CBSE
Class XII Biology
Sample Paper 4

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. How is Copper T used? [1]

2. From where do the signals for parturition originate? [1]

3. Seeds are considered better for a staple food than vegetative parts of the plant? [1]

4. Name the accessory genital glands in human male. [1]

5. Name two sex-linked diseases in human beings. [1]

6. Which principle is associated with monohybrid cross of 3:1 ratio? [1]

7. What do the triplets AUG and UGA code for during protein synthesis? [1]

8. How is the action of exonuclease different from that of endonuclease? [1]

9. Why does toxin insecticidal protein not kill the Bacillus? [1]

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

i. Clown fish living among the tentacles of sea anemone.

ii. Ticks living on the skin of dogs.

11. Assertion: Addition or deletion of a base from a gene produces entirely a new polypeptide. [1]

Reason: Substitution mutation replaces a single amino acid in a polypeptide.

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: During DNA replication, the discontinuous synthesised fragments are joined by DNA polymerase.

Reason: A RNA sequence provides binding site for RNA polymerase.

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: In recombinant DNA technology, human genes are often transferred into bacteria (prokaryotes) or yeast (eukaryote). [1]

Reason: Both bacteria and yeast multiply very fast to form huge populations which express the desired gene.

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: Scavenging improves the environment. [1]

Reason: A scavenger disposes of dead organic matter.

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: Earth's rich biodiversity is vital for the very survival of mankind. [1]

Reason: Besides the direct benefits, there are many indirect benefits we receive through ecosystem services such as pollination and flood control.

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]

Cancer is one of the most dreaded diseases of human beings and is a major cause of death all over the globe. More than a million Indians suffer from cancer and a large number of them die from it annually. The mechanisms that underlie development of cancer or oncogenic transformation of cells, its treatment and control have been some of the most intense areas of research in biology and medicine. In our body, cell growth and differentiation is highly controlled and regulated. In cancer cells, there is breakdown of these regulatory mechanisms. Normal cells show a property called contact inhibition by virtue of which contact with other cells inhibits their uncontrolled growth. Cancer cells appears to have lost this property. As a result of this, cancerous cells just continue to divide giving rise to masses of cells called tumors.

(i) The chemical carcinogens present in tobacco smoke have been identified as a major cause of _____ cancer.

a. Lung
b. Skin
c. Breast
d. Prostate

(ii) In _____, a piece of the suspected tissue cut into thin sections is stained and examined under microscope.

a. X-ray
b. Biopsy
c. CT Scan
d. MRI

(iii) In which type of cancer treatment, the tumor cells are irradiated lethally?

a. Immunotherapy
b. Surgery
c. Radiotherapy
d. Chemotherapy

(iv) Which substances help in activating the immune system and destroying the tumor in cancer patients?

a. α-interferon
b. antibiotics
c. analgesics
d. Tranquilisers

(v) **Assertion**: Several chemotherapeutic drugs are used to kill cancerous cells. Some of these are specific for particular tumors.
Reason: Majority of drugs have side effects like hair loss, anemia, etc.

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]

Genetic code

During replication and transcription, a nucleic acid was copied to form another nucleic acid. Hence, these processes are easy to conceptualise on the basis of complementarity. The process of translation requires transfer of genetic information from a polymer of nucleotides to a polymer of amino acids. Neither does any complementarity exist between nucleotides and amino acids, nor could any be drawn theoretically. There existed ample evidences, though, to support the notion that change in nucleic acids (genetic material) were responsible for change in amino acids in proteins. This led to the proposition of a genetic code that could direct the sequence of amino acids during synthesis of proteins. It was George Gamow, a physicist, who argued that since there are only 4 bases and if they have to code for 20 amino acids, the code should constitute a combination of bases. He suggested that in order to code for all the 20 amino acids, the code should be made up of three nucleotides. Marshall Nirenberg's cell-free system for protein synthesis finally helped the code to be deciphered. Severo Ochoa enzyme (polynucleotide phosphorylase) was also helpful in polymerising RNA with defined sequences in a template independent manner (enzymatic synthesis of RNA). Finally a checker-board for genetic code was prepared.

(i) How many codons are there in the genetic code?
a. 61
b. 64
c. 71
d. 74

(ii) Out of total number of codons how many of them do not code for any amino acids?
a. 5
b. 6
c. 3
d. 7

(iii) From bacteria to human, _____ would code for Phenylalanine (phe).
a. AUU
b. AUA
c. UAA
d. UUU

(iv) Which of the following codon has dual function?
a. AUG
b. AUU
c. AUA
d. UAA

(v) Which of the following statement is incorrect regarding genetic code?
a. The codon is triplet.
b. Some amino acids are coded by more than one codon.
c. The genetic code has commas.
d. The code is nearly universal.

Section B

17. Write the location and function of Cowper's gland. [2]

18. The haploid chromosome number for Drosophila is 4.
(a) How many linkage groups should you expect to find in Drosophila?
(b) What can you say about the inheritance of two characters governed by two different genes, one located on chromosome number 3 and the other on chromosome number 4? [2]

19. Mention any two symptoms of AIDS. [2]

20. What are the advantages of the techniques of GM crops? [2]

OR

Bacillus thuringiensis produces insecticidal protein. Why does this toxin not kill *Bacillus*?

21.
(a) State the role of DNA ligase in biotech.
(b) What happens when *Meloidoyne incognitia* consumes cells with RNAi gene? [2]

22. Why is the introduction of genetically engineered lymphocytes into an ADA deficiency patient not a permanent cure? Suggest a possible permanent cure. [2]

OR

How are restriction enzymes different from the topoisomerases functionally?

23. A particular species of wild cat is endangered. In order to save them from extinction, which is a desirable approach in situ or ex situ? Justify your answer. [2]

24. What is camouflage? Explain by giving an example. [2]

25. How do humans maintain constant body temperature in summer and winter? [2]

Section C

26. Explain why meiosis and gametogenesis are always interlinked? [3]

27. In human beings, blue eye colour is recessive to brown eye colour.
A brown-eyed man has a blue-eyed mother.
(a) What is the genotype of the man and his mother?
(b) What are the possible genotypes of his father?
(c) If a man marries a blue-eyed woman, what are the possible genotypes of their offspring? [3]

28. The mosquitoes grow in stagnant water around the residential areas, coolers in the house, flower pots, etc. They act as vectors for various diseases.
(a) Name any three diseases spread by mosquitoes.
(b) How can we control the breeding of insect vectors?
(c) Mention the name of the fish that feeds on mosquito larvae. [3]

29. Name the genes responsible for making Bt cotton plants resistant to bollworm attack. How do such plants attain resistance against bollworm attacks? Explain. [3]

30. Explain mutualism with the help of any two examples. How is it different from commensalism?

Section D

31.
(i) Draw a labelled sectional view of the seminiferous tubule of a human male.
(ii) Define spermiogenesis. Where does it occur? [5]

OR

(i) State what is apomixis. Comment on its significance. How can it be commercially used?
(ii) Draw a longitudinal section of a post-pollinated pistil showing the entry of the pollen tube into the mature embryo sac.

32. Who proposed the chromosome theory of inheritance? Give the salient features of this theory. [5]

OR

Describe in brief the process of transcription.

33. [5]

(i) Which gas gives puffed appearance to the dough? Name the metabolic pathway taking place resulting in the formation of this gas.

(ii) In which food would you find lactic acid bacteria? Mention any two applications of it.

(iii) What is the significance of SCP?

OR

(i) Define the term cirrhosis.

(ii) What are the side-effects of the use of anabolic steroids in females and males?

(iii) Mention any two useful measures for prevention and control of alcohol and drugs abuse among adolescents.

CBSE
Class XII Biology
Sample Paper 4 (Solution)

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

Section A

1. Copper T is an Intra Uterine Device (IUD) inserted by doctors or expert nurses in the uterus through vagina.

2. The signals for parturition originate from the fully developed foetus and the placenta which induce mild uterine contractions called foetal ejection reflex.

3. Seeds contain minimum quantity of water and can remain dormant for a long period.

4. Seminal vesicles, prostate glands and Cowper's glands.

5. Colour blindness and Haemophilia.

6. Principle of segregation.

7. AUG – Methionine, UGA – Termination codon Non sense codon).

8. Exonuclease removes the nucleotides from the ends of DNA molecules while endonuclease makes cut at specific position within a DNA molecule.

9. The toxin insecticidal protein exist as inactive protoxins.

10.

i. Commensalism
ii. Ectoparasitism.

11. b; Mutation is an abrupt and discontinuous process where a gene or a chromosome undergoes heritable changes in its structure or its number. Therefore, addition or deletion of a base from a gene produces entirely a new polypeptide. In substitution mutation, one base is substituted for another. Hence, both assertion and reason are true, and reason is not the correct explanation of the assertion.

OR

d; During DNA replication, the discontinuous synthesised fragments are joined by the enzyme DNA ligase. During protein synthesis, the region of DNA that provides binding site for RNA polymerase is promoter and initiate the process of transcription. Hence, both assertion and reason are false.

12. a; In recombinant DNA technology, human genes can be transferred into bacteria and yeast because these organisms multiply rapidly to form the huge population that expresses the transferred gene in the short period of time. Hence, both assertion and reason are true, and reason is the correct explanation of the assertion.

13. a; Scavenging is the breaking down of organic material and recycle it into the ecosystem as nutrients. This helps to keep an ecosystem free of the bodies of dead animals, or carrion. A scavenger disposes of dead organic matter and thus helps to recycle the nutrients. Hence, both assertion and reason are true, and reason is the correct explanation of the assertion.

14. b; Earth's rich biodiversity is vital for the very survival of mankind because the reason for conserving biodiversity are narrowly utilitarian, broadly utilitarian and ethical. Besides the direct benefits (food, fibre, firewood, pharmaceuticals, etc.), there are many indirect benefits we receive through ecosystem services such as pollination, pest control, climate moderation and flood control. Hence, both assertion and reason are true, and reason is not the correct explanation of the assertion.

15.

(i) a; The chemical carcinogens present in tobacco smoke have been identified as a major cause of lung cancer.

(ii) b; In biopsy, a piece of the suspected tissue cut into thin sections is stained and examined under microscope.

(iii) c; In radiotherapy, tumor cells are irradiated lethally, taking proper care of the normal tissues surrounding the tumor mass.

(iv) a; The cancer patients are given substances called biological response modifiers such as α-interferon which activate their immune system and help in destroying the tumor.

(v) b; Several chemotherapeutic drugs are used to kill cancerous cells. Some of these are specific for particular tumors. Majority of drugs have side effects like hair loss, anemia, etc.

16.

(i) b; There are 64 codons in the genetic code.

(ii) c; Out of 64 codons, 3 of them do not code for any amino acids.

(iii) d; From bacteria to human, UUU would code for Phenylalanine (phe).

(iv) a; AUG has dual functions. It codes for Methionine (met), and it also act as initiator codon.

(v) c; The salient features of genetic code includes:

i. The codon is triplet. 61 codons code for amino acids and 3 codons do not code for any amino acids.

ii. Some amino acids are coded by more than one codon, hence the code is degenerate.

iii. The genetic code is commaless.

iv. The code is nearly universal: for example, from bacteria to human UUU would code for Phenylalanine (phe).

Section B

17. Cowper's glands (Bulbourethral glands): These are paired glands situated beneath the bladder and on each side of the urethra into which their ducts open. They are about the size of a pea and form the floor of the pelvis. They secrete clear, white, viscous, alkaline, mucoid lubricant which neutralise the activity of acidic female vaginal secretions and increase the mobility and survival potential of sperms in the genital tract of the female.

18.

(a) 4; because the linkage group equals the number of haploid chromosomes.

(b) The two characters being located on two different chromosomes will be unlinked and hence will follow Mendelian inheritance and the law of independent assortment.

19. Symptoms of AIDS:

(i) Swollen lymph nodes and fever

(ii) Sweating at night and weight loss

20. There are two advantages:

(a) Any gene from any organism or a synthetic gene can be used for transfer.

(b) Change in genotype is precisely controlled.

OR

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

21.

(a) DNA ligase helps in joining the DNA fragments by forming phosphodiester bonds between adjacent nucleotides, hence it is also known as molecular glue.

(b) Its specific mRNA will be silenced so it cannot survive in the host expressing RNAi.

22. The genetically engineered lymphocytes are not immortal, the patient requires periodic infusion of such genetically engineered lymphocytes. If the gene isolate from the bone marrow cells producing ADA is introduced into cells at early embryonic stages, it could be a permanent cure.

OR

Restriction enzymes are nucleases which cut DNA into short pieces containing identifiable genes at specific sites. These pieces are then introduced into plasmids, yeasts or plant cells. However, topoisomerases break and reseal strands of DNA which serve as starting points for replication.

23. Ex situ is a desirable approach to protect the wild cat. The organism is protected outside their natural habitat where special care is taken to protect them. By using cryopreservation techniques, gametes of threatened species can be preserved under very low temperature.

24. Camouflage is a type of protective mechanism in many animals where they assume different shapes and colours resembling to the background for deceiving the predators as well as for ensuring better survival. Example – stick insect resembles like a dry stick and leaf insect looks like a leaf.

25. Humans maintain a constant body temperature of 37°C. In summer, the outside temperature is more than the body temperature. In this condition, humans sweat profusely. This brings down the body temperature (cooling) when the sweat evaporates. Similarly, in winter, the outside temperature is much lower than 37°C. In this condition, the skin contracts to conserve body heat and to raise the body temperature.

Section C

26. In sexually reproducing organisms, the process of meiosis occurs during gametogenesis to reduce the number of chromosomes to half in male and female gametes. During fertilisation, the fusion of male and female gametes takes place to form the diploid zygote. The diploid zygote grows into an adult organism and reproduces sexually.

If there is no meiosis in the reproductive cells during gametogenesis, then the chromosomes will double at each fertilisation and an abnormal organism will be formed. Thus, meiosis and gametogenesis are always linked to avoid the multiplication of species and to restore the original diploid chromosome number.

27. According to the given condition, brown eye colour is dominant over blue eye colour.

Father × Mother (blue-eyed)

↓

Man (brown eyed)

(a) The mother genotype must be bb as she is recessive for blue-coloured eye. The man is brown-eyed (dominant character). It is possible that the genotype is Bb as he is procuring one of the recessive genes from his mother.

(b) As the genotype of the man is Bb, so the possible genotypes of his father are BB or Bb.

(c)

Parents	...	Brown-eyed man (heterozygous)	×	Blue-eyed woman
Genes	...	Bb	×	bb
Gametes	...	B, b	×	b, b

b	Bb Brown-eyed	bb Blue-eyes
b	Bb Brown-eyed	bb Blue-eyed

Result: 50% offspring with brown eye having genotype Bb. 50% offspring with blue eye having genotype bb.

28.

(a) Malaria, Dengue and Chikungunya.

(b) The most important measure to control or eliminate the insect vectors and their breeding places can be achieved by avoiding stagnation of water in and around residential areas, regular cleaning of household coolers, use of mosquito nets, spraying of insecticides in ditches, drainage areas and swamps, etc. In addition, doors and windows should be provided with wire mesh to prevent the entry of mosquitoes.

(c) Gambusia fish feeds on mosquito larvae.

29. The gene responsible for making Bt cotton plant resistant to bollworms is cry IAC and cry II AB. These genes are secreted in the form of protein crystals during a particular phase of their growth and contain insecticidal proteins which exist in the inactive form. When an insect ingests the inactive toxin, it gets converted to the active form in the gut under alkaline conditions. This solubilises the crystals and the active toxin binds to the surface of epithelial cells and creates pores which cause cell swelling and lysis, causing the death of the insect.

30. Mutualism is the relationship between two organisms where both are benefited for food, shelter and substratum for attachment. Two examples are

(i) Mycorrhizae are the mutualistic relationship between fungi and the roots of higher plants. The fungi help in mineral nutrition of the plant with which they are associated and obtain in turn carbohydrates from the plant.

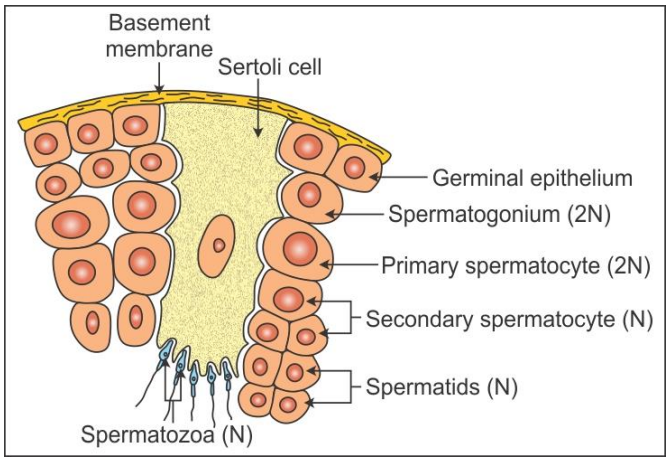
(ii) The association of *Trichonympha* and termites is symbiotic. *Trichonympha* lives in the gut of termites and digests the cellulose of wood for them and in turn termites provide food, shelter and constant internal environment to *Trichonympha*.

Commensalism is an interaction between two organisms where one is benefited and the other is neither harmed nor benefited. Example: The sucker fish bears a sucker on the dorsal side of its head which helps it to attach itself to the body of the shark. It benefits the sucker fish with free transport and free food left behind by the shark.

Section D

31.

(i) Sectional view of the seminiferous tubule of a human male:



(ii) Spermiogenesis is the process of transformation of spermatids into spermatozoa. This process occurs in the seminiferous tubules of the testis.

OR

(i) Apomixis is the mode of reproduction which does not involve formation of zygote through gametic fusion.

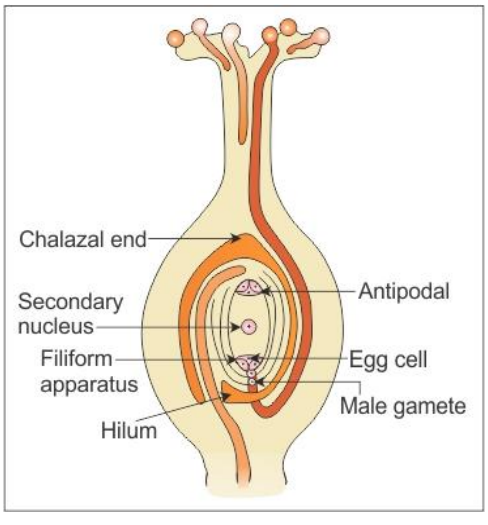
Significance of apomixis:

a. Adventives embryos are better clones than cuttings.

b. Embryos formed through apomixes are generally free from infections.

Hybrid varieties provide higher and better yield. If hybrid seeds are produced every year, they do not maintain hybrid characters because of segregation of traits. Moreover, production of hybrid seeds every year is very costly. This can be avoided by introducing apomixes in hybrid seeds.

(ii) Longitudinal section of a post-pollinated pistil:



32. Walter Sutton and Theodor Boveri proposed the chromosome theory of inheritance. Its main features are

(i) Each chromosome carries several specific determiners which play an essential role in the development of an organism. A loss of complete chromosome or its fragment leads to deviation in the structure and function of an organism.

(ii) The somatic cell of an organism bears two identical sets of chromosomes (diploid) each received from mother (maternal chromosome) and father (paternal chromosome). These two chromosomes of one type constitute the homologous pair.

(iii) The paired homologous chromosomes separate during meiosis, and each gamete receives one homologous chromosome.

(iv) The paired condition of both chromosomes is maintained during fertilisation

(v) Each chromosome contains numerous genes and the position assigned to each gene is called locus. These genes help the organism to develop from the zygote.

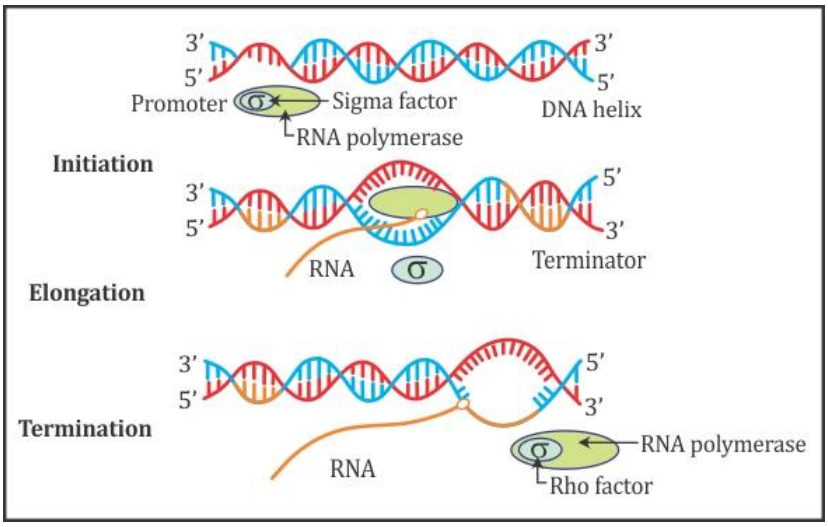
(vi) Each chromosome retains its individuality, uniqueness and continuity throughout the life of an organism and from generation to generation. They never get lost or mixed up but behave as units.

OR

Transcription: It is the formation of an mRNA strand on a DNA strand in the nucleus. The mechanism of mRNA synthesis is analogous to DNA replication where only one of the two strands (sense strand) acts as a template. The formation of mRNA takes place in the 5′–3′ direction, so the sequence of nucleotides on the DNA template (sense strand) must be in the 3′–5′ direction.

This process involves unwinding of DNA and transcription starts at a specific point called the promoter region. DNA-dependent RNA polymerase enzyme binds to the 'Pribnow box' at the promoter region and starts transcription. RNA polymerase contains a detachable subunit called the sigma (σ) factor. It helps the enzyme to bind firmly to DNA. The RNA core polymerase (minus sigma factor) moves down the DNA at a faster pace and this continues to synthesise a new RNA chain. It requires the building blocks of uracil (U), adenine (A), cytosine (C) and guanine (G). The base sequence in DNA decides the base sequence in mRNA as A pairs with U and G pairs with C. The mRNA is synthesised on the DNA template in the 5′–3′ direction, and so, successive nucleotides are attached at the 3′–OH end of the growing mRNA strand. So, the information of DNA coded in the sequence of bases of the cistron is transcribed to mRNA. This process continues until it reaches the terminator sequence in the sense DNA strand (3′–AAAAAAT–5′). At this point, another protein particle, the

rho (ρ) factor, forms a complex with RNA polymerase. This causes the enzyme to go off the DNA track, and thus, new mRNA is released. Many mRNA are synthesised in rapid succession along the cistron. The completed mRNA moves away from the nucleus and binds to a group of ribosomes in the cytoplasm.



33.

(i) Production of carbon dioxide during fermentation gives the puffed appearance to the dough. Bacteria or yeast undergoes anaerobic pathway and produce the carbon dioxide gas for making the dough to rise.

(ii) Lactic acid bacteria are found in milk.

a. Lactic acid bacteria convert milk to curd at suitable temperature and also improves the nutritional quality by increasing vitamin B12.

b. This bacterium plays a beneficial role in checking disease causing microbes in human stomach.

(iii) Significance of SCP:

a. SCP is rich in high-quality protein and is rather poor in fats; hence, it is a valuable supplement in human diet. Its use bridges the gap between the requirement and supply of proteins in human diet.

b. It reduces the pressure on agricultural production systems for the supply of required proteins.

c. SCP production based on industrial effluents helps in reducing environmental pollution.

OR

(i) The chronic use of drugs and alcohol damages nervous system and liver. This condition is called cirrhosis.

(ii) The side-effects of the use of anabolic steroids in females include masculinisation (features like males), increased aggressiveness, mood swings, depression, abnormal menstrual cycles, excessive hair growth on the face and body, enlargement of clitoris, deepening of voice. In males, it

includes acne, increased aggressiveness, mood swings, depression, reduction of size of the testicles, decreased sperm production, potential for kidney and liver dysfunction, breast enlargement, premature baldness, enlargement of the prostate gland.

(iii) Measures useful for prevention and control of alcohol and drugs abuse among adolescents are:

a. Avoid undue peer pressure - Every child has his/her own choice and personality, which should be respected and nurtured. A child should not be pushed unduly to perform beyond his/her threshold limits; be it studies, sports or other activities.

b. Education and counselling - Educating and counselling him/ her to face problems and stresses, and to accept disappointments and failures as a part of life. It would also be worthwhile to channelize the child's energy into healthy pursuits like sports, reading, music, yoga and other extracurricular activities.