LIBERTY PAPER SET

STD. 12 : Biology

Full Solution

Time : 3 Hours **ASSIGNTMENT PAPER 9**

Part A

1. (C) **2.** (D) **3.** (C) **4.** (C) **5.** (B) **6.** (B) **7.** (B) **8.** (C) **9.** (A) **10.** (B) **11.** (A) **12.** (C) **13.** (C) **14.** (A)
15. (D) **16.** (B) **17.** (B) **18.** (D) **19.** (A) **20.** (D) **21.** (B) **22.** (B) **23.** (D) **24.** (A) **25.** (A) **26.** (A) **27.** (C)
28. (A) **29.** (B) **30.** (B) **31.** (C) **32.** (D) **33.** (C) **34.** (B) **35.** (A) **36.** (D) **37.** (C) **38.** (C) **39.** (C) **40.** (C)
41. (C) **42.** (D) **43.** (A) **44.** (B) **45.** (D) **46.** (C) **47.** (B) **48.** (D) **49.** (A) **50.** (B)

Part B

Section A

➢ **Write the answer of the following questions : (Each carries 2 Mark)**

1.

➥ (i) True fruits :

- Develop only from the ovary.
- In most plants, by the time the fruit develops from the ovary, other floral parts degenerate and fall off.

➥ (ii) False fruits :

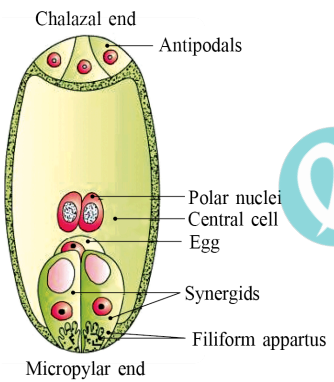
- The thalamus also contributes to fruit formation.
- Can be observed in a few species such as apple, strawberry, cashew, etc.

➥ (iii) Parthenocarpic fruits :

- Although in most of the species, fruits are the results of fertilisation, there are a few species in which fruits develop without fertilisation. Such fruits are called parthenocarpic fruits. eg. Banana.
- Banana is one such example.
- Parthenocarpy can be induced through the application of growth hormones and such fruits are seedless.

2.

➥



➥ The female gametophyte is formed by the mitotic division of the functional megaspore.

➥ The megaspore divides mitotically thrice to form 8 nucleate embryo sacs. The process of formation of 7-celled, 8 nucleate nature of female gametophyte is mentioned below :

- Two nuclei are formed after the cell undergoes first mitotic division.
- These two nuclei move towards the micropylar end and the chalazal end, respectively.
- They divide and redivide to form 8 nucleate stage.
- Consequently, there are four nuclei each on either ends.
- At the micropylar end, three out of the four nuclei differentiate into an egg cell and synergids.
- At the chalazal end, three out of the four nuclei differentiate as antipodal cells.
- The remaining cells, each from either ends move towards the centre and are known as polar nuclei.
- Therefore on maturation, the female gametophyte looks like a 7-celled structure.

3.

- Yes, the use of contraceptives is justified because of following reason :
  - These help in controlling the rapid growth of human population.
  - These do not interfere with the sexual desire or act.
  - These are also helpful in preventing unwanted pregnancies and controlling STIs.
  - They do not have any side effect.

4.

- Chromosomal disorder is caused due to absence or excess or abnormal arrangement of one or more chromosomes. It is of 2 types :

  (i) Aneuploidy (ii) Euploidy

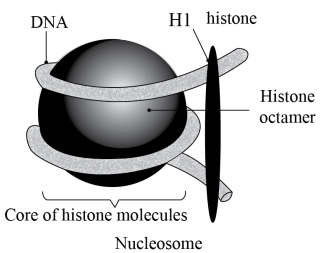
- (i) Aneuploidy
  - Failure of segregation of chromatids during cell division cycle results in the gain or loss of a chromosomes, is called aneuploidy.

    (i) Down's syndrome : It is the presence of an additional copy of chromosome number 21 (trisomy of 21).
  - Total 47 Chromosome Present
- Features :
  - They are short statured with small round head.
  - Broad flat face.
  - Furrowed big tongue and partially open mouth.
  - Retarded physical, psychomotor & mental development.

    (ii) Klinefelter's Syndrome : It is the presence of an additional copy of X-chromosome in male (trisomy).
- Features :
  - Overall masculine development. However, the fetninine developtnent is also expressed. e.g. Development of breast (Gynaecomastia).
  - Sterile.
  - Mentally retarded.

5.

- Taken the distance between two consecutive base pairs as 0.34 nm (0.34×10^{-9} m), if the length of DNA double helix in a typical mammalian cell is calculated (simply by multiplying the total number of bp with distance between two consecutive bp,
- The length of DNA = Total no. of base pair × Distance between two base pair
- 6.6×10^{9} bp $\times$ 0.34×10^{-9} m/bp it comes out to be approximately 2.2 metres.
- A length that is far, greater than the dimension of a typical nucleus (approximately 10^{-6} m).
- In prokaryotes, such as, E. coli, though they do not have a defined nucleus, the DNA is not scattered throughout the cell.
- DNA (being negatively charged) is held with some proteins (that have positive charges) in a region termed as 'nucleoid'.
- The DNA in nucleoid is organised in large loops held by proteins.



- In eukaryotes, this organisation is much more complex. There is a set of positively charged, basic proteins called histones.
- A protein acquires charge depending upon the abundance of amino acids residues with charged side chains.
- Histones are rich in the basic amino acid residues lysine and arginine.

- Both the amino acid residues carry positive charges in their side chains.
- Histones are organised to form a unit of eight molecules called histone octamer.
- Nucleosome :
- The negatively charged DNA is wrapped around the positively charged histone octamer to form a structure called nucleosome.
- A typical nucleosome contains 200 bp of DNA helix.
- Nucleosomes constitute the repeating unit of a structure in nucleus called chromatin, thread- like stained (coloured) bodies seen in nucleus.
- The nucleosomes in chromatin are seen as 'beads-on-string' structure when viewed under electron microscope (EM).
- The beads-on-string structure in chromatin is packaged to form chromatin fibers that are further coiled and condensed at metaphase stage of cell division to form chromosomes.
- Non-histone Chromosomal (NHC) proteins :
- The packaging of chromatin at higher level requires additional set of proteins that collectively are referred to as Non-histone Chromosomal (NHC) proteins.
- Euchromatin :
- In a typical nucleus, some region of chromatin are loosely packed (and stains light) and are referred to as euchromatin.
- Heterochromatin :
- The chromatin that is more densely packed and stains dark are known as heterochromatin. Euchromatin is said to be transcriptionally active chromatin, whereas heterochromatin is inactive.

6.

- (a) Amoebiasis
- Amoebiasis (Amoebic dysentery) : Pathogen is Entamoeba histolytica.
  - Mode of transmission : Houseflies (mechanical carriers) transmit parasites from faeces to food & water.
  - Symptoms : constipation, abdominal pain and cramps, stools with excess mucus and blood clots.
- (b) Malaria
- Maintaining personal and community hygiene is important for the prevention and control of many infectious diseases.
- Personal hygiene includes keeping the body clean, consuming pure water for drinking, food, vegetables etc.
- Disposal of sewage and excreta in public sanitation, periodic cleaning and keeping of reservoirs, cisterns, cesspools, tanks etc.
- Furthermore, it is necessary to follow the norms of cleanliness even in public use.
- Such measures are especially indispensable in places where infectious pathogens are spread through food and water like typhoid, amoebic, asceriasis etc.
- Close contact with the person as well as the use of items used in their mouth should be avoided as a treatment for the mentioned remedies used in air-borne diseases like pneumonia and cold.
- In insect-borne diseases like malaria and filariasis, the control and destruction of vectors and their breeding sites is essential.
- To achieve this purpose, water should not be allowed to accumulate in and around the residential area. Regular cleaning of the cooler used in the house is also a must.
- Use Gambusia fish which eat mosquito eggs.
- Places like pits, drainage, mud should be sprayed with pesticides.
- (c) Ascariasis
  - Intestinal parasitic worms (*Ascaris lumbricoid*) are responsible for this disease.
- Spread through :
  - The eggs of this parasite come out with the faeces of the infected person. It contaminates the soil, water and plants. Its spread in a healthy person is by consuming such contaminated water, vegetables, fruits etc.
- Symptoms :
  - Internal bleeding, muscle pain, fever, anemia and intestinal obstruction.

- (d) Pneumonia
- Pathogen : *Streptococcus pneumonia and Haemophiles influenza*
- Spread through :
  - Droplets or aerosols released by an infected person through coughing or sneezing. Inhalation or by using the utensils of an infected person.
  - As a result of infection, the alveoli get filled with fluid leading to severe problem in respiration.
- Symptoms :
  - Fever, chills, cough and headache
  - In severe condition, the lips and fingers become gray to blue in color.
- Treatment : Antibiotics

7.

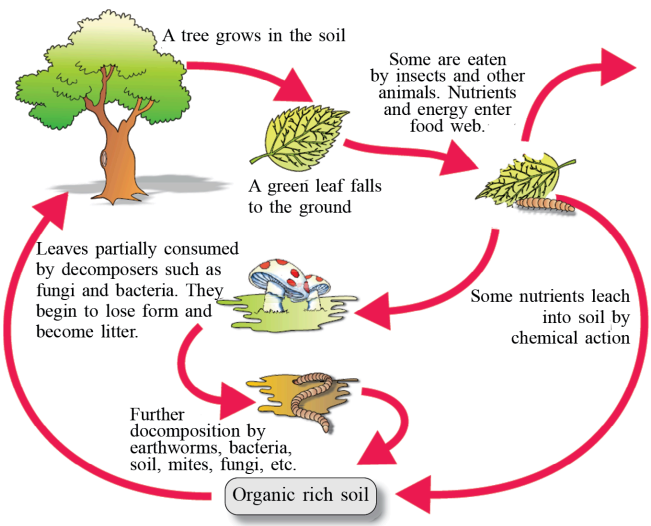
- This interaction confers benefits on both the interacting species.
- **Lichen :** It is a mutualistic relationship between a fungus & photosynthesizing algae or cyanobacteria.
- **Mycorrhizae :** Associations between fungi & the roots of higher plants. The fungi help the plant in the absorption of essential nutrients from the soil while the plant provides the fungi with carbohydrates.
- **Mutualism between plant & animal through pollination and seed dispersion:**
- **Examples :**

  (1) **Fig trees & wasps.** The fig species is pollinated only by its 'partner' wasp species.
  - Female wasp pollinates the fig inflorescence while searching for suitable egg-laying sites in fruits.
  - The fig offers the wasp some developing seeds, as food for the wasp larvae.

  (2) **Orchids** show diversity of floral patterns. They can attract the right pollinator insect (bees & bumblebees) to ensure pollination. Not all orchids offer rewards.

  (3) **'Sexual deceit of *Ophrys*** (Mediterranean orchid). One petal of its flower resembles female bee in size, colour & markings.
  - So male bee 'pseudocopulates' with the flower and is dusted with pollen. When this bee 'pseudocopulates' with another flower, it transfers pollen to it.
  - If the female bee's colour patterns change slightly during evolution, pollination success will be reduced unless the orchid flower co-evolves to maintain the resemblance of its petal to the female bee.

8.



9.

- When alien species are introduced unintentionally or deliberately for whatever purpose, some of them turn invasive, and cause decline or extinction of indigenous species.
- The Nile perch introduced into Lake Victoria in east Africa eventually led to the extinction of an ecologically unique assemblage of more than 200 species of cichlid fish in the lake.
- The environmental damage caused and threat posed to our native species by invasive weed species like carrot grass (Parthenium), Lantana and water hyacinth (Eicchornia).
- The recent illegal introduction of the African catfish Clarias gariepinus for aquaculture purposes is posing a threat to the indigenous catfishes in our rivers.

10.

- Pathogen : *Salmonella typhi*
- Spread through :
  - contaminated food-water
- Signs/symptoms :
  - Persistent high fever (39°C to 40°C)
  - Weakness, abdominal pain, constipation, headache and loss of appetite.
  - In severe cases intestinal perforation and sometimes death are possible.
- Diagnosis : Widal test
- Treatment : Antibiotics

11.

- The size of a population for any species is not a static parameter. It keeps changing with time, depending on various factors including food availability, predation pressure and adverse weather.
- In fact, it is these changes in population density that give us some idea of what is happening to the population – whether it is flourishing or declining.
- Whatever might be the ultimate reasons, the density of a population in a given habitat during a given period, fluctuates due to changes in four basic processes, two of which (natality and immigration) contribute to an increase in population density and two (mortality and emigration) to a decrease.

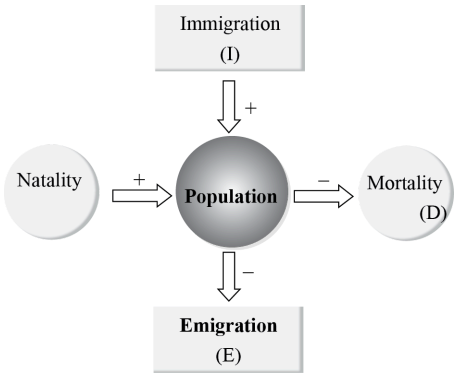
  (i) Natality refers to the number of births during a given period in the population that are added to the initial density.

  (ii) Mortality is the number of deaths in the population during a given period.

  (iii) Immigration is the number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration.

  (iv) Emigration is the number of individuals of the population who left the habitat and gone elsewhere during the time period under consideration.
- So, if N is the population density at time t, then its density at time t + 1 is

  $Nt + 1 = Nt + [(B + I) – (D + E)]$
- Population density will increase if the number of births plus the number of immigrants (B + I) is more than the number of deaths plus the number of emigrants (D + E).
- Under normal conditions, births and deaths are the most important factors influencing population density, the other two factors assuming importance only under special conditions.
- For instance, if a new habitat is just being colonized, immigration may contribute more significantly to population growth than birth rates.



12.

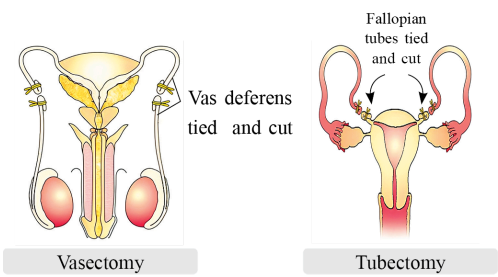
- Surgical Method of sterilisation :
- Surgical methods, also called sterilisation, are generally advised for the male/female partner as a terminal method to prevent any more pregnancies.
- Surgical intervention blocks gamete transport and thereby prevent conception.

(1) Vasectomy :

- Sterilisation procedure in the male is called 'vasectomy'.
- In vasectomy, a small part of the vas deferens is removed or tied up through a small incision on the scrotum.

(2) Tubectomy :

- Sterilisation procedure in female, is called tubectomy.
- In tubectomy, a small part of the fallopian tube is removed or tied up through a small incision in the abdomen or through vagina.
- These techniques are highly effective but their reversibility is very poor.
- It needs to be emphasised that the selection of a suitable contraceptive method and its use should always be undertaken in consultation with qualified medical professionals.
- One must also remember that contraceptives are not regular requirements for the maintenance of reproductive health.
- In fact, they are practiced against a natural reproductive event, i.e., conception/pregnancy. One is forced to use these methods either to prevent pregnancy or to delay or space pregnancy due to personal reasons.
- No doubt, the widespread use of these methods has a significant role in checking uncontrolled growth of population.
- However, their possible ill-effects like nausea, abdominal pain, breakthrough bleeding, irregular menstrual bleeding or even breast cancer, though not very significant, should not be totally ignored.

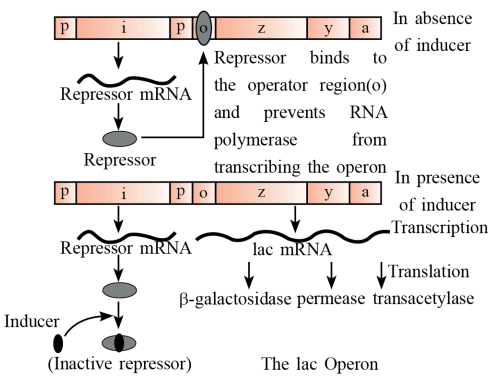


Section B

➢ **Write the answer of the following questions : (Each carries 3 Mark)**

13.

- The elucidation of the lac operon was also a result of a close association between a geneticist, Francois Jacob and a biochemist, Jacque Monod.
- They were the first to elucidate a transcriptionally regulated system.
- In lac operon (here lac refers to lactose), a polycistronic structural gene is regulated by a common promoter and regulatory genes.
- Such arrangement is very common in bacteria and is referred to as operon.
- The lac operon consists of one regulatory gene (the i gene - here the term i does not refer to inducer, rather it is derived from the word inhibitor) and three structural genes (z, y, and a).
- The i gene codes for the repressor of the lac operon.
- The z gene codes for beta-galactosidase (β-gal), which is primarily responsible for the hydrolysis of the disaccharide, lactose into its monomeric units, galactose and glucose.
- The y gene codes for permease, which increases permeability of the cell to β-galactosides.
- The a gene encodes a transacetylase.
- Hence, all the three gene products in lac operon are required for metabolism of lactose. In most other operons as well, the genes present in the operon are needed together to function in the same or related metabolic pathway.
- Inducer :
- Lactose is the substrate for the enzyme beta-galactosidase and it regulates switching on and off of the operon. Hence, it is termed as inducer.
- In the absence of a perferred carbon source such as glucose, if lactose is provided in the growth medium of the bacteria, the lactose is transported into the cells through the action of permease (Remember, a very low level of expression of lac operon has to be present in the cell all the time, otherwise lactose cannot enter the cells).
- The lactose then induces the operon in the following manner.
- The repressor of the operon is synthesised (all-the-time-constitutively) from the i gene. The repressor protein binds to the operator region of the operon and prevents RNA polymerase from transcribing the operon.
- In the presence of an inducer, such as lactose or allolactose, the repressor is inactivated by interaction with the inducer.
- This allows RNA polymerase access to the promoter and transcription proceeds. Essentially, regulation of lac operon can also be visualised as regulation of enzyme synthesis by its substrate.
- Remember, glucose or galactose cannot act as inducers for lac operon.
- Lac operon would remain expressed untill all the amount of lactose is converted to glucose & Galactose.
- Regulation of lac operon by repressor is referred to as negative regulation. Lac operon is under control of positive regulation as well, but it is beyond the scope of discussion at this level.



14.

- When a colony of bacteria is grown in agar culture medium supplemented with tetracycline antibiotics, the tetracycline-sensitive colonies die.
- Darwinian selection theory suggests that the environment selects organisms with useful variation over those which do not have useful variations.
- It is mainly because, in a dynamic environment, these organisms are better adapted to survive.
- A well-defined example for Darwin's theory is antibiotic resistance in bacteria.
- When bacteria were grown on tetracycline containing agar medium, all the bacteria died. However, the ones having variations conferring tetracycline resistance survived. Later, these bacteria multiplied and increased their number.
- As a result of this, tetracycline-resistant bacteria evolved and survived because of the environment that selected these over the others.

15.

- Cancer cells appear to have lost this property. As a result of this, cancerous cells just continue to divide giving rise to masses of cells called tumors.
- There are two types of tumors :
- Benign tumours :
  - Confined to the place of its origin. They do not spread to other parts. Cause little damage,
- Malignant tumours :
  - Mass of proliferating cells (neoplastic or tumour cells) that grow rapidly, invade and damage the surrounding normal tissues. Due to active division and growth, they starve normal cells by competing for nutrients.
  - Cells sloughed from tumours reach other sites via blood where they form a new tumour. This is called metastasis.

16.

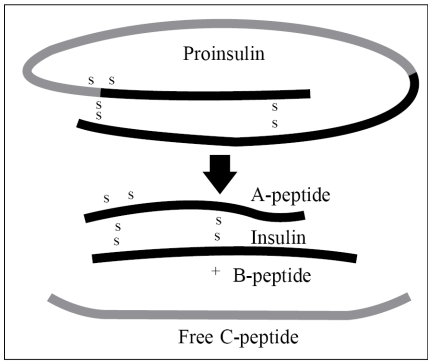
- Self-incompatibility refers to a genetically controlled mechanism that prevents self-pollination and promote cross-pollination in flowers.
- Self-pollination cannot lead to the formation of seeds in a self-incompatible species. This happens because the pollens are unable to fertilize the ovules that would develop into an embryo and hence form seeds.

17.

- Some microbes are used to prepare drugs.
- Antibiotics which is produced by the use of microbes, inhibits the growth of pathogens or kill them.
- This drugs commonly derived from fungi and bacteria.
- *Penicillium notatum*(fungi) secrete penicillin antibiotic which inhibits or slow down the growth of *staphylococci* bacterium.
- Antibiotics weaken the cell wall of bacteria. Such weak bacteria are destroyed by immune cells that is WBC.
- Streptomysin, tetracyclin, penicilin etc. Are common antibiotics.

18.

- Insulin is produced by beta cells of pancreas.
- Insulin plays important role in a sugar or carbohydrate metabolism.
- Due to lack of insulin diabetes mellitus occurs in humans.
- Insulin used for diabetes was earlier extracted from pancreas of slaughtered cattle and pigs.
- Insulin from an animal source, though caused some patients to develop allergy or other types of reactions to the foreign protein.



- Insulin consists of two short polypeptide chains: chain A and chain B.
- Polypeptide Chain A contains 21 amino acids and chain B contains 30 amino acids that are linked together by disulphide bridges.
- In mammals, including humans, insulin is synthesised as a pro-hormone (like a pro-enzyme, the pro-hormone also needs to be processed before it becomes a fully mature and functional hormone) which contains an extra stretch called the C peptide.
- This C peptide is not present in the mature insulin and is removed during maturation into insulin.
- The main challenge for production of insulin using rDNA techniques was getting insulin assembled into a mature form.
- In 1983, Eli Lilly an American company prepared two DNA sequences corresponding to A and B, chains of human insulin and introduced them in plasmids of E. coli to produce insulin chains.
- Chains A and B were produced separately, extracted and combined by creating disulfide bonds to form human insulin.

19.

- Certain companies are being granted patents for products and technologies that make use of the genetic materials, plants and other biological resources that have long been identified, developed and used by farmers and indigenous people of a specific region/country.
- Examples :
- Rice is an important food grain, the presence of which goes back thousands of years in Asia's agricultural history.
- There are an estimated 200,000 varieties of rice in India alone.
- The diversity of rice in India is one of the richest in the world.
- Basmati rice is distinct for its unique aroma and flavour and 27 documented varieties of Basmati are grown in India.
- There is reference to Basmati in ancient texts, folklore and poetry, as it has been grown for centuries.
- In 1997, an American company got patent rights on Basmati rice through the US Patent and Trademark Office.
- This allowed the company to sell a 'new' variety of Basmati, in the US and abroad.
- This 'new' variety of Basmati had actually been derived from Indian farmer's varieties.
- Indian Basmati was crossed with semi-dwarf varieties and claimed as an invention or a novelty.
- The patent extends to functional equivalents, implying that other people selling Basmati rice could be restricted by the patent.
- Several attempts have also been made to patent uses.
- products and processes based on Indian traditional herbal medicines, e.g., turmeric, neem other countries/individuals may encash on our rich legacy and we may not be able to do anything about it.

20.

- The most important of them are :
- (i) Genetic diversity :
  - A single species might show high diversity at the genetic level over its distributional range.
  - The genetic variation shown by the medicinal plant *Rauwolfia vomitoria* growing in different Himalayan ranges might be in terms of the potency and concentration of the active chemical (reserpine) that the plant produces.
  - India has more than 50,000 genetically different strains of rice, and 1,000 varieties of mango.

➥ (ii) Species diversity :

- The diversity at the species level, for example, the Western Ghats have a greater amphibian species diversity than the Eastern Ghats.

➥ (iii) Ecological diversity :

- At the ecosystem level, India, for instance, with its deserts, rain forests, mangroves, coral reefs, wetlands, estuaries, and alpine meadows has a greater ecosystem diversity than a Scandinavian country like Norway.

21.

➥ Decomposition :

- 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 feacal matter, constitute detritus, which is the raw material for decomposition.

➥ Important steps for decomposition :

- The important steps in the process of decomposition are fragmentation, leaching, catabolism, humification and mineralisation.

➥ 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.

➥ 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 mineralisation.

➥ Factors affecting decomposition :

- Decomposition is largely an oxygen-requiring process.
- The rate of decomposition is controlled by chemical composition of detritus and climatic factors.
- In a particular climatic condition, decomposition rate is slower if detritus is rich in lignin and chitin.
- Decomposition rate is quicker, if detritus is rich in nitrogen and water-soluble substances like sugars.
- Temperature and soil moisture are the most important climatic factors that regulate decomposition through their effects on the activities of soil microbes.
- Warm and moist environment favour decomposition, whereas low temperature and anaerobiosis inhibit decomposition resulting in build up of organic materials.

Section C

➢ **Write the answer of the following questions : (Each carries 4 Mark)**

22. Explain menstrual cycle in female in detail. (Diagram is not required)

➥ (i) Menarche - The first menstruation begins at puberty and is called menarche.

➥ (ii) Menopause - In human beings, menstrual cycles ceases around 50 years of age; that is termed as menopause.

➥ (iii) Menstrual cycle - In human females, menstruation is repeated at an average interval of about 28/29 days, and the cycle of events starting from one menstruation till the next one is called the menstrual cycle.

- Menstrual cycle: It is the reproductive cycle of female primates (such as monkeys, apes, and humans).
- The menstrual cycle is the sequence of events that begins with one menstruation and ends with the next.
- Menstruation occurs every 28/29 days in human females.
- Menstruation, the follicular phase, ovulation, and the luteal phase are the four phases of the menstrual cycle.
- Hormones that regulate the menstrual cycle are: Follicle-stimulating hormone (FSH), Luteinizing hormone (LH), Estrogen and Progesterone.

23.

- Mendal worked with and crossed pea plants that differed in two characters" as is seen in the cross between a pea plant that has seeds with yellow colour and round shape and one that had seeds of green colour and wrinkled shape.
- Mendel found that the seeds resulting from the crossing of the parents, had yellow coloured and round shaped seeds
- Yellow colour was dominant over green & round shape dominant over wrinkled.
- These results were identical to those that he got when he made separate monohybrid crosses. Yellow and green seeded plants and between round and wrinkled seeded plants.
- Let us use the genotypic symbols Y for dominant yellow seed colour and y for recessive green seed colour. R for round shaped seeds and r for wrinkled seed shape.
- The genotype of the parents can then be written as RRYY and rryy.
- The cross between the two plants can be written down as in figure. showing the genotypes of the parent plants.
- The gametes RY and ry unite on fertilisation to produce of F1 hybrid RrYy.
- When Mendel self hybridised the F_1 plants, he found that 3/4 of F_2 plants and yellow seeds and 1/4 had green.
- The yellow and green colour segregated in a 3 : 1 ratio. Round and wrinkled seed shape also segregated in a 3 : 1 ratio; Just like in a monohybrid cross.

Parent : RRYY × rryy

Gametes : (RY) (ry)

F_1 : RrYy (Round yellow)

Selfing : RrYy × RrYy

Gametes : (RY) (Ry) (rY) (ry) (RY) (Ry) (rY) (ry)

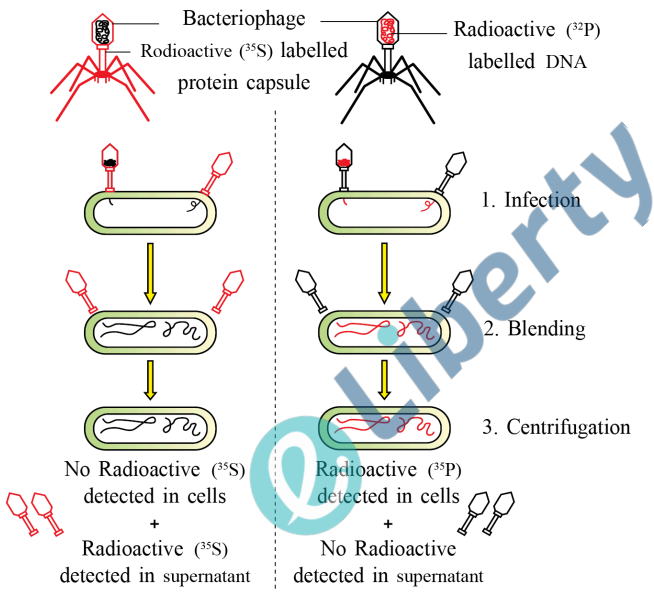
F_2 :

	(RY)	(Ry)	(rY)	(ry)
(RY)	RRYY	RRYy	RrYY	RrYy
(Ry)	RRYy	RRyy	RrYy	Rryy
(rY)	RrYY	RrYy	rrYY	rrYy
(ry)	RrYy	RrYy	rrYy	rryy

24.

- 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.
- The bacteriophage attaches to the bacteria and its genetic material then enters the bacterial cell.
- The bacterial cell treats the viral genetic material as if it was its own and subsequently manufactures more virus particles.
- 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.
- 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.



The Hershey-Chase experiment

25.

- As traditional breeding techniques failed to keep pace with demand and to provide sufficiently fast and efficient systems for crop improvement, another technology called tissue culture got developed.
- It was learnt by scientists, during 1950s, that whole plants could be regenerated from explants, i.e., any part of a plant taken out and grown in a test tube, under sterile conditions in special nutrient media.
- This capacity to generate a whole plant from any cell/explant is called totipotency.
- It is important to stress here that the nutrient medium must provide a carbon source such as sucrose and also inorganic salts, vitamins, amino acids and growth regulators like auxins, cytokinins etc.
- By application of these methods it is possible to achieve propagation of a large number of plants in very short durations.
- This called micro-propagation.
- Each of these plants will be genetically identical to the original plant from which they were grown, i.e., they are somaclones.
- Many important food plants like tomato, banana, apple, etc., have been produced on commercial scale using this method. Try to visit a tissue culture laboratory with your teacher to better understand and appreciate the process.

- Another important application of the method is the recovery of healthy pltnts from diseased plants.
- Even if the plant is infected with a virus, the meristem (apical and axillary) is free of virus.
- Hence, one can remove the meristem and grow it in vitro to obtain virus-free plants. Scientists have succeeded in culturing meristems of banana. Sugarcane, potato. etc.
- Somatic hybridisation
- Scientists have even isolated single cells from plants and after digesting their cell walls have been able to isolate naked protoplasts (surrounded by plasm membranes).
- Isolated protoplasts from two different varieties of plants - each having a desirable character - can be fused to get hybrid protoplasts, which can be further grown to form a new plant. These hybrides are called somatic hybrids while the process is called somatic hybridisation.
- When a protoplast of tomato is fused with that potato, and then they are grown - to form new hybrid plants combining tomato and potato characteristics.
- Well this has been achieved - resulting in formation of pomato; unfortunately this plant did not have all the desired combination of characteristics for its commercial utilisation.

26.

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	Monohybrid cross		Dihybrid cross
1	Monohybrid cross is a genetic cross between two homozygous individuals to obtain progenies with a single contrasting character.	1	Dihybrid corss is a cross between two pure plants to obtain progenies with two contrasting characters.
2	Phenotypic ratio is 3 : 1 in the F_2 generation.	2	Phenotypic ratio is 9 : 3 : 3 : 1 in the F_2 generation.
3	It produces a genotypic ratio of 1 : 2 : 1 in F_2 generation.	3	It produces a genotypic ratio of 1 : 2 : 2 : 4 : 2 : 1 : 2 : 1 in F_2 generation.
4	A single pair of gene is involved.	4	Two pair of gene is involved.

27.

- Plasmodium enters the human body in the form of *sporozoites* when an infected female *Anopheles* mosquito bites a human.
- Initially this parasite multiplies in the liver cells and then invades the blood cells causing RBC's to rupture.
- Rupture of RBC releases a toxic substance called hemozoin, which causes chills and high fever for 3 to 4 days.
- At this stage, when a female Anopheles mosquito bites an infected person, the parasite enters the mosquito's body, where it develops further.
- There they multiply and form sporozoites.
- This sporozoite is stored in the salivary gland of the mosquito.
- When this infected female mosquito bites a person, the parasite enters her body and develops.
- Malaria parasite requires two hosts to complete its life cycle,
- 1) Man, 2) Mosquitoes.
- Reproduction in Plasmodium
- Asexual reproduction in humans :
  - The parasite reproduces in the human RBC and destroys the RBC.
  - In RBC the sexual stage (germ cells) develop male and female germs (male-microgamete, female-mega gamete).
  - These genes enter mosquitoes from humans through mosquito bites.
- Sexual reproduction in mosquito :
  - The sexual genes (Gametes) entered into the mosquito from the human being are fertilized in the intestine of the mosquito and induce development.

- In order to develop, the sporozoite stage is stored in the salivary gland of the mosquito.
- Malaria is a disease caused by *Plasmodium*-like parasites in humans.
- Different species of Plasmodium like (*Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale*) are responsible for different types of malaria.