CBSE Class 12 Biology

Sample Paper 01 (2020-21)

Maximum Marks: 70

Time Allowed: 3 hours

General Instructions:

i. All questions are compulsory.
ii. The question paper has four sections: Section A, Section B, Section C and Section D. There are 33 questions in the question paper.
iii. Section–A has 14 questions of 1 mark each and 02 case-based questions. Section–B has 9 questions of 2 marks each. Section–C has 5 questions of 3 marks each and Section–D has 3 questions of 5 marks each.
iv. There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
v. Wherever necessary, neat and properly labeled diagrams should be drawn.

Section A

1. At what stage does the meiosis occur in an organism exhibiting the haploidic life cycle and mention the fate of the products thus produced.
2. How many sperms will be produced from 10 primary spermatocytes and how many eggs will be produced from 10 primary oocytes?
3. Who first observed the X-chromosome? What was it called then?
4. Correct the following statement:
   In E.T. techniques, embryos are always transferred into the uterus.
5. How does the increase and the decrease in the value of r affect the population size?
6. How many kinds of phenotypes would you expect in F_2-generation in a monohybrid cross exhibiting codominance?
7. Mention two contrasting flower related traits studied by Mendel in pea plant experiments.
8. Name the respective forms in which the malarial parasite gains entry into

(i) Human body

(ii) Body of female anopheles

9. Name a molecular diagnostic technique to detect the presence of a pathogen in its early stage of infection.
10. Which one of the following is the baker's yeast used in fermentation? Saccharum barberi, Saccharomyces cerevisiae, Sonalika
11. **Assertion:** An organism with a lethal mutation may not even develop beyond the zygote stage.

    Reason: All types of gene mutations are lethal.

    a. The assertion is a true statement but the reason is false.
    b. Both assertion and reason are true and the reason is the correct explanation of the assertion.
    c. Both assertion and reason are true but the reason is not the correct explanation of the assertion.
    d. Both assertion and reason are false.

OR

Assertion: In human beings, 23 pairs of chromosomes are present in diploid cells.

Reason: 22 pairs of chromosomes are equal in male and female but a pair sex chromosome is different in them.

a. Both assertion and reason are correct
b. The assertion is correct but the reason is incorrect
c. Both assertion and reason are incorrect
d. The assertion is correct but reason does not explain the assertion

12. **Assertion:** Interferons are a type of antibodies produced by body cells infected by bacteria.

    Reason: Interferons stimulate inflammation at the site of injury.

    a. Both Assertion and Reason are false
    b. Both Assertion and Reason are true and the Reason is the correct explanation of the Assertion
    c. Both Assertion and Reason are true and the Reason is not the correct explanation of the Assertion
    d. The assertion is a true statement but the reason is false.

13. **Assertion:** Replication and transcription occur in the nucleus but translation occurs in the cytoplasm.
    Reason: mRNA is transferred from the nucleus into the cytoplasm where ribosomes and amino acids are available for protein synthesis.
    a. Both Assertion and Reason are true
    b. Both Assertion and Reason are true
    c. Assertion is true, but Reason is false
    d. Both Assertion and Reason are false
14. **Assertion:** India included in one of the 12 mega diversity countries of the world.
    Reason: Probably more than 1,00,000 plant species and more than 3,00,000 animal species yet to be discovered and described from India.
    a. Assertion and reason both are correct statements and reason is correct explanation for assertion.
    b. Assertion and reason both are correct statements but reason is not correct explanation for assertion.
    c. Assertion is correct statement but reason is wrong statement.
    d. Assertion is wrong statement but reason is correct statement.
15. **Read the following and answer any four questions:**
    For any species, the minimal requirement is one more species on which it can feed. Even a plant species, which makes its own food, cannot survive alone; it needs soil microbes to break down the organic matter in soil and return the inorganic nutrients for absorption. In nature, animals, plants and microbes do not and cannot live in isolation but interact in various ways to form a biological community. Even in minimal communities, many interactive linkages exist, although all may not be readily apparent. Interspecific interactions arise from the interaction of populations of two different species. They could be beneficial, detrimental or neutral neither harm nor benefit to one of the species or both. Interspecific interactions may result in mutualism, competition. parasitism, Predation, commensalism and amensalism.
    i. Species interaction with negative influence on both is referred to as
        a. amensalism
        b. mutualism
        c. commensalism
        d. competition

ii. Which of the following exhibits mutualism?
   a. Mycorrhizae living on the roots of higher plants.
   b. Wasps pollinating fig inflorescence.
   c. Sea anemone often found on the shell of a hermit crab.
   d. All of these

iii. An interaction between two individuals where one is benefitted while the other is neither benefitted nor harmed is called
   a. predation
   b. symbiosis
   c. amensalism
   d. commensalism

iv. Which of the following is not an example of a prey-predator relationship?
   a. Tiger eating a deer
   b. Plant Nepenthes trapping an insect
   c. Bacteria decomposing organic matter
   d. Crocodile killing a man

v. **Assertion-** The Abingdon tortoise in the Galapagos Islands became extinct within a decade after goats were introduced on the island.
   Reason- Abingdon tortoise extinct due to the greater browsing efficiency of the goats.
   a. Both Assertion and Reason are true and Reason is the correct explanation of the Assertion
   b. Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion
   c. Our Assertion is true but the Reason is false
   d. Both the statements are false

16. **Read the following and answer any four questions:**

In angiosperm, the seed is the final product of sexual reproduction. It is described as a fertilized ovule. The seeds are formed inside the fruit. The seed consists of a seed coat, cotyledon, and the embryo axis. A mature seed is usually non - albuminous or albuminous. Integument of ovules harder as tough protective seed coat. Sometimes due to reduced water content, the general metabolic activity of the seed slows down and the seed enters a state of inactivity. In the mature plant, the fruit develops from the ovary they are called true fruit. The fruit is the result of fertilization. There are a few species in

which fruit develop without fertilization banana is such an example

i. Which of the following have non-albuminous seed?
   a. Sunflower
   b. Groundnut
   c. Maize
   d. Barley

ii. The entry of oxygen and water in the seed during germination:
   a. micropyle
   b. chalazal
   c. epicotyl
   d. hypocotyl

iii. The embryo enters the state of inactivity called:
   a. pericarp
   b. dormancy
   c. apomixis
   d. none of these

iv. The wall of the ovary develops into the wall of fruit called:
   a. scutellum
   b. pericarp
   c. plumule
   d. radicle

v. The figure given below represent

   a. true fruit
   b. parthenocarpic fruit
   c. false fruit of apple
   d. false fruit of strawberry

Section B

17. Write the full form of the following:
    (i) MMR
    (ii) IVF
    (iii) GIFT
    (iv) ART
18. If a father and son are both defective in red-green color vision, is it likely that the son inherited the trait from his father? Comment.
19. A farmer adds Azotobacter culture to the soil before sowing maize. How does it increase the yield of maize?
20. What are the advantages of the techniques of GM crops?

OR

Expand ELISA. On what principle is ELISA test based? List two ways by which an infection can be detected by this test.

21. Certain molecular processes are given in column (A). Provide the terms given to these processes in column (B), after selecting them from the terms: Recombination, gene regulation, prokaryotic, transcription, eukaryotic transcription, translation, replication, gene transfer, DNA fingerprinting.

	Column A	**Column B**
(i)	DNA → DNA	
(ii)	DNA → hnRNA	
(iii)	hnRNA → Protein	
(iv)	Repressor Protein + Operator → No transcription	

22. How are DNA fragments visualized during gel-electrophoresis? What is elution?

OR

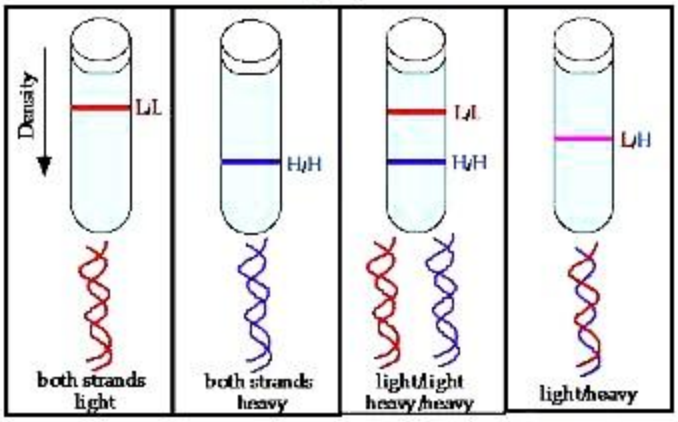
Both a winemaker and a molecular biologist who had developed a recombinant vaccine claim to be biotechnologists. Who in your opinion is correct?

23. What could be the possible explanation for greater vulnerability of amphibians to extinction as compared to other animal groups?

24. Why are herbivores considered similar to predators in the iconological context? Explain.
25. What do you mean by IUCN?

Section C

26. Differentiate between Genotype and Phenotype.
27. In the medium where E.coli was growing, lactose was ladded, which induced the lac operon. Then why does lac operon shut down after sometime after addition of lactose in the medium?
28. Do you consider passive smoking is more dangerous than active smoking? Why?
29. Answer the following questions based on Meselson and Stahl's experiment.



i. Write the name of the chemical substance used as a source of nitrogen in the experiment by them.
ii. How did the scientists make it possible to distinguish the heavy DNA molecule from the light DNA molecule? Explain.
iii. Write the conclusion the scientists arrived at after completing the experiment.

30. i. Name the causative agents of pneumonia and the common cold.
ii. How do these differ in their symptoms?
iii. Mention two symptoms common to both.

OR

Name an opioid drug and its source plant. How does the drug affect the human body?

Section D

31. The following is the illustration of the sequence of ovarian events 'a' to 'V in a human female:

i. Identify the figure that illustrates corpus luteum and name the pituitary hormone that influences its formation.
ii. Specify the endocrine function of corpus luteum. How does it influence the uterus? Why is it essential?
iii. What is the difference between 'd' and 'e'?
iv. Draw a neat labelled sketch of mature oocyte.

OR

i. Briefly explain the events of fertilisation and implantation in an adult human female.
ii. How does implantation lead to pregnancy?

32. Explain briefly about Restriction enzymes and DNA.

OR

For the selection of recombinants, insertional inactivation of the antibiotic marker has been superseded by insertional inactivation of a marker gene coding for a chromogenic substrate. Give reasons.

33. How do biofertilisers enrich the fertility of the soil?

OR

Explain the process of sewage water treatment before it can be discharged into natural water bodies. Why is this treatment essential?

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Solution

Section A

1. The zygote stage is the stage at which meiosis occurs in organisms with the haploidic life cycle. The zygote divides by meiosis to form the haploid spores which then grow into the haploid organisms.
2. 40 sperms, 10 eggs.
3. Henking first observed the X-chromosome and he called it as X body.
4. In ET (embryo transfer) technique, an embryo of 8 cell stage or lesser is transferred to the fallopian tube (zygote intrafallopian transfer) while that of more than 8 blastomere stage is transferred to the uterus (intrauterine transfer).
5. Increase in 'r' increases the population size while decrease in 'r' decreases the population size.
6. In codominance, alleles are able to express themselves independently when present together. Thus, in a monohybrid cross showing codominance, there would be three kinds of phenotypes in the F_2-generation.
7. Two contrasting flower traits are
   i. Violet flowers and white flowers.
   ii. Axial flowers and terminal flowers.
8. (i) Sporozoite
   (ii) Gametocycte
9. Polymerase chain reaction (PCR) is a technique used in molecular biology to amplify a single copy or a few copies of a segment of DNA across several orders of magnitude, generating thousands to millions of copies of a particular DNA sequence.
10. Saccharomyces cerevisiae
11. (a) The assertion is a true statement but the reason is false.
    Explanation: An organism with the lethal mutation may not even develop beyond the zygote stage due to change in the gene but all kinds of mutations are not lethal. The mutation is the main source of variation essential for evolution.

OR

(a) Both assertion and reason are correct

Explanation:

- In human beings, 23 pairs of chromosomes are present in diploid cells.
- Twenty-two pairs of chromosomes are equal in male and female but a pair sex chromosome is different in them. Male contains XY and females contain XX sex chromosomes.

12. (a) Both Assertion and Reason are false

    Explanation: Interferons are a group of signaling proteins made and released by host cells in response to the presence of pathogens to increase anti-viral defense. It does not stimulate inflammation at the site of injury.

13. (a) Both Assertion and Reason are true

    Explanation: Synthesis of RNA from DNA is called transcription and it occurs in the nucleus of eukaryotic cells.

    DNA replication occurs in the cytoplasm of prokaryotes and in the nucleus of eukaryotes. Regardless of where DNA replication occurs, the basic process is the same.

    Synthesis of protein from RNA is called translation and it occurs in the cytoplasm of eukaryotic cells.

    Messenger RNA (mRNA) is a molecule in cells that carries codes from the DNA in the nucleus to the sites of protein synthesis in the cytoplasm (ribosome) where they can be joined together in specific order to make a specific protein.

14. (a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

    Explanation: Although India has only 2.4 percent of the world's land area, its share of the global species diversity is an impressive 8.1 percent. That is what makes our country one of the 12 mega diversity countries of the world. Nearly 45,000 species of plants and twice as many of animals have been recorded from India. Applying this proportion to India's diversity figures, we estimate that there are probably more than 1,00,000 plant species and more than 3,00,000 animal species yet to be discovered and described.

15. i. (d) competition
    ii. (d) All of these
    iii. (d) commensalism
    iv. (c) Bacteria decomposing organic matter
    v. (a) Both Assertion and Reason are true and Reason is the correct explanation of the

Assertion

16. i. (b) groundnut
    ii. (a) micropyle
    iii. (b) dormancy
    iv. (b) pericarp
    v. (d) false fruit of strawberry

Section B

17. (i) Maternal mortality rate
    (ii) In vitro fertilization
    (iii) Gamete intra fallopian transfer
    (iv) Assisted reproductive technologies.
18. The genes for colour blindness are present on the X chromosome. But X chromosome in a son (male child) is not contributed by the father but comes from the mother. Hence, even if a father and his son both are suffering from colour blindness, the son has inherited this trait from his mother.
19. Azotobacter is a free-living nitrogen-fixing bacteria. It fixes atmospheric nitrogen in the soil and increases the fertility of soil. Maize plants cultivated in fertile soil result in the increase in yield.
20. There are two advantages -
    (i) Any gene can be used for transfer.
    (ii) Change in genotype is precisely controlled.

OR

ELISA-Enzyme Linked Immunosorbent Assay.
ELISA is based on antigen-antibody interaction.
The two ways to detect the presence of infection or disease by ELISA are as follows:

i. The presence of antigens (proteins, glycoproteins, etc) is detected.
ii. Antibodies produced against the pathogens are detected.

21.

	Column A	**Column B**
(i)	DNA $\rightarrow$ DNA	Replication
(ii)	DNA $\rightarrow$ hnRNA	

		Eukaryotic transcription
(iii)	hnRNA → Protein	Translation
(iv)	Repressor Protein + Operator → No transcription	Gene regulation

22.
- The separated DNA fragments can be visualized after staining with ethidium bromide followed by exposure to UV radiation.
- **Elution**- It is cutting and extraction of desired DNA bands from agarose gel to get its purified form.

OR

The basic definition of biotechnology says is a set of methods to use live organisms to produce products and processes for the benefit of humankind. So, it is correct to include a winemaker, as well as a molecular biologist under the category of biotechnologies as one has developed a recombinant vaccine and the other has developed wine using living organisms for human welfare.

23. Scientists have yet to understand the proper cause for the large scale extinction of amphibians. Some of the possible reasons are disease, habitat destruction and modification, exploitation, pollution, pesticide use, exotic species, and ultraviolet-B radiation. Small populations that survive within small fragments are often susceptible to inbreeding, genetic drift, or extinction due to small fluctuations in the environment. Their complex reproductive need may be one of the causes of the high vulnerability of amphibians to extinction.
24. Herbivores are considered similar to predators in iconological context because they transfer the energy fixed by plants to the next tropic level of carnivores. They also maintain the plant population under control.

25. International Union of conservation of Nature and Natural Resources. The IUCN is a union consisting of environmental experts and scientists from 160 countries. Its purpose is to preserve nature and seek solutions for the most urgent environmental problems.

Section C

26.

Genotype	Phenotype

It is the gene complement/gene makeup of an individual.	It is the external manifestation of gene products brought to expression.
Genotype remains the same throughout the life of an individual.	The phenotype may change with time and environment e.g., young and old man.
Genotype cannot be studied directly. It can be known through the study of ancestors, mating or offspring.	The phenotype can be known through direct observation.
It is not influenced by phenotype.	Genotype establishes the boundaries within which phenotype can be expressed.
In a given environment or time, individuals with similar genotypes will produce similar phenotypes.	Individuals with similar phenotypes may not belong to the same genotype.
Individuals with different genotypes may have similar phenotype e.g., tallness for TT and Tt.	Individuals with different phenotypes usually have different genotypes.

27. Lac operon is shut down after some times when the added lactose is utilized from the medium. It is because the repressor protein binds to the operator region of the operon and prevent RNA polymerase from transcribing the operon.
28. Passive smoking is definitely more dangerous than active smoking. A smoker is aware about the dangers of smoking and is doing it deliberately. But a non-smoker does not do it deliberately but situations force him/her to inhale the smoke. While epidemiological data show a higher prevalence of smoking-related diseases in smokers but still passive smoking is more dangerous because of non-intension factor involved in it.
29. i. NH_4Cl (ammonium chloride).
    ii. The heavy and light DNA molecules can be differentiated by centrifugation in a cesium chloride (CsCl) density gradient. The ^{15}N-DNA was heavier than ^{14}N-DNA and the hybrid ^{15}N - ^{14}N -DNA had density intermediate of the two.
    iii. Scientists concluded that the DNA replication is semiconservative, i.e. of the two strands of DNA, one is the parental strand, while another is newly synthesised.

30. i. Causative agent of pneumonia is *Streptococcus pneumoniae* while the causative agent of common cold is rhinovirus.

ii. Following are the symptoms of pneumonia and common cold that differs from other:

Pneumonia	Common cold
Infects alveoli of lungs	Infects nose & respiratory passage instead of lungs
Fever, chills	Nasal congestion and discharge, sore throat
Lips /fingers may turn grey to black in severe case	Lips/fingers are not affected in case of common cold

iii. **Symptoms common to pneumonia and common cold**: Cough and Headache

OR

Morphine is an opioid drug. Its source plant is papaver somniferum.
- These drugs bind to specific opioid receptors present in central nervous system and gastrointestinal tract and slow down the body functions

Section D

31. i. Stage 'g' represents the developing corpus luteum. Luteinising hormone (LH) secreted by pituitary help in its formation.

ii. The corpus luteum secretes a large amount of hormone progesterone. It is essential for the maintenance of endometrium of the uterus. It is a necessity for implantation and for pregnancy,

iii. Stage 'd' represents the tertiary follicle with a small cavity-antrum. It is surrounded by many layers of granulosa cells. It contains primary oocyte (meiosis-I arrested at prophase-I) stage V represents the mature follicle called Graafian follicle with a fluid-filled cavity antrum. It contains secondary Oocyte and a tiny first polar body.
The mature follicle is surrounded by theca externa and theca interna. It bursts to release secondary oocyte (Ovulation)

iv.

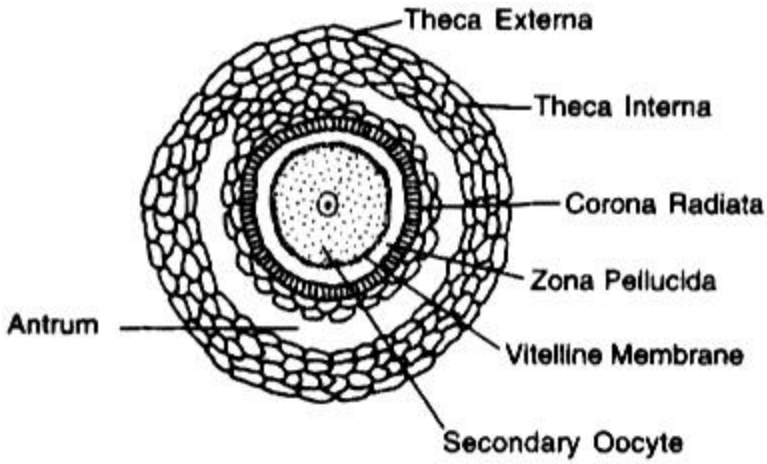
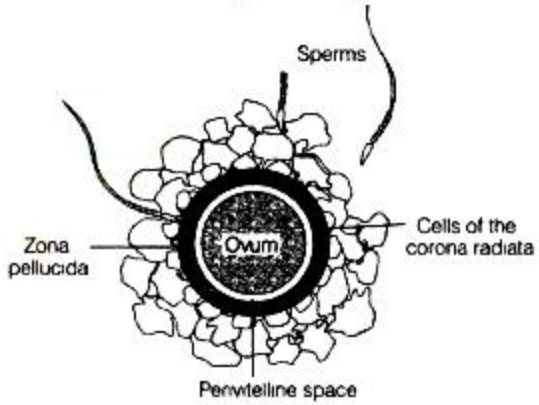


Figure: Structure of a mature oocyte

OR

i. Fertilisation is the process of fusion of a sperm with an ovum. The following events of fertilisation and implantation in an adult human female are as follows-
   a. The motile sperms move through the cervix, enter the uterus and reach the junction of the isthmus and ampulla (ampullary-isthmic junction) of the Fallopian tube.
   b. The ovum released from the ovary also reaches the ampullary-isthmic junction, where fertilisation takes place.
   c. Fertilisation can only occur if the ovum and sperms are transported simultaneously to this junction. This explains why all copulations do not lead to fertilisation and pregnancy.
   d. The sperm comes in contact with the zona pellucida of the ovum and induces changes in the membrane, which blocks the entry of the other sperms. Thus, it ensures that only one sperm can fertilise an ovum, i.e. secondary oocyte.

e.



During **Implantation** the mitotic division starts as the zygote moves through the isthmus

of the oviduct towards the uterus called **cleavage**, forming 2, 4, 8, 16 daughter cells called **blastomeres.**

i. The embryo with 8-16 blastomeres is called morula. But, it is not larger than a zygote.
ii. The morula continues to divide and transforms into blastocyst as it moves further into the uterus.
iii. The blastomeres in the blastocyst are arranged into an outer layer called trophoblast and the inner group of cells attached to trophoblast called the inner cell mass.
iv. The trophoblast layer then gets attached to the endometrium and the inner cell mass differentiates into the embryo. After attachment, the uterine cells divide rapidly and cover the blastocyst.
As a result, the blastocyst becomes embedded in the endometrium of the uterus. This is called implantation and it leads to pregnancy.

32. Restriction Enzymes and DNA: Restriction enzymes are those enzymes which cleave/cut the DNA at the particular sequence of the bases. More than 900 restriction enzymes have been isolated from over 230 strains of bacteria, each of which recognises different recognition sequences. Restriction enzymes belong to a larger class of enzymes called nucleases. They may be
    i. Exonucleases-remove nucleotides from the ends of DNA
    ii. Endonucleases - make cuts at specific positions within the DNA. Each restriction endonuclease recognises specific palindromic nucleotide sequences in the DNA. It functions by inspecting the length of DNA sequence, identify specific recognition sequence, bind to DNA and cut the two strands at specific points in the sugar-phosphate backbones.

OR

Selection of recombinants due to inactivation of antibiotics is a laborious process as it requires:

i. a vector with two antibiotic resistance marker.
ii. preparation of two kinds of media plate with one antibiotic each.

Transformed cells are first plated on that antibiotic plate which has not been insertional inactivated (ampicillin) and incubated overnight for growth of transformants. For the

selection of recombinants, these transformants are Replica plated on second antibiotic (tetracycline) plate (which got inactivated due to insertion of a gene). Non-recombinants grow on both the plates (one carrying ampicillin and the other carrying tetracycline) while recombinants will grow only on ampicillin plate.
This entire exercise is laborious and takes more time (two overnight incubation) as well. However. if we choose the second option (insertional inactivation of a marker that produces colour in the presence of a chromogenic compound), we can distinguish between the recombinants and nonsubstrate recombinants on a single medium plate (containing one antibiotic and the chromogenic compound) after overnight growth.

33. Biofertilisers are the organisms which increase the nutrient availability to the crop plants either directly or through soil enrichment. They play a role in increasing soil fertility and soil productivity. They are of three types-bacteria, cyanobacteria and mycorrhizal fungi. Bacteria and cyanobacteria function as biofertilisers because of their property of nitrogen fixation while mycorrhizal fungi preferentially withdraw minerals from decaying organic matter for the plant with which they are associated. Nitrogen fixation is the process of conversion of molecular or dinitrogen of the air into nitrogenous compounds.
Nitrogen-fixing bacteria and cyano-bacteria may be free-living or form a symbiotic association with the roots, stem & leaves of higher plants. For example, the Azolla-Anabaena association is of great importance to agriculture. *Azolla pinnata* is a free-floating freshwater fern which multiplies rapidly doubling every 5-7 days. The fern can co-exist with rice plants because it does not interfere with their growth. In some southeastern countries especially. China and in southern states in India rice fields are regularly provided with Azolla. Anabaena azollae residing in the leaf-cavities of fern> fixes nitrogen. A part of fixed nitrogen is excreted in cavities and available to the fern. The decaying fern plants, release the same for utilisation of the rice plants. When a field is dried at the time of harvesting the fern functions as green manure, decomposing and enriching the field for the next crop.

OR

Primary treatment of sewage involves the physical removal of large and small particles from sewage through filtration and sedimentation.
The steps involved in this process are:

i. Floating debris is removed by sequential filtration by passing through wire mesh screens.
ii. After this, the grit (soil and small pebbles) is removed by sedimentation in settling tanks. The sediment is called primary sludge and the supernatant forms the primary effluent.
iii. The effluent is then taken for the secondary treatment.

The secondary treatment of sewage is also called biological treatment because, in this treatment, sewage is subjected to biodegradation. It means that it involves the participation of microorganisms. The process of secondary treatment involves the following steps:

i. Primary effluent is passed into large aeration tanks with constant mechanical agitation and air supply. This allows vigorous growth of useful aerobic microbes into floes (masses of bacteria and fungi filaments).
ii. These microbes consume a major part of organic matter in the effluent while growing. This reduces the BOD of the effluent.
iii. When BOD of sewage gets reduced, it is passed into the settling tank. The bacterial floes settle in the tank and the sediment is called activated sludge. A small amount of activated sludge is pumped back into the aeration tank to serve as inoculum.
iv. The remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters, where other kinds of bacteria, which grow anaerobically, digest the bacteria and the fungi in the sludge. During this process, bacteria produce a mixture of gases, such as methane, hydrogen sulphide and carbon dioxide, which form biogas. The effluent from secondary treatment is generally released into natural water bodies. It helps to reduce water pollution and water-borne diseases.

The gases from biogas are used as a source of energy because it is inflammable.