



Prajna Education Trust®
PACE PRE-UNIVERSITY COLLEGE
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II PUC ANNUAL EXAMINATION APRIL/MAY 2022

DATE: 04/05/2022

SUB: BIOLOGY (36)

ANSWER KEY

PART A

I. Answer any 10 of the following in a word/sentence each

10 X1 = 10

1) What is Parthenogenesis?

Female gamete undergoes development to form new organism without fertilization.

2) Define Polyembryony.

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.

Sporopollenin

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

Erythroxylem coca

5) Give one example for Pleiotropy.

Phenylketoneuria (PKU), Sickle cell anemia.

6) Write one symptom of Turner's syndrome.

Females are sterile

Ovaries are rudimentary

Lack of secondary sexual characters

(Any one)

7) What is the function of DNA ligase?

It helps in joining the ends of cut DNA molecules.

8) Give one example for hormone releasing IUDs.

Progestasert, LNG-20.

9) Write an example for auto immune disease.

Rheumatoid arthritis.

10) Write the use of Nucleopolyhedrovirus.

They are species specific, narrow spectrum insecticides or biocontrol agents.

11) What is Plasmid?

Autonomously replicating circular extrachromosomal DNA present in bacteria.

12) What are Biofertilisers?

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

13) Write the function of statins?

Blood cholesterol lowering agent.

14) What are transgenic animals?

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?

Species confined to a specific region and not found anywhere else.

PART B

II. Answer Any 5 of the following in 3-5 sentences each, wherever applicable

5X2=10

16) Define the following terms

a) **Staminate flower:** Unisexual male flowers bearing stamens.

b) **Pistillate flower:** Unisexual female flowers bearing pistil.

17) Differentiate between albuminous and non-albuminous seeds.

Albuminous seeds	Non-albuminous seeds
They retain a part of the endosperm as it is not completely used up during embryo development.	They have no residual endosperm as it is completely consumed during embryo development
Eg; Wheat, Maize, Barley, Castor	Eg; Pea, groundnut

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

- (i) Wings of butterfly and that of birds
- (ii) Eye of octopus and that of mammals
- (iii) Flippers of penguins and that of dolphins

(Any two)

19) Differentiate between Menarche and Menopause.

Menarche: First menstruation begins at puberty.

Menopause: Menstrual cycle ceases around 50 years of age.

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

- Two different types of gametes in terms of the sex chromosomes are produced by females i.e., female heterogamety.
- The two different sex chromosomes of a female bird have been designated to be the Z and W-chromosomes.
- In these organisms the females have one Z and one W-chromosome, whereas males have a pair Z-chromosomes besides the autosomes.

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

- **Inbreeding:** The mating of more closely related individuals within the same breed for 4-6 generations.
- **Outbreeding:** The breeding of unrelated animals.

22) Mention two examples for primary lymphoid organs.

Bone marrow and Thymus.

23) Differentiate between linkage and recombination.

- **Linkage:** Physical association of the genes on a chromosome.
- **Recombination:** The generation of non-parental gene combination.

24) Mention any two causes for the biodiversity losses.

- (i) Habitat loss and fragmentation
- (ii) Over exploitation
- (iii) Alien-species invasion
- (iv) Co-extinction

(Any 2 of the four)

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

Uses of PCR:

- (i) Multiple copies of gene of interest is synthesized in-vitro.
- (ii) Used to detect HIV in suspected AIDS patient.
- (iii) Used to detect mutations in genes in suspected cancer patients.
- (iv) It is used identify many genetic disorders.

The scientific name of the bacterium from which the thermostable DNA polymerase enzyme is obtained is *Thermus aquaticus*.

PART C

III. Answer Any 5 of the following in 40-80 words each, wherever applicable 5X3=15

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

In cleistogamous flowers the anthers and stigma lie close to each other. When anthers dehisce in the flower buds pollen grains come in contact with stigma to effect pollination. As there is no chance of cross pollen landing on the stigma, cleistogamous flowers are invariably autogamous.

27) Mention the stages of sexual reproduction.

Pre-fertilisation, Fertilisation, Post-fertilisation.

28) Describe the role of oxytocin hormone in Parturition.

The release of oxytocin from the maternal pituitary is triggered by foetal ejection reflex. 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.

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

- (i) Individual is short statured with small round head.
- (ii) Furrow tongue and partially opened mouth.
- (iii) Palm is broad with characteristic palm crease.
- (iv) Physical psychomotors and mental development is retarded.

(Any two)

The chromosome number in Down's syndrome is **trisomy of chromosome 21**.

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

a) **Splicing:** It is a process where the introns are removed and the exons are joined in a definite order.

b) **Capping:** Addition of an unusual nucleotide 'methyl guanosine triphosphate' to the 5' end of hnRNA.

c) **Tailing:** Addition of 200-300 adenylate residues to the 3' end of hnRNA in a template independent manner.

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

- (i) Surgery
- (ii) Radiation therapy
- (iii) Immunotherapy

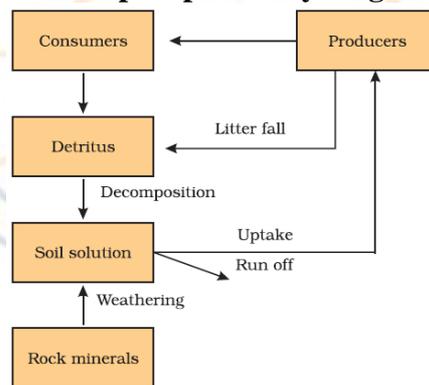
32) What is ozone hole? Write any two effects of UV-B rays on skin.

Large area of thinned ozone layer, commonly called as the ozone hole.

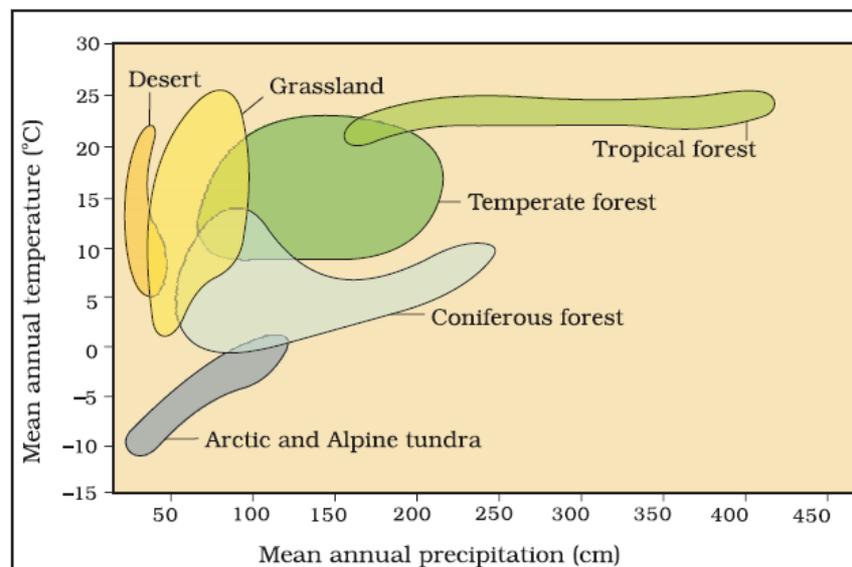
Effects of UV-B radiations:

Aging of skin, damage to skin cells and various types of skin cancer.

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



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



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

Method of producing thousands plants through tissue culture is called micropropagation.

Significance: The plants produced by micropropagation are genetically identical to the original plant.

Examples: Tomato, banana, apple.

(any one example).

PART D
Section I

III. Answer Any Four of the following in 200-250 words each, wherever applicable

5X4=20

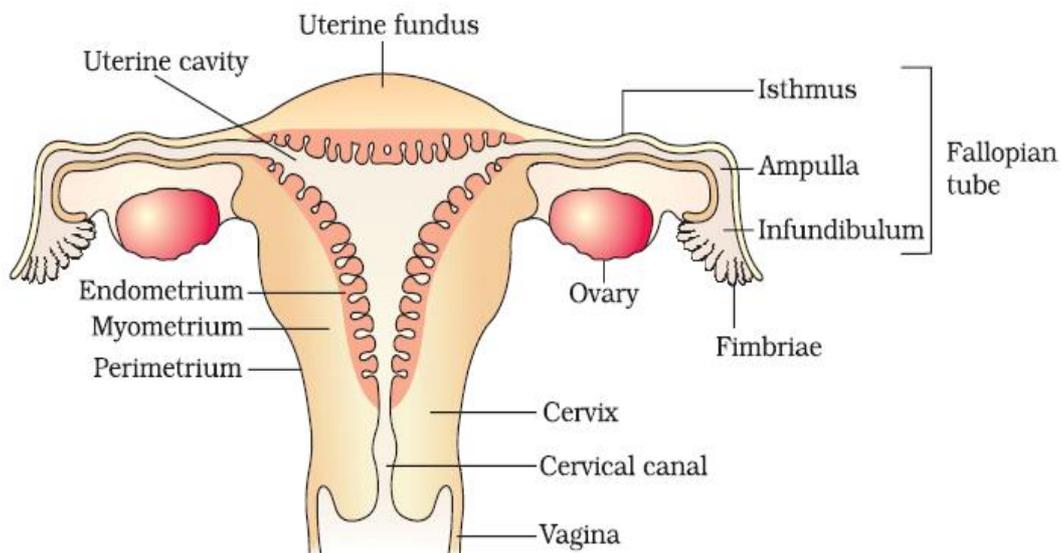
36) a) Write the procedure of IVF-ET technique.

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. The zygote or early embryos (with upto 8 blastomeres) could then be transferred into the fallopian tube (ZIFT-zygote intra fallopian transfer) and embryos with more than 8 blastomeres, into the uterus (IUT-intra uterine transfer), to complete its further development.

b) Write the procedure of ISI technique.

Intra Cytoplasmic Sperm Injection (CSI) is another specialized 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.

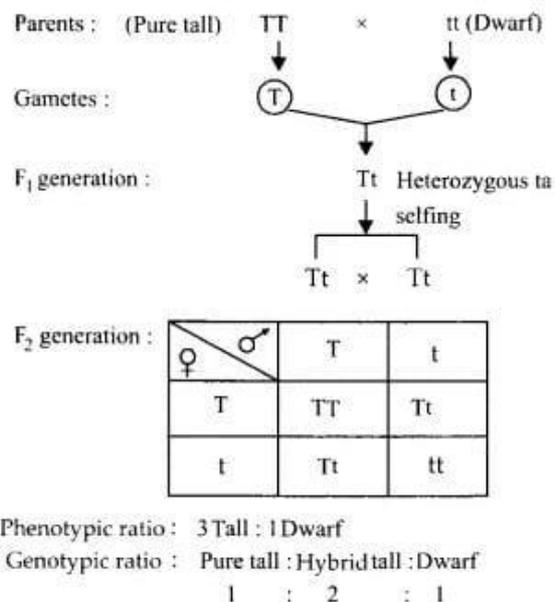


38) Define Megasporogenesis. Describe the internal structure of a mature embryo sac of an angiosperm flower.

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

- The nucleus of functional megaspore divides mitotically to form two nuclei which move to opposite poles & form a **2 nucleate** embryo sac.
- Sequentially, two more nuclear mitotic divisions occur resulting in the formation of a **4 nucleate** & later the **8 nucleate** stages of the embryo sac.
- The divisions differ from normal mitosis by only nuclear division but without wall formation.
- After **8 nucleate** stage, cell wall formation occurs to form typical **embryo sac** or **female gametophyte**.
- Three cells are organized at micropylar end to form the **egg apparatus**. It consists of two synergids & one egg cell.
- Synergids have special cell thickenings at micropylar end called **filiform apparatus**, which helps in **guiding pollen tubes** into the synergid.
- Three cells are at chalazal end to form **antipodals**. The large central cell is consisting of **two polar nuclei**. Hence a typical mature embryo sac of angiosperms is **8 nucleate & 7 celled**.

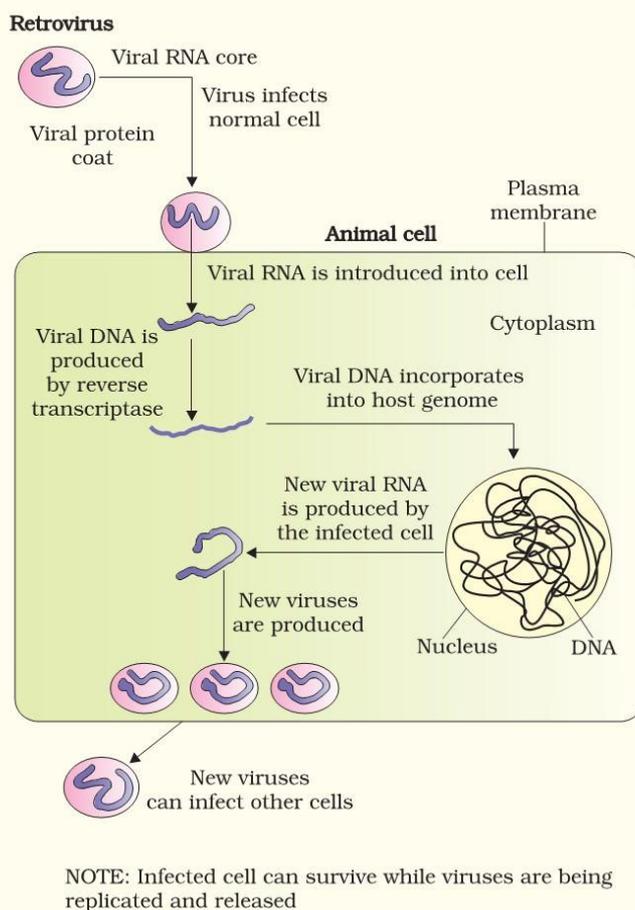
39) Write the schematic representation of one gene inheritance in *Pisum Sativum* plant.



40) Write any five salient features of genetic code.

- 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.
- One codon codes for only one amino acid, hence, it is unambiguous and specific.
- Some amino acids are coded by more than one codon, hence the code is degenerate.
- The codon is read in mRNA in a contiguous fashion. There are no punctuations.
- 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.
- AUG has dual functions. It codes for Methionine (met), and it also act as initiator codon.

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



42) Write a detailed note on adaptive radiations.

- The evolution of different species in a given geographical area starting from its original character and radiating to other geographical area is called adaptive radiation.
Example- Finches in Galapagos island-
- During Darwin's journey to Galapagos Island he observed small black birds called Darwin's Finches.
- The finches were diverse in their food habitats like original from seeds eating features to many other forms with altered beaks arose enabling them to become insectivorous and vegetarian finches.

Adaptive radiation in Australian marsupials

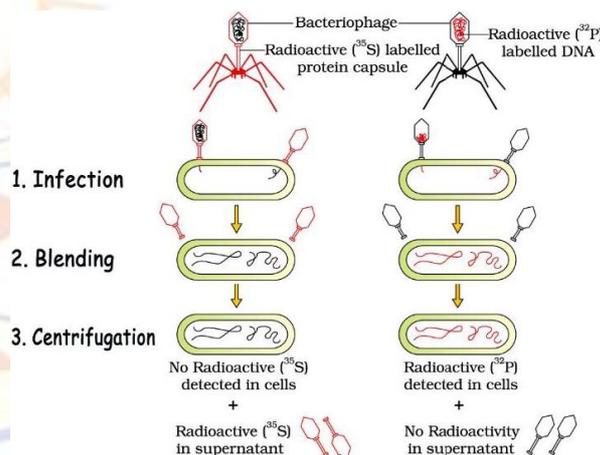
- A number of marsupials, each different from the other evolved from an ancestral stock but all within the Australian continent.
Examples- Tasmanian wolf, tiger cat, marsupial rat, kangaroo, wombat, sugar glider etc.

Adaptive radiation in Placental mammals-

- In Australia adaptive radiation is exhibited where placental mammals are evolved into varieties each of which appears to be similar to a corresponding marsupials.
Example- placental wolf and Tasmanian wolf marsupial

43) Describe the Hershey-Chase experiment to prove that the DNA is genetic material.

- Hershey & Chase grew some bacteriophage viruses on a medium containing radioactive phosphorus (P^{32}) and some others on medium containing radioactive sulphur (S^{35}).
- Viruses grown in P^{32} got **radioactive DNA** because only DNA contains phosphorus. Viruses grown in S^{35} got **radioactive protein** because protein contains sulphur.
- These preparations were used separately to infect *E. coli*.
- After infection, the *E. coli* cells were gently agitated in a blender to remove the virus particles from the bacteria.
- Then the culture was centrifuged to separate lighter virus particles from heavier bacterial cells.
- Bacteria infected with viruses having radioactive DNA were radioactive. i.e., DNA had passed from the virus to bacteria. Bacteria infected with viruses having radioactive proteins were not radioactive. i.e., proteins did not enter the bacteria from the viruses. This proves that DNA is the genetic material.

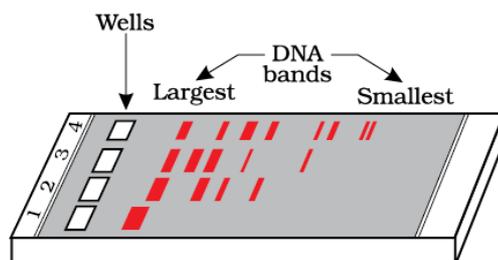


Section II

IV. Answer Any three of the following in 200-250 words each, wherever applicable 5X3=15

44) With a neat labelled diagram, explain the technique of gel electrophoresis in DNA Technology.

- The cut fragments of the DNA by the action of REN are now separated and then isolated by Agarose gel electrophoresis.
- The agar is used to prepare the gel which is extracted from brown algae.
- The stain used in the process is ethidium bromide.
- The DNA is loaded in the wells made on the agarose gel and the set-up is connected to electricity. When the charge is passed, the negatively charged DNA fragments will move towards the anode (+) on the other end of the agarose gel slab.



- Due to difference in thickness and weight, the DNA fragments move at different paced based on charge/mass ratio. The DNA is now stained with ethidium bromide and observed under the UV light.
- **Elution:** Cutting of fragments from gel and isolating DNA is called elution.
- This isolated DNA is further used for further processes of rDNA technology.

45) Explain the important points for the successful beekeeping.

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.

- The primary effluent is passed into large aeration tanks where it is constantly agitated which allows vigorous growth of useful aerobic microbes into flocs.
- Flocs are the masses of bacteria associated with fungal filaments to form mesh like structures.
- While growing, the microbes significantly reduces the BOD (biochemical oxygen demand) which is the amount of oxygen required to oxidize total organic matter in the effluent.
- The BOD test measures the rate of uptake of oxygen by micro-organisms, the greater the BOD of waste water, more is its polluting potential.
- The effluent is then passed into a settling tank where the bacterial 'flocs' are allowed to sediment and the 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 where other kinds of bacteria grow anaerobically which digest the bacteria and the fungi in the sludge.
- During digestion, bacteria produce a mixture of gases such as methane, hydrogen sulphide and carbon dioxide which form biogas .
- 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.

- Some strains of *Bacillus thuringiensis* have proteins that kill insects like coleopterans (beetles), lepidopterans (tobacco budworm, armyworm) & dipterans (flies, mosquitoes).
- *B. thuringiensis* forms an insecticidal protein (**Bt toxin**) crystal during a phase of their growth. It does not kill the *Bacillus* as it exists as inactive *protoxins*.
- When an insect ingests the toxin, it becomes active due to alkaline pH of the gut which solubilise the crystals. Toxin binds to surface of mid-gut epithelial cells creating pores. It causes cell swelling and lysis and death of the insect.
- **Bt toxin genes** were isolated from *B. thuringiensis* and incorporated into crop plants such as cotton.
- Most Bt toxins are insect-group specific. They are coded by **cry genes**. E.g. proteins encoded by *cryIAc* & *cryIIAb* genes control cotton bollworms. Protein of *cryIAb* gene controls corn borer.

48) Write a note on Decomposition process.

- Decomposers break down complex organic matter into inorganic substances like carbon dioxide, water and nutrients and the process is called decomposition.
- Dead plant remains such as leaves, bark, flowers and dead remains of animals, including fecal matter is called detritus.
- Detritus is the raw material for decomposition.

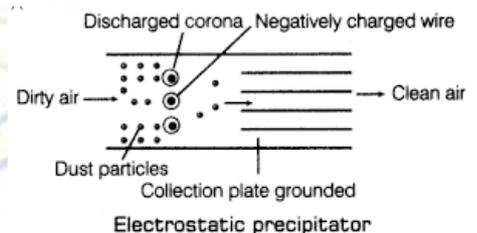
- Detritivores are the organisms break down detritus into smaller particles. Example-Earthworm
- The important steps in the process of decomposition are fragmentation, leaching, catabolism, humification and
- **Fragmentation** is thr breaking down of detritus into smaller particles.
- The process by which watersoluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts is called as **leaching**.
- The eprocess by which bacterial and fungal enzymes degrade detritus into simpler inorganic substances called as **catabolism**.
- **Humification** is the accumulation of a dark coloured amorphous substance called humus.
- The humus is further degraded by some microbes and release of inorganic nutrients occur by the process known as **mineralisation**.

Factors affecting the rate of decomposition

- Large amount of oxygen is required for decomposition as it is an energy requiring process.
- **Chitin** and **lignin** present in detritus slower the rate of decomposition.
- Nitrogen and water-soluble substances like sugars in detritus increases the rate of decomposition.
- Warm and moist environment favour decomposition whereas low temperature, dryness and anaerobiosis inhibit decomposition.

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

- Electrostatic precipitator 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.
- The 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:

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