

**Sample Question Paper - 15**  
**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. How does the application of the fungal Genus *Glomus* to the agricultural farm increase the farm output?
- 2. Name the causative organism, two symptoms and mode of transmission of amoebiasis.

**OR**

A student on a school trip started sneezing and wheezing soon after reaching the hill station for no explained reasons. But, on return to the plains, the symptoms disappeared. What is such a response called? How does the body produce it?

- 3. How does a restriction nuclease function? Explain.
- 4. All cloning vectors do have a 'selectable marker'. Describe its role in recombinant DNA technology.
- 5. Why does Bt toxin not kill the bacterium that produces it, but kill the insect that ingests it?
- 6. Why are cattle and goats not seen browsing on *Calotropis* growing in the fields?

**OR**

Differentiate between mutualism, parasitism and commensalism. Provide one example for each of them.

**SECTION - B**

- 7. (a) Write the difference between proinsulin and mature insulin.
- (b) How did American company Eli Lilly produce human insulin using rDNA technique?

**OR**

- (a) Tobacco plants are damaged severely when infested with *Meloidogyne incognita*. Name and explain the strategy that is adopted to stop this infestation.
- (b) Name the vector used for introducing the nematode specific gene in tobacco plant.

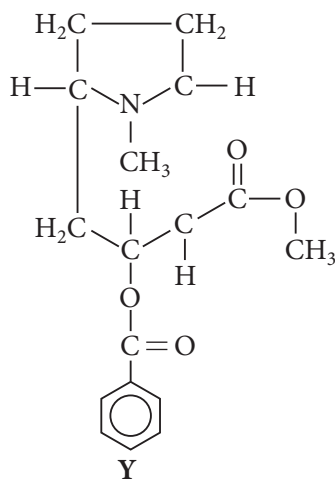
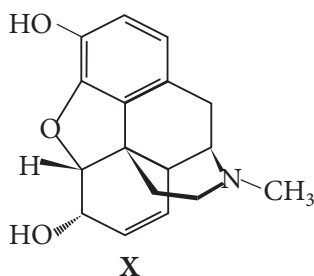
- 8. Prior to a sports event, blood and urine samples of sports persons are collected for drug tests.



- (a) Why is there a need to conduct such tests?
- (b) Name the drugs the authorities usually test for.
- (c) Write the generic names of two plants from which these drugs are obtained.
9. (a) Name the selectable markers in the cloning vector pBR322. Mention the role they play.
- (b) Why is the coding sequence of an enzyme  $\beta$ -galactosidase a preferred selectable marker in comparison to the ones named above?
10. (a) "Organisms may be conformers or regulators". Explain this statement and give one example of each.
- (b) Why are there more conformers than regulators in the animal world?
11. Explain any three ways other than zoological parks, botanical gardens and wildlife safaries by which threatened species of plants and animals are being conserved '*ex-situ*'.
12. How is designation of certain areas as hotspots a step towards biodiversity conservation? Name any two hotspots in India.

## SECTION - C

13. Surveys and statistics show that use of drugs and alcohol has been on the rise especially among the youth. This is really a cause of concern as it could result in many harmful effects. Identify the given structures of drug and answer the following questions.



- (a) Write the effects of drug X and drug Y.
- (b) Name the source of drugs X and Y.
- (c) Mention any two class of drugs, their sources and their ill effects in a tabular form.

**OR**

Chemicals are toxic and biocides which kill even useful organisms, harmful for human beings and animals, pollute soil and water.

- (a) Organic farmers prefer biological control of diseases and pests to the use of chemicals for the same purpose. Justify.
- (b) Give an example of a bacterium, a fungus and an insect that are used as biocontrol agents.

## Solution

### BIOLOGY - 044

#### Class 12 - Biology

1. Many members of the Genus *Glomus* form symbiotic associations with plants to form mycorrhiza. *Glomus* helps to absorb phosphorus from soil and passes it to the plant. Plants having such associations show other benefits also, such as resistance to root-borne pathogens, tolerance to salinity and drought and an overall increase in plant growth and development. Therefore, *Glomus* increases the farm yield.

2. *Entamoeba histolytica* is a protozoan parasite in the large intestine of human which causes amoebiasis (amoebic dysentery). Symptoms of this disease include diarrhoea alternating with constipation, abdominal pain and cramps, stool with excess mucus and blood clots. Houseflies act as mechanical carriers and serve to transmit the parasite from faeces of infected person to food and food products, thereby contaminating them. Drinking water and food contaminated by the faecal matter is the main source of infection.

OR

Hill station and plains do have different weather conditions and environment. Sneezing and wheezing on hill station is due to exposure to different allergens, this response is called allergy. It is a hypersensitive response of a person to foreign substance coming in contact with or entering the body. Allergy involves IgE antibodies and release of chemicals like histamine and serotonin from mast cells.

3. Restriction nucleases act as molecular scissors or chemical scalpels. Each restriction endonuclease functions by 'inspecting' the length of a DNA sequence. Once it finds its specific recognition sequence, it will bind to the DNA and cut each of the two strands of the double helix at specific points in their sugar-phosphate backbones. Each restriction endonuclease recognises a specific palindromic nucleotide sequence

in the DNA.

4. Selectable markers are the gene sequence present in cloning vectors that help in selecting those host cells which contain vectors (transformants) and eliminating the non-transformants. Generally, the genes encoding resistance to antibiotics such as tetracycline, ampicillin, kanamycin or chloramphenicol are useful selectable markers for *E.coli*. Plasmid pBR322 has two resistance genes -ampicillin resistance ( $\text{amp}^R$ ) and tetracycline resistance ( $\text{tet}^R$ ) which are considered useful for selectable markers.

5. Soil bacterium *Bacillus thuringiensis* produces proteins that kill certain insects like lepidopterans (tobacco budworm, armyworm), coleopterans (beetles) and dipterans (flies, mosquitoes), etc. *B. thuringiensis* forms some protein crystals. These crystals contain a toxic insecticidal protein. This toxin does not kill the *Bacillus* (bacterium) because it exists as inactive protoxins in them. But, once an insect ingests the crystals, it is converted into an active form of toxin due to the alkaline pH of the alimentary canal that solubilises the crystals.

The activated toxin binds to the surface of midgut epithelial cells and creates pores which cause cell swelling and lysis and finally cause death of the insect.

6. Cattle and goats are never seen grazing on *Calotropis*, because *Calotropis* is a weed that produces highly poisonous cardiac glycosides. It is a harmful chemical that makes herbivores sick, inhibits feeding or digestion, disrupts reproduction or even kills them. A wide variety of chemical substances that we extract from plants on a commercial scale (nicotine, caffeine, quinine, strychnine, opium etc., are produced by them act as defences against grazers and browsers.

OR

Differences between mutualism, commensalism and parasitism are as follows:

	Mutualism	Commensalism	Parasitism
(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.	It is an interaction between two living organisms of different species in which one organism called parasite obtains its food from another living organism called host, i.e., one is benefitted and other is harmed.



(ii)	Contact between the two organisms is obligatory.	Contact between commensal and its benefactor may be periodic or continuous.	Contact between host and parasite may be temporary or permanent.
(iii)	Nitrogen fixing blue-green alga or cyanobacterium called <i>Anabaena</i> is associated with water fern <i>Azolla</i> 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.	E.g., <i>Cuscuta</i> is a total stem parasite, malarial parasite can be intracellular (endoparasite), etc.

7. (a) Mature insulin is made up of 51 amino acids arranged in two polypeptide chains, A having 21 amino acids and B with 30 amino acids. This hormone develops from a storage product called proinsulin which has three chains A, B and C. C chain with 33 amino acids is removed prior to insulin formation.

(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.

OR

(a) 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 infection was based on the process of RNA interference (RNAi). RNA interference (RNAi) is the phenomenon of inhibiting activity of a gene by synthesis of RNA molecules complementary to the mRNA. The normal (*in vivo* synthesised) mRNA of a gene is said to be “sense” because it carries the codons that are “read” during translation. Normally, the complement to the mRNA “sense” strand will not contain a sequence of codons that can be translated to produce a functional protein; thus, this complementary strand is called “anti-sense RNA”. The anti-sense RNA and mRNA molecules will anneal to form duplex RNA molecules that cannot be translated. Thus, the presence of anti-sense RNA will block translation of the mRNA of the affected gene. The source of this complementary RNA could be from an infection by viruses having RNA genomes or mobile genetic elements (transposons) that replicate

via a RNA intermediate. Using *Agrobacterium* vectors, nematode-specific anti-sense genes are introduced into the host plant. The introduction of DNA produces anti-sense RNA in the host cells. The transgenic host plants expresses anti-sense RNA. As in consequence, nematode infestation fails in the transgenic plants because the complementary anti-sense RNA forms a double stranded RNA (dsRNA) which interferes or blocks the translation and thus, silences the mRNA of the nematode. The result was that the parasite could not survive in transgenic plant. In such way, the transgenic plant gets protected from the parasite.

(b) *Agrobacterium* vectors are used for introducing nematode specific gene in tobacco plant.

8. (a) It is necessary to conduct such tests on sportspersons because they take various drugs like cocaine/coca alkaloids and cannabinoids to increase their muscle tone and performance in sports.

(b) Cocaine/coca alkaloids and cannabinoids.

(c) Cannabinoids are obtained from *Cannabis sativa* and cocaine is obtained from *Erythroxylum coca*.

9. (a) Plasmid pBR322 is a most widely used cloning vector. It has two resistance genes ampicillin resistance ( $\text{amp}^R$ ) and tetracycline resistance ( $\text{tet}^R$ ) which are considered useful as selectable markers. Selectable markers help in identifying and eliminating non-transformants and selectively permitting the growth of transformants. Bacterial cells containing recombinant pBR322 will be unable to grow in the presence of ampicillin, but will grow on tetracycline.

(b) Selection of recombinants due to inactivation of antibiotics is a cumbersome procedure because it requires simultaneous plating on two plates having different antibiotics. Therefore, alternative selectable



markers have been developed which differentiate recombinants from non-recombinants on the basis of their ability to produce colour in the presence of a chromogenic substrate. In this, a recombinant DNA is inserted within the coding sequence of an enzyme,  $\beta$ -galactosidase. This results into inactivation of the enzyme, which is referred to as insertional inactivation. The presence of a chromogenic substrate gives blue coloured colonies if the plasmid in the bacteria does not have an insert. Presence of insert results into insertional inactivation of the  $\beta$ -galactosidase and the colonies do not produce any colour, these are identified as recombinant colonies.

**10. (a)** Organisms may be conformers or regulators. Conformers are the organisms that have following characteristics:

- (i) A constant internal environment or homeostasis is absent in them.
- (ii) Their body temperature changes according to that of the environment.
- (iii) Osmotic concentration of body fluids varies according to that of external medium.
- (iv) They consume lesser amount of energy.
- (v) They have a narrow range of distribution.
- (vi) They are less active. Example : *Asterias*

Regulators are the organisms that have following characteristics:

- (i) They possess homeostasis.
- (ii) They maintain their body temperature.
- (iii) Their body fluids have a fixed osmotic concentration.
- (iv) They consume large amount of energy.
- (v) They have a wide range of distribution.
- (vi) They are more active. Example : Human beings

**(b)** During the course of evolution, the cost and benefits of maintaining a constant internal environment were taken into consideration. Considering the huge cost of maintaining a fixed body temperature and osmotic concentration of body fluids, many organisms have not evolved homeostasis. Therefore, an overwhelming majority (99%) of animals are conformers. Their body temperature changes with the ambient temperature. Due to this reason, there are more conformers than regulators in the animal world.

**11.** Some *ex-situ* conservation strategies are:

(i) Seed banks : Seeds are of two types - Orthodox seeds and recalcitrant seeds. Orthodox seeds can tolerate reduction in moisture content (upto 5%), anaerobic conditions and low temperature ( $-10^{\circ}\text{C}$  to  $-20^{\circ}\text{C}$ ), e.g., cereals, legumes.

Recalcitrant seeds get killed on reduction of moisture and exposure to low temperature, e.g., tea, cocoa, etc.

(ii) Orchards : Plants with recalcitrant seeds are grown in orchards where all possible strains and varieties are maintained.

(iii) Tissue culture : It is carried out through callus formation, embryoids, pollen grains culture, etc. for those plants that are either seedless or where clone is to be maintained. The method is useful in maintaining a large number of genotypes in small area, rapid multiplication of endangered species and hybrid rescue.

**12.** Biodiversity hotspots' are the regions which are characterised by very high levels of species richness and high degree of endemism. India has three hotspots-Indo-Burma (North-East India), Himalayas, and Western Ghats. Importance of hotspots are as follows:

- (i) Maintaining genetic diversity of all present species and varieties.
- (ii) Maintaining viable populations of native species, subspecies and varieties.
- (iii) Maintaining resilience in species/habitats/ ecosystems to adapt to environmental changes.
- (iv) Maintaining the various types of communities/ ecosystems/habitats both in number and distribution.
- (v) Checking human aided introduction of alien/ exotic species.

**13. (a)** Drug X is morphine. It is a strong analgesic and has sedative and calming effect. It decreases blood pressure and suppresses respiratory centre. Drug Y is cocaine. It has vasoconstrictor properties and is powerful CNS stimulant. Its excessive dosage causes hallucinations.

**(b)** Morphine (drug X) is obtained from the *Papaver somniferum* while cocaine (drug Y) is obtained from *Erythroxylum coca*.



(c)

S.No.	Class of drugs	Source	Danger/ill-effects
(i)	Opioids	<i>Papaver somniferum</i>	(i) Morphine depresses respiratory centre, lowers blood pressure and heart beat. (ii) Heroin is a depressant and slows down body functions. Both of them affect the central nervous system.
(ii)	Canna-binoids	<i>Cannabis sativa</i>	They are used in the form of hashish, ganja, charas and marijuana. They are hallucinogens and affect cardiovascular system, and increases blood sugar level.

OR

(a) Chemical pesticides used in agricultural fields are toxic and they kill even useful organisms along with harmful ones, harm human beings and animals, pollute soil, water and crop plants. It is estimated that despite the use of chemical pesticides 30% of the agricultural produce is lost to pathogens and pests because these continue to develop resistance against various pesticides. Now, organic farmers prefer biological control of diseases and pests to the use of chemicals. Biopesticides are the biological agents that control the growth of weeds, insects and pathogens in an agricultural field. They have targeted actions and are harmless to the crop plants, other beneficial field animals and humans. In organic farming, pests and pathogens are not eradicated but kept at manageable levels by a system of checks and balances as operating in ecosystem. An organic farmer holds the view that eradicating pests is undesirable because without them the beneficial predatory and parasitic organisms which depend upon them for food would also be annihilated.

(b) Bacterium as a biocontrol agent : *Bacillus thuringiensis* is effective against the cabbage looper.

Fungi as a biocontrol agent : *Trichoderma* found in root ecosystem exerts biocontrol over several plant pathogens.

Insect as a biocontrol agent : Lady bird beetle and dragonflies feed on aphids and prey upon mosquitoes.