Sample Question Paper - 2
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

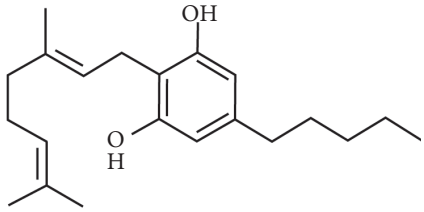
1. A patient showed symptoms of sustained high fever, stomach pain and constipation, but no blood clot in stools. Name the disease and its pathogen. Write the diagnostic test for the disease. How does the disease get transmitted?

2. Why are some molecules called bioactive molecules? Give two examples of such molecules.

OR

Name a genus of baculovirus. Why are they considered good biocontrol agents?

3. Write the scientific name of the source plant of the given structure and mention their effect on the human body.



4. Name two groups of organisms which constitute 'flocs'. Write their influence on the level of BOD during biological treatment of sewage.

5. Age pyramid is the graphic representation of different age groups found in a population. Construct an age pyramid which reflects a stable growth status of human population.

6. How do mammals differ from amphibians in context of equilibrium maintenance between organism and external environment ?

OR

How diapause differs from hibernation ?

SECTION - B

7. Cancer is one of the most dreaded disease. Explain 'contact inhibition' and 'metastasis' with respect to the disease.

OR

Name a human disease, its causal organism, symptoms (any three) and vector, spread by intake of water and food contaminated by human faecal matter.

8. Principle of vaccination is based on the property of "memory" of the immune system. Justify the statement by taking one suitable example.

9. State how has *Agrobacterium tumefaciens* been made a useful cloning vector to transfer DNA to plant cells.

10. There are many animals that have become extinct in the wild but continue to be maintained in zoological parks.

(a) What type of biodiversity conservation is observed in this case?

(b) Explain any other two ways which help in this type of conservation.

11. The following graph shows the species-area relationship. Answer the following questions as directed.

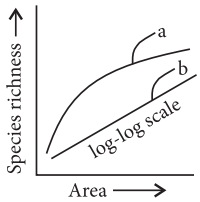
(a) Name the naturalist who studied the kind of relationship shown in the graph. Write the observation made by him.

(b) Write the situation as discovered by the ecologists when the value of 'Z' (slope of the line) lies between

(i) 0.1 and 0.2 (ii) 0.6 and 1.2.

What does 'Z' stand for?

(c) When would the slope of the line 'b' become steeper?



12. A foreign DNA can be ligated at the *Bam*HI site of tetracycline resistance gene in the vector pBR322. Draw pBR322 cloning vector. Label 'ori', 'rop' and tetracycline resistance site on it and state their functions.

SECTION - C

13. Genetic engineering helps in developing new combinations of genetic material. It involves various tools, such as restriction enzymes, vectors, etc. Restriction enzymes in bacteria have two components. One component enables *E.coli* to protect itself from attack of bacteriophages with help of defence mechanism called restriction-modification system. Restriction enzymes are nucleases which recognise palindromic DNA sequence and cut the same.

(a) How does *E.coli* protect itself from attack of bacteriophage?

(b) DNA sequences from two different sources are provided.

I. 5′–ATCAGAATTCGCCGGG–3′
3′–TAGTCTTAAGCGGCCC–5′

II. 5′–TGATACGAATTCGG–3′
3′–ACTATGCTTAAGCC–5′

How *Eco*RI would help to obtain *r*DNA from the given DNA sources?

(c) Why restriction endonucleases are also called molecular scissors?

OR

In order to increase crop production, scientists have altered the genetic composition of plants and produced transgenic plants. GM crops express one or more transgenes and are more advantageous than conventional crops. Nematodes are common parasites in number of plants, resulting in drastic reduction in yield.

(a) Name the nematode which causes root knot disease in tobacco. How it affects the plant?

(b) Discuss the phenomenon which help in developing pest resistant plants.

Solution

BIOLOGY - 044

Class 12 - Biology

1. Bacterial disease typhoid, caused by *Salmonella typhi* is characterised by sustained high fever (39° - 40°C), stomach pain and constipation. Typhoid fever is diagnosed by Widal test and is transmitted through contaminated food and water.

2. Bioactive compounds are those compounds that have an effect on living organisms, tissues or cells. Bioactive compounds are found in both plant and animal products or can be synthetically produced. Two examples of bioactive compounds are cyclosporin A and statins.

OR

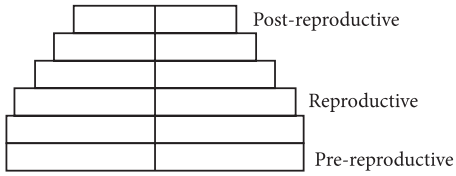
Nucleopolyhedrovirus, a genus of baculoviruses are useful in controlling many insects and other arthropods. They are species specific narrow spectrum bioinsecticides with no side effects on plants, mammals, birds, fish and non-target insects. Therefore, they serve as an important component of integrated pest management programme in dealing with ecological sensitive areas. These properties are useful in organic farming .

3. Drugs, marijuana and hashish are obtained from *Cannabis sativa*. Being hallucinogenic, they give feeling of well being and happiness. Sometimes, marijuana causes uncontrolled laughter and dilation of pupil.

4. Aerobic bacteria and fungi constitute 'flocs'. 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 produce 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 manure or part of compost.

5. The bell-shaped age pyramid reflects a stable growth status of human population. It can be represented as follows:



6. Mammals are regulators, *i.e.*, they regulate body functions and maintain homeostasis through having constant body temperature and constant osmotic concentration. However, amphibians are conformers, *i.e.*, they change body temperature and body fluid osmolarity with that of ambient environment.

OR

Differences between diapause and hibernation are :

	Diapause	**Hibernation**
(i)	It is dormant stage in the development of an organism.	It is state of inactivity in mature organism.
(ii)	It occurs both in summer and winter.	It occurs only during winter.

7. The normal cells are characterised by contact inhibition by virtue of which contact with other cells inhibits their uncontrolled growth. Metastasis is a property shown by cancerous cells in which these cells detach from the tumors and move to distant sites through body fluids and develop secondary tumors. Metastasis is fatal because the cancerous cells damage other normal cells, compete with them for vital nutrients and disrupt the normal metabolism.

OR

Amoebiasis is caused due to protozoan parasite *Entamoeba histolytica*. The symptoms of this disease are constipation, abdominal pain, cramps, stools with excess mucous and blood clots. It is transmitted through faecal oral route. Drinking water and food contaminated by the faecal matter are the main sources of infection. Houseflies act as mechanical carriers and serve to transmit the parasite from faeces of infected person to food and food products, thereby contaminating them.

8. The principle of vaccination is based on the property of 'memory' of the immune system. It is because vaccines generate memory-B cells and T-cells that recognise the pathogen quickly. For example, in

snake bites the injection which is given to the patients contains preformed antibodies against the snake venom. This type of immunisation is called passive immunisation.

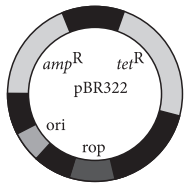
9. *Agrobacterium tumefaciens* is a soil-inhabiting bacterium that may invade growing plants at the junction of root and stem, where it can cause a cancerous growth known as a crown gall. *A. tumefaciens* contains Ti plasmid which carries gene for tumour formation. For using *Agrobacterium tumefaciens* as a cloning vector, researchers deleted the genes which govern auxin and cytokinin production (the oncogene) from T-DNA of Ti plasmid. It is known as disarming. After disarming, this T-DNA is inserted into chromosomes of the host plant where it produces copies of itself.

10. (a) Zoological Parks represent *ex-situ* conservation.
(b) *Ex-situ* conservation is conservation of endangered plants and animals outside their natural homes. It includes tissue culture and cryopreservation. Tissue culture is carried out through callus formation, embryoids, pollen grain culture and shoot tip culture for those plants which are either seedless, variable seed progeny or where clone is to be maintained. The method is useful in maintaining a large number of genotypes in small area, rapid multiplication of even endangered species and for hybrid rescue. Shoot tip culture maintains virus free plants. It is used for international exchange of germplasm in vegetatively multiplied cultivars, *e.g.,* banana, potato. Cryopreservation is *ex-situ* conservation technique in which tissues, organs, embryos, seeds, etc. are stored at very low temperature of –196°C. At this temperature the living material can be stored indefinitely in compact, low maintenance refrigeration units. It can be revived through special technique when required. In order to prevent extinction, endangered organisms are being cryopreserved so that they can be revived to help in conservation.

11. (a) Alexander von Humboldt studied species-area relationship. He observed that within a region, the species richness increased with increasing area but upto a certain limit.
(b) (i) Ecologists have discovered that the value of Z lies in the range of 0.1–0.2 regardless of taxonomic group or region, *i.e.*, whether it is plants in Britain, birds in California or molluscs in New York, the slopes of the regression line are similar.

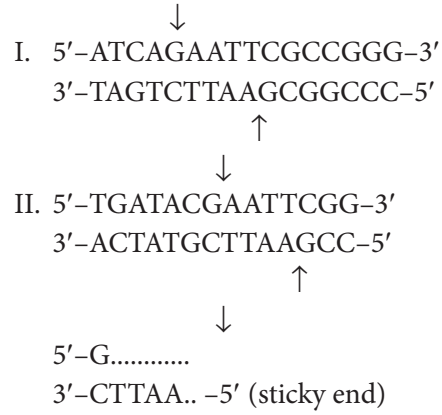
(ii) When the species-area relationship is considered for a very large area like a whole continent, regression coefficient Z or slope of the line becomes steeper with Z values in the range of 0.6 –1.2.
(c) Slope of line b, would become steeper when the value of Z ranges from 0.6 to 1.2 as for mammals of tropical forests of different continents, the slope is found to be 1.15.

12. The diagrammatic representation of *E. coli* cloning vector pBR322 is as follows :



Origin of replication (*ori*) : This is a sequence from where replication starts and any piece of DNA when linked to this sequence can be made to replicate within the host cells. This sequence is also responsible for controlling the copy number of the linked DNA. So, if one wants to recover many copies of the target DNA it should be cloned in a vector whose origin support high copy number. *rop* : *rop* codes for protein involved in the replication of plasmid. amp^R: gene for ampicillin resistance which help in selecting transformants.

13. (a) Restriction modification system in *E.coli* have two components (i) Restriction enzymes and (ii) Methylase. Methylase adds methyl groups to particular palindromic region of bacterial DNA so that restriction enzyme inhibits propagation of bacteriophage (foreign DNA) and is thus unable to harm the bacterial genome.
(b) When given DNA sequences from different sources are cut with same restriction endonuclease, *i.e.*, *Eco*RI, they would produce complementary sticky ends.



With the help of DNA ligase, the complementary sticky ends of the two DNAs can be joined end to end to create *r*DNA.

(c) Restriction endonucleases attach itself between same two bases on the opposite strands and causes a break in the two by cutting the phosphodiester bond. Because of it, restriction endonucleases are also called as molecular scissors.

OR

(a) *Meloidogyne ingonita* is a common parasite in tobacco which causes root knot disease. The host plants are robbed of nutrients. Roots develop cracks that invite secondary infections. Water and mineral absorption are impaired. Consequently, there is drastic reduction in yield.

(b) With the help of T-DNA plasmid of *Agrobacterium,* nematode specific genes are introduced in host plant. They produce both sense and antisense RNAs which form dsRNAs to initiate RNAi and silence the *m*RNAs of the nematode.

The correct sequence of steps involved in making tobacco plant resistant to nematode are:

(i) RNase enzyme called 'dicer' cuts all dsRNA molecules into small interfering RNAs (siRNAs) (21-23 nucleotides long).

(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 parasite proteins are synthesised that resulted in the death of the parasite (nematode) in the transgenic host. Thus, the transgenic plant gets itself protected from the parasite.