BIOLOGY

VMC MODULES ENGLISH

MINERAL NURTITION IN PLANTS

Illustration

1. Do plants need soil to grow?

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2. By which technique the role of elements are defined?

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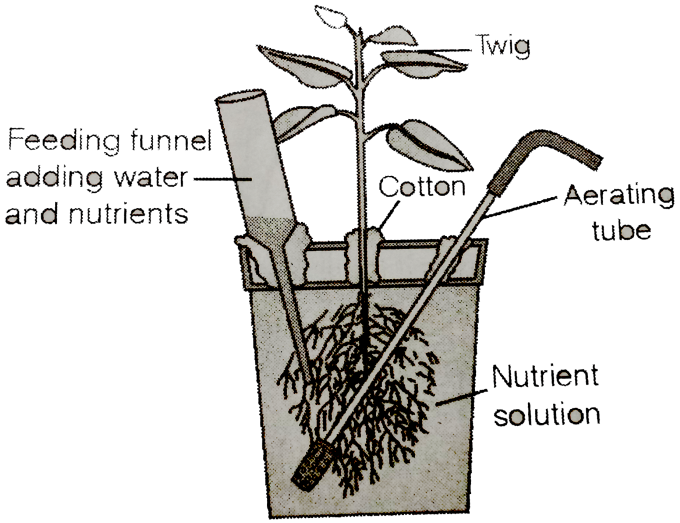
3. Carefully observed the following figure



(a) Name the technique shown in the figure

and the scientist who demonstrated this technique for the first time.

(b) Name atleast three plants for which this technique can be employed for their commercial production.

(c) What is the significance of aerating tube and feeding funnel in this setup ?

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4. Name three plants for which hydroponics can be employed for their commercial

production

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5. What is the significance of aerating tube and feeding funnel in this set-up?

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6. It is observed that deficiency of a particular element showed its symptoms initially in older leaves and then in younger leaves.

(a) Does it indicate that the element is actively mobilised or relatively immobile ?

(b) Name two elements which are highly mobile and two which are relatively immobile.

(c) How is the aspect of mobility of elements important to horticulture and agriculture ?

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7. What are essential elements? How many elements are reported from plants?

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8. Are some essential elements more important than others? Explain.

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9. If an element increases the growth rate of a plant, can it be defined as an essential element?

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10. Why Nitrogen is not considered a true mineral?

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11. Discuss Ion Traffic into the Root.

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12. Differentiate between two types of absorption of minerals in plants from soil.

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13. Which are more likely to be leached from the soil by heavy rains-cations or anions? Explain.

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14. What is passive absorption of minerals?

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15. In what manner carrier proteins are different from ion channels?

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

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17. What plant tissue systems are modified by root nodule formation?

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

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19. What are requirements of nitrogen fixation ?

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20. Giving examples discuss the role of amides. How they are formed ?

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Solved Examples

1. Select an incorrect statement

A. Basic needs of all living organisms are essentially the same.

B. All organisms require macromolecules, like carbohydrates, proteins and fats, and minerals for their growth and development

C. Green plants can prepare most of their food from complex substances.

D. Some non-green plants are termed heterotrophs.

Answer: C

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2. Select an incorrect statement

A. In the formation of carbohydrates, fats and proteins, carbon, hydrogen and oxygen play an important role.

B. plants need a variety of elements for their survival

C. source of elements is primarily the inorganic form of ions present in the air

D. these are absorbed by the root system.

Answer: C

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3. Which of the following is not criterion for essentiality of an element?

A. The element must be absolutely necessary for supporting normal growth and reproduction.

B. The requirement of the element must be specific and not replaceable by another element.

C. The element must be directly involved in the metabolism of the plant.

D. The requirement of the element are replaceable by another element.

Answer: D

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4. Select an incorrect statement

A. Carbon enters a plants atmospheric carbon dioxide

B. Hydrogen is obtained mainly from water

C. Oxygen can come from the air, or from water, and in the form of inorganic ions.

D. Carbon, hydrogen and oxygen are minerals

Answer: D

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5. Select an incorrect statement

A. Nitrogen is not considered a true mineral.

B. Nitrogen is inert and plants cannot make use of it directly.

C. Nitrogen is absorbed by plants in the form of nitrogen gas

D. Phosphorus is absorbed as phosphate, and sulphur mainly as sulphate.

Answer: C

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6. Which of the following is generally not a role of minerals in plants

A. Participate in various metabolic activities of the plant through their effect on enzymes.

B. Some elements regulate the permeability of cell wall

C. Some are required for the maintenance of osmotic pressure of cell sap,

D. Some participate in an electron transport system, buffer action, electrical neutrality, etc.

Answer: B

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7. Which of the following is incorrect statement for hydroponics

A. role of individual elements has been largely determined

B. usually, a small volume of nutrient solution is required for hydroponic culture

C. concentration of nutrients is adjusted frequently to prevent changes in

nutrient concentration and pH of the medium.

D. Vigorous bubbling of the air through the medium is also routinely done to provide sufficient oxygen

Answer: B

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8. Which of the following is not a role or function of nitrogen

A. Major constituents of proteins, nucleic acids, vitamins and hormones,

B. Its deficiency causes yellowing of older leaves (chlorosis)

C. Its deficiency causes purple colouration in shoot axis surface

D. Its deficiency causes premature fall of leaf and flowerbuds.

Answer: D

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9. Which of the following is not a physiological role of potassium ?

A. n plants, it is more abundant in meristematic tissues, buds, leaves and

roof tips.

B. It helps determine anion-cation balance in cells and is involved in protein synthesis

C. Its deficiency induces scorched leaf tips, shorter internodes, dieback, chlorosis in inter-veinal areas

D. Deficiency of potassium causes delay in seed germination, purple or red spots on leaves, dark green leaves,

Answer: D

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10. Which of the following is not a role or function of magnesium

A. It is used in the synthesis of cell wall, particularly as calcium pectate in the middle lamella.

B. It activates enzymes in respiration and photosynthesis, and in the synthesis of DNA and RNA.

C. It is a constituent of the ring structure of chlorophyll and maintains ribosome structure.

D. Deficiency of magnesium induces chlorosis between the leaf veins (interveinal chlorosis) and necrotic or purple coloured spots on older leaves.

Answer: A

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11. Which element is present in two amino acids, cysteine and methionine, and is the main constituent of several coenzymes, vitamins (thiamine, biotin) and ferredoxin.

A. Sulphur

B. Boron

C. Molybdenum

D. Copper

Answer: A

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12. Which of the element is required in larger amounts in comparison to other micronutrients. It is an important constituent of proteins like ferredoxin and cytochromes

A. Boron

B. Molybdenum

C. Copper

D. Iron

Answer: D

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13. The best defined function of manganese is

A. in the splitting of water to liberate oxygen during photosynthesis

B. in the synthesis of auxin.

C. activates enzymes in respiration and photosynthesis, and in the synthesis of DNA and RNA

D. it is associated with certain enzymes involved in redox reactions

Answer: A

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14. Which of the following is not a role of Molybdenum

A. It is a component of several enzymes, including nitrogenase and nitrate reductase

B. Its deficiency may cause nitrogen deficiency

C. Plants deficient in molybdenum show slight retardation of growth, inter-veinal

chlorosis, etc.

D. It helps in determining solute concentration and anioncation balance in cells

Answer: D

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15. Select incorrect statement

A. Sulphur deficiency causes chlorosis of younger leaves, stunted growth and anthocyanin accumulation.

B. Magnesium deficiency may cause premature leaf abscission.

C. The chlorosis of leaves is a typical symptom of iron deficiency.

D. The symptoms of Molybdenum deficiency include Rosette like appearance and Khaira disease of rice

Answer: D

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16. Select incorrect statement

A. Ions are known to accumulate in cells, i.e. they may move (e.g., into the inner space) against concentration or ecp gradients.

B. The symplastic pathway, essentially, involves diffusion and bulk flow of water from cell to cell through spaces between cell wall polysaccharides.

C. The movement of ions is usually termed as flux. The movement into the cell is influx and the outward movement is efflux.

D. he ion channels are trans-membrane proteins that function as selective pores.

Answer: B

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17. Select an incorrect statement for translocation of solutes

A. P.R. Stout and D.R. Hoagland (1939) proved that mineral salts are translocated through xylem.

B. By feeding plants with heavy isotopes, it was shown conclusively that inorganic substances move up the plant through xylem.

C. Any solute conducted through the xylem is carried along with the ascending streams of water, which are pulled up through the plant by transpirational pull.

D. The rates at which inorganic solutes are translocated through the xylem vessels, correspond closely with the rates of translocation of water.

Answer: B

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18. Most abundant elements in the living cells are

A. Nitogen

B. Boron

C. Molybdenum

D. Copper

Answer: A

19. As living organisms die and decay, inorganic nitrogen is liberated.

The dead remains of animals and plants are

decomposed through microbial activities to produce ammonia. This process is called

A. ammonification

B. nitrification

C. denitrification

D. nitrate assimilation

Answer: A

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20. What is the role of Thiobacillus and Pseudomonas in Nitrogen cycle.

A. Ammonifying bacteria

B. Nitrifying bacteria

C. Denitrifying bacteria

D. Nitrogen fixing bacteria

Answer: C

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Practice Exercise 1

1. Most of the mass of organic material of a plant comes from

A. water

B. atmospheric oxygen

C. carbon dioxide

D. nitrogen

Answer: C

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2. A chelating agent has ot more than two donor atoms to bind to a single metal ion. Which of the following is not a chelating agent ?

A. Oxalo

B. thiosulphato

C. Glycinato

D. Ethylene

Answer: B

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3. Who concluded that all the vegetation is only water:

A. Option1 Lavoisier

B. Option2 Aristotle

C. Option3 Theophrastus

D. Option3 Van Helmont

Answer: D

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4. Which of the following statements is not concerned with hydroponics :

A. Identification of essential elements

B. To observe the deficiency symptoms

C. Used for the commercial production of vegetables

D. Optimum growth, if nutrient solution is poorly aerated

Answer: D

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5. Which of the following chelating agents are found in soil naturally:

A. EDTA

B. EDDHA

C. DCMU

D. Siderophores

Answer: D

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Practice Exercise 2

1. Micronutrients are needed in very small amount because

A. most of them are mobile in the plant.

B. most serve mainly as cofactors of enzymes.

C. most are supplied in large enough quantities in seeds.

D. they play only a minor role in the growth and health of the plant.

Answer: B

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2. A mineral deficiency is likely to affect older leaves more than younger leaves if:

A. the mineral is a micronutrient.

B. the mineral is very mobile within the plant.

C. the mineral is required for chlorophyll synthesis.

D. the mineral is a macronutrient.

Answer: B

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3. Two groups of tomatoes were grown under laboratory conditions, one with humus added to the soil and one a control without humus. The leaves of the plants grown without humus were yellowish (less green) compared with those of the plants grown in humus-enriched soil. The best explanation for this difference is that

A. the healthy plants used the food in the decomposing leaves of the humus for energy to make chlorophyll.

B. the humus made the soil more loosely packed, so water penetrated more easily to the roots.

C. the humus contained minerals such as magnesium and iron, needed for the synthesis of chlorophyll.

D. the heat released by the decomposing leaves of the humus caused more rapid growth and chlorophyll synthesis.

Answer: C

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4. Macronutrients

A. are so called because they are more essential than micronutrients.

B. include manganese, boron, and zinc, among others.

C. function as catalysts.

D. are required in concentrations of at least 1 gram per kilogram of plant dry

matter

Answer: D

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5. Which of the following is not an essential mineral element for plants?

A. Potassium

B. Magnesium

C. Calcium

D. Lead

Answer: D

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Practice Exercise 3

1. Which of the following is not an important step in soil formation?

A. Removal of bacteria

B. Mechanical weathering

C. Chemical weathering

D. Clay formation

Answer: A

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2. Mycorrhizae enhance plant nutrition mainly by

A. absorbing water and minerals through the fungal hyphae.

B. providing sugar to root cells, which have no chloroplasts.

C. converting atmospheric nitrogen to ammonia.

D. enabling the roots to parasitize neighboring plants.

Answer: A

3. Select the incorrect statement for single ion channel :

A. Transport proteins

B. Rapid change in shape

C. Gated channels

D. Movement across membranes

Answer: D

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4. Mineral absorption is :

A. Only active

B. Only passive

C. Both passive and active

D. Mostly passive

Answer: C

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5. Transport proteins of _____ cells are control points where a plant adjusts the quantity and type solutes that reach the xylem,

A. Epidermal

B. Xylem

C. Endodermal

D. Pericycle

Answer: C

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Practice Exercise 4

1. Nitrogen fixation is

A. performed only by plants.

B. the oxidation of nitrogen gas.

C. catalyzed by the enzyme nitrogenase.

D. a single-step chemical reaction.

Answer: C

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2. Nitrification is

A. performed only by plants.

B. the reduction of ammonium ions to nitrate ions.

C. the reduction of nitrate ions to nitrogen gas.

D. performed by certain bacteria in the soil.

Answer: D

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3. Nitrate reduction

A. is performed by plants.

B. takes place in mitochondria.

C. is catalyzed by the enzyme nitrogenase.

D. includes the reduction of nitrite ions to nitrate ions.

Answer: A

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4. Which of the following is a parasite?

A. Venus flytrap

B. Pitcher plant

C. Sundew

D. Dodder

Answer: D

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5. All carnivorous plants

A. are parasites.

B. depend on animals as a source of carbon.

C. are incapable of photosynthesis.

D. obtain supplemental nitrogen from animals.

Answer: D

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In Chapter Exercise A

1. Mineral ions in plants are:

A. Never remobilised

B. Frequently remobilised

C. Always remobilised

D. Remobilised in the form of inorganic ions

Answer: B

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2. Which of the following mineral requires chelation in alkaline soil to increase its solubility:

A. Iron

B. Manganese

C. Magnesium

D. Phosphorus

Answer: A

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3. In Hydroponics :

A. pH is maintained at 8-9

B. Reuse of water and minerals is possible

C. Chemically active medium is used

D. Yield is not uniform

Answer: B

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4. Who at first demonstrated that plants can be grown to maturity in a defined soil less culture :

A. J.V. Sachs

B. Knoop

C. Skoog

D. Hoagland

Answer: A

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5. Mark the incorrect one:

A. Some plant species accumulate selenium

B. All discovered elements have not been reported in plants

C. All the elements found in plants are essential for plants

D. Radioactive strontium can be present in plants growing near nuclear sites.

Answer: C

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6. In hydroponics :

A. Cost of infrastructure is low

B. Soil borne pathogens are absent

C. Problem of weeding is present

D. pH is maintained at 7-8.

Answer: B

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7. Which is not a chelating agent in mineral nutrition :

A. EDTA,Citric Acid

B. EDDHA,Caffic acid

C. Siderophores,Trataric

D. EDB,Humic acid

Answer: D

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8. Which is not used in hydroponics :

A. Pertile

B. EDTA

C. EDB

D. Borosilicate glass

Answer: C

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9. Chelating agents used in culture experiments are

A. Electron donor

B. Electron acceptor

C. Carbon donor

D. Oxygen donor

Answer: A

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In Chapter Exercise B

1. Fertilizers

A. are often characterized by their N-P-O percentages.

B. are not required if crops are removed frequently enough.

C. restored needed mineral nutrients to the soil.

D. are needed to provide carbon, hydrogen, and oxygen to plants.

Answer: C

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2. Minerals useful in photosynthesis and binding of ribosomal subunits are respectively:

A. S,Mg

B. K,B

C. Mn,Mg

D. Fe,Mo

Answer: C

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3. In which disease, gums comes out from plants :

A. Dieback

B. Necrosis

C. Internal cork of apple

D. Exantherma

Answer: D

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4. Most deleterious effect of aluminium toxicity to plant is:

A. Necrosis at high concentration

B. Impaired phosphate availability

C. Weedicide effect

D. Disruption of iron uptake

Answer: D

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5. Nickel in an essential part of which of the following enzymes:

A. Urease

B. Nitrogenase

C. Nitrate reductase

D. PEP carboxy lase

Answer: A

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6. Boron is not required for :

A. Pollen germination

B. Photolysis of water

C. Sugar translocation

D. Uptake and utilisation of Cat^{++} ions

Answer: B

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7. Classification of essential elements is :

A. A quantitative feature

B. Based on the size of minerals

C. A qualitative feature

D. Based on the size of the plant

Answer: A

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8. Molybodenum is involved in

A. Nitrogen fixation and not in nitrate assimilation

B. Nitrogen fixation, nitrate assimilation

C. Nitrate assimilation, not in nitrogen fixation

D. Neither nitrogen fixation nor nitrate assimilation

Answer: B

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9. Which one of the following is called as partial mineral element?

A. P

B. N

C. S

D. K

Answer: B

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10. Boron and potassium are required for:

A. Chlorophyll and cyochromes

B. Translocation of sugars

C. Energy metabolism

D. Stabilisation of ribosomal fractions

Answer: B

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In Chapter Exercise C

1. Some of the problems associated with intensive irrigation include all but

A. mineral runoff

B. aquifer depletion

C. overfertilization

D. soil salinization

Answer: C

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2. If all protein transporters of membrane are saturated then rate of diffusion:

A. Is maximum

B. Remains same

C. Is minimum

D. Is optimum

Answer: A

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3. ‘Pump’ proteins in active transport:

A. Are present in cell wal

B. Perform downhill transport

C. Do not use energy

D. Perform uphill transport

Answer: D

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4. During active intake of minerals in first phase :

A. An initial rapid uptake of ions into the free space

B. The ions are taken slowly into the inner space

C. The ions are taken rapidly into the inner space

D. The ions are taken slowly into the outer space

Answer: A

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5. During in active absorption of ions:

A. Carriers are involved for both influx and efflux of ions

B. Immobile carriers with pores pumpions

C. Ions move in outer space against ecp gradients

D. Downhill transport of ions occurs

Answer: A

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6. Plants absorb minerals from the soil :

A. Independently of water absorbtion

B. By a process independent of water absorbtion

C. Only when soil solution is hypertonic to cell sap

D. Only when soil solution is hypotonic to cell sap

Answer: B

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7. Retranslocation of minerals from mature leaf to young leaf occurs through mostly:

A. Xylem

B. Phloem

C. Parenchyma

D. Apoplast

Answer: B

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8. Entry of ions into the cell across the plasma membrane occurs to maintain electrical equilibrium was proposed by:

A. Hylmo

B. Overstreet

C. Donnan

D. Home'

Answer: C

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9. Mineral deficient soil of tropical rain forests is due to:

A. Slow decomposition of humus

B. Excessive leaching

C. Alkalinity in soil

D. Excess of Cation

Answer: B

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10. We would expect the greatest difference in plant health between two groups of plants of the same species, one group with mycorrhizae and one group without mycorrhizae, in an environment

A. where nitrogen-fixing bacteria are abundant.

B. that has soil with poor drainage.

C. that has hot summers and cold winters.

D. in which the soil is relatively deficient in mineral nutrients.

Answer: D

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In Chapter Exercise D

1. The specific relationship between a legume and its mutualistic Rhizobium strain probably depends on

A. each legume having a chemical dialogue with a fungus.

B. each Rhizobium strain having a form of nitrogenase that works only in the appropriate legume host.

C. each legume being found where the soil has only the Rhizobium specific to that legume.

D. specific recognition between the chemical signals and signal receptors of

the Rhizobium strain and legume species.

Answer: D

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2. Epiphytes are

A. fungi that attack plants.

B. fungi that form mutualistic associations with roots.

C. nonphotosynthetic parasitic plants.

D. plants that grow on other plants.

Answer: D

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3. Denitrification is actually a process of:

A. Oxidation

B. Reduction

C. Ammonification

D. Deamination

Answer: B

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4. What is Hydroponics?Who discovered this technique?

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5. Nitrification was discovered by:

A. Schloesing and Muntz

B. Winogradsky

C. V. Helmont

D. Woodward

Answer: A

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6. How is manganese involved in photosynthesis?

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7. The pink colour proteinaceous pigment that acts as an oxgen scavenger is absent in all, expect :

A. Nostoc

B. Anabaena

C. Pisum sativum

D. Ginkgo

Answer: C

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8. The first stable product of biological nitrogen fixation is:

A. Nitrate

B. Nitrite

C. Ammonia

D. Amino acid

Answer: C

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9. Amides are:

A. Not transported in plants

B. Deaminated keto acids

C. Storage form of nitrogen

D. Precursor of amino acids

Answer: C

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10. Smallest angiospermic parasite Arceuthobium is:

A. Total root parasite

B. Total stem parasite

C. Partial root parasite

D. Partial stem parasite

Answer: B

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