Sample Question Paper - 16
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. Distinguish between the roles of flocs and anaerobic sludge digesters in sewage treatment.

2. State two different roles of spleen in the human body.

OR

(a) Name the protozoan parasite that causes amoebic dysentery in humans.

(b) Mention two diagnostic symptoms of the disease.

3. Why the plants that inhabit a desert are not found in a mangrove? Give reasons.

4. Restriction endonucleases are used in genetic engineering to form *r*DNA, which are DNA from different sources. How does the restriction enzyme *Eco*RI specifically act on DNA molecule? Explain.

5. β-galactosidase enzyme is considered a better selectable marker. Justify the statement.

6. How has the use of *Agrobacterium* as vectors helped in controlling *Meloidogyne incognita* infestation in tobacco plants?

OR

List any four ways by which GMOs have been useful for enhanced crop output.

SECTION - B

7. Name the genes responsible for making Bt cotton plants resistant to bollworm attack. How do such plant attain resistance against bollworm attacks? Explain.

OR

(a) Mention the cause of ADA deficiency in humans. How has genetic engineering helped patients suffering from it?

(b) What are the disadvantages of technique used for the treatment of ADA deficient patients?

8. AIDS caused by Human immunodeficiency virus (HIV) which are retrovirus having an envelope enclose the RNA genome. How does the HIV breakdown the immune system of the AIDS patient?

9. "Predation is usually referred to as detrimental association". State any three positive roles that a predator plays in an ecosystem.

10. PCR involves amplification of gene or interest using primers and enzyme DNA polymerase. Describe the roles of heat, primers and the bacterium *Thermus aquaticus* in the process of PCR.

11. **(a)** List four causes of biodiversity loss.

(b) Why is tropical environment able to support greater species diversity?

12. '*In-situ*' conservation can help endangered/threatened species. Justify the statement.

SECTION - C

13. Immunodeficiency diseases are conditions where the defence mechanisms of the body are weakened, leading to repeated microbial infections. Individuals who require repeated blood transfusions, drug addicts who take drugs intravenously or individuals having multiple sexual partners are at high risk of getting these infections.

(a) What precaution(s) would you recommend to a patient requiring repeated blood transfusion?

(b) If the advise is not followed by the patient, there is an apprehension that the patient might contract a disease that would destroy the immune system of his/her body. Explain with the help of schematic diagram only how the immune system would get affected and destroyed.

OR

(a) How do organic farmers control pests? Give two examples.

(b) State the difference in their approach from that of conventional pest control methods.

Solution

BIOLOGY - 044

Class 12 - Biology

1. 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.

In anaerobic sludge digesters, aerobic microbes present in the sludge get killed. Anaerobic microbes digest the organic mass as well as aerobic microbes of the sludge. During this digestion, bacteria produces a mixture of gases such as methane, hydrogen sulphide and carbon dioxide. These gases form biogas which can be used as source of energy as it is inflammable. The spent sludge of anaerobic sludge digester can be used as a manure.

2. (i) In adults spleen is the secondary lymphoid organ. It is the site where proliferation and differentiation of B and T lymphocytes takes place and (ii) In fetus, spleen produces all types of blood cells.

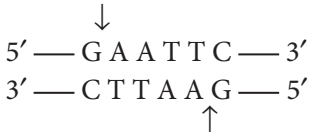
OR

(a) *Entamoeba histolytica*

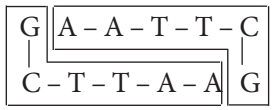
(b) Abdominal pain and blood in faeces.

3. Plants inhabiting desert (xerophytes) are not found in mangroves, because xerophytic plants are adapted to dry and hot environment. They possess various physical modifications to tolerate extreme water scarcity and heat, like extensive root system, succulent organs, leaf reduced to spines, etc. Mangrove swamp is a region of vegetation where soil is highly saline and water logged. Only halophytes can survive in such regions as they possess aerial roots called pneumatophores through which gaseous exchange occurs. Roots of xerophytes are positively geotropic and will suffocate and die in such badly aerated soil ultimately leading the whole plant to death.

4. *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

5. The gene for the enzyme β-galactosidase is an alternative selectable marker. Alternative selectable marker is developed to differentiate recombinants and non-recombinants on the basis of their ability to produce colour in the presence of a chromogenic substance. When a recombinant DNA is inserted in the coding sequence of an enzyme β-galactosidase, presence of insert results into insertional inactivation of the β-galactosidase and therefore the colonies do not produce any colour and are marked as recombinant colonies. Hence, β-galactosidase enzyme is considered a better selectable marker.

6. A nematode *Meloidogyne incognita* infects the roots of tobacco plants and causes a great reduction in yield. A novel strategy that was adopted to prevent this infestation was based on the process of RNA interference (RNAi), *i.e.*, silencing of gene expression using a dsRNA. Using *Agrobacterium* vectors, nematode-specific genes were introduced into the host plant (tobacco plant). The introduction of DNA was such that it produced both sense and anti-sense RNA in the host cells. These two RNAs being complementary to each other formed a dsRNA (double stranded RNA) that initiated RNAi and thus, silenced specific *m*RNA of the nematode and prevents translation of *m*RNA (silencing).

OR

Genetically modified organisms have been useful for enhanced crop output as they have :

(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

7. Cotton bollworms enjoy feeding on cotton plants but get killed when feed on Bt cotton plant because

the latter is genetically modified for pest resistance specifically to bollworm infestation.

Two genes *cry*IAc and *cry*IIAb control cotton bollworms. These two genes were isolated from *Bacillus thuringiensis* and incorporated into cotton plant. The genetically modified plant is called Bt cotton as it contains Bt toxin genes. The bacterium *Bacillus thuringiensis* produces Bt toxin proteins as inactive protoxins. When the insect larvae ingest any plant part, toxin becomes active in the alkaline pH of the gut and kills the insect pests. That is how Bt cotton attains resistance against bollworm.

OR

Adenosine deaminase (ADA) enzyme is crucial for the immune system to function. Its deficiency is caused due to the deletion of the gene for adenosine deaminase. In some patients, ADA deficiency can be cured by the bone marrow transplantation. It can be treated by enzyme replacement therapy, in which functional ADA is given to the patient by injection.

Two disadvantages of enzyme replacement therapy are :

(i) It is not permanent cure because the patient of ADA deficiency do not have functional T-lymphocytes, they cannot provide immune responses against invading pathogens.

(ii) It is a costly method.

8. Macrophages act as HIV factory in humans. Events that occur in 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. Predators play important role in ecosystem. These are discussed as follows:

(i) Maintaining prey population : In nature, the population of predator is quite small as compared to that of the prey. The prey has high reproductive potential. If, for some time, the prey population is allowed to grow without predation, then it would grow beyond the carrying capacity of the environment. The predator keeps the population of the prey under check so that an equilibrium is maintained. Example, the prickly pear cactus introduced in Australia in the early 1920's caused havoc by spreading rapidly into millions of hectares of rangeland. Finally, the invasive cactus was brought under control only after a cactus-feeding predator (a moth) from its natural habitat was introduced into the country.

(ii) Maintaining species diversity : Predators also help in maintaining species diversity in a community, by reducing the intensity of competition among competing prey species. Example, in the rocky intertidal communities of the American Pacific Coast, the starfish *Pisaster* is an important predator.

When all the starfish were removed from an enclosed intertidal area, more than 10 species of invertebrates became extinct within a year because of interspecific competition.

(iii) Vegetation : Predation helps in growth of vegetation all over the globe by restricting population of herbivores.

10. In the process of PCR (polymerase chain reaction), the role of high temperature, primer and *Thermus aquaticus* is as follows:

(a) High temperature : During high temperature, denaturation step takes place. In this step, the target DNA is heated to a high temperature (94° to 96°C) resulting in the separation of two strands.

(b) Primers : During annealing, the two oligonucleotide primers anneal to each of the ssDNA template since the sequence of the primers is complementary to the 3′ ends of the template DNA. Presence of primer is important for polymerisation to take place. Temperature (40°C – 60°C) is kept low depending on the length and sequence of primers.

(c) *Thermus aquaticus* : During the final step called polymerisation, the enzyme DNA polymerase synthesises the DNA segment between the primers. Usually, *Taq* DNA polymerase isolated from a thermophilic bacterium *Thermus aquaticus* helps in

synthesis of DNA region between the primers, using deoxynucleoside triphosphates and Mg^{2+}.

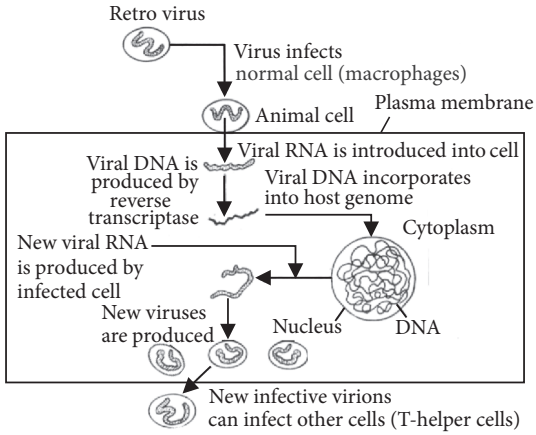
11. (a) The four causes of biodiversity loss are –
(i) Habitat loss and fragmentation
(ii) Over-exploitation
(iii) Alien species invasions
(iv) Co-extinctions

(b) Continuous favourable environment with little seasonal changes of temperature and moisture supports greater species diversity in tropical areas. Also, more solar energy is available in tropics, which promotes higher productivity and increased biodiversity.

12. '*In-situ*' conservation helps endangered and threatened species by protecting them in their natural habitats along with their ecosystem and its biodiversity. For example, National parks are the areas maintained by the government for better conservation of wildlife. It is a place where cultivation, grazing, forestry and habitat manipulation are restricted. Sanctuaries are places where wild animals can take refuge without being hunted. Activities like collection of forest products, private ownership of land, tilling of land, etc., are allowed but animal hunting is prohibited. Biosphere reserves are meant for preserving genetic diversity in representative ecosystems of various natural biomes and unique biological communities by protecting wild populations, traditional lifestyle of tribals and domesticated plant/animal genetic resources.

13. (a) If a patient requires repeated blood transfusion, it should be ensured that donor's blood has been screened for HIV and the syringes used should be new and disposable.

(b) If the patient does not follow these precautions, then he might be infected with HIV which causes AIDS (Acquired Immunodeficiency Syndrome).
AIDS is a disorder of cell mediated immune system of the body. There is a reduction in the number of helper T-cells which stimulate antibody production by B-cells. This results in the loss of natural defence of the body against viral infection.



Thus, the immune system gets hampered due to the action of AIDS virus on T-lymphocytes and macrophages.

OR

(a) Organic farming involves the use of biopesticides, *i.e.*, biocontrol agents to control weeds, insects and pathogen. These biocontrol agents include viruses, bacteria, protozoa, fungi and mites. Example : *Baculovirus heliothis* can control cotton bollworm (*Helicoverpa zea*) whereas *Bacillus thuringiensis* is effective against cabbage looper (*Trichoplusia ni*).

(b) Conventional pest control involves the use of chemical pesticides to control pests in crop-field. Pesticides are toxic and harmful to crop plants, other crop field animals and humans. On the other hand, organic farmers use biopesticides to control field pests. This approach is environment friendly, exercises specific control over pests and is harmless to humans.

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