CBSE
Class XII Biology
Sample Paper 3

Time: 3 Hours **Total Marks: 70**

General Instructions:

(i) All questions are compulsory.

(ii) The question paper has four sections: Section A, Section B, Section C and Section D. There are 33 questions in the question paper.

(iii) Section A 14 questions of 1 mark each and 02 case-based questions. Section B has 9 questions of 2 marks each. Section C has 5 questions of 3 marks each. Section D has 3 questions of 5 marks each.

(iv) There is no overall choice in the question paper. However, internal choices are provided in some questions. A student has to attempt only one of the alternatives in such questions.

(v) Wherever necessary, neat and properly labelled diagrams should be drawn.

Section A

1. Where are Sertoli cells located? [1]

2. What technical term is applied to fruits formed without fertilization? [1]

3. Why do pollen grains produce in enormous quantities in anemophilous flowers? [1]

4. What is the disadvantage of amniocentesis? [1]

5. The map distance in a certain organism between genes A and B is 8 units, between B and C is 4 units and between C and D is 12 units. Which one of these gene pairs will show more recombination frequency? Give reason. [1]

6. A mother has 'O' blood group and the child has also 'O' blood group. What will be the expected blood group of the father? [1]

7. State the function of enzyme – DNA ligase. [1]

8. Why is the enzyme cellulase used for isolating genetic material from plant cells but not for animal cells? [1]

9. Name the bacterium which produces Bt toxin. [1]

10. Name the interactions in each of the following: [1]

i. Cucuta growing on a shoe flower plant.

ii. Mycorrhizae living on the roots of higher roots.

11. Assertion: Mutations are necessary for the survival of the species. [1]

Reason: Lack of mutation gives a temporary advantage to a species in an unchanged environment.

a. Both assertion and reason are true, and reason is the correct explanation of the assertion.
b. Both assertion and reason are true, and reason is not the correct explanation of the assertion.
c. Assertion is true but reason is false.
d. Both assertion and reason are false.

OR

Assertion: Only the sense strand of DNA is copied into mRNA.

Reason: The antisense strand plays a role in replication.

a. Both assertion and reason are true, and reason is the correct explanation of the assertion.
b. Both assertion and reason are true, and reason is not the correct explanation of the assertion.
c. Assertion is true but reason is false.
d. Both assertion and reason are false.

12. Assertion: Monoclonal antibodies are ideal for diagnosis of diseases caused by closely related pathogens. [1]

Reason: Monoclonal antibodies are far more specific and reproducible than the antibodies produced by conventional techniques.

a. Both assertion and reason are true, and reason is the correct explanation of the assertion.
b. Both assertion and reason are true, and reason is not the correct explanation of the assertion.
c. Assertion is true but reason is false.
d. Both assertion and reason are false.

13. Assertion: Leguminous plants can grow well in nitrogen deficient soils. [1]

Reason: They need little nitrogen.

a. Both assertion and reason are true, and reason is the correct explanation of the assertion.
b. Both assertion and reason are true, and reason is not the correct explanation of the assertion.
c. Assertion is true but reason is false.
d. Both assertion and reason are false.

14. Assertion: Species diversity on earth is not uniformly distributed but shows interesting patterns. [1]

Reason: It is generally highest in the tropics and decreases towards the poles.

a. Both assertion and reason are true, and reason is the correct explanation of the assertion.
b. Both assertion and reason are true, and reason is not the correct explanation of the assertion.

c. Assertion is true but reason is false.
d. Both assertion and reason are false.

15. *Read the following and answer any four questions from 15 (i) to 15 (v) given below:* [4]

Biocontrol refers to the use of biological methods for controlling plant diseases and pests. In modern society, the problems of controlling plant diseases and pests have been tackled increasingly by the use of chemicals like insecticides and pesticides. These chemicals are toxic and extremely harmful, to human beings and animals alike, and have been polluting our environment. Our soil is also polluted through the use of weedicides to remove weeds. The use of biocontrol measures will greatly reduce our dependence on toxic chemicals and pesticides. An important part of the biological farming approach is to become familiar with the various life forms that inhabit the field, predators as well as pests, and also their life cycles, patterns of feeding and the habitats that they prefer. This will help develop appropriate means of biocontrol.

(i) Which of the following are used to get rid of mosquitoes?
   a. Scale insect
   b. Dragonflies
   c. Houseflies
   d. Butterflies

(ii) Soil bacterium, _____ acts as a biopesticide.
   a. Bacillus thuringiensis
   b. Rhizobium
   c. Azotobacter
   d. Clostridium

(iii) _____ are the biological control agents that attack insects and other arthropods.
   a. Baculoviruses
   b. Bacillus thuringiensis
   c. Rhizobium
   d. Azotobacter

(iv) A bioherbicide obtained from fungus _____ is used to control several plant pathogens.
   a. Agaricus
   b. Penicillium
   c. Trichoderma
   d. Aspergillus

(v) **Assertion:** Trichoderma species are free-living fungi.
Reason: They are effective biocontrol agents of several plant pathogens.

a. Both assertion and reason are true, and reason is the correct explanation of the assertion.
b. Both assertion and reason are true, and reason is not the correct explanation of the assertion.
c. Assertion is true but reason is false.
d. Both assertion and reason are false.

16. *Read the following and answer any four questions from 16 (i) to 16 (v) given below:* [4]

The process of copying genetic information from one strand of the DNA into RNA is termed as transcription. The principle of complementarity governs the process of transcription. In transcription only a segment of DNA and only one of the strands is copied into RNA because if both strands act a template, they would code for RNA molecule with different sequences, and in turn, if they code for proteins, the sequence of amino acids in the proteins would be different. Hence, one segment of the DNA would be coding for two different proteins, and this would complicate the genetic information transfer machinery. The other reason is the two RNA molecules if produced simultaneously would be complementary to each other, they would form a double stranded RNA. This would prevent RNA from being translated into protein and the exercise of transcription would become a futile one.

(i) During transcription, adenine forms base pair with
a. Cytosine
b. Guanine
c. Uracil
d. Thymine

(ii) Which of the following is NOT a part of transcription unit?
a. A promoter
b. The structural genes
c. A terminator
d. Replication fork

(iii) _____ is the formation of m-RNA strand on a DNA strand in the nucleus.
a. Central dogma
b. Transcription
c. Replication
d. Translation

(iv) Replication fork is formed during
a. transcription
b. Replication
c. Translation
d. DNA Fingerprinting

(v) Which of the following initiates the transcription process?

a. Rho factor
b. RNA polymerase
c. AAA sequence
d. Ligase

Section B

17. A bilobed and dithecous anther has 100 microspore mother cells per microsporangium. How many male gametophytes can it produce? [2]

18. Among the following genotypes: [2]

AA, I^AI^B, aa, Bb, I^Bi, Aa, rr, BB, ii

(i) Which are heterozygous and which are homozygous?

(ii) Which of the genotypes have the same phenotypes (the capital letter stands for dominance)?

19. In which ways have the study of biology helped us to control infectious diseases? [2]

20. How can the following be made possible for biotechnology experiments? [2]

(a) Introduction of DNA from bacterial cell.

(b) Reintroduction of the recombinant DNA into a bacterial cell.

OR

What are transgenic plants? Give some examples.

21. Explain why children eating golden rice are unlikely to suffer from 'night blindness'?[2]

22. Give one example each of transgenic plant and transgenic animal. [2]

OR

How is 'Rosie' considered different from a normal cow? Explain. [2]

23. Give two examples of commensal species. [2]

24. Write a short note on interspecific competition. [2]

25. How is cactus adapted to survive in its habitat? [2]

Section C

26. What are the similarities between spermatogenesis and oogenesis? [3]

27. Why is pedigree analysis done in the study of human genetics? State the conclusions which can be drawn from it. [3]

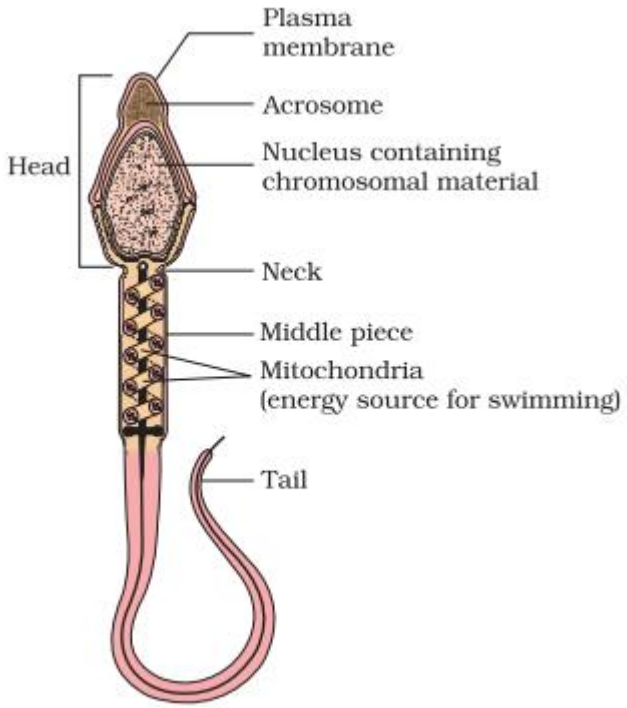
28. Give the pathogen, mode of transmission and symptoms of the disease Ascariasis. [3]

29. Expand PCR. Mention its importance in biotechnology. [3]

30. Name and explain the type of interaction that exists in mycorrhizae and between cattle egret and cattle. [3]

Section D

31. With reference to the given diagram of human sperm, answer the following questions: [5]



(a) Name the enzyme that helps the sperm to penetrate into ovum during fertilization. Where is this enzyme present?
(b) What is the utility of mitochondria in the middle piece of sperm?
(c) What will happen in the absence of mitochondria?
(d) State the function of LH in human males.

OR

Describe briefly the structure of a monocotyledonous albuminous (maize) seed. Also, draw a labelled diagram to show its parts.

32. What will happen in each case? Also, cite example for the conditions provided.

(i) When complete sets of chromosomes are added to the diploid genome?

(ii) When individual chromosomes are added to or deleted from the diploid genome?

(iii) When a part of the chromosome is lost?

(iv) When a part of chromosome breaks and attaches to another non-homologous chromosome?

(v) When a part of the chromosome breaks and attaches to its homologue? [5]

OR

Give the salient features of the double helix structure of DNA.

33.

(i) What does AIDS stand for? Write its causative agent.

(ii) What are the various routes by which transmission of the human immunodeficiency virus takes place?

(iii) List any two high risk group of people.

(iv) Suggest any two methods for its prevention. [5]

OR

(i) Write the source and the effect on the human body of the following drugs:

a. Morphine
b. Cocaine
c. Marijuana

(ii) What are antibiotics? Name the classes of organisms that produce antibiotics.

CBSE
Class XII Biology
Sample Paper 3 (Solution)

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

Section A

1. Each seminiferous tubule is lined on its inside by two types of cells called male germ cells and sertoli cells. Hence, sertoli cells are located in seminiferous tubules.
2. Parthenocarpy.
3. To compensate lot of wastage.
4. It enhances the female infanticide.
5. Between C and D; the greater the distance between linked genes, the greater will be probability of recombination.
6. A, B and O.
7. It joins the Okazaki fragments after replacing RNA primer with DNA.
8. Due to the presence of cell wall in plants, cellulase is used, whereas the animal cell lacks cell wall.
9. Bacillus thuringiensis.
10.
    i. Parasitism
    ii. Mutualism

11. a; Mutations are necessary for the survival of the species as it leads to variation in DNA to adapt the changed environment. However, lack of mutation gives a temporary advantage to a species in an unchanged environment. Hence, both assertion and reason are true, and reason is the correct explanation of the assertion.

    OR

    b; The sense strand is the strand of DNA that has the same sequence as the mRNA whereas the antisense strand is the non-coding DNA strand of a gene which is used as the template during transcription. It undergoes translation into a protein. In replication process, the two strands of DNA separate and act as a template for the synthesis of new complementary strands. After the completion of replication, each DNA molecule would have one parental and one newly synthesised strand. Hence, both assertion and reason are true, but reason is not the correct explanation of the assertion.

12. a; A monoclonal antibody is made so that it binds to only one substance so they are ideal for diagnosis of diseases caused by closely related pathogens. Also, these are specific and reproducible and can be produced by conventional techniques. Hence, both assertion and reason are true, and reason is the correct explanation of the assertion.

13. c; Leguminous plants can grow well in nitrogen deficient soils because they can fix atmospheric nitrogen. They need more amount of nitrogen so they convert nitrogen gas from the air to a plant available form. Hence, assertion is true but reason is false.

14. a; Species diversity on earth is not uniformly distributed but shows interesting patterns. It is generally highest in the tropics and decreases towards the poles. With the change in the altitudes, there is a change in the species which are found in an area. Hence, both assertion and reason are true, and reason is the correct explanation of the assertion.

15.

(i) b; Dragonflies are used to get rid of mosquitoes.

(ii) a; Soil bacterium, *Bacillus thuringiensis* acts as a biopesticide.

(iii) a; Baculoviruses are the biological control agents that attack insects and other arthropods.

(iv) c; A bioherbicide obtained from fungus *Trichoderma* is used to control several plant pathogens.

(v) b; *Trichoderma* species are free-living fungi that are very common in the root ecosystems. They are effective biocontrol agents of several plant pathogens. Hence, both assertion and reason are true, and reason is not the correct explanation of the assertion.

16.

(i) c; During transcription, adenine forms base pair with uracil instead of thymine.

(ii) d; A transcription unit in DNA is defined by the three regions in the DNA: A Promoter, The Structural gene and A Terminator.

(iii) b; Transcription is the formation of m-RNA strand on a DNA strand in the nucleus.

(iv) b; Replication fork is formed during the process of replication

(v) RNA polymerase enzyme bonds to the Pribnow box at the promotor region and starts the transcription process.

Section B

17. Each microsporangium has 100 microspore mother cells which form 400 microspores by meiosis (100 × 4).

In an anther, there are four microsporangia. So, the total number of microspores will be 4 × 400 = 1600.

As each microspore forms one male gametophyte, 1600 male gametophytes can be produced.

18.

(i) Heterozygous: I^AI^B, Bb, I^Bi, Aa

Homozygous: AA, aa, r, BB, ii

(ii) AA and Aa have the same phenotype; BB and Bb have similar phenotype.

19. Study of biology has helped to control infectious diseases in the following ways:

(i) The use of vaccines and immunisation programmes has enabled us to completely eradicate a deadly disease such as small pox.

(ii) The use of antibiotics and various other drugs has effectively treated many infectious diseases.

20.

(a) By treating the bacteria with lysozyme.

(b) By incubating the bacteria with rRNA on ice, followed by placing them at 42°C.

OR

The plants obtained from genetic engineering containing transgene are known as transgenic plants. Examples – Bt Cotton, Golden rice, Flavr Savr tomato.

21. It is because golden rice is genetically engineered with Vitamin A precursor carotenoids. So lack of vitamin A causes night blindness.

22. Transgenic Plant**:** Flavr Savr Tomato

Transgenic Animal: Super mouse

OR

Rosie, produced human protein enriched milk which contains the human α-lactalbumin and it is a more balanced product for human babies than the natural cow milk.

23. Epiphytes like mosses, ferns and money plant growing on trees benefit from better light conditions but generally do not harm the tree.

24. It is the competition between the individuals of two different species occurring in a habitat. In shallow South American lakes, the visiting flamingos and resident fishes have interspecific competition for their common food.

25. Cactus is adapted to xerophytic desert or arid regions due to the presence of deep root system and spines which are the replaced leaves for minimizing the rate of transpiration. They also have mucilage for holding water.

Section C

26. Similarities between spermatogenesis and oogenesis:

(i) Both processes occur in three phases—multiplicative phase, growth phase and maturation phase.

(ii) Both processes lead to the formation of haploid gametes.

(iii) In the multiplicative phase, mitotic division in both processes differentiates the primordial germ cells of the testes and ovaries into gametogonia (spermatogonia and oogonia).

27. Pedigree analysis is done in the study of human genetics as

(i) It helps genetic counsellors to guide couples about the possibility of having children with genetic defects such as haemophilia.

(ii) It indicates that Mendel's principles are also applicable to human genetics with some modifications found out later such as quantitative inheritance, sex-linked characters and other linkages.

Hence, we can conclude that pedigree analysis is the study of pedigree for the transmission of a particular trait and finding the possibility of the absence or presence of that trait in homozygous or heterozygous state in a particular individual.

28. Pathogen: Roundworm (Ascaris) – an intestinal parasite

Mode of transmission: Contaminated water, vegetables and fruits

Symptoms: Internal bleeding, muscular pain, fever, anaemia and blockage of the intestinal passage.

29. PCR stands for polymerase chain reaction. In this reaction, multiple copies of the gene or DNA of interest are synthesised *in vitro* using two sets of primers and the enzyme DNA polymerase.

Importance in biotechnology:

(i) PCR is used to detect the viral or bacterial pathogen in the body when the disease symptoms have not appeared; it is done by amplification of DNA using the polymerase enzyme.

(ii) It is used to detect HIV in patients suspected with AIDS.

(iii) It is used to detect gene mutations in persons suspected with cancer.

30. Mycorrhiza is associations between fungi and the roots of higher plants. It is an example of mutualism in which both fungi and plants are dependent on each other for nutritional needs. Fungi absorb and transport essential nutrients to plants and in turn plants supply sugar molecules to the fungi.

The interaction which exists between cattle egret and cattle is known as commensalism. In this type of interaction, one species is benefited, whereas the other is neither benefited nor harmed. The cattle egret (bird) usually moves in proximity to the grazing cattle. As cattle move in the grass, they stir up the grass and flush out the insects which then become an easy target for the egret. In this way, the cattle is neither benefited nor harmed, but the egret is benefited.

Section D

31.

(a) Acrosome is found at the anterior region of head of the sperm that contains hydrolytic enzyme called hyalourinidase. This enzyme helps the sperm to penetrate into ovum during fertilization by dispersing the cells of corona radiate.

(b) The presence of mitochondria in the middle piece of sperm provides energy to sperms for its movement.

(c) The absence of mitochondria makes the sperm immobile, which, in turn, cause no fertilization in the fallopian tube.

(d) In males, LH is also called as ICSH (Interstitial cell stimulating hormone) which stimulates the interstitial cells to release testosterone.

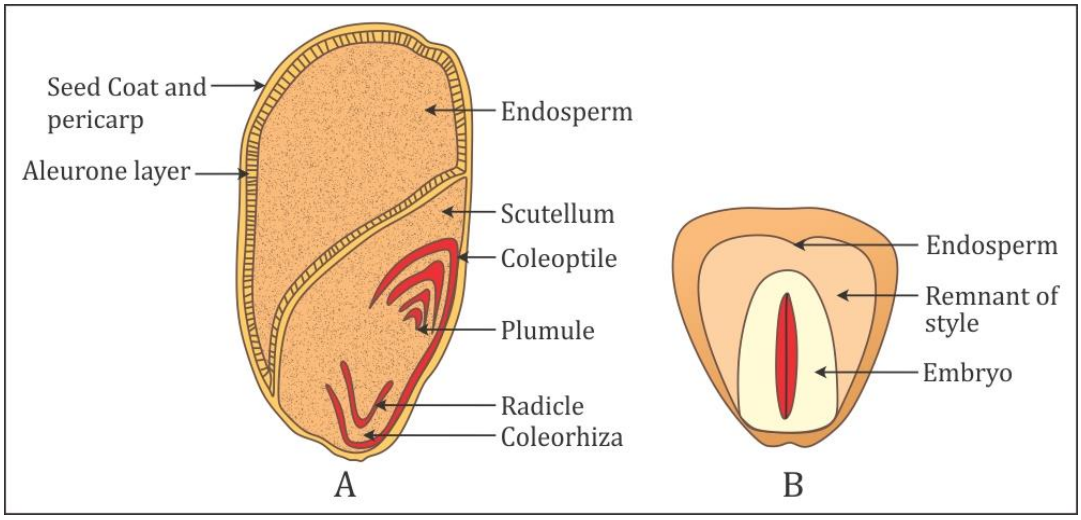
OR

Structure of monocotyledonous albuminous seed:

(i) Seed coat: It is a thin layer which surrounds the whole grain. It is a single-seeded fruit where the seed coat is fused with the fruit wall.

(ii) Endosperm: It occupies the larger part towards the rounded end. It is filled with stored food, mainly starch. It is surrounded by a sheath of special tissue called the aleurone layer. It contains abundant protein.

(iii) Embryo: The embryo consists of a single cotyledon called the scutellum. It is thin, small and without food. It has secretory epidermal tissues which are in direct contact with the endosperm for the absorption of nutrition. The region of the embryonic axis below the cotyledon is the radicle covered with a protective sheath called the coleorhiza. Above the point of attachment of the cotyledon, the embryonic axis becomes the plumule which is enclosed by a leaf-like covering called the coleoptile.



32.

(a) Euploidy will occur. Wheat is an example of polyploidy (hexaploid) with 42 chromosomes (6 times of a normal haploid, N = 7).

(b) Aneuploidy will occur. It may be trisomic when the diploid organism bears one chromosome extra (2N + 1) or monosomic when the diploid has a loss of one chromosome (2N − 1). Down's syndrome is the best known example of aneuploidy.

(c) Deletion. Cri-du chat syndrome.

(d) Translocation will occur. In certain leukaemias, such as chronic myeloid leukaemia (CML), the malignant cells have the chromosome 22 shortened because of the translocation of a piece of its long arm.

(e) Inversion will occur. It produces unbalanced meiotic products, thus leading to sterility.

OR

Features of the double helix structure of DNA:

(i) It is made of two polynucleotide chains where the backbone is constituted by sugar–phosphate and the base projects inside.

(ii) The two chains run in anti-parallel directions. One chain has the polarity 5′–3′ and the other has 3′–5′.

(iii) The bases in the two strands are paired through hydrogen bonds (H bonds). Adenine forms two hydrogen bonds with thymine from the opposite strand and *vice versa*. Similarly, guanine is bonded with cytosine with three H bonds.

(iv) The two chains are coiled in a right-handed fashion. The pitch of the helix is 3.4 nm, and there are roughly ten base pairs in each turn. The distance between a base pair in a helix is approximately equal to 0.34 nm.

(v) The plane of one base pair stacks over the other in the double helix. This, in addition to the H bonds, confers stability of the helical structure.

33.

(i) AIDS stands for Acquired Immuno Deficiency Syndrome. It is caused by HIV-III (Human Immune Deficiency Virus III).

(ii) It is transmitted through:

a. Use of contaminated razors for shaving.
b. Transfusion of infected blood or blood products.
c. Organ transplant.
d. From infected mother to her child through placenta.

(iii) Risk group of people:

a. Drug users.
b. Male homosexuality.

(iv) Prevention:

a. Maintain good moral character and avoid homosexual intercourse.
b. Avoid blood transfusion from the drug abusers.

OR

(i)

a. Morphine: It is the main constituent of opium. It is a strong analgesic and has a sedative and calming effect. It suppresses brain functions and relieves intense pain during fractures, burns and surgery.
b. Cocaine: It is obtained from the coca plant (*Erythroxylum coca*). It interferes with the transport of the neurotransmitter dopamine. It has a potent stimulating action on CNS, producing a sense of euphoria and increased energy. Excessive dosage of cocaine causes lack of sleep, loss of appetite and hallucination, ultimately leading to damage of mental functions and insanity.
c. Marijuana: It is obtained from the direct inflorescence and the top leaves of the female plant of *Cannabis sativa*. Marijuana interferes with short-term memory, impairs thoughts and reasoning, changes the perception of time and produces mild euphoria. It lowers the levels of sex hormones, suppresses the immune system and may cause psychosis.

(ii) Antibiotic is a chemical substance obtained as a metabolic product from one living organism and has an inhibitory effect on another living organism.

Three group of living organisms are responsible for producing antibiotics:

a. Eubacteria (simple bacteria).
b. Actinomycetales.
c. Fungi.