Sample Question Paper - 4
Biology (044)
Class- XII, Session: 2021-22
TERM II

Time allowed : 2 hours ***Maximum marks : 35***

General Instructions :

(i) All questions are compulsory.

(ii) The question paper has three sections and 13 questions. All questions are compulsory.

(iii) Section–A has 6 questions of 2 marks each; Section–B has 6 questions of 3 marks each; and Section–C has a case-based question of 5 marks.

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

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

SECTION - A

1. Malaria, typhoid, pneumonia and amoebiasis are some of the human infectious diseases. Which one of these are transmitted through mechanical carriers?

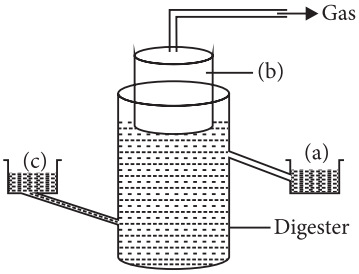
2. Name the bacterium responsible for the large holes seen in "Swiss Cheese". What are these holes due to?

OR

Explain the role of flocs in sewage treatment.

3. Differentiate between the roles of B-lymphocytes and T-lymphocytes in generating immune responses.

4.



The diagram above is that of a typical biogas plant. Explain the sequence of events occurring in a biogas plant. Identify a, b and c.

5. How do organisms cope with stressful external environmental conditions which are localised or of short duration?

OR

Differentiate between parasitism and competition, giving one example of each. State the common characteristic they share.

6. Differentiate between commensalism and mutualism by taking one example each from plants only.

SECTION - B

7. How does a vaccine for a particular disease immunise the human body against that disease?

OR

Write the scientific names of the causal organisms of elephantiasis and ringworm in humans. Mention the body parts affected by them.

8. Name the cells that act as HIV factory in humans when infected by HIV. Explain the events that occur in the infected cell.

9. **(a)** How is an exonuclease functionally different from an endonuclease?

(b) Give an example of any two endonucleases other than *Sal* I.

10. How does over-exploitation of beneficial species affect biodiversity? Explain with the help of one example.

11. Biodiversity is required for maintaining and sustaining supply of goods and services from various species as well as ecosystem. Discuss broadly utilitarian services of biodiversity to nature.

12. **(a)** Write the palindromic nucleotide sequence *Eco*RI recognises.

(b) Name the enzymes that help in forming recombinant DNA.

SECTION - C

13. Unless the vector and source DNA are cut, fragments separated and joined, the desired recombinant vector molecule cannot be created.

(a) How are the desirable DNA sequences cut?

(b) Explain the technique used to separate the cut fragments.

(c) How are the resultant fragments joined to the vector DNA molecule?

OR

(a) Name the source from which insulin was extracted earlier. Why is this insulin no more used by diabetic people?

(b) Explain the process of synthesis of insulin by Eli Lilly company. Name the techniques used by the company.

(c) How is the insulin produced by human body different from the insulin produced by the above mentioned company?

Solution

BIOLOGY - 044

Class 12 - Biology

1. Mechanical carrier is one that simply carries pathogens to a susceptible individual and is not essential to the development of the pathogen. The pathogens are simply carried on the mouthparts, legs, body surface of the carrier from an infected to a susceptible host. Amoebiasis and typhoid are carried through mechanical carriers like housefly.

2. Bacterium responsible for large holes in Swiss Cheese is *Propionibacterium shermanii*. These large holes in Swiss Cheese are due to CO_2 gas produced by the bacteria.

OR

Flocs are masses of aerobic bacteria held together by slime and fungal filaments to form mesh like structures. These microbes digest a lot of organic matter, converting it into microbial biomass and releasing a lot of minerals. This reduces Biochemical Oxygen Demand or BOD.

3. Differences between the role of B-lymphocytes (B-cells) and T-lymphocytes (T-cells) in generating immune responses are :

	B-lymphocytes (B-cells)	T-lymphocytes (T-cells)
(i)	B-cells form humoral or antibody mediated immune system(AMIS).	T-cells form cell-mediated immune system (CMIS).
(ii)	They defend against viruses and bacteria that enter the blood and lymph.	They defend against pathogens including protists and fungi that enter the cells.
(iii)	B-cells formed by division of plasma cells produce antibodies and provide immunity against foreign substances.	T-lymphocytes produce different types of T-cells by the division of lymphoblast, *e.g.*, killer T-cells react against cancer cells, suppressor cells inhibit immune system.

4. In the given diagram, 'a' is sludge, 'b' is gas holder and 'c' is dung and water.

The biogas production is an anaerobic process and is carried out in an air tight, closed cylindrical concrete tank called a digester. The tank has a concrete inlet basin on one side for feeding fresh cattle dung. There is a concrete outlet on the outer side for removing the digested sludge. The top of the tank serves as the gas tank. It has an outlet pipe for the biogas. Biogas generation is a three-stage anaerobic digestion of animal and other organic wastes. In the first stage of anaerobic digestion, facultative anaerobic decomposer microbes bring about enzymatic breakdown of complex organic compounds into simpler and soluble compounds often called monomers. For this, the decomposer microbes secrete cellulases, proteases and lipases (cellulolytic, proteolytic and lipolytic enzymes). In the second stage, the simple soluble compounds of microbial digestion or monomers are acted upon by fermentation causing microbes. The latter change the monomers into organic acids. Organic acids, especially acetic acid, are acted upon by methanogenic bacteria in the third or final stage. The methane bacteria convert organic acids as well as carbon dioxide into methane. The biogas thus formed is conducted through the outlet pipe and used for domestic purposes. The digested sludge is removed from tank and is used as fertiliser.

5. Living organisms cope with stressful conditions by any of the following methods:

(i) Migration : The organism can migrate temporarily from the unfavourable habitat to more favourable area and return when unfavourable period is over, *e.g.*, Siberian birds migrate from Siberia to other parts every winter.

(ii) Hibernation or winter sleep : The phenomenon of spending extreme cold period of the year in an inactive stage by an animal, *e.g.*, polar bears undergo hibernation during winter season to escape extreme cold.

(iii) Aestivation or summer sleep : The phenomenon of spending dry hot period of the year in an inactive stage by an animal *e.g.*, snails and fish.

(iv) Diapause : It is a dormant stage in the development of an organism, occurs in both summer and winter. During this period metabolism of body slows down.

OR

Differences between parasitism and competition are as follows:

	Parasitism	Competition
(i)	It is relationship between two living organisms of different species in which one organism obtains food from another living organism.	It is rivalry between two or more organisms of same or different species for obtaining the same resources
(ii)	*E.g.*, lice, an ectoparasite sucks blood of animals and *Trypanosoma*, an endoparasite feeds on body fluid.	*E.g.*, in forest areas, trees, shrubs, herbs and vines compete with each other for sunlight, nutrients, water, pollinators, etc.

6. The differences between mutualism and commensalism are as follows :

	Mutualism	Commensalism
(i)	It is an association between two organisms in which both are benefitted.	It is an association between two organisms in which only one is benefitted. The second is neither benefitted nor harmed.
(ii)	Contact between the two organisms is obligatory.	Contact between commensal and its benefactor may be periodic or continuous.
(iii)	Nitrogen fixing blue -green alga or cyanobacterium called *Anabaena* is associated with water fern *Azolla* in a mutualistic interaction.	Many epiphytes, *e.g.*, orchids, are found growing on the branches and in the forks of trees. These epiphytes use the trees only for attachment and manufacture their own food by photosynthesis.

7. Vaccine is suspension or extract of weakened (attenuated/ dead) pathogens of disease which when injected into healthy person provides it active acquired immunity to the disease.

Vaccination stimulates the antibody production and formation of memory cells without causing the disease. When the vaccinated person is attacked by the same pathogen, the exising memory B or T cells recognise the antigen quickly and attack the invaders with massive production of lymphocytes and antibodies.

OR

Elephantiasis is caused by *Wuchereria bancrofti* and mainly affects the lymphatic vessels of the lower limbs.

Ringworm is caused by *Trichophyton* and *Epidermophyton.* Mainly affects skin, scalp and nails.

8. Macrophages act as HIV factory in humans. Events that occur in HIV infected cells are:

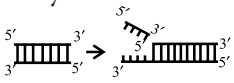
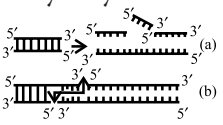
(i) After the entrance of the virus into the body of the person, the virus enters into macrophages where RNA genome of the virus replicates to form viral DNA with the help of reverse transcriptase enzyme.

(ii) Viral DNA gets incorporated into the host cell's DNA and directs the infected cells to produce viruses.

(iii) Simultaneously, HIV virus enters into helper T lymphocytes where it replicates and produces more viruses. This is repeated so that the number of helper T lymphocytes decreases in the body of the infected person.

(iv) Due to decrease in the number of helper T lymphocytes in the body, the person starts suffering from infections and gets immune deficiency and he/ she is unable to protect himself/herself against these infections.

9. (a) Differences between action of exonucleases and endonucleases are as follows :

	Exonucleases	Endonucleases
(i)	These nucleases cleave base pairs of DNA at their terminal ends.	They cleave DNA at any point except the terminal ends.
(ii)	They act on single strand of DNA or gaps in double stranded DNA.	They cleave one strand or both strands of double stranded DNA.
(iii)	They do not cut RNA. 	They may cut RNA. 

(b) Two examples of endonucleases other than *Sal*I are *Eco*RI and *Hind*III.

10. Excessive exploitation of a species, whether a plant or animal, reduces size of its population so that it becomes vulnerable to extinction. For example,

presently many marine fish population around the world are declining due to over harvesting results in endangering the continued existence of some commercially important species.

11. Following are the broadly utilitarian services of biodiversity to nature:

(i) Oxygen : Through photosynthetic activity, plants replenish oxygen of the atmosphere.

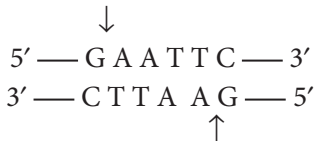
(ii) Pollination : Bees, bumble bees, butterflies, moths, beetles, birds and bats are engaged in pollination of plants which is essential for formation of fruits and seeds.

(iii) Climate Regulation : Forests and oceanic systems regulate global climate.

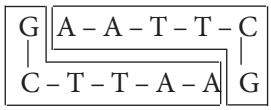
(iv) Flood and Erosion Control : Plant cover protects the soil from wind and water erosion. Run off of rain water is reduced so that flood water is rarely formed.

(v) Nutrient Cycling : It is essential for continued availability of nutrients to plants without which there would be no photosynthetic activity.

12. (a) *Eco*RI is a type II restriction endonuclease enzyme which recognizes the base sequence at palindrome sites in DNA duplex and cut its strand. It recognizes the base sequence GAATTC in DNA duplex and cut its strands between G and A as shown below:



The product obtained is as follows:



Sticky ends

(b) Enzymes which help in formation of recombinant DNA are :

(i) Lysing enzymes, *e.g.* lysozyme, cellulase, chitinase.

(ii) Cleaving enzymes like exonucleases, endonucleases and restriction endonucleases.

13. (a) Desirable DNA sequences are cut by the use of enzyme restriction endonuclease. When restriction enzymes cut the strand of DNA a little away from the centre of the palindromic sites, between the same two bases on the opposite strands, it leaves single stranded portions at the ends. This forms overhanging stretches called sticky ends on each strand. They are called sticky as they form hydrogen bonds with their complementary cut counterparts. The stickiness of the ends facilitates the action of the enzyme DNA ligase.

(b) After the cutting of DNA by restriction enzyme, fragments of DNA are formed. Separation of DNA fragments according to their size or length is done by a technique called agarose gel electrophoresis.

It is a technique of separation of molecules such as DNA, RNA or protein, under the influence of an electrical field, so that they migrate in the direction of electrode bearing the opposite charge, *viz*., positively charged molecules move towards cathode (–ve electrode) and negatively charged molecules travel towards anode (+ve electrode) through a medium/ matrix. Most commonly used matrix is agarose.

DNA fragments separate according to size through the pores of agarose gel. Hence the smaller, the fragment size, the farther it moves.

The separated DNA fragments can be seen only after staining the DNA with a compound known as ethidium bromide (EtBr) followed by exposure to UV radiation. The fragments are visible as bright orange coloured bands.

(c) DNA ligase help to join resultant fragments to the vector DNA molecule. DNA ligases join two individual fragments of double stranded DNA by the formation of phosphodiester bond between them.

OR

(a) Earlier insulin was extracted from pancreas of slaughtered cattle and pig. This insulin is not in use, as some diabetic patients developed allergic reaction to it.

(b) In 1983, Eli Lilly an American company, first prepared two DNA sequences corresponding to A and B chains of human insulin and introduced them in plasmids of *Escherichia coli* to produce insulin chains. Chains A and B were produced separately, extracted and combined by creating disulfide bonds to form human insulin (humulin). It is recombinant DNA technological process.

(c) The difference between humulin (insulin synthesised by Eli Lilly) and insulin produced by the human pancreas is that humulin consists of two polypeptide chains (A and B) produced separately, extracted and combined by creating disulfide bond while insulin produced by human pancreas contains chains A, B and C and during maturation chain C is removed.