1. Which of the following is a limiting nutrient for both natural and agricultural ecosystems?
(a) Carbon (b) Nitrogen
(c) Sulphur (d) Hydrogen

2. Two nitrogen atoms are joined by
(a) a double covalent bond
(b) ionic bond
(c) a triple covalent bond
(d) None of the above

3. The first stable product of fixation of atmospheric nitrogen in leguminous plants is ***NEET 2013***
(a) NO_2^- (b) ammonia (c) NO_3^- (d) glutamate

4. Decomposition of organic nitrogen of dead plants and animals into ammonia is called
(a) nitrification (b) denitrification
(c) ammonification (d) nitrogen-fixation

5. Which of the following is a characteristic feature of nitrifying bacteria?
(a) Oxidise ammonia to nitrates
(b) Convert proteins into ammonia
(c) Convert free nitrogen to nitrogen compounds
(d) Reduce nitrates to free nitrogen

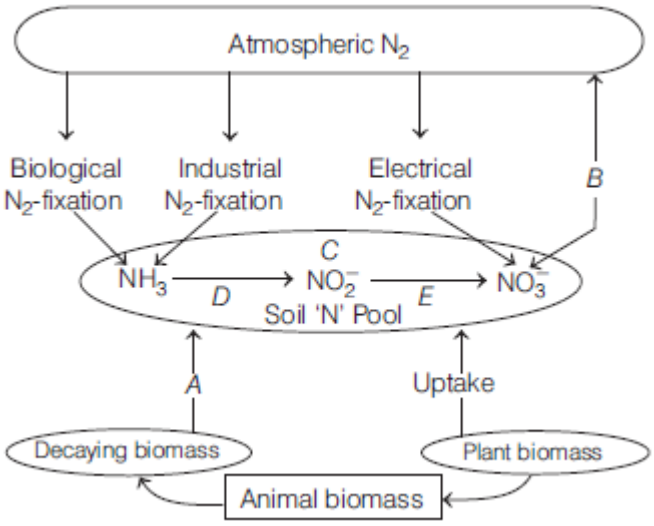
6. The soil area around the plant roots associated with the soil microorganisms is called
(a) phyllosphere (b) rhizosphere
(c) Both (a) and (b) (d) None of these

7. Observe the steps given below for nitrification

$$2NH_3 + 3O_2 \longrightarrow 2NO_2^- + 2H^+ + 2H_2O$$
$$2NO_2^- + O_2 \longrightarrow 2NO_3^-$$

The steps given above are carried out by
(a) *Nitrobacter* (b) *Nitrosomonas*
(c) *Nitrococcus* (d) All of these

8. Identify *A* to *D* in the given flow diagram which links the major nitrogen pools and choose the correct combination from the options given below.



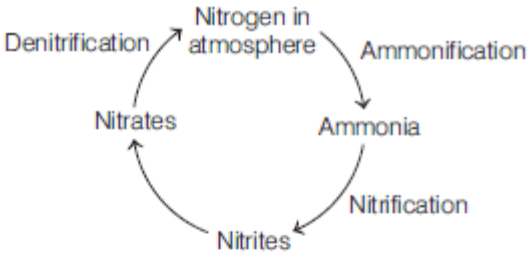
(a) A–Nitrification, B–Ammonification, C–*Nitrobacter*, D–*Nitrosomonas*
(b) A–Ammonification, B–Denitrification, C–Nitrification, D–*Nitrosomonas*, E–*Nitrobacter*
(c) A–Denitrification, B–*Nitrobacter*, C–Nitrification, D–*Nitrosomonas*, E–Ammonification
(d) A–*Nitrobacter*, B–Denitrification, C–*Nitrosomonas*,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

9. Which of the following is a bacterium involved in denitrification?
(a) *Azotobacter* (b) *Nitrosomonas*
(c) *Pseudomonas* (d) *Nitrobacter*

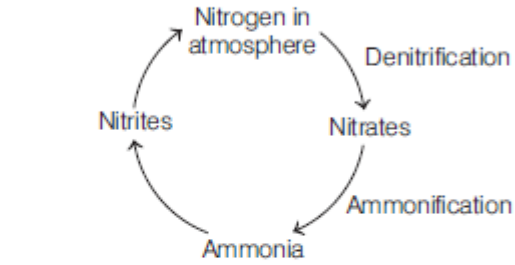
10. Which of the following bacteria reduces nitrate in soil into nitrogen? ***NEET (Odisha) 2019***
(a) *Nitrobacter* (b) *Nitrococcus*
(c) *Thiobacillus* (d) *Nitrosomonas*

11. Which of the following diagrams correctly depicts N_2-cycle?

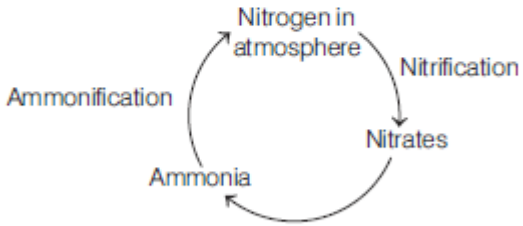
(a)



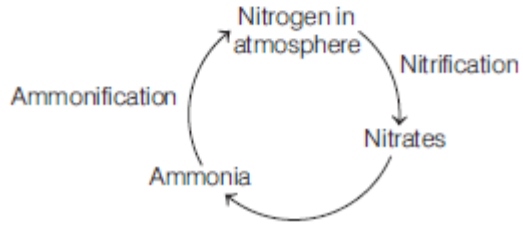
(b)



(c)



(d)



12. Reduction of nitrogen to ammonia by living organisms is called
(a) biological nitrogen-fixation
(b) nitrification
(c) denitrification
(d) assimilation

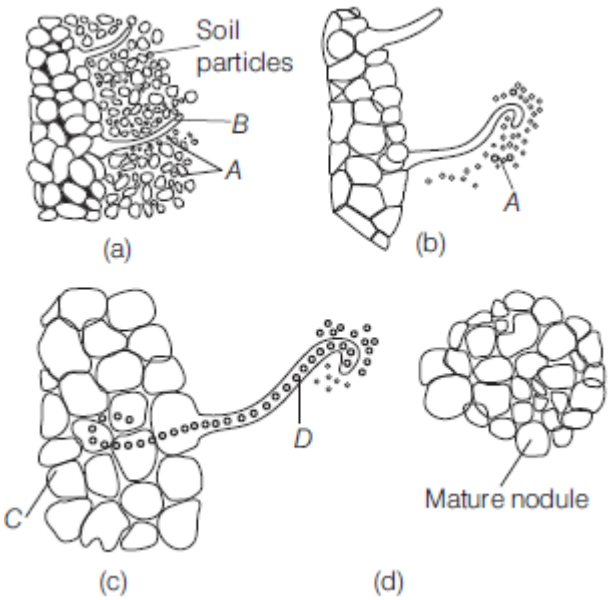
13. Free-living nitrogen-fixing bacteria is
(a) *Bacillus polymixa* (b) *Pseudomonas*
(c) *E. coli* (d) *Anabaena*

14. Which one of the following organisms are added as nitrogen-fixers in the rice field cultivation?
(a) *Alnus* (b) *Azolla*
(c) *Cycas* (d) *Marchantia*

15. Identify the non-leguminous plant that forms nodules to fix nitrogen.
(a) *Alnus* (b) *Pinus*
(c) *Cycas* (d) None of these

16. I. Leghaemoglobin is a unique ...*A*... and is chemically similar to the ...*B*... found in animal system.
II. ...*C*... is a very important constituent of ferredoxin, which plays an important role in biological N_2 -fixation.
III. In root nodules of leguminous plant, a red pigment, called ...*D*... is present, which is located in the membrane. Fill in the blanks (*A*-*D*).
(a) A–protein, B–haemoglobin, C–leghaemoglobin, D–iron
(b) A–iron, B–leghaemoglobin, C–protein, D–haemoglobin
(c) A–protein B–leghaemoglobin, C–iron, D–haemoglobin
(d) A–protein, B–haemoglobin, C–iron, D–leghaemoglobin

17. Identify the *A* to *D* correctly in the given diagram of root nodule development and choose the correct option accordingly.



(a) A–*Rhizobium* bacteria, B–Cortex cell, C–Outer cortex, D–Infection thread
(b) A–*Rhizobium* bacteria, B–Root hair, C–Inner cortex, D–Infection thread
(c) A–*Rhizobium* bacteria, B–Endodermal cell, C–Inner endodermis, D–Infection thread
(d) A–*Nitrosomonas* bacteria, B–Root hair, C–Inner cortex, D–Infection thread

18. Enzyme involved in nitrogen metabolism is
(a) phosphoenol pyruvate carboxylase
(b) ribulose bisphosphate carboxylase oxygenase
(c) nitrogenase
(d) alcohol dehydrogenase

19. The function of leghaemoglobin in the root nodules of legumes is
(a) oxygen removal
(b) inhibition of nitrogenase activity
(c) expression of *nif* gene
(d) nodule differentiation

20. During N_2-fixation, reduction of one molecule of N_2 into two molecules of NH_3 onsumes……molecules of ATP.
(a) 4 (b) 16
(c) 56 (d) 38

21. Various factors affect biological nitrogen-fixation by microbes. Identify the one which greatly and adversely affect the nitrogen-fixation.
(a) light (b) soil pH
(c) temperature (d) air

22. Which one is the correct summarised equation for nitrogen-fixation?

(a) $N_2 + 8e^- + 8H^+ + 8ATP \longrightarrow NH_3 + H_2 + 16ADP + 16Pi$

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

(c) $2NH_3 + 4O_2 \longrightarrow 2H^+ + 2H_2O + 2NO_3^-$

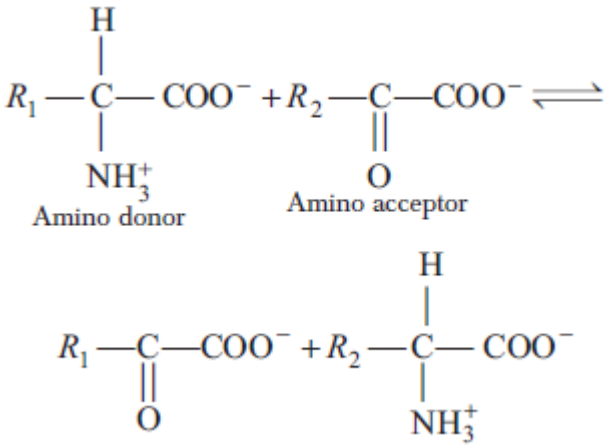
(d) $2\,NH_3 + 3O_2 \rightarrow 2\,NO_2^- + 2\,H^+ + 2\,H_2O$

23. The following reaction represents

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

(a) reductive amination (b) transamination
(c) amination (d) nitrification

24. What does the given reaction show?



Choose the correct option.

(a) Oxidative deamination (b) Reductive amination
(c) Transamination (d) Deamination

25. The two most abundant amides found in plants are

(a) asparagine and glutamine (b) lysine and asparagine
(c) glutamine and lysine (d) None of the above

26. Oily seeds contain

(a) Porphyrin (b) Chlorine
(c) Lecithin (d) Arginine

27. Minerals of soil are derived from

(a) Rocks (b) Clay
(c) Sub soil (d) Organisms

28. Which one of the following scientists used the nutrient culture solution in hydroponic cultures

(a) Sachs (b) Webster
(c) Wallace (d) Knop

29. Technique of growing plants without soil in nutrient solutions is called

(a) Parthenogenesis (b) Hydroponics
(c) Aquaculture (d) Tissue culture

30. Which of the following ions of heavy metals participate in process of photosynthesis in higher plants

(a) *Pb, Fe, Ni, Co* (b) *Mg, Zn, Cu, Hg*
(c) *Mg, Mn, Co, Fe* (d) *Mg, Cu, Mn, Fe*

1. (b)
2. (c)
3. (b)
4. (*c*) Ammonification is the process by which the organic nitrogen of dead plants and animals is converted to ammonium ions (NH4) by the action of saprotrophic fungi and bacteria.

5. (a)
6. (*b*) Rhizosphere is the narrow region of soil which is directly influenced by root secretions and is associated with the soil microorganisms.

7. (d)
8. (b)
9. (c)
10. (c) *Thiobacillus denitrificans* and *Pseudomonas denitrificans* reduce nitrate in soil into nitrogen through a process is called denitrification. On the other hand, *Nitrosomonas* and *Nitrococcus* oxidise ammonia into nitrite. The bacterium, *Nitrobacter* oxidises nitrite to nitrate. These processes together are known as nitrification.
11. (a)
12. (a)
13. (a)
14. (*b*) *Azolla* is added along with *Anabaena* to rice plants (a blue-green algae) which symbiotically fix atmospheric nitrogen to make it available to rice plants.

15. (*a*) *Alnus* is a non-leguminous plant that forms nodules to fix the atmospheric nitrogen with *Frankia*.

16. (d)
17. (b)
18. (*c*) The reduction of nitrogen to ammonia by living organisms is called biological nitrogen-fixation. Certain rokaryotic species are capable of fixing nitrogen due to the presence of nitrogenase enzyme in them.

19. (*a*) Leghaemoglobin is a red coloured pigment found in the root nodules of leguminous plants. It combines with oxygen and thus helps in oxygen removal from root nodules.
20. (b)
21. (*b*) The soil pH greatly and adversely affects the rhizosphere. This also effects the growth and multiplication of nitrogen-fixing bacterium and nodule formation.

22. (b)
23. (*a*) The reaction given in question represents reductive amination. In this process, a-ketoglutaric acid from the Krebs' cycle is converted into glutamate in the presence of coenzyme NADH or NADPH. The reaction occurs in the presence of enzyme glutamate dehydrogenase.
24. (*c*) The given reaction shows transamination. It involves the transfer of amino group from one amino acid to the ketogroup of a ketoacid. Glutamic acid is the main amino acid from which the transfer of NH2, the amino group takes place and other amino acids are formed through ransamination. The enzyme transaminase catalyses all such reactions.

25. (a)
26. C

27. A

28. (d) The nutrient solution composition proposed by Knop (1865) and Arnon and Hoagland's (1940) are commonly used.

29. B

30. D