Sample Question Paper - 17
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. Ram collected water samples from pond (A) and river (B). The BOD of water samples A and B were 400 mg/L and 150 mg/L respectively. Which sample is more polluted? Why sewage water is treated until the BOD is reduced?

2. **(a)** Name the parasite that causes filariasis in humans. Mention its two diagnostic symptoms.

(b) How filariasis is transmitted to others?

OR

Antigenic stimulus induces an immune response in a host. Immune response is the way by which body defends itself against substances it sees as harmful or foreign. Name and explain the two types of immune responses in humans.

3. Write the role of '*ori*' and 'restriction' site in a cloning vector pBR322.

4. In the year 1963, two enzymes responsible for restricting the growth of bacteriophage in *E. coli* were isolated. How did the enzymes act to restrict the growth of the bacteriophage?

5. "Plants that inhabit a rainforest are not found in a wetland". Explain.

6. Transgenic plants have foreign genes introduced through genetic engineering. Due to genetic modifications, GM plant have been useful in many ways. List any four ways by which GMOs have been useful for enhanced crop output.

OR

Explain the process of RNA interference.

SECTION - B

7. DNA fragments formed by the use of restriction enzymes are separated using agarose gel electrophoresis. Explain the technique.

OR

(a) Why are restriction endonucleases so called?

(b) What is a palindromic nucleotide sequence? How do restriction endonucleases act on palindromic sites to create 'sticky ends'?

8. A young boy when brought a pet dog home started to complain of watery eyes and running nose. The symptoms disappeared when the boy was kept away from the pet.

(a) Name the type of antibody and the chemicals responsible for such a response in the boy.

(b) Mention the name of drugs that could be given to the boy for immediate relief from such a response.

9. How did an American Company, Eli Lilly use the knowledge of rDNA technology to produce human insulin?

10. Explain parasitism and co-evolution with the help of one example of each.

11. What are the two types of desirable approaches to conserve biodiversity? Explain with examples bringing out the difference between the two types.

12. Name and explain any two ways that are responsible for the loss of biodiversity.

SECTION - C

13. **(a)** Rahul met an accident and was heavily bleeding. He was immediately taken to hospital. Doctor gave an injection to protect him from deadly diseases.

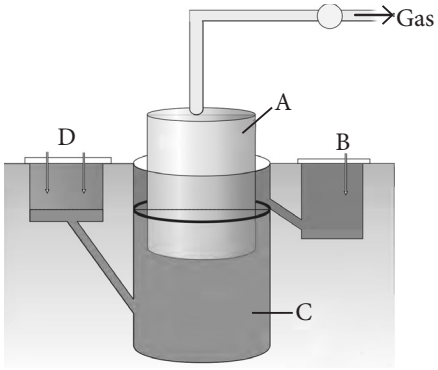
(i) What did the doctor injected to Rahul?

(ii) How would the injection protect Rahul against the disease?

(iii) Can you tell against which disease he was injected? What kind of immunity does it provide?

(b) There are two types of immunity, one is acquired by vaccination and other by directly taking antibodies from outside. Identify two types of immunity and differentiate between them.

OR



(a) The above diagram shows a typical biogas plant. Identify A, B, C and D in the diagram.

(b) How is activated sludge formed during sewage treatment?

Solution

BIOLOGY - 044

Class 12 - Biology

1. Water sample having high BOD is more polluted as compared to water sample having low BOD. Hence, water sample A having BOD 400 mg/L (pond water) is more polluted as compared to water sample B having BOD 150 mg/L (river water).

Sewage water is highly polluted and contains high amount of organic waste hence biochemical oxygen demand (BOD) of sewage water is high. Sewage is treated in sewage treatment plants to remove pollutants, as a result with the reduction in pollution, BOD of the water decreases.

2. **(a)** Filariasis is a helminthic disease caused by *Wuchereria* (*W. bancrofti* and *W. malayi*). It causes swelling of lymphatic vessels of lower limbs resulting in swelling of feet, legs, scrotal sacs and thighs. **(b)** Filariasis spreads from one human being to other through the bite of female mosquito, *Culex*.

OR

Immune response is the specific reactivity induced in a host by an antigenic stimulus. It is of two types - primary and secondary immune response.

(i) The reaction of the body's immune system to the first attack of microbes (antigens) is called primary immune response. It takes much longer time to develop because of the requirement of suitable receptor development. This response is feeble and declines rapidly. This produces both receptors and memory cells.

(ii) The reaction of the body's immune system to any subsequent infection of the same microbe is termed secondary immune response. It is quicker and more intense than primary immune response because memory B cells present quick response against invading microbes.

3. Origin of replication (*ori*) site in cloning vector pBR322 is a sequence from where replication starts. Any piece of DNA when linked to this sequence can be made to replicate within host cell. Restriction site within the marker tet^R and amp^R genes permit an easy selection for cells transformed with the recombinant pBR322.

4. In 1963, the two enzymes responsible for restricting the growth of bacteriophage in *Escherichia coli* were isolated. One of these added methyl groups to DNA while the other cut DNA at specific sequences *i.e.*, restriction endonuclease. To restrict the growth of bacteriophage, the *E. coli* recognises and cut foreign DNA into pieces by restriction endonucleases and in order to prevent cleavage of its own DNA by these enzymes, it modifies its DNA by adding methyl groups. Thus, it remains unrecognised.

5. Plants that inhabit rainforest are not able to germinate in wetland due to presence of excess water and anaerobic conditions (due to water logging). Wetlands are marshy areas and plants growing there have negatively geotropic roots, called pneumatophores which help in gaseous exchange. Pneumatophores are not present in plants inhabiting rainforests.

6. Genetically modified organisms have been useful for enhanced crop output as it has :

(i) made crops more tolerant to abiotic stresses (cold, drought, salt, heat).

(ii) reduced reliance on chemical pesticides (pest-resistant crops).

(iii) increased efficiency of mineral usage by plants (this prevents early exhaustion of fertility of soil).

(iv) enhanced nutritional value of food, *e.g.*, Vitamin 'A' enriched rice.

OR

Different steps involved in RNA silencing are as follows:

(i) Double-stranded RNAs are processed into approximately 21-23 nucleotide RNAs with two nucleotides. An RNase enzyme called Dicer cuts the dsRNA molecules (from a virus, transposon, or through transformation) into small interfering RNAs (siRNAs).

(ii) Each siRNA complexes with ribonucleases (distinct from Dicer) to form an RNA-induced silencing complex (RISC).

(iii) The siRNA unwinds and RISC is activated.

(iv) The activated RISC targets complementary *m*RNA molecules. The siRNA strands act as guides where the RISCs cut the transcripts in an area where the siRNA binds to the *m*RNA. This destroys the *m*RNA.

(v) When *m*RNA of the parasite is destroyed no protein is synthesised. It results in the death of the parasite in the transgenic host.

7. 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.

OR

(a) Restriction endonucleases are so called because they cut DNA duplex at specific points. Their single stranded free ends are called 'sticky ends' which can be joined end to end by DNA ligases.

(b) Palindromic nucleotide sequences are base pair sequences that are the same when read forward (left to right) or backward (right to left) from a central axis of symmetry.

Restriction enzymes cut the strand of DNA a little away from the centre of the palindrome sites but between the same two bases of the opposite strands. This leaves single stranded unpaired bases at cut ends. These ends with unpaired bases are called sticky ends or cohesive ends. The latter are named so because they form hydrogen bonds with their complementary cut counterparts. The sticky ends facilitate the action of the enzyme DNA ligase.

8. (a) Such a response in the boy is called allergy which occurs due to production of IgE antibodies and chemicals like histamine and serotonin from the mast cells.

(b) Anti-histamines, adrenaline and steroids could be given to the boy for immediate relief from such a response.

9. 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.

10. Parasitism is the interspecific interaction where one of species (called parasite) depends on the other species (host) for food and shelter and damages the host. *E.g.,* malarial parasite in blood cells of humans. Co-evolution in parasitism refers to the process in which parasite evolves mechanism to interact and neutralise the mechanism evolved by the host to reject or resist parasite.

11. Conservation of biodiversity is protection, uplift and scientific management of biodiversity so as to maintain it at its optimum level and derive sustainable benefits for the present as well as future generations. There are two types of conservation strategies – *in-situ* (on site) and *ex-situ* (offsite).

In-situ conservation is conservation and protection of the whole ecosystem and its biodiversity at all levels in their natural habitat in order to protect the threatened species. It involves hotspots and protected areas. Hotspots are areas of high endemism and high level of species richness. Protected areas are ecological/ biogeographical areas where biological diversity along with natural and cultural resources is protected, maintained and managed through legal or other effective measures. Protected areas include national parks, sanctuaries and biosphere reserves.

Ex-situ conservation is conservation of threatened plants and animals in places outside their natural homes under full protection and supervision. It includes offsite collections and gene banks.

12. The two ways that are responsible for the loss of biodiversity are alien species invasion and co-extinctions.

Non-native or alien species are often introduced inadvertently by man for their economic and other uses. They often become invasive and drive away the local species. For example:

(i) Water hyacinth (*Eichhornia crassipes*) was introduced in Indian waters to reduce pollution but it turned out to be a problematic species. It has clogged water bodies including wetlands at many places resulting in death of several aquatic plants and animals.

(ii) Nile Perch (a predator fish) was introduced in lake Victoria of South Africa. It killed and eliminated ecologically unique assemblage of over 200 native species of small cichlid fish.

(iii) African catfish *Clarias gariepinus* introduced for aquaculture in India posses threat to indigenous catfishes.

Co-extinction means that when a species become extinct, the plant and animal species associated with it in an obligatory relation also become extinct. For example, the case of a co-evolved plant-pollinator mutualism like in *Pronuba yuccaselles* and *Yucca* where extinction of one invariably leads to the extinction of the other.

13. (a) (i) Rahul was injected with anti-tetanus toxin.

(ii) The injection containing preformed antibodies or antitoxin (preparation containing antibodies to toxin) would neutralise the pathogenic agents and would give quick relief.

(iii) Rahul was given injection against tetanus as it provides artificial passive immunity.

(b) Two types of immunity are active immunity, acquired due to vaccination or previous contraction of disease and passive immunity, produced due to obtaining antibiodies from outside.

The given table shows differences between active and passive immunity:

	Active immunity	Passive immunity
(i)	Exposure to antigen.	No exposure to antigen.
(ii)	It is developed when the person's own cells produce antibodies in response to infection or vaccine.	It is developed when antibodies produced in other organisms are injected into a person to counter act antigen such as snake venom.
(iii)	It provides relief only after long period.	It provides immediate relief.
(iv)	It has no side effects.	It may cause reaction.
(v)	It is long lasting.	It is not long lasting.
(vi)	*E.g.*, MMR vaccine for measles, mumps, rubella.	*E.g.*, Colostrum rich in IgA antibodies provides immunity to newborn.

OR

(a) A - Gas holder
B - Sludge
C - Digester
D - Dung and water

(b) Sewage water can be purified by passing it through sewage treatment plants with the action of microorganisms. A sewage treatment plant separates solids from liquids by physical processes and purifies the liquid by biological processes. There are three stages of this treatment; primary, secondary and tertiary. Primary treatment is physical, secondary and tertiary treatments are biological and chemical respectively. After the primary sewage treatment, primary effluent is taken for secondary or biological treatment into aeration tanks. A large number of aerobic heterotrophic microbes grow in the aeration tank. They form flocs which are masses of bacteria held together by slime and fungal filaments to form mesh-like structures. The microbes in flocs digest a lot of organic matter, converting it into microbial biomass and releasing lot of minerals. This decreases the biochemical oxygen demand (BOD) of effluent. The effluent is then passed into settling tank where the bacterial flocs are allowed to sediment. The sediment of settling tank is called activated sludge. A part of it is further used as inoculum in aeration tank to start a new batch of secondary sewage treatment and the remaining is passed into a large tank called anaerobic sludge digesters.