CBSE
Class XII Biology
Sample Paper – 9 (Solution)

Time: 3 hrs. **Total Marks: 70**

Section A

1. It is the transfer of pollen from one flower to the stigma of another flower on a separate plant of the same species.

2. It is the transient pore created in the cell membrane of the host for the uptake of foreign DNA molecules.

3. Cellulase enzyme is needed for isolating genetic material from plant cells and not from animal cells because it needs to breakdown the plant cell wall made of cellulose because animal cells do not have a cell wall.

4. Ocean and forest

5. A graphical representation of biomass per unit area in different levels of a food chain is called a pyramid of biomass.

Section B

6. The acrosome of a mammalian sperm carries sperm lysine and hyaluronidase enzyme which facilitates the sperm to penetrate the ovum during fertilisation. When the acrosome does not function normally, the sperm fails to penetrate the walls of the ovum and causes no fertilisation.

7. The proportion of A is equal to T and that of G is equal to C. So, according to Chargaff's rule, the percentage of adenine will be 30%.

8.

DNA	RNA
(i) The sugar in DNA is deoxyribose. (ii) The nitrogenous bases in DNA are adenine, guanine, cytosine and thymine.	(i) The sugar in RNA is ribose. (ii) The nitrogenous bases in RNA are adenine, guanine, cytosine and uracil.

9. The insecticidal protein (Bt toxin) exists as an inactive protoxin. However, when an insect ingests the inactive toxin, it is converted to an active form of the toxin because of the alkaline pH of the gut which solubilises the crystals of protein. Thus, this toxin does not kill the bacillus.

10. In the scarcity of water, the leaves of the plant roll up to minimise the rate of transpiration. During rolling, the stomata remain unexposed to the Sun so as to reduce the rate of transpiration. These plants may go through the special photosynthetic pathway called the crassulacean acid metabolism (CAM) pathway which enables their stomata to remain closed during the day.

OR

Effects of algal bloom:

(i) It causes the depletion of oxygen in water for other organisms.

(ii) It releases toxins in water to inhibit the growth of other algae and aquatic animals.

11. The detritus food chain in an aquatic ecosystem and the grazing food chain in a terrestrial ecosystem are responsible for the flow of a larger fraction of energy.

The major difference between the food chains is that the grazing food chain starts with green plants called producers as the first trophic level, whereas the detritus food chain begins with dead organic matter called saprophytes as the first trophic level.

12. The group of animals having same ancestry characters, general appearance and size is called 'breed'.
They have been developed as a result of animal breeding which aims at increasing the yield of animals and improving the desirable qualities of the progeny.

Section C

13. External fertilisation involves the union of the sperm with the egg outside the body of the female. It generally occurs in water.
Disadvantages:
(i) Organisms have to produce a large number of gametes into the surrounding medium (water) to enhance the chances of syngamy.
(ii) The offspring are extremely vulnerable to predators, threatening their survival up to adulthood.

14. The first half of the menstrual cycle is a stage of repair and proliferation where it is associated with the growing of follicles in the ovary. This is called the follicular phase.
The immature Graafian follicles start ripening in the ovary in the presence of FSH released from the anterior pituitary. This occurs in the absence of the inhibitory action of progesterone. Subsequently, oestrogen hormone is secreted by the follicular cells which cause the repairing of the endometrial lining of the uterus. The vascular supply to the uterus increases, and the endometrium enlarges to receive the fertilised ovum.

15. An ABO blood type in human is an example of multiple allelism where alleles I^A, I^B and i produce the four phenotypes (A, B, AB and O) of blood groups. In an individual, any two different alleles out of many (I^A, I^B and i) or the same allele in duplicate are present to represent any blood group.
Multiple allelism is a phenomenon which occurs when more than two alleles exist at a given locus of a chromosome, and in a given individual, only two of these alleles occur, one derived from each parent.
In garden pea, one of the allele (tallness) for any contrasting character is dominant over the other allele (dwarfness) of the same character; however, in case of the ABO blood group, alleles I^A and I^B are codominant.

16. The sex of the child will be male.
Symptoms:
(i) Sterile
(ii) Underdeveloped genitalia
(iii) Formation of female-like enlarged breasts
(iv) Tall with long limbs and sparse hair on the body

17.

No.	Syndrome	Cause	Characteristics of affected individuals	Sex/Male/Female/Both
1.	Down's	Trisomy of 21	(i) Broad forehead (ii) Permanently open mouth, protruding and furrowed tongue and projecting lower lip	Both
2.	Klinefelter's	XXY	Overall masculine development	Male
3.	Turner's	45 with XO	(i) Short stature females with webbed neck (ii) Body hair absent	Female

18. Diagnostic symptoms:

(a) Any wound which does not heal quickly.

(b) Any persistent lump or thickening in tissues, especially in the lip, tongue or breast.

(c) A regular change from normal in bowel movements.

19.

(a) The Green Revolution has made our country self-sufficient in food. Wheat production has increased from 11 million tonnes to 75 million tonnes, and rice production has increased from 35 million tonnes to 89.5 million tonnes during the period 1960–2000.

(b) It has increased the buffer stocks of food grains of our country to meet any natural calamities.

(c) It has improved the economic conditions of farmers.

20. Crop varieties are made disease resistant by conventional breeding or mutation breeding.

(a) Conventional breeding includes hybridisation and selection. The various sequential steps involved are

(i) Screening germplasm for resistance sources.

(ii) Hybridisation of selected parents.

(iii) Selection and evaluation of the hybrids and testing, and finally, the release of new varieties.

(b) Mutation breeding is the sudden and heritable change in a character of an organism.

It is done artificially through the use of chemicals or physical mutagens.

Disease-resistant varieties of wheat and *Brassica* are Himgiri and Pusa swarnim, respectively.

21.

(a) They have a better temperature and pH control system.
(b) They have a foam control system for the prevention of foaming and shearing damage to cells due to agitation.
(c) They have system sterilisation.

22.

(a) Isolate nematode-specific genes
(c) Produce sense and antisense RNA in the host cells
(d) Being complementary, sense and antisense RNA form double-stranded RNA (dsRNA)
(f) Silence the specific mRNA of the nematode
(g) Parasite cannot survive in the transgenic tobacco host expressing RNA
(h) Transgenic plant tobacco is protected from nematode

23. Factors which affect population density:

(a) Natality: It includes production of new individuals by birth, hatching, germination or division.
(b) Mortality: It includes decrease in the number of individuals per unit of time due to death.
(c) Emigration: It is the number of individuals going out of a population to join another population.

24.

(a) Key criteria for determining a hotspot:
  (i) Number of endemic species, i.e. the species which are found nowhere else.
  (ii) Degree of threat which is measured in terms of habitat loss.
(b) The Western Ghats and Northeast Himalayas are the two most biodiversity-rich zones of India.

OR

The food chain gets shortened if there is elimination of some trophic levels from a food chain. This happens due to undesirable activities of man to fulfil his needs. So, man causes the shortening of the food chain either by consuming plants or herbivores or carnivores.

Effects: Shortening of the food chain results in disturbing the natural ecosystem which exists in nature. It creates intraspecific and interspecific struggle among the species resulting in an imbalance in the functioning of the ecosystem and biosphere.

Section D

25.

(i) Unisexuality: Unisexuality ensures the process of cross-pollination as male and female sex organs are found on separate plants. So, cross-pollination is a rule in unisexual flowers. Examples: Maize, papaya

(ii) Self-sterility: In some plants, the pollen grains do not germinate on the stigma of the same flower and they become sterile. Examples: Petunia, apple

(iii) Dichogamy: In some flowers, the ripening of stamens and stigma take place at different times and this ensures cross-pollination and prevents self-pollination. If the stamens mature before carpels, then it is called protandry. Examples: Cotton and lady finger. If the carpels ripen before the stamens, it is called protogyny. Example: Solanum

(iv) Herkogamy**:** In some flowers, the essential organs of the flower mature at the same time but they are so placed at their different lengths that pollen grains from the anthers are unable to reach the stigma of the same flower. Example: Hibiscus

(v) Heterostyly: Some flowers are dimorphic-one type of flowers bear long stamen and short style, while the other type of flowers have short stamens and a long style.

Pollination in these flowers occurs when the short stamen of one flower and short stigma of another flower mature at the same time. Similarly, when the long stamens ripe, the long stigma will ripen. Example: Primrose

OR

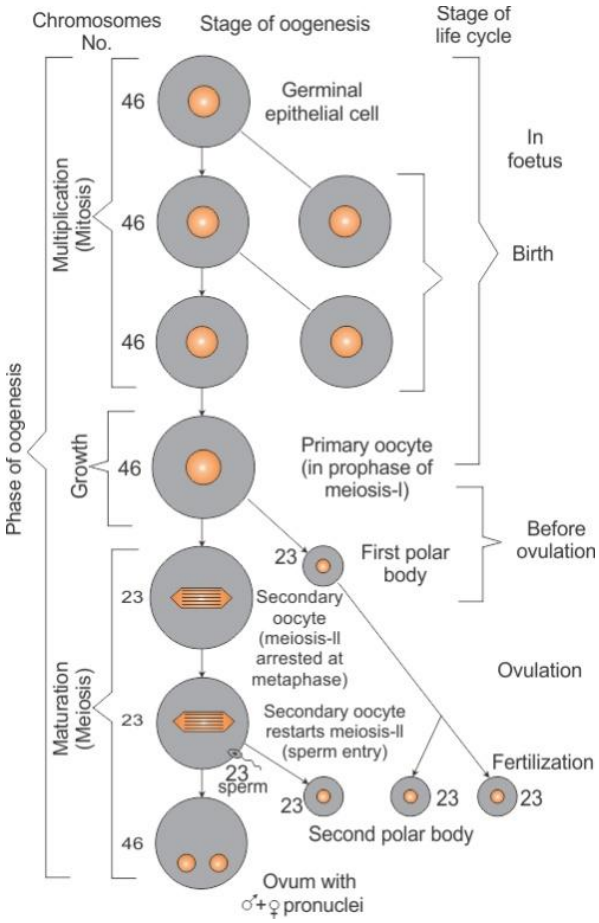
(a) Oogenesis is the process of formation of haploid ova in the Graafian follicles of the ovary. The events which occur during oogenesis are

(i) Multiplicative phase: During this phase, the follicle cells are differentiated from the germinal epithelium of the ovary because of repeated mitotic divisions. Some follicle cells become large and are known as egg mother cells. These cells again multiply by mitosis to form oogonia which grow in the follicles.

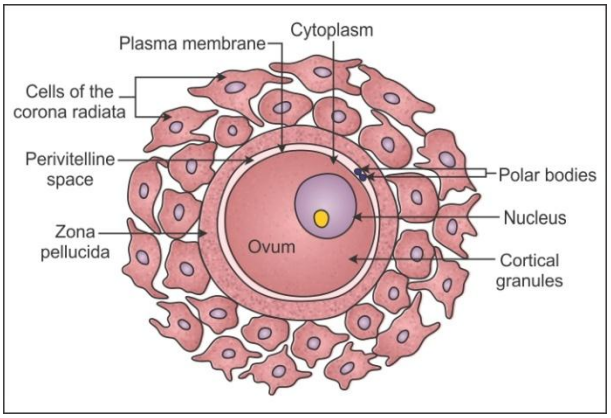
(ii) Growth phase: During this phase, oogonium grows into large primary oocytes by getting nourishment from follicle cells.

(iii) Maturation phase: This phase involves meiosis. In meiosis I, large haploid oocytes and a small polar body are formed.

Now, the follicle ruptures to release the secondary oocyte. Meiosis II occurs after sperm entry and forms a haploid large ovum and a small polar body. Polar bodies have no function and degenerate.


Chromosomes No.
Stage of oogenesis
Stage of life cycle
Germinal epithelial cell
In foetus
Birth
Multiplication (Mitosis)
Phase of oogenesis
Growth
Primary oocyte (in prophase of meiosis-I)
Before ovulation
First polar body
Secondary oocyte (meiosis-II arrested at metaphase)
Ovulation
Maturation (Meiosis)
Secondary oocyte restarts meiosis-II (sperm entry)
Fertilization
sperm
Second polar body
Ovum with ♂+♀ pronuclei
46
23

(b)


Plasma membrane
Cytoplasm
Cells of the corona radiata
Perivitelline space
Polar bodies
Nucleus
Zona pellucida
Ovum
Cortical granules

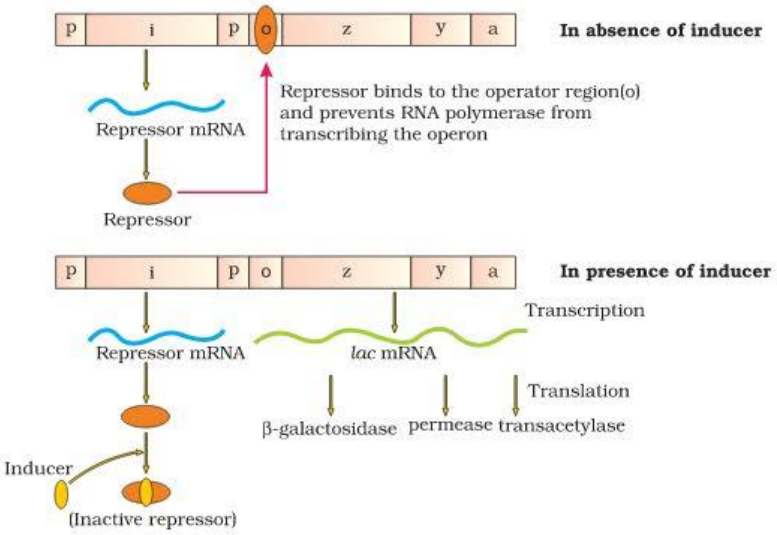
26. Lac operon consists of regulator gene, promoter gene, operatoral gene and structural gene.

The *E. coli* bacterium carries numerous genes and these genes turn on and off according to requirement. When these genes are turned on, they produce enzymes which metabolise the new substrate. This phenomenon is known as induction, and the small molecules eliciting this induction are called inducers. In this lac operon, the presence of lactose acts as an inducer.

The lac operon contains a promoter, an operator and three closely related structural genes—z, y and a coding for enzymes β-galactosidase, β-galactoside permease and β-galactoside transacetylase, respectively. β-galactoside permease pumps lactose into the cells, whereas β-galactosidase catalyses the conversion of lactose into glucose and galactose. These genes are not expressed in the absence of lactose. The promoter (P) for the operon is the site at which RNA polymerase binds to initiate transcription of the structural genes. The operator (O) is the site at which the protein repressor—the product of regulator gene—binds. In the presence of a regulator protein, the RNA-polymerase is prevented from attaching to the promoter.

A regulator gene is a DNA segment independent of an operon and it synthesises a repressor protein. This protein combines with the operator and makes it inactive. This prevents RNA polymerase from binding to the adjoining promoter (P) and from initiating transcription of the structural gene. Therefore, RNA polymerase is required to negotiate the operator before transcription can occur. The repressor binds to the operator in the absence of a metabolite (effector molecule–lactose).

When an inducer or effector molecule-lactose is added to the system, it binds to the repressor to form a complex which is unable to bind the operator. The RNA polymerase enzyme now becomes free to bond with the promoter (P) and so the operator is switched on. This initiates the transcription of structural genes, producing the three polypeptides. These enzymes bring about the metabolism of lactose into glucose and galactose.



OR

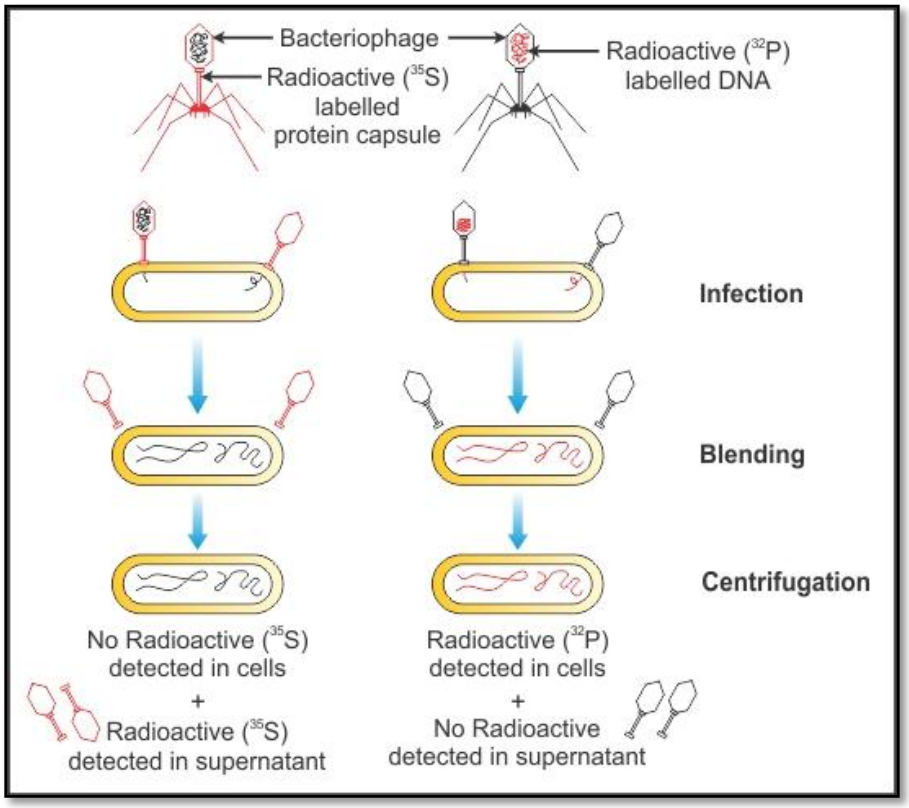
The proof for DNA as the genetic material came from the experiments of Alfred Hershey and Martha Chase (1952) who worked with bacteriophages.

The bacteriophage on infection injects only the DNA into the bacterial cell and not the protein coat. The bacterial cell treats the viral DNA as its own and subsequently manufactures more virus particles. They made two different preparations of the phage. In one, the DNA was made radioactive with ^{32}P, and in the other, the protein coat was made radioactive with ^{35}S.

These two phage preparations were allowed to infect the bacterial cell separately. Soon after infection, the cultures were gently agitated in a blender to separate the adhering protein coats of the virus from the bacterial cells.

The culture was also centrifuged to separate the viral coat and bacterial cells. When the phage containing radioactive DNA was used to infect the bacteria, its radioactivity was found in the bacterial cells (in the sediment) indicating that the DNA has been injected into the bacterial cell.

So, DNA is the genetic material and not the proteins.



27. Vaccine is an antibody-provoking agent. A small amount of antigen (vaccine) is injected into the body which stimulates the synthesis of antibodies against the antigen.

Various types of vaccines currently used are

(i) Killed vaccines: These vaccines are prepared by killing the pathogenic organisms by heat, ultraviolet rays and alcohol. Examples: Typhoid vaccine, Salk Polio vaccine, cholera vaccine, rabies vaccine, plague vaccine

(ii) Toxoid: These are prepared by destroying the toxic properties of the toxins produced by organisms but retaining their antigenic property. Toxoid stimulates antibody production without producing the symptoms of the disease. Examples: Tetanus toxoid is used for tetanus and diphtheria toxoid is used for diphtheria bacilli.

(iii) Attenuated living vaccines: The living pathogenic organism is weakened by exposing to higher temperature and is injected into the body. Examples: Oral polio vaccine, BCG, MMR, yellow fever vaccine

(iv) Antibodies as vaccines: Serum is used after a person or animal has been exposed to infection. It contains antibodies against that pathogen and provides passive artificial immunity. Examples: Anti-rabies serum, anti-tetanus serum

OR

Sewage treatment in sewage treatment plants is carried out in two ways:

(a) Primary treatment: It involves the physical removal of particles from the sewage through filtration and sedimentation. Floating debris is removed by filtration, and grit is removed by sedimentation. Thus, all solids which settle form the primary sludge and the supernatant forms the effluent.

(b) Secondary treatment: The effluent from primary treatment is passed to aeration tanks where air is pumped into it. This allows the growth of useful aerobic microbes into flocs (masses of bacteria associated with fungal filaments) and microbes consume the major part of the organic matter in the effluent. This reduces the biological oxygen demand (BOD) of the effluent.

The effluent is then passed into the settling tank where bacterial flocs are allowed to sediment. This sediment is called activated sludge. The small portion of this activated sludge is again passed to the aeration tank to serve as the inocula. The remaining major part of this sludge is pumped into large anaerobic sludge digesters. Here, anaerobic bacteria digest bacteria and fungi in the sludge. During this digestion, bacteria produce a mixture of gases such as methane, H_2S, and CO_2. This treatment is essential as the sewage or municipal waste discharged into rivers, streams and other water bodies contains human excreta, organic wastes and several pathogenic microbes.