CBSE

Class XII Biology

Sample Paper – 5 (Solution)

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

Section A

1. It is a sterilisation method in females where the fallopian tube is cut (tubal ligation).

2. Macrophages engulf the microbes. They secrete pyrogen and activate and stimulate the T-cells and B-cells.

3. *Spirulina* is commercially used for the production of single cell protein.

4. These are restriction endonucleases which cut the DNA molecule into fragments with sticky ends.

5. Humulin is genetically engineered insulin.

Section B

6. The presence of mitochondria in the middle piece of the sperm provides it with energy for movement. The absence of mitochondria makes the sperms immobile, which in turn, cause no fertilisation in the fallopian tube.

7.

Monohybrid Cross	Reciprocal Cross
It is a cross where two forms of a single trait are hybridised.	It is a second cross involving the same strains but carried by sexes opposite to those in the first cross.
It is a one-sided or both sided cross which deals with the transmission of a single trait.	It is both sided cross which deals with the transmission of one, two or more traits.

8.

(a) The figure shows homologous organs depicting divergent evolution.

(b) It tells about the common ancestry of the organisms which may look structurally different. This phenomenon is due to different adaptations to varying conditions of groups of common ancestral organisms.

9. Gene gun is the new technology where vectorless direct gene transfer occurs in organisms. DNA coated onto microscopic pellets is directly shot into target cells. This technique is used to insert genes which promote tissue repair into cells near wounds, leading to a reduction of healing time.

10.

(i) Use of contaminated razors for shaving
(ii) Transfusion of infected blood or blood products
(iii) Organ transplant
(iv) From infected mother to her child through placenta

OR

The meristem is the part of the plant which is free of virus. The meristem of the plant is removed and grown *in vitro* to obtain virus-free plants. The scientists have been successful in culturing meristems of banana, sugarcane and potato.

11. The two methods of vectorless gene transfer are as shown below:

(i) Microinjection: The technique of introducing foreign DNA into a target cell by injecting the DNA directly into the nucleus with the help of a micro-needle is called micro-injection.

(ii) Electroporation: The process in which transient holes are produced in the plasma membrane of the target cell to incorporate foreign DNA is called electroporation.

12. The first community invading the habitat and starting ecological succession is called a pioneer community. Examples: Phytoplankton in hydrosere and lichens in lithosere

The most stable community developed at the end of ecological succession is called a climax community. Example: Forest stage

Section C

13. During fertilisation, the pollen tube reaches into the ovule through the micropyle. One of the two gametes joins with the egg cell resulting in the production of a zygote. This is called syngamy and the other with the two polar nuclei producing a triploid primary endosperm nucleus. This is called triple fusion. This completes the process of fertilisation.

After fertilisation, the ovule converts into the seed and the whole ovary develops into a complete fruit. The ovary wall forms the pericarp of the fruit. The integument of the ovule is converted to a seed coat. The egg of the ovule divides mitotically and forms the multicellular diploid embryo.

14.

(i) Each primary oocyte undergoes two maturation divisions (Meiosis I & II) and produces one ovum and three polar bodies with half the number of chromosomes.

(ii) Polar bodies contain a minute quantity of the cytoplasm as they allow the ovum to have sufficient cytoplasm for extra chromosomal inheritance and for early development of the embryo.

(iii) During meiosis I, crossing over occurs which provides a new combination of genetic material. This brings about variation.

15.

(i) It carries specific amino acids from the cytoplasm to the ribosomal sites for the formation of a polypeptide chain according with the sequence specified by m-RNA.

(ii) The t-RNA charged with the amino acid serves as an adaptor molecule to decode the information on the mRNA.

(iii) It elongates the polypeptide chain by the addition of several newly synthesised amino acids.

16.

Parents ... Pure tall white × Pure dwarf red

Genes ... DDrr ddRR

Gametes ...

DdRr ...100% Tall pink

F_1 generation:

On self-fertilisation: $F_1 \times F_1$

Genes ... DdRr × DdRr

Gametes ... DR, Dr, dR, dr × DR, Dr, dR, dr

	DR	**Dr**	**dR**	**dr**
DR	**DDDRR** Tall Red	**DDRr** Tall pink	**DdRR** Tall red	**DdRr** Tall pink
Dr	**DDRr** Tall pink	**DDrr** Tall white	**DdRr** Tall pink	**Ddrr** Tall white
dR	**DdRR** Tall red	**DdRr** Tall pink	**Ddrr** Dwarf red	**ddRr** Dwarf pink
dr	**DdRr** Tall pink	**Ddrr** Tall white	**ddRr** Dwarf pink	**ddrr** Dwarf white

Phenotypic ratio: Tall Red = 3; Tall white = 3;
Tall Pink = 6; Dwarf Red = 1;
Dwarf white = 1; Dwarf Pink = 2.

Genotypic ratio:

DDRR = 1; DdRR = 2; Ddrr = 1; Ddrr = 2;
DDRr = 2; DdRr = 4; ddRR = 1; ddrr = 1;
ddRr = 2

17. Lactose acts as an inducer in lac operon. It binds to the repressor and forms a complex, inducer–repressor, which remains unable to bind the operator. The RNA polymerase now becomes free to join with the promoter, and the operator is switched on. This initiates the transcription of the structural genes, producing the three polypeptides. In the absence of lactose, no inactivation of repressor occurs, and hence, the repressor binds to the operator region of the operon, thus preventing RNA polymerase from transcribing the operon. This inactivates the production of structural genes in E. coli.

18. Pathogen: *Entamoeba histolytica*

Mode of transmission: It spreads through ingesting contaminated cysts with food and water (faecal or route).

Symptoms:

(i) Pathogen erodes the mucous membrane of the intestine and produces bleeding ulcers.

(ii) Stools are accompanied by mucus and blood.

19.

(i) Chemical pesticides are quite expansive, and its synthesis needs a large amount of energy.

(ii) Their production pollutes the atmosphere.

(iii) Most of the chemical pesticides are washed away with the rainwater and pollute the soil and water resources.

20. *Agrobacterium tumefaciens* is a plant pathogenic bacterium which can transfer part of its plasmid DNA as it infects host plants. Species of Agrobacterium produce tumours in almost all dicotyledonous plants. These bacteria contain large T_1 plasmids which pass on their tumour-causing gene into the genome of the host plant. Gall is formed on the host plant. Therefore, these bacteria are known as 'natural genetic engineers' of plants as gene transfer occurs without human interference.

T_1 plasmid-based vectors are now commonly used for genetic transformation.

21.

(a) Transgenic animals are so-called because they contain a foreign or a trans gene and have been modified by insertion of recombinant DNA. Positive traits have been inserted in them to produce products which are beneficial to humans.

(b) Role of transgenic animals:

(i) Vaccine safety: Transgenic animals are predominantly used for testing of vaccines before they are used on human beings. Example: Transgenic mice are used to test the safety of polio vaccine.

(ii) Biological products: Many human diseases are controlled by biological products. The transgenic animals which produce these products are introduced with DNA which codes for a particular product like human protein (α–I–antitrypsin) for treating emphysema. In 1997, the first transgenic cow Rosie was produced which was capable of secreting human protein-enriched milk. The milk contained human alpha-lactalbumin and was nutritionally a more balanced product for human babies than cow milk.

22. Succession differences in terrestrial and aquatic systems:

Terrestrial succession	Aquatic succession
(a) Lichens and mosses constitute the pioneer community. (b) This succession begins on a bare rock. (c) The climax community is generally dominated by trees.	(a) Phytoplankton and zooplankton constitute the pioneer community. (b) This succession begins in ponds. (c) The climax community is established with shallow water which is later transformed into a terrestrial habitat.

23. They undergo two types of adaptations, i.e. lowering of water loss and adapting to arid conditions, e.g. the kangaroo rat conserves water by excreting solid urine and can live from birth to death without even drinking water. Camels show unique adjustments to desert conditions, being very economical in water use, tolerant to wide fluctuations in body temperature and are able to maintain blood stream moisture even during extreme heat stress.

24. The interaction of populations of two or more different species is known as population interaction.

The various types of population interactions include predation, parasitism, amensalism, commensalism, protocooperation, mutualism and competition.

Section D

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

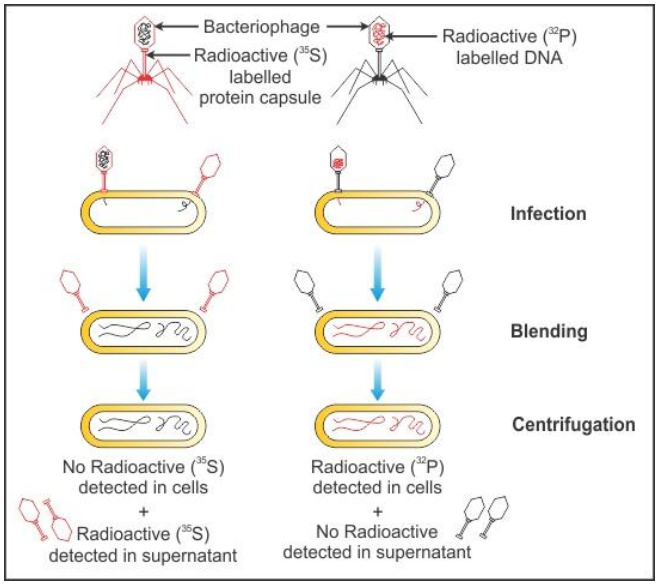
On infection, the bacteriophage injects only the DNA into the bacterial cell and not the protein coat. The bacterial cell treats the viral DNA as its own and subsequently manufactures more virus particles. They made two different preparations of the phage. In one, the DNA was made radioactive with ^{32}P.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

These two phage preparations were allowed to infect bacterial cells 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 the 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 and not proteins is the genetic material.



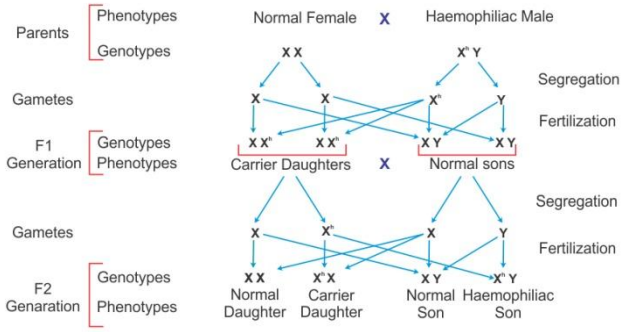
OR

Symptoms of haemophilia: Haemophilia is also called bleeder's disease in which a single cut leads to non-stop bleeding. It prevents clotting of blood. A seriously affected person may bleed to death after even a minor skin cut.

Symptoms of sickle cell anaemia: In this disease, red blood cells become elongated and curved under low oxygen tension. Individuals with this disease suffer attacks because of aggregation of red blood cells. These erythrocytes are destroyed more rapidly than the normal red blood cells leading to anaemia.

Inheritance pattern of haemophilia:

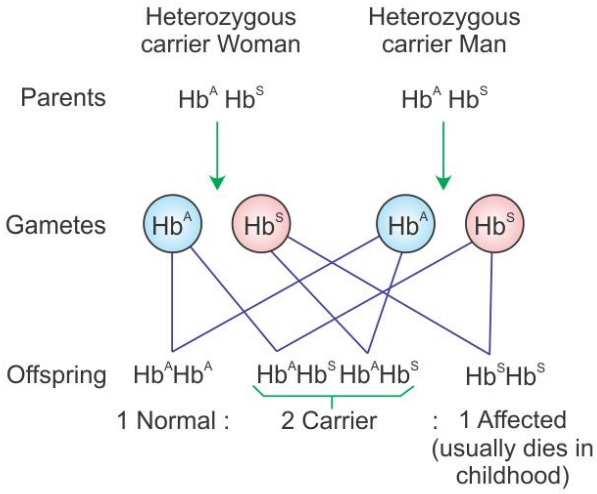
Haemophilia is a sex-linked recessive disease which shows its transmission from unaffected carrier female to some of the male progeny. It shows criss-cross inheritance. The heterozygous female (carrier) for haemophilia may transmit the disease to the sons. The possibility of a female becoming a haemophilic is extremely rare because the mother of such a female has to be at least a carrier and the father should be haemophilic.



Inheritance pattern of sickle cell anaemia:

Sickle cell anaemia is an autosomal hereditary disease which can be transmitted from parents to offspring when both partners are carrier for the gene (heterozygous).

It is controlled by a single pair of allele Hb^A and Hb^S. Of the three possible genotypes Hb^A Hb^A, Hb^A Hb^S and Hb^S Hb^S, only the last one shows the diseased phenotype. Heterozygous (Hb^A Hb^S) individuals appear apparently unaffected, but they are carrier of the disease as there is 50% probability of transmission of the mutant gene to the progeny, thus exhibiting the sickle cell trait.



26.

(a) Corpus luteum: It secretes progesterone hormone which inhibits the production of gonadotropin hormone from the pituitary. This prevents the sloughing off of the uterine lining and supports pregnancy.

(b) Endometrium: It provides a place for the implantation of the fertilised ovum. If fertilisation fails to occur, then the endometrium lining sloughs off, leading to menstrual flow.

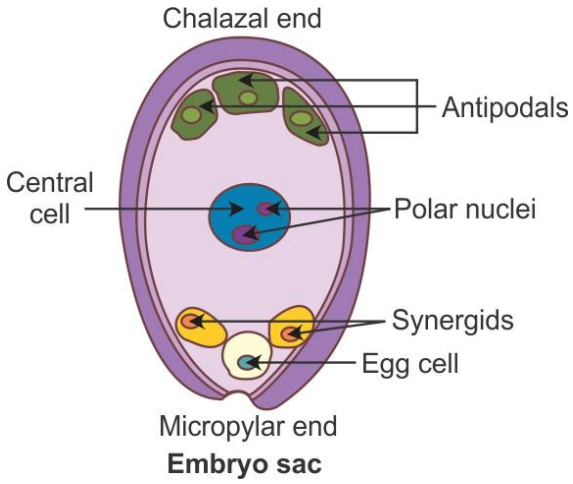
(c) Acrosome: The acrosome carries the sperm lysin which facilitates the sperm to penetrate the ovum during fertilisation.

(d) Sperm tail: It provides mobility to the sperm with the head forward in the fluid medium.

(e) Fimbriae: It increases the surface area for catching ovum during ovulation.

OR

(a)



Embryo sac

(b) The filiform apparatus present at the micropylar end of the synergids guides the entry of pollen tubes which carries two male gametes. Of the two gametes, one fuses with the egg cell to form a zygote and the other gamete fuses with two polar nuclei to form the primary endosperm nucleus. This is called triple fusion and such type of fertilisation is called double fertilisation.

27.

(a) Lichens are the pioneer species on a bare rock. They are resistant to desiccation and extremes of temperature. They produce organic acids which corrode the rock surface. This produces depressions and releases minerals which facilitate their further growth. The dead lichens add organic matter to the forming soil. The next community develops on this meagre soil formed. The climax community will be trees.

(b) Detritivores break down detritus into smaller particles and this process is called fragmentation. Example: Earthworm is a detrivore.
Decomposers break down complex organic matter into inorganic substances and the process is called decomposition. Example: Bacteria are decomposers.

OR

(a) The increase in the atmospheric temperature of the Earth because of the increase in the concentration of greenhouse gases (CO_2, CH_4 and CFC) is called global warming.
Causes of global warming:
(i) Burning of fossil fuel in automobiles and industries.
(ii) Deforestation
Effects of global warming:
(i) Because of the rise in temperature, the polar ice caps will melt resulting in the rise of the seawater level.
(ii) Global warming will lead to explosive growth of weeds, increased incidence of plant diseases and pests. All these factors will decrease crop production in tropical and subtropical regions.
(iii) Effect on weather and climate leading to chances of cyclones and flood.

(b) Control measures:
(i) Deforestation should be reduced.
(ii) Plantation of trees should be enhanced.
(iii) Limited use of fossil fuels by developing and using alternate sources of energy.
(iv) Reduction in human population.