g., C, H, O, N, S, P, K, Mg, Ca, Fe.

2.Minor nutrients: (Plants require in very small amount), e.g., B, Mn, Zn, Cu, Mo, Cl.

83 **(a)**
Drosera (sundew plant), *Dionaea* (venus fly trap), *Aldrovanda* (water flea trap), *Utricularia* (bladder wort), sarracenia (devil's boots), pinguicula (butter wort) and *Nepenthes* (pitcher plant) are carnivorous or incarnivorous plants, which grow in nitrogen deficient soil.

84 **(b)**
Fe is an important constituent of proteins which is involved in the transfer of electrons like ferredoxin and cytochromes. It is reversibly oxidised from Fe^{2+} to Fe^{3+} during electron transfer.
Cu It is essential for the overall metabolism in plants. Like iron, it is associated with certain enzymes involved in redox reactions and is reversibly oxidised from Cu to Cu^{2+}

85 **(b)**
Denitrification is the reduction of nitrate to gaseous compounds of nitrogen. Under anaerobic conditions, some microorganism use nitrate and other oxidised ions as source of oxygen, *e.g., Pseudomonas denitrificans, Thiobacillus denitrificans, Micrococcus denitrificans,* etc.

86 **(a)**
Nitrogenase is an enzyme required for nitrogen fixation. It is anaerobic in nature and destroyed in the presence of oxygen.

87 **(d)**
To get the least risk of diseased condition, it is important to change and replace the nutrient and media daily. There are risks associated with them. *Salmonella* grows very rapidly in still water. High moisture content uncovarages the growth of pathogens and plant pests

88 **(c)**
The technique of growing plants in a nutrient solution is known as hydroponics. Since then, a number of improvised methods have been employed to try and determine the mineral nutrients essential for plants.
The essence of all three methods involves the culture of plants in a soil free, defined mineral solution. These plants in a soil free, defined mineral solution. These methods require purified water and mineral nutrient salts

89 **(b)**
Large.
Macronutrients are generally present in plant tissues in large amount (in excess of 10 m mole kg^{-1} of dry matter)

90 **(b)**
Leibeg, Father of biochemistry was first to record minerals/elements in plant ash.

91 **(c)**
Nitrogen fixation is the conversion of inert atmospheric nitrogen or dinitrogen (N_2) into utilizable compounds of nitrogen like nitrate, ammonia, amino acids, etc.

92 **(b)**
For the plant, growth best temperature preferred is between 15°C and 30°C

93 **(c)**
Nickel is not an essential micronutrient for plant growth.

94 **(b)**
***Nif* gene** is responsible for biological nitrogen fixation, which directs the synthesis of nitrogenase enzyme.

95 **(c)**

Hydroponics are of three types *i.e.*, tank system, film system and aeroponics. In tank system, roots are emerged in nutrient solution and air is bubbled through the solution. In film system, plants are grown in a tube haring a thin film of recirculated nutrient solution. In aeroponics, roots are suspended in air over the nutrient solution, which is whipped into nutrient mist by a rotor

96 **(b)**

For the proper growth of plants some elements are essentially required, these are known as elements. **Calcium** is used for the synthesis of cell wall. Deficiency of calcium leads to stunted growth and necrosis of root tips and young leaves. **Potassium** deficiency causes scorched leaf tips, shorter internodes and chlorasis in inter-veinal areas. Deficiency of **copper** shows necrosis of the tips of young leaves. While, **phosphorus** deficiency causes premature leaf falling.

97 **(c)**

Hydroponics.

The technique of growing plants in a nutrient solution is known as hydroponics. Since then, a number of improvised methods have been employed to try and determine the mineral nutrients essential for plants.

The essence of all three methods involves the culture of plants in a soil free, defined mineral solution. These plants in a soil free, defined mineral solution. These methods require purified water and mineral nutrient salts

98 **(b)**

In 1860, Julius Von Sachs, a prominent German botanist, demonstrated for the first time that the plants could be grown to maturity in a defined nutrient solution in the complete absence of soil

99 **(d)**

Potassium deficiency causes yellowish edges in the leaves

100 **(b)**

VAM is endomycorrhizae, which can be used in annul crops like cereals, pulses, oil seeds and fruit crops. It is vericular, aurbuscular and mycorrhizal

101 **(d)**

In plants, nitrogen is required by all the parts, particularly by the meristematic tissues and the metabolically active cells

102 **(a)**

All of the above

103 **(c)**

Of the known macronutrients, carbon, hydrogen and oxygen are mainly obtained from CO_2 and H_2O, while the others are absorbed from the soil as mineral nutrients

104 **(c)**

Water is required for germination. After the seedling emerges from the seed coat starts growing, the seedlings food reserves becomes typically exhausted. At this point, it requires a continuous supply of water along the with the nutrients and light

105 **(b)**

The entry and exit to and from symplast is an active process and require metabolic energy

106 **(c)**

Magnesium is an important constituent for chlorophyll synthesis.

107 **(a)**

Boron is the micronutrient for plants, present in the soil in very small amounts. It is absorbed from the soil in the form of boric acid (H_3BO_3) and tetraborate anions. Boron is required for pollen germination, seed germination and cell differentiation.

108 **(b)**

Rhizoplane is the external surface of roots, bound together with closely adhering soil particles and debris

109 **(d)**

Mg^{2+} is an activator of ribulose bisphosphate carboxylase oxygenase and phosphoenol pyruvate carboxylase

110 **(a)**

The ultimate source of nitrogen is atmosphere

111 **(d)**

Of all the floral crops produced by the hydroponic method, the carnation is surely the undisputed leader. It is the most popular which is cultivated commercially

112 **(a)**

Elements like calcium are a part of structural component of the cell and hence, are not released. The deficiency symptoms tend to appear first in the young tissues whenever, the elements are not demobilized.

113 **(b)**

The plant ash left behind forms a very small

proportion of plants dry weight. Analysis of plant ash shows that about 92 minerals elements are present in different plants.

114 **(c)**
The environment in hydroponics greenhouse is tightly controlled for maximum efficiency and this new mind set is called CEA (Controlled Environment Agriculture)

115 **(b)**
In the final phase, ions are taken up into the inner space of cells

116 **(c)**
Disadvantages of hydroponics are
(i) Expense to set up (ii) High technical knowledge

117 **(a)**
The nutrient solution, in flowering culture hydroponics is constantly recycled using a pump

118 **(d)**
The macronutrients includes carbon, hydrogen, oxygen, nitrogen, phosphorus, sulphur, potassium, calcium and magnesium

119 **(d)**
The process of decay of dead organic matter is known as **ammonification.**

120 **(c)**
Nitrogen is absorbed by the plants mainly as NO_3^- thought some is also taken up as NH_4^+

121 **(a)**
Deficiency of manganese (Mn) causes grey spots of oat.

122 **(d)**
An organism (such as bacterium) that will grow in a minimal medium is called a **prototroph**, while a 'mutant' of it that will not grow on a minimal medium but requires the addition of some compound like an amino acid or vitamin is called **auxotroph**.

123 **(c)**
Cobalt and selenium.
The number of essential elements known for the growth and reproduction of plants is 17

124 **(b)**
Nitrogen is a limiting nutrient for both natural and agricultural ecosystems

125 **(c)**
Deficiency of zinc is characterised by a reduction in intermodal growth due to which plant develops rosette habit of growth. The leaves may also be small and distorted. These results are due to loss of capacity to produce **auxin** (indole acetic acid)

126 **(a)**
Julius Von Sachs was German botanist

127 **(d)**
The essential elements, which are required in traces (*i.e.*,) mg/g of dry matter) by the plants are called micronutrients or trace elements. They are six in number Zn, Mn, B, Cu, Mo, and Cl

128 **(d)**
Macronutrients are generally present in plant tissues in large amount (in excess of 10 m mole kg^{-1} of dry matter)

129 **(a)**
Due to the deficiency of nitrogen, delaying of flowering appears

130 **(b)**
Calcium is a macronutrient.

131 **(d)**
Ions uptake takes place in two steps
(i) **Initial phase** Rapid uptake of ions into the 'outer free space' of cells, the apoplast. It is called passive uptake
(ii) **Second phase** Ions are driven up into the inner space, by the symplast of the cells

132 **(b)**
For the uptake of ions in the first phase, the pathway followed is called passive uptake

133 **(c)**
Necrosis is the term used for the death of plant tissues

134 **(d)**
Monovalent ions ($e.g.$, Na^+, K^+) increases the membrane permeability, while the divalent ions (Ca^{2+}) decreases the same

135 **(a)**
Cuscuta is a total stem parasite that grows in number of plants like *Duranta, Zizyphus, Citrus,* etc.

136 **(d)**
Oxidised form.
Nitrogen is mainly absorbed in the form of nitrate from soil

137 **(c)**
In plants, manganese is absorbed in the form of manganous ions (Mn^{2+}). It activates many enzymes involved in photosynthesis, respiration and nitrogen metabolism. The

best defined function of manganese is in the splitting of water to liberate oxygen during photosynthesis, i.e., photolysis of water.

138 **(b)**

Nitrification is the phenomenon of conversion of ammonium to nitrate. In the first step, the ammonium ions are oxidized to nitrites by *Nitrosococcus, Nitrosomonas*. The nitrites are changed to nitrate in the second step by *Nitrocystis, Nitrobacter*.

140 **(a)**

Nitrogenase catalyses the reaction. Formation of ammonia is a reduction process.

One molecule of nitrogen produces two molecules of ammonia

141 **(d)**

Nitrogen is the constituent of all chlorophylls, hormones and vitamins

142 **(d)**

Necrosis or death of tissue, particularly leaf tissue, occurs due to deficiency of Ca, Mg, Cu, K.

143 **(c)**

Leghaemoglobin during biological nitrogen fixation in root nodules of legumes protects the nirogenase enzyme from oxygen.

144 **(b)**

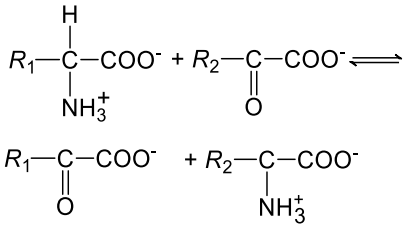
Carbon is a macronutrient, which is an essential component of all organic compounds. Plants obtain carbon in the form of carbon dioxide from atmosphere, not from the soil.

145 **(c)**

Transamination.

Once the glutamic acid is synthesized by reductive amination, other amino acids are synthesized by the transfer of its amino group to other carbon skeletons. Therefore, glutamic acid is used as a starting material for the synthesis of other amino acids.

Such a transfer of amino group ($-NH_2$) from an amino donor compound to the carbonyl position ($= CO$) of an amino acceptor compound is called transamination



146 **(d)**

Pullularia helps in nitrogen fixation

147 **(b)**

By process of nitrogen fixation atmospheric nitrogen is fixed as nitrate which by denitrification converted to ammonia.

148 **(d)**

Some ammonia (NH_3) is oxidized to form nitrites (NO_2) and nitrates (NO_3) through the action of autotrophic bacteria, *e.g., Nitrosomonas* and *Nitrobacter*. This process is called **nitrification** and the energy released supports the existence of nitrifying bacteria. The organic nitrogen of plants and animals is ultimately broken by the action of saprophytic fungi and bacteria to ammonia (NH_3) in a process called **ammonification**. Other types of anaerobic soil bacteria (*e.g., Pseudomonas*) act on nitrate in the process of denitrification by which nitrogen is liberated into the atmosphere. It involves the reduction of nitrate ions (NO_3) to nitrogen dioxide (N_2O), nitrogen monoxide (NO) or nitrogen (N_2).

149 **(d)**

Anabaena, nostoc, Aulosira and *Tolypothrix* are free living nitrogen-fixing cyanobacteria, whereas *Rhizobium* sp, *Frankia*, etc, are symbiotic nitrogen-fixing bacteria and *Azotobacter*(aerobic), *Clostridium*(anaerobic), *Beijerinckia* (aerobic), *Rhodosprillum, Chromatium, Rhodopseudomonas* are free living nitrogen-fixing bacteria. Aspergillus niger causes aspergillosis and produce citric acid, oxalic acid, etc.

150 **(d)**

Perlite is a volcanic rock that has been superheated into very lightweight expanded glass pebbles. It is used loose or in plastic sleeves immersed in the water. It is also used in potting soil mixes to decrease the soil density. Perlite has

similar properties and uses to vermiculite but in general, holds more air and less water.
Like perlite, vermiculite is a mineral that has been superheated until it has expanded into light pebbles. Vermiculite holds more water than perlite and has a natural 'wicking' property that can draw water and nutrients in a passive hydroponic system

151 **(a)**
Genes that direct the steps in nodulation of a legume by a specific rhizobial strain are called *nod* genes. Many *nod* genes from different rhizobia are highly conserved and are contained on large plasmids, which given then host specificity.
In symplasmid of *Rhizobium leguminosarum* var. *viciae*, *nod* genes for nitrogen fixation, the *nif* genes.
Number of *nod* genes are present in different species leading to *nod* factors, which induce root hair curling cell division, nodule formation.

152 **(b)**
Anabaena forms an association called symbiotic association with *Azolla*, which is extensively used in rice cultivation

153 **(c)**
Denitrifying bacteria breaks down nitrites and nitrates anaerobically to produce free nitrogen, *e.g., Bacillus denitrificans*.

154 **(c)**
The appearance of yellow colour due to the destruction of chlorophyll is called **chlorosis**. This disease is caused due to deficiency of potassium mineral.

155 **(b)**
The inorganic essential elements which are obtained from soil are called minerals in form of ions. The movement of ions is called flux.

156 **(c)**
Monotropa is a saprophytic plant, whereas *Nepnthes, Sarracenia, Drosera, Dionaea* and *Utricularia* are insectivorous plant.

157 **(a)**
Molybdenum is absorbed as molybdate by plants. It is involved in nitrogen metabolism including nitrogen fixation. It is a component of enzyme nitrogenase and acts as enzyme activator. Its deficiency causes chlorosis and necrosis, whiptail of cauliflower and premature leaf fall.

158 **(d)**
Plants requires purified water and mineral nutrient salts for their growth

159 **(a)**
The organic acid – α-ketoglutaric acid, plays a key role in the synthesis of amino acid. The ammonia formed by nitrogen assimilation (*i.e.,* reduction of nitrates), reacts with α-ketoglutaric acid to form an amino acid, *i.e.*, glutamic acid.
In this process, α-ketoglutaric acid comes from Krebs cycle and hydrogen is donated by the coenzyme NADH or NADPH. The reaction occurs in the presence of enzyme glutamic dehydrogenase

160 **(c)**
Plastocyanin is a copper containing protein that accepts electrons by the copper cycling between Cu^{2+} and Cu^{+} states during photosphorylation.

161 **(c)**
Decron is used as an alternative for minerals.

162 **(a)**
Leghaemoglobin is an oxygen scavenger. It protects the nitrogen fixing enzyme nitrogenase.

163 **(c)**
The molecular nitrogen (N_2) is correctly termed as dinitrogen $N \equiv N$

164 **(b)**
Due to deficiency of **zinc**, the leaves become distorted, sickle shaped and get clustered to form rosette. This effect is known as **little leaf disease**.

165 **(a)**
Zn, Mo, Fe, Cu are required by plants in very low amount, so they are called **trace elements** or microelements.

166 **(d)**
Hydroponics is a usefull technique in the areas having thin, infertile and dry soils. By this method, essential elements were identified and their deficiency symptoms were discovered

167 **(c)**
Bacteria and fungi are mostly heterotrophic, i.e., they required an organic source of carbon,

when these grow on dead decaying organism, these are called **saprophytes**.

168 **(d)**
Nucleic acids (DNA and RNA) are macromolecules and polymers of nucleotides, building blocks of the nucleic acid are nucleotides, which consists of nitrogenous base, pentose sugar and phosphate, so the elements occurring in nucleic acid are carbon, hydrogen, oxygen, nitrogen and phosphorus.

169 **(c)**
Nitrogenase is generally involved in the nitrogen metabolism as an enzyme

170 **(b)**
Phosphorus is not a constituent of cell membrane, certain nucleic acids and cell proteins

171 **(c)**
Two nitrogen atoms are joined by the triple covalent bond

172 **(c)**
Haber-Bosch method is used for manufacturing ammonia from atmospheric nitrogen.

173 **(a)**
Mn^{+2} acts as an activator of nitrogenase during nitrogen fixation

174 **(b)**
Chlorosis is the loss of chlorophyll, which results in the yellowing of leaves

175 **(d)**
One of the major function of Ca^{+2} or calcium ion is to increase the handnsi of cell well other function are
(i) Organisation of mitotic spindle
(ii) Meristematic activity
(iii) Metabolism
(iv) Prevention of mineral and organic acid toxicity
(v) Secondary messenger for some hormonal signals

176 **(a)**
Deficiency of nitrogen leads to yellowing of leaves that appeared first in old leaves.

177 **(c)**
Except option (c), all the given statement are incorrect

178 **(a)**
The plant that get their nitrogen directly from animals and are autotrophic in nature are known as insectivorous plants, *e*. *g*., pitcher plant

179 **(a)**
In the initial phase, ions are taken up into the outer space of cells

180 **(c)**
Absorption of minerals takes place in the form of ions

181 **(b)**
According to proton transport theory, proposed by **Levitt** (1974), the regulation of stomata (i.e., opening and closing) depends upon the entry and exit of potassium ions (K^+) in the guard cells. In guard cells, during the day time, the malic acid is formed at first, which dissociates into cations and anions.

182 **(c)**
Chostridium, nostoc and *Rhizobium* cause nitrogen-fixation, while Pseudomonas under anaerobic condition uses nitrate and reduces it to gaseous compounds of nitrogen.

183 **(c)**
Iron is added along with EDTA

184 **(b)**
The essential elements, which are required by plants in comparatively large amounts, are called as **microelements**, e.g., C, H, O, N, P, K, Ca, S, Mg, Fe.
The essential elements, which are required in very small amount by the plants are called **microelements**, e.g., Zn, Mn, B, Cu, Mo and Cl.

185 **(a)**
About 98% of the mass of every living organism including bacterium and human beings is composed of just six elements, i.e., carbon (C), hydrogen (H), nitrogen (N), oxygen (O), phosphorus (P) and sulphur (S).

186 **(b)**
Utricularia or bladderwort is a submerged aquatic insectivorous plant. Its rootless, floating stem bears highly dissected leaves. A portion of leaf is modified into sac-like bladders of about 1.3 mm in diameter. Each bladder is guarded by a small valve, which opens inwardly. Small insects flow into the bladder with water but not able to come out to the pressure of volve.

187 **(a)**
Aeroponics is the process of growing plants in an

air or mist environment without any use of soil or an aggregate medium

188 **(c)**
Most of the minerals present in the soil can enter the plants through roots

189 **(b)**
Boron is required by plants for (i) uptake and utilisation of Ca^{2+} (ii) pollen germination and cell differentiation (iii) **carbohydrate translocation**.

190 **(a)**
Removal of $-NH_2$ group is called **deamination**, while that of – COOH group is called **decarboxylation**.

191 **(d)**
Various micronutrients are added to the nutrient water to supply essential elements and chelating agents keep them soluble

192 **(b)**
Calcium involved in selective permeability of cell membranes. It activates certain enzymes required for development of stem and root apex and as calcium pectate in the middle lamella of cell wall. The deficiency of calcium causes stunted growth, degeneration of meristems especially root apex, chlorosis, necrosis and curling.

193 **(b)**
Nitrogen is present in almost all the living matter; chiefly macromolecules like proteins, nucleic acids and in amino acids, purines, pyrimidines, porphyrins and coenzymes

194 **(a)**
The *Casuarina* tree has nitrogen fixing root nodules that harbor a filamentous streptomycete like nitrogen fixing organism called *Frankia*.

195 **(c)**
Deficiency of zinc causes leaf malformations like little leaf, leaf rosettes, interveinal chlorosis, khaira disease of rice and several types of leaf distortions.
Deficiency of molybdenum causes whiptail disease, loosening of inflorescence in cauliflower.

196 **(b)**
A chemical element required by plants in relatively small quantity is known as **micronutrient**. They are typically found in cofactors and coenzymes. They include copper, zinc, molybdenum, manganese, cobalt and boron.

197 **(b)**
A-Protein^{-2} reduction; B-$2NH_3$

198 **(c)**
Plants requires both macro and micronutrients for their proper growth

199 **(c)**
Both (a) and (b).
Essential elements can be grouped into four broad categories on the basis of their diverse functions
(i) Essential elements that acts as a components of biomolecules and hence, structural elements of cells (*e*. *g*., carbon, hydrogen, oxygen and nitrogen)
(ii) Essential elements that are components of energy-related chemical compounds in plants
(iii) Essential elements that activates or inhibits enzymes
(iv) Some essential elements can alter the osmotic potential of a cell

200 **(b)**
A-Rhizobial bacteria
B-Cortex cell
C-Inner cortex
D-Infection thread

201 **(b)**
Movement of ions out of the cells is called efflux

202 **(a)**
The enzyme nitrogenase is required for the process of biological nitrogen fixation only. Fixation of atmospheric nitrogen occur through other route also.

203 **(a)**
The process of conversion of nitrogen to ammonia is termed as ammonification

204 **(d)**
Alnus, Casuarina, Xanthomonas are some non-leguminous plants that forms nodules to fix the nitrogen

205 **(c)**
Photolysis of water is associated with pigment system-II and catalysed by presence of Mn^{2+} and Cl^{-} ions.

$$4H_2O \rightleftharpoons H^+ + 4OH^-$$

$$4OH^- \xrightarrow[Mn^{2+},cl^-]{Z-complex} 2H_2O + O_2 \uparrow + 4e^-$$

206 **(d)**
Nitrifying bacteria (one of the chemosynthetic bacteria) oxidize ammonia to nitrates and obtain energy for the preparation of food. This oxidation occurs in two steps. In the first step, ammonia is oxidized to nitrite by nitrite bacteria (*e.g., Nitrosomonas* and *Nitrosococuus*). In the second step, nitrate is oxidised to nitrate by nitrate bacteria (*e.g., Nitrocystis* and *Nitrobacter*).

207 **(a)**
Both macronutrients and micronutrients are important for plant but in different amount.

208 **(a)**
Magnesium (Mg), Phosphorus (P) and Nitrogen (N) will be used in the given culture.

209 **(a)**
Essential ions are absorbed in different amounts with the need of roots hairs

210 **(b)**
Nickel and cadmium are physiologically inactive minerals for plants, i.e., not required for healthy growth of plants.

211 **(b)**
For existence of nitrogen, two nitrogen atoms are required N ≡ N

212 **(a)**
In the final phase, ions are taken up slowly

213 **(a)**
The passive uptake may be mediated or non-mediated

214 **(d)**
Active uptake of ions requires the expenditure of metabolic energy, *i.e.*, ATP

215 **(d)**
Fruit size can be increased by treating the soil with **boron**. It facilitates translocation of sugar in plants through phlolem. If the fruit size is not inc creasing means that carbohydrate is not translocated.

216 **(a)**
Nitrogen is the mineral elements which is required by the plants in the greatest amount

217 **(a)**
Phosphorus is a constituent of nucleic acids, proteins, $NADP^+$, etc. its deficiency causes, poor growth, chlorosis (mottled), necrosis and premature falling of leaves and flowers.

218 **(d)**
The criteria for essentially of an element are given below
(i) The element must be absolutely necessary for supporting normal growth and reproduction. In the absence of the element, the plants do not complete their life cycle or set the seeds
(ii) The requirement of the element must be specific and not replaceable by any another element. In other words, deficiency of any one element cannot be met by supplying some other element
(iii) The element must be directly involved in the metabolism of the plant

219 **(d)**
Soilless culture helps in knowing the essentially of an element as well as the diseases it may cause due to its deficiency and the toxicity caused by an element

220 **(a)**
Magnesium is a component of chlorophyll and an important binding substance for ribosomal sub-units. Its deficiency causes inter-veinal chlorosis, development of anthocyanin and depression of internal phloem.

221 **(a)**
The practice of growing plants in nutrient enriched water without oil is called hydroponics. The system of growing plants with their roots bathed in the nutrient mist (a cloud of moisture in air) is called aeroponics

222 **(b)**
Epiphytes are those plants, which are attached to another plant but do not grow parasitically upon it, i.e., can merely using it for support. **Example**- Orchids, mosses, algae, etc.

223 **(d)**
In addition to the 17 essential elements, there are some beneficial elements such as sodium, silicon, cobalt and selenium. They are required by higher plant

224 **(d)**
Leghaemoglobin is red, oxygen-binding iron containing protein pigment present in the root nodules. It is useful for nitrogen fixation as it functions as an oxygen buffer and keeps

the free oxygen levels within the nodule low.

225 **(c)**

Plants obtains iron in the form of ferric ions (Fe^{3+}). It is required in larger amounts in comparison to other micronutrients

226 **(a)**

Deficiency of **sulphur** leads to

1.Chlorosis followed by necrosis

2.Change in pigmentation

Deficiency of **calcium** leads to

1.Stunted growth

2.Chlorosis

3.Necrosis and curling

Deficiency of **potassium** leads to

1.Chlorosis followed by necrosis

2.Widespread blackening

Deficiency of **molybdenum** leads to

1.Marginal necrosis

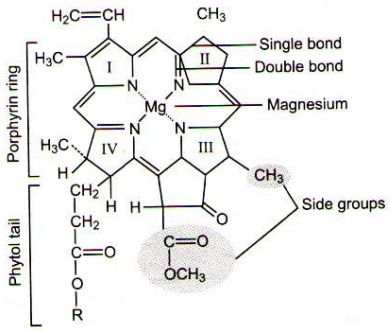
2.Whiptail disease

227 **(a)**

Hydroponics were first demonstrated in the year 1860

228 **(d)**

Magnesium is at the centre of the porphyrin ring in chlorophyll. Structure of chlorophyll Structure of chlorophy II molecule can be shown as follows.



229 **(d)**

Cyanobacteria or blue-green algae have the quality to fix atmospheric nitrogen. It is possible due to presence of heterocysts.