CBSE
Class XII Biology
Sample Paper – 6 (Solution)

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

Section A

1. Endosperm with 27, embryo with 18.

2. Plasmids and bacteriophages

3. Insulin from animal sources is used to cause allergy and reactions in human beings, so it was genetically engineered in bacteria.

4. Frog (prey) is eaten by a snake (predator).

5. Temperature and humidity

Section B

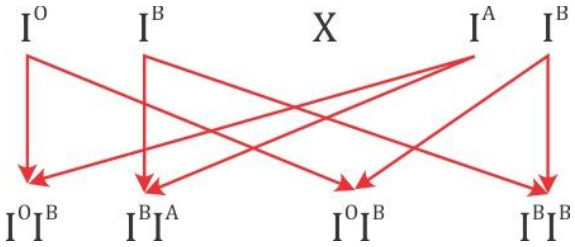
6. The testes remain suspended in the scrotum to maintain their temperature 2°C to 3°C lower than the body. This lower temperature is essential to maintain the viability of sperms. Otherwise, it leads to sterility of sperms at body temperature.

7.

(a) Base pairing of nitrogen bases is based on their chemical compatibility with respect to bonding and minimum distance for H-bond formation.

(b) Purine is a double-ringed structure and pyrimidine is a single-ringed structure, a purine–pyrimidine pairing generates approximately uniform distance between the two strands of the helix.

8.



25% of children have the same blood group as the father.

The sex-specific blood grouping cannot be predicted as the blood group is an autosomal trait.

9. Gene transfer in animals is done through direct methods such as electroporation or microinjection or using a particle gun.

In the formation of Dolly, the cloned sheep, the fertilised egg of its mother was removed by a micro needle and the nucleus from an udder cell was micro-injected in the egg after removing the egg nucleus. The egg developed into Dolly with genes identical to her mother.

10. There are two basic strategies:

(i) *In situ* (on site): This strategy emphasises protection of total ecosystems. The *in situ* approach includes protection of a group of typical ecosystems through a network of protected areas. This means the endangered species are protected in their natural habitat so that the entire ecosystem is protected.

(ii) *Ex situ* (off site): These conservation strategies include botanical gardens, zoos, conservation stands, gene, pollen, seed, seedling, tissue culture and DNA banks.

OR

(a) High growth due to surplus food and space.

(b) 'b' is more realistic because with an increasing number of individuals in a population, there is restricted growth because of competition and predation.

11. Surgical procedures block gamete transport and thereby prevent conception. In human males, the sterilisation procedure is called vasectomy, i.e. a small part of the vas deferens is removed or tied up through a small incision on the scrotum.

12. Tobacco smoke causes inflammation of bronchi called bronchitis and inflammation of lung alveoli called emphysema.
Two toxic substances present in tobacco are nicotine and carbon monoxide.

Section C

13. Significance of pollen grain:

(i) Pollen grains of many species cause allergies and bronchial afflictions leading to chronic respiratory disorders, asthma and bronchitis.

(ii) Pollen grains are rich in nutrients, and these are used as pollen tablets as food supplements in some countries.

(iii) They play an important role in sexual reproduction and results in the formation of fruits and seed.

14. Endocrine glands which control the process of spermatogenesis:

(i) Interstitial cells or Leydig cells lie between the seminiferous tubules and secrete testosterone. It is essential to make sperms.

(ii) Interstitial cell-stimulating hormone (ICSH): It is the product of the anterior lobe of the pituitary gland and identical to the hypophyseal gonadotropin, luteinising hormone (LH) and follicle-stimulating hormone (FSH). Under the control of FSH and testosterone, Sertoli cells secrete an androgen-binding protein (ABP) which concentrates testosterone in the seminiferous tubules. Sertoli cells also secrete another protein, called inhibin, which suppresses FSH synthesis.

(iii) FSH: It acts directly on spermatogonia to stimulate sperm production. Release of LH or ICSH is, in turn, controlled by the release of hypothalamic gonadotropin-releasing hormone or GnRH.

The level of testosterone is under negative feedback control, a rising level of testosterone suppresses the release of GnRH from the hypothalamus.

15.

(i) This result is genetically explained as the mechanism of incomplete dominance. When a black-coloured cock is bred with a white-coloured hen, the F_1 hybrid (steel-blue) does not relate to either of the parents but exhibits the blending characters of two parents.

(ii) On selfing the $F_1 \times F_1$:

Parents	...	Steel blue	×	Steel blue
Genes	...	Ss	×	Ss
Gametes	...	S s	×	S s

	S	s
S	SS Black	Ss Steel-blue
s	Ss Steel-blue	ss White

Result: Black = 1; Steel blue = 2; White = 1

16. During DNA replication, the new nucleotides are arranged in a highly accurate manner according to base-pairing rule, but sometimes (1 in 10,000) wrong bases (nucleotides) may be added. To overcome this, proofreading is done to remove the wrong bases before it proceeds to add new bases in the 5′–3′ direction. The DNA polymerase picks up the damaged DNA strand, wrong bases and chews off the erroneous region. The enzyme DNA Pol-I helps in filling the gap with the correct bases. So, proofreading confirms the accuracy of base pairing in replication.

17. Effect of anthropogenic actions on organic evolution can be explained by the following examples:

(i) Use of chemicals like mosquito repellents, pesticides and fungicides has enabled the selection of mosquito and pest species which are better adaptive to the environment. Because of the anthropogenic action, the rate of evolution has increased, and as a result, in a very short time, a new species have evolved which can resist the chemicals.

(ii) Use of antibiotics has increased the rate of evolution of bacteria and virus. Among many species of bacteria, mutation occurred in few individuals. Because of selection using antibiotics, individuals with resistive properties got selected and produced a large number of progeny.

18. Advantages of biological control over chemical control:

(i) Biological control is self-perpetuating and no manufacturing is required for the synthesis of pathogen or beneficial organism.

(ii) The beneficial organisms can seek and find out the pest.

(iii) The pests are unable to develop resistance against the pathogens of biological control.

19. Inflammation: It is the reaction of local tissue or blood to an injury or infection. It leads to swelling of the injured area because of leakage of fluid into the tissue.

At the site of injury, histamine is released from lymphocytes which causes vasodilatation, redness, swelling and generation of heat. This is called inflammatory response. In systematic inflammatory response, the WBC count of the blood increases considerably to set the body's thermostat at a higher temperature (fever).

20. Applications of recombinant DNA technology:

(i) This technology is used to elucidate molecular events in the biological process such as cellular differentiation and ageing.

(ii) This technology is used to make gene maps and for finding the complete nucleotide sequence of the genome of various organisms.

(iii) In the biochemical and pharmaceutical industry, the useful chemical compounds can be produced cheaply and efficiently.

21.

(i) Plasmids are separate from the main genome and can be easily isolated and introduced.

(ii) Restriction endonucleases cut the DNA from different sources in such a way as to produce single-stranded free ends (sticky ends) which can undergo complementary pairing to form recombinant DNA.

(iii) Recombinant DNA technology involves the transfer of a DNA fragment from the donor organism to the DNA molecule of the recipient.

22. Many sessile animals such as barnacles and molluscs living in the very cold intertidal zones of the northern shores and several insects and spiders resist the effect of cold by a process called cold hardening. These organisms have ice-nucleating proteins which induce ice formation in the extracellular spaces at very low sub-zero temperature. Some freeze-avoiding animals can tolerate temperature below $0^{o}C$ by accumulating glycerol or anti-freeze proteins which lower the freezing point of their body fluids. Because of these anti-freeze compounds, the fish in the Antarctica region remain active in seawater.

23.

(a) A - Fish and clean water organisms depict dissolved oxygen; B - Decomposers depict biochemical oxygen demand (BOD)

(b) As the sewage is decomposed, there is a gradual rise in dissolved oxygen downstream with the reappearance of fish and other clean water organisms. This leads to the recovery of river water from sewage water.

(c) Effects on aquatic life:

a. It causes a high mortality rate among aquatic animals.

b. The excessive nutrients facilitate algal growth causing algal bloom.

OR

Ectoparasite is a parasite which feeds on the external surface of the host organism.
Examples:

(i) Lice are parasites on humans and ticks are parasites on dogs.

(ii) Many marine fish are infested with ectoparasite copepods.

24.

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

Section D

25. Characteristics of wind-pollinated flowers (anemophily):

(i) Flowers are inconspicuous, odourless and not showy.

(ii) Pollen grains are produced in large quantities as a result of a lot of wastage.

(iii) Pollen grains are small, smooth and dry. Sometimes, they also bear winged seeds.

(iv) Anthers are exserted.

(v) The flowers are usually unisexual.

(vi) The stigma is highly exposed and branched. They may often have a feathery stigma to easily trap air-borne pollen grains.

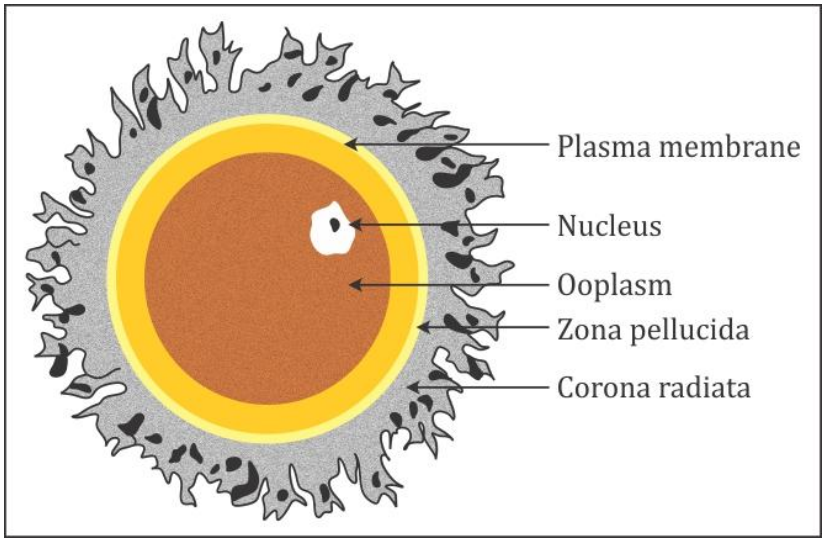
(vii) They are devoid of nectar and edible pollen.

(viii) They may often have a single ovule in each ovary and numerous flowers are packed into an inflorescence.

(Any five points)

OR

The human ovum is a rounded haploid structure which lacks the yolk (alecithal). It is non-motile containing an eccentric located nucleus with the bulk of the cytoplasm. The nucleus of an ovum is called the germinal vesicle and it contains a prominent nucleolus. The cytoplasm is called ooplasm and is surrounded by the vitelline membrane and again by a transparent, thick and non-cellular layer, the zona pellucida. The vitelline membrane is a very thin and transparent, and there lies a narrow perivitelline space between the vitelline membrane and zona pellucida. Outside the zona pellucida, there is a thick coat of radially elongated follicle cells called cellular corona radiata. These follicle cells are attached by hyaluronic acid (a mucopolysaccharide) and act as a barrier for the entry of sperms. The ovum has a polarity and the side of the ovum which extrudes the polar bodies and has a nucleus is called the animal pole. The opposite side is called the vegetal pole.



26. Oparin–Haldane theory suggests that life came into existence as a result of chemical evolution by polymerisation of simple molecules which took place on the primordial Earth under the impact of certain favourable conditions. The oceans of the primitive Earth contained a rich supply of these simple molecules.

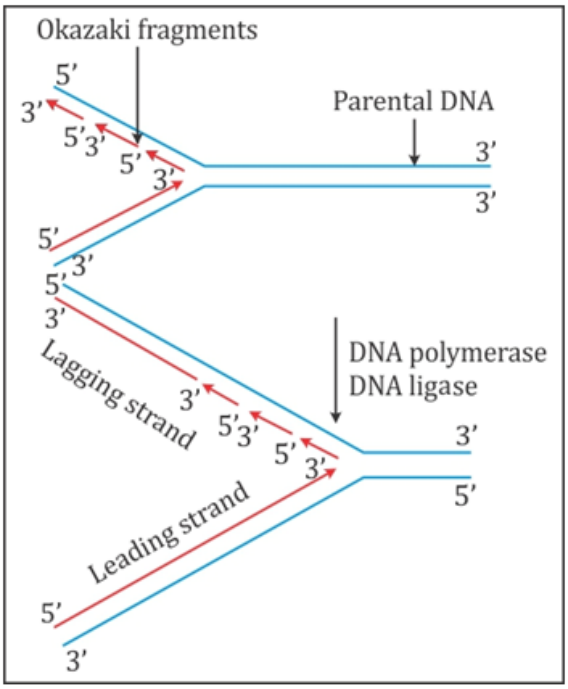
Miller and Urey actually tested the Oparin–Haldane theory and created those conditions in their experiment which were probably present on the primitive Earth. They took glass tubes, flasks and condensers. For their experiment, they created an atmosphere containing hydrogen, ammonia, methane and water vapour in one flask. They passed electric sparks from electrodes in the gaseous chamber of the flask and heated another flask containing water. They passed the mixture of these gases through the condenser. After a week, they analysed the liquid for chemical composition inside the apparatus. They found a large number of complex organic compounds such as acetic acid, urea, fatty acids, lactic acid and amino acids such as glycine, alanine and aspartic acid. So, they called this process abiotic synthesis.

OR

The mechanism of DNA replication:

(i) Origin or replication: It is the start point where DNA replication begins at a specific point where interwound DNA segments start unwinding. In prokaryotic cells, there is a single origin of replication, whereas in eukaryotic cells, there are numerous origins which merge during the process of replication.

(ii) Unwinding of two DNA strands: It takes place in the presence of enzymes–helicases which unwind the helix and topoisomerases which break and reseal one strand of DNA. The unwinding of DNA leads to the formation of a Y-shaped structure of the two strands of the DNA duplex called a replication fork.



(iii) Synthesis of primer: It is a stretch of RNA formed on the DNA where synthesis of new DNA starts. The DNA-directed RNA polymerase synthesises the primer strands of RNA for the leading and lagging strands. New strands grow from the fork and as replication proceeds, it appears as if the point of divergence at the fork is moving.

(iv) Synthesis of leading (continuous) strand: The synthesis of the continuous strand (new) of DNA is formed in the 5′–3′ direction on the 3′-5′ DNA template because of the addition of deoxyribonucleotides at the 3′ end of primer RNA. This process occurs in the presence of the enzyme DNA polymerase and ATP. Because one new strand is formed in a continuous stretch in the 5′-3′ direction, it is called the leading strand.

(v) Formation of lagging (discontinuous) strand: In the second parental strand, the enzyme primase forms the RNA primer. The enzyme DNA polymerase synthesises the DNA in the form of short stretches once again in the 5′–3′ direction starting from an RNA primer. These DNA short segments, consisting of numerous nucleotides, are called Okazaki fragments. The Okazaki short segments are joined by the enzyme DNA ligase. It is called a lagging strand.
This newly synthesised second DNA strand is called the lagging strand because it is formed later in reference to the first continuous strand.

27. Main steps in breeding a new genetic variety of crop:

(i) Collection of variability: Collection and preservation of all the different wild varieties, species and relatives of the cultivated species is a pre-requisite for effective exploitation of natural genes available in the population. The entire collection of plants/seeds having all the diverse alleles for all genes in a given crop is called a germplasm collection.

(ii) Evaluation and selection of parents: The germplasm is evaluated so as to identify plants with a desirable combination of characters. The selected plants are multiplied and used in the process of hybridisation. Pure lines are created wherever desirable and possible.

(iii) Cross hybridisation among the selected parents: Hybridisation is done to combine the desired characters from two different plants (parents) to produce hybrids which genetically combine the desired characters in one plant.
For example, high protein quality of one parent may need to be combined with disease resistance from another parent.

(iv) Selection and testing of superior recombinants: This step consists of selecting, among the progeny of the hybrids, those plants which have the desired character combination. These are self-pollinated for several generations till they reach a state of uniformity (homozygosity) so that the characters will not segregate in the progeny.

(v) Testing, release and commercialisation of new cultivars: The newly selected lines are evaluated for their yield and other agronomic traits of quality and disease resistance. This evaluation is done by growing these in research fields and recording their performance under ideal fertiliser application, irrigation and other crop management practices. The evaluation in research fields is followed by testing the materials in farmers' fields, for at least three growing seasons at several locations in the country, representing all the agroclimatic zones where the crop is usually grown. The material is evaluated and compared to the best available local crop cultivar—a check or reference cultivar.

OR

Life cycle of Plasmodium:

(i) Plasmodium sporozoites enter the human body through the bite of a female Anopheles mosquito.

(ii) Plasmodium first undergoes asexual reproduction where the parasites enter the liver cells and then attack the RBCs resulting in their rupture.

(iii) The rupture of RBCs produces a toxic element called haemozoin which is responsible for a chill and high fever for 3–4 days.

(iv) When the female Anopheles mosquito bites an infected person, these parasites enter the mosquito's body and multiply forming sporozoites.

(v) These sporozoites are stored in the salivary glands of mosquito and are released when a healthy person is bitten by this mosquito.

(vi) When the mosquito bites a human, the sporozoites are introduced into the body of human beings.

Thus, plasmodium requires two hosts—man and mosquito—to complete its life cycle. The female Anopheles mosquito acts as the vector.