



CREATIVE LEARNING CLASSES, KARKALA
SECOND PU ANNUAL EXAMINATION APRIL – 2022
BIOLOGY
DESCRIPTIVE EXAM DETAILED SOLUTION

PART - A

I. Answer any ten of the following questions in one word or one sentence each **10 X 1 =10**

1. What is Parthenogenesis?

A: The female gamete undergoes development to form new organism without fertilization is called parthenogenesis.

2. Define polyembryony.

A: Occurrence of more than one embryo in a seed is referred to as polyembryony.

3. Mention the organic resistant material present in the exine of pollen grains.

A: Sporopollenin.

4. Write the scientific name of the plant from which coca alkaloid is obtained.

A: *Erythroxylum coca*

5. Give one example for pleiotropy.

A: Phenylketonuria

6. Write one symptom of Turner's syndrome.

A: Rudimentary ovaries OR Lack of secondary sexual character (menstruation)

7. What is the function of DNA ligase?

A: Ligase is an enzyme which joins/combines the corresponding ends of two DNA fragments.

8. Give one example for hormone releasing IUDs.

A: LNG-20 OR PROGESTASERT

9: Write an example for auto immune disease.

A: Rheumatoid arthritis.

10. Write the use of Nucleopolyhedrovirus.

A: Species-specific, Narrow spectrum insecticidal application.

11. What is plasmid?

A: Plasmid is an autonomously replicating circular extra chromosomal DNA.

12. What are biofertilisers?

A: Biofertilisers are organisms that enrich the nutrient quality of the soil.

13. Write the function of statins.

A: It is used as a blood-cholesterol lowering agent.

14. What are transgenic animals?

A: Animals that have had their DNA manipulated to possess and express an extra (foreign) gene are known as transgenic animals.

15. What do you mean by endemism?

A: Species confined to that region and not found anywhere else.

II. Answer any five of the following questions in 3 to 5 sentences each wherever applicable 5X2=10

16. Define the following terms:

a) Staminate flower: Unisexual male flower, i.e., bearing stamens

b) Pistillate flower: Unisexual female flower, i.e., bearing pistils

17. Differentiate between albuminous and non-albuminous seeds.

A: Albuminous seed: Seeds retain the part of endosperm.

Non-albuminous seeds: Seeds have no residual endosperm.

18. Write any two examples of analogous organs in animals.

A: Example 1: Wing of butterfly and wing of bird

Example 2: eyes of octopus and mammals

Example 3: flippers of Penguins and Dolphins. (ANY TWO)

19. Differentiate between Menarche and Menopause.

A: Menarche: The first menstruation begins at puberty in human female.

Menopause: The menstrual cycle ceases at age of 50 years is called menopause.

20. Give a brief account on female heterogamety in sex determination.

A: Female heterogamety in which male produce same chromosomal gametes where as female produces different chromosomal gametes. Eg. Birds in which they follow ZZ and ZW chromosomal sex determination in which female bird as ZW sex chromosomes where as male ZZ sex chromosomes along with the autosomes. The sex determination of the young one depends of the type of female gamete fuses with the sperm.

21. Differentiate between inbreeding and outbreeding with reference to the animal breeding.

A: Inbreeding: It refers to the mating of more closely related individuals within the same breed for 4-6 generations.

Outbreeding: It is the breeding of unrelated animals which may be between the individuals of the same breed but having no common ancestors for 4-6 generations.

22. Mention two examples for primary lymphoid organs.

Example 1: Bone marrow

Example 2: Thymus

23. Differentiate between linkage and recombination.

A: Linkage: Physical association of genes on a chromosome.

Recombination: Generation of non-parental gene combination.

24. Mention any two causes for the biodiversity losses.

1. Habitat loss and fragmentation
2. Over exploitation
3. Alien species invasion
4. Co-extinctions (ANY TWO)

25. Write the use of polymerase chain reaction and write the scientific name of the bacteria from which thermostable DNA polymerase enzyme is obtained?

PCR helps to synthesis multiple copies of the gene (or DNA) of interest.

Scientific name of the bacteria: *Thermus aquaticus*

PART – C

III. Answer FIVE of the following questions in 40 – 80 words each, wherever applicable: 5 x 3 = 15

26. Cleistogamous flowers are invariably autogamous. Justify the statement.

- Cleistogamous flowers do not open at all.
- In such flowers, the anthers and stigma lie close to each other.
- When anthers dehisce in the flower buds, pollen grains come in contact with the stigma to effect pollination.
- Thus, cleistogamous flowers are invariably autogamous as there is no chance of cross-pollen landing on the stigma.
- Cleistogamous flowers produce assured seed-set even in the absence of pollinators.

27. Mention the stages of sexual reproduction.

- Pre-fertilization events
- Fertilization events
- Post-fertilization events

28. Describe the role of oxytocin hormone in Parturition.

- **Oxytocin** acts on the uterine muscle and causes stronger uterine contractions, which in turn stimulates further secretion of oxytocin.
- The stimulatory reflex between the uterine contraction and oxytocin secretion continues resulting in stronger and stronger contractions.
- This leads to **expulsion of the baby out of the uterus through the birth canal – parturition.**

29. Write two symptoms of down's syndrome and write the chromosome number in down's syndrome.

Symptoms of Down's syndrome:

- The affected individual is short statured with small round head, furrowed tongue and partially open mouth.
- Palm is broad with characteristic palm crease.
- Physical, psychomotor and mental development is retarded.

Chromosome number in Down's syndrome: 47 due to Trisomy of chromosome 21.

30. With reference to transcription in eukaryotes, explain the following terms:

- I. Splicing
- II. Capping
- III. tailing

- I) Splicing: Removal introns and joining of exons in a defined order.
- II)Capping: Addition of an unusual nucleotide (methyl guanosine triphosphate) to the 5'-end of hnRNA.
- III) Tailing: Adenylate residues (200-300) are added at 3'-end of mRNA in a template independent manner.

31. Mention the common approaches for the treatment of cancers.

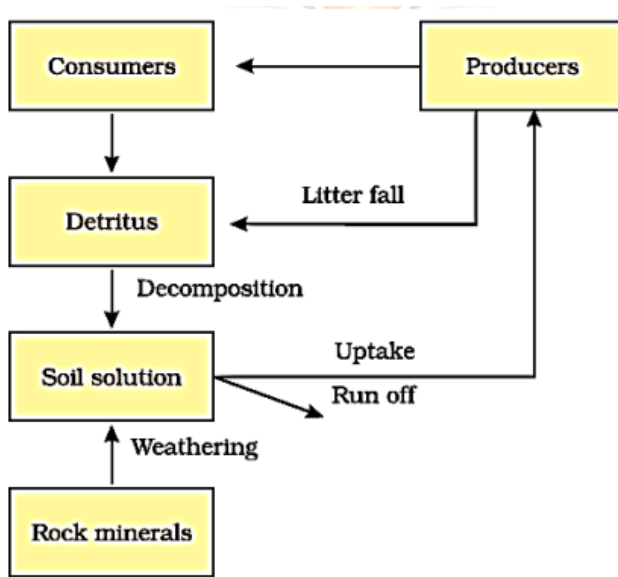
- The common approaches for treatment of cancer are:
 - ✓ Surgery
 - ✓ Radiation therapy and
 - ✓ Immunotherapy

32. What is ozone hole? Write any two effects of UV-B rays on skin.

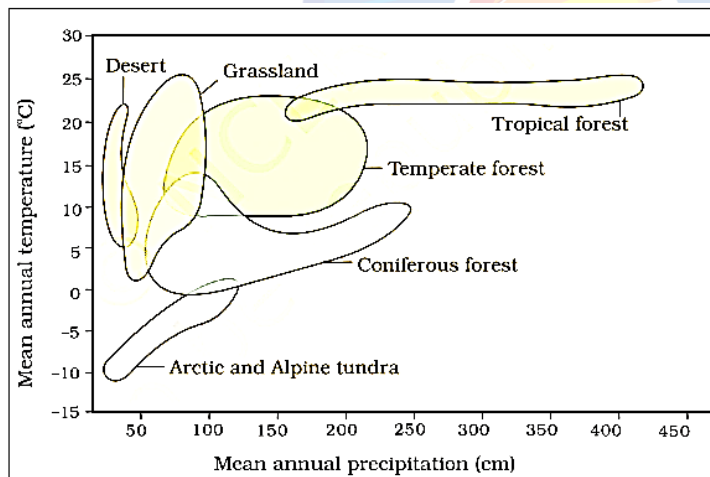
- Formation of a large area of thinned ozone layer, commonly called as the ozone hole.
- Effects of UV-B rays on skin:
 - ✓ It causes aging of skin
 - ✓ Damage to skin cells and
 - ✓ Various types of skin cancers.

33. Give the scheme of simplified model of phosphorous cycling in terrestrial ecosystem.

Ans:



34. Give the graphic representation of biome distribution with respect to annual temperature and precipitation.



Biome distribution with respect to annual temperature and precipitation

35. What is micropropagation? Write its significance and mention one example for it.

- The method of producing thousands of plants through tissue culture is called **micropropagation**.
- Significance: Each of the plants produced by micropropagation will be genetically identical to the original plant from which they were grown are called as **somaclones**.
- Example: Many important food plants like tomato, banana, apple, etc., have been produced on commercial scale using this method.

PART-D
SECTION-I

IV. Answer any four of the following questions in 200 to 250 words each, wherever applicable:

4X5=20

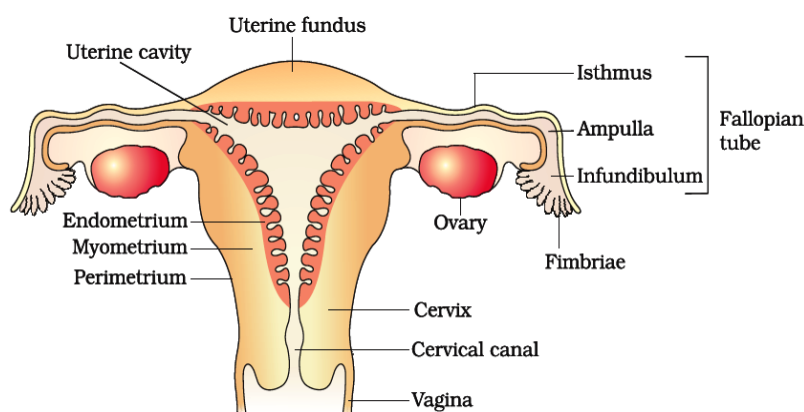
36. a) write the procedure of IVF-ET technique.

- In vitro fertilisation (IVF–fertilisation outside the body in almost similar conditions as that in the body) followed by embryo transfer (ET) is one of such methods.
- In this method, popularly known as test tube baby programme, ova from the wife/donor (female) and sperms from the husband/donor (male) are collected and are induced to form zygote under simulated conditions in the laboratory.
- Such zygote is then allowed to develop as embryo and is then transferred into the uterus of surrogate mother.

b) write the procedure of ICSI technique.

- Intra cytoplasmic sperm injection (ICSI) is another specialised procedure to form an embryo in the laboratory in which a sperm is directly injected into the ovum.

37. Sketch and label the sectional view of human female reproductive system.



38. Define megasporogenesis. Describe the internal structure of a mature embryo sac of an angiosperm flower.

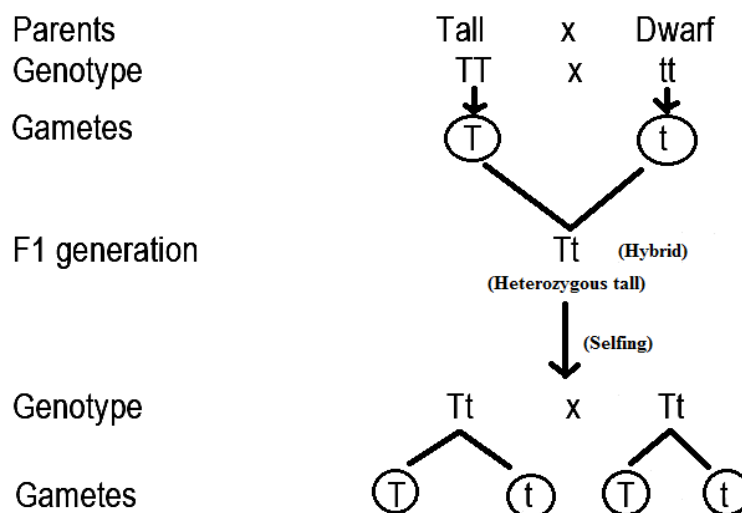
- The process of formation of megaspores from the megaspore mother cell through meiosis is called megasporogenesis.

Internal structure of mature embryo sac:

- There is a characteristic distribution of the cells within the embryo sac.
- Three cells are grouped together at the micropylar end and constitute the egg apparatus.
- The egg apparatus, in turn, consists of two synergids and one egg cell.
- The synergids have special cellular thickenings at the micropylar tip called filiform apparatus, which play an important role in guiding the pollen tubes into the synergid.
- Three cells are at the chalazal end and are called the antipodals.

- The large central cell, as mentioned earlier, has two polar nuclei.
- Thus, a typical angiosperm embryo sac, at maturity, though 8-nucleate is 7-celled.

39. Write the schematic representation of one gene inheritance in pisum sativum plant.



F2 generation:

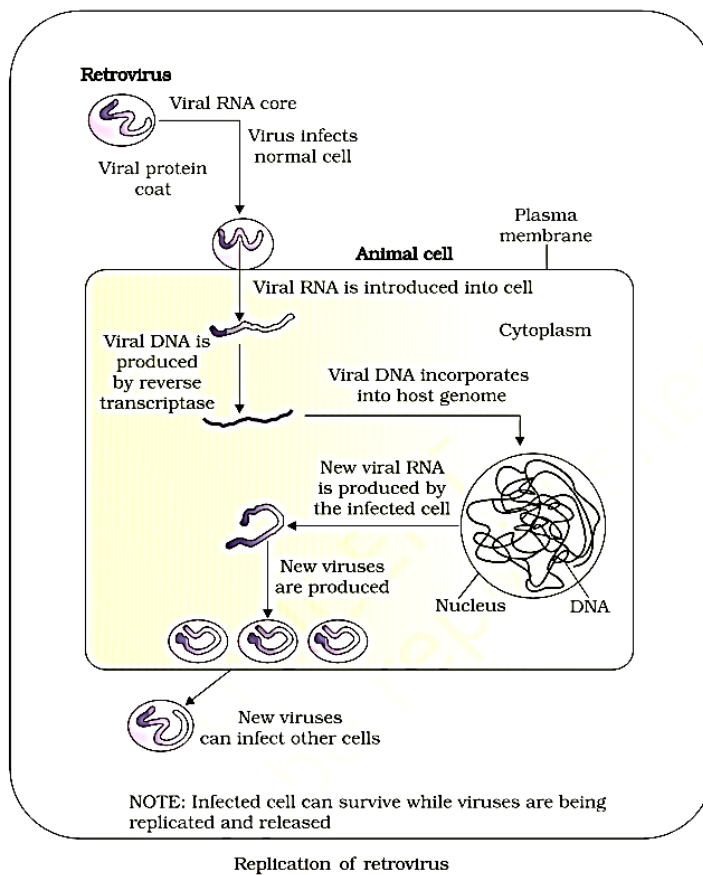
	T	t
T	TT Tall	Tt Tall
t	Tt Tall	tt Dwarf

- Phenotypic ratio- Tall: Dwarf – 3:1
- Genotypic ratio- TT: Tt: tt - 1:2:1

40. Write any five salient features of genetic code.

- The salient features of genetic code are as follows:
 - (i) The codon is triplet. 61 codons code for amino acids and 3 codons do not code for any amino acids, hence they function as stop codons.
 - (ii) Some amino acids are coded by more than one codon; hence the code is degenerate.
 - (iii) The codon is read in mRNA in a contiguous fashion. There are no punctuations.
 - (iv) The code is nearly universal: for example, from bacteria to human UUU would code for Phenylalanine (Phe). Some exceptions to this rule have been found in mitochondrial codons, and in some protozoans.
 - (v) AUG has dual functions. It codes for Methionine (met), and it also act as initiator codon.
 - (vi) UAA, UAG, UGA are stop terminator codons.

41. Give the schematic representation of the replication of retrovirus.



42. Write a detailed note on adaptive radiations.

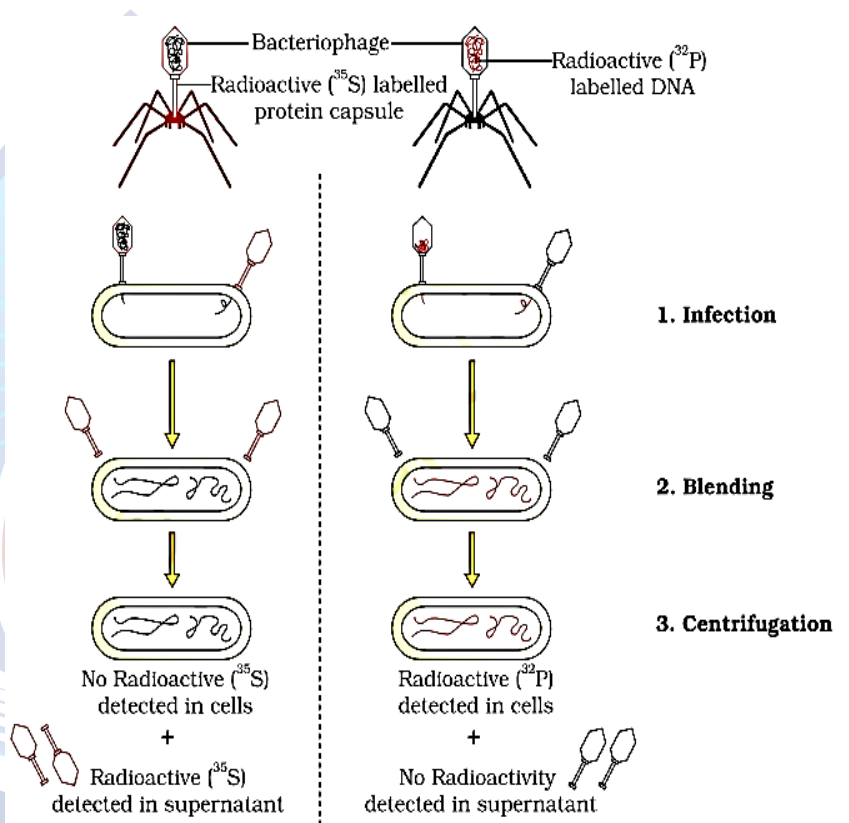
- The process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography (habitats) is called adaptive radiation.
- Darwin's finches represent one of the best examples of this phenomenon. In Galapagos Islands, Darwin observed an amazing diversity of creatures among the small black birds later called Darwin's Finches. He realized that there were many varieties of finches in the same island. All the varieties, he conjectured, evolved on the island itself. From the original seed-eating features, many other forms with altered beaks arose, enabling them to become insectivorous and vegetarian finches.
- Another example is Australian marsupials. A number of marsupials, each different from the other (Figure 7.6) evolved from an ancestral stock, but all within the Australian island continent.
- Placental mammals in Australia also exhibit adaptive radiation in evolving into varieties of such placental mammals each of which appears to be 'similar' to a corresponding marsupial (e.g., Placental wolf and Tasmanian wolf-marsupial).

43. Describe the Hershey chase experiment to prove that the DNA is genetic material.

- The unequivocal proof that DNA is the genetic material came from the experiments of Alfred Hershey and Martha Chase (1952).

- They worked with viruses that infect bacteria called bacteriophages.
- Hershey and Chase worked to discover whether it was protein or DNA from the viruses that entered the bacteria.
- They grew some viruses on a medium that contained radioactive phosphorus and some others on medium that contained radioactive sulfur.
- Viruses grown in the presence of radioactive phosphorus contained radioactive DNA but not radioactive protein because DNA contains phosphorus but protein does not.
- Similarly, viruses grown on radioactive sulfur contained radioactive protein but not radioactive DNA because DNA does not contain sulfur.

- Radioactive phages were allowed to attach to *E. coli* bacteria.
- Then, as the infection proceeded, the viral coats were removed from the bacteria by agitating them in a blender.
- The virus particles were separated from the bacteria by spinning them in a centrifuge.
- Bacteria which was infected with viruses that had radioactive DNA were radioactive, indicating that DNA was the material that passed from the virus to the bacteria.



The Hershey-Chase experiment

- Bacteria that were infected with viruses that had radioactive proteins were not radioactive.
- This indicates that proteins did not enter the bacteria from the viruses.
- DNA is therefore the genetic material that is passed from virus to bacteria.

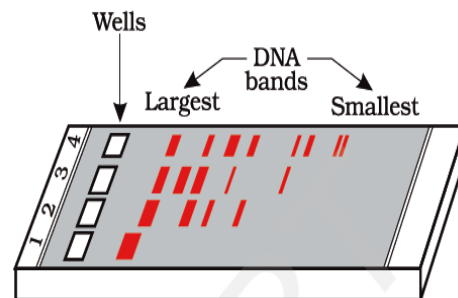
SECTION-II

V. Answer any three of the following questions in 200 to 250 words each wherever applicable 3X5=15

44. With a neat labeled diagram, explain the technique of gel electrophoresis in rDNA technology .

- The cutting of DNA by restriction endonucleases results in the fragments of DNA.
- **The technique used for the separation of DNA fragments is known as gel electrophoresis.**
- Since DNA fragments are negatively charged molecules, they can be separated by forcing them to move towards the anode under an electric field through a medium/matrix.

- The DNA fragments separate (resolve) according to their size through **sieving effect** provided by the agarose gel.
- Hence, the smaller the fragment size, the farther it moves.
- The separated DNA fragments can be visualised only after staining the DNA with a compound known as **ethidium bromide followed by exposure to UV radiation**.
- (Pure DNA fragments are not seen in the visible light without staining).



A typical agarose gel electrophoresis showing migration of undigested (lane 1) and digested set of DNA fragments (lane 2-4)

- This gives bright orange coloured bands of DNA in an ethidium bromide stained gel exposed to UV light.
- The separated bands of DNA are cut out from the agarose gel and extracted from the gel piece. This step is known as **elution**.
- The DNA fragments purified in this way are used in constructing recombinant DNA by joining them with cloning vectors.

45. Explain the important points for the successful bee keeping.

- The following points are important for successful bee-keeping:
 - (i) Knowledge of the nature and habits of bees,
 - (ii) Selection of suitable location for keeping the beehives,
 - (iii) Catching and hiving of swarms (group of bees),
 - (iv) Management of beehives during different seasons, and
 - (v) Handling and collection of honey and of beeswax.

46. Describe the secondary treatment process of sewage treatment.

- Treatment of waste water is done by the heterotrophic microbes naturally present in the sewage.

Secondary treatment or Biological treatment:

- The primary effluent is passed into large aeration tanks where it is constantly agitated mechanically and air is pumped into it.
- This allows vigorous growth of useful aerobic microbes into **flocs** (masses of bacteria associated with fungal filaments to form mesh like structures).
- While growing, these microbes consume the major part of the organic matter in the effluent.
- This significantly reduces the BOD (biochemical oxygen demand) of the effluent.
- Once the BOD of sewage or waste water is reduced significantly, the effluent is then passed into a settling tank where the bacterial 'flocs' are allowed to sediment. This sediment is called **activated sludge**.
- A small part of the activated sludge is pumped back into the aeration tank to serve as the inoculum.
- The remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters.

- Here, other kinds of bacteria, which grow anaerobically, digest the bacteria and the fungi in the sludge.
- During this digestion, bacteria produce a mixture of gases such as methane, hydrogen sulphide and carbon dioxide.
- These gases form biogas and can be used as source of energy as it is inflammable.
- The effluent from the secondary treatment plant is generally released into natural water bodies like rivers and streams.

47. Give an account on the development of Bt. Cotton plant.

- *B. thuringiensis* forms protein crystals during a particular phase of their growth. These crystals contain a toxic insecticidal protein.
- Specific Bt toxin genes were isolated from *Bacillus thuringiensis* and incorporated into the cotton plant to produce Bt cotton.
- Such Bt Cotton plants are resistant to cotton bollworms.
- The expression of Bt toxin gene in Bt cotton plant produces crystal protein/Bt toxin.
- The Bt toxin protein exist as inactive protoxins but once an insect ingests the inactive toxin, it is converted into an active form of toxin due to the alkaline pH of the gut which solubilise the crystals.
- The activated toxin binds to the surface of midgut epithelial cells and create pores that cause cell swelling and lysis and eventually cause death of the insect.

48. Write a note on Decomposition process.

- The process of breakdown of complex organic matter into inorganic substances like carbon dioxide, water and nutrients by the decomposers is called decomposition.
- The earthworm being referred to as the farmer's 'friend', because they help in the breakdown of complex organic matter as well as in loosening of the soil.
- Dead plant remains such as leaves, bark, flowers and dead remain of animals, including fecal matter, constitute detritus, which is the raw material for decomposition.
- The important steps in the process of decomposition are fragmentation, leaching, catabolism, humification and mineralization.

Fragmentation:

- Detritivores (e.g., earthworm) break down detritus into smaller particles. This process is called fragmentation.

Leaching:

- By the process of leaching, water soluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts.

Catabolism:

- Bacterial and fungal enzymes degrade detritus into simpler inorganic substances. This process is called as catabolism.

- It is important to note that all the above steps in decomposition operate simultaneously on the detritus.

Humification:

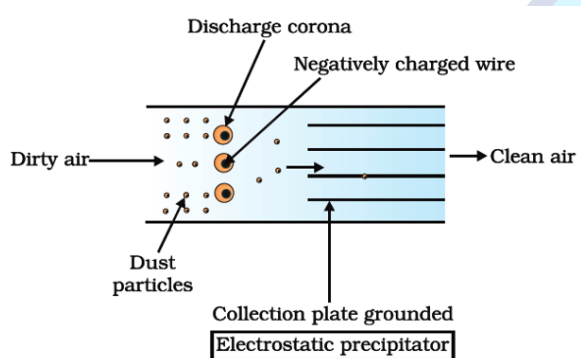
- Humification leads to accumulation of a dark coloured amorphous substance called humus that is highly resistant to microbial action and undergoes decomposition at an extremely slow rate.
- Being colloidal in nature it serves as a reservoir of nutrients.

Mineralisation:

- The humus is further degraded by some microbes and release of inorganic nutrients occur by the process known as mineralization.

49. With a neat labeled diagram, explain the process of removal of air pollutants by using electrostatic precipitator.

The electrostatic precipitator:



- It can remove over 99 per cent particulate matter present in the exhaust from a thermal power plant.
- It has electrode wires that are maintained at several thousand volts, which produce a corona that releases electrons.
- These electrons attach to dust particles giving them a net negative charge.
- The collecting plates are grounded and attract the charged dust particles.
- The velocity of air between the plates must be low enough to allow the dust to fall.

50. Define the following terms:

- a) Adaptations b) Natality c) Mortality d) Immigration e) Emigration

- a) Adaptations: **Adaptation** is any attribute of the organism (morphological, physiological, behavioural) that enables the organism to survive and reproduce in its habitat.
- b) **Natality**: It refers to the number of births during a given period in the population that are added to the initial density.
- c) **Mortality**: It is the number of deaths in the population during a given period.
- d) **Immigration**: It is the number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration.
- e) **Emigration**: It is the number of individuals of the population who left the habitat and gone elsewhere during the time period under consideration.

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