

Question Paper

Conducted by the Central Board of Secondary Education (CBSE)



Time Allowed: 2 Hours

Maximum Marks: 35

General Instructions

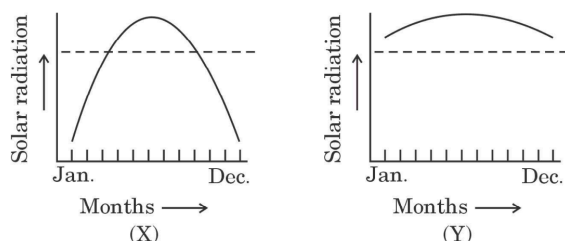
- (i) This question paper contains **13 questions**. All questions are compulsory.
- (ii) Section A: Questions 1 to 6 carry 2 marks each.
- (iii) Section B: Questions 7 to 12 carry 3 marks each.
- (iv) Section C: Questions 13 carry 5 marks each.
- (v) Attempt one alternative where an internal choice is provided. Follow the instructions within each question.
- (vi) Draw neat, properly labelled diagrams wherever necessary.

Section A

1. A patient who has undergone an organ transplant is put on 'immunosuppressant'. Name the 'immunosuppressant' and its source organism.

2. Though filariasis is not fatal, but the disease in humans is responsible for considerable suffering, gross deformities and disability. Write the scientific name of any two helminth worms causing the disease and state two chronic manifestations of filariasis.

3(a). Study the given graphs (X) and (Y) depicting the annual variation in solar radiation on Earth from January to December and answer the undermentioned questions.



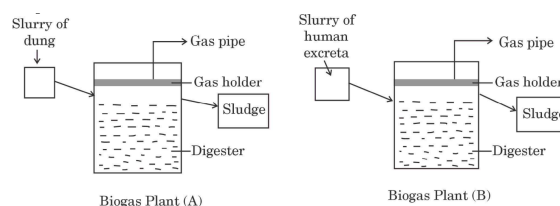
- (i) Identify the graph that depicts (I) tropical region, and (II) temperate region, respectively.
- (ii) Which of the two regions, (X) or (Y), will show high biological diversity and why? Give two reasons.

OR

3(b). (i) When prickly pear cactus was introduced into Australia in early 1920s, it caused havoc and ecosystem instability by achieving very high population densities. Explain the reason for its rapid spread into millions of hectares of rangeland.

(ii) State the importance of 'Prey-predator' relationship in a habitat.

4. Study the given diagrams of Biogas plants - 'A' and 'B' and answer the questions that follow:



Which one of the two biogas plants can be used for generating gas fuel and electricity and why? Give suitable reasons in support of your answer.

5. When tourists go to places of high altitude like Rohtang Pass or Mansarovar, they are advised not to venture out for two days at least to get acclimatized to the prevailing conditions there. Explain how they get acclimatized.

6(a). A person suffering from AIDS dies of opportunistic infections (ARC) i.e., infections that could have been otherwise overcome.

- (i) State one reason as to why an 'HIV' patient dies of 'opportunistic infections'.
- (ii) Give the scientific name of one bacterium and one parasite which mainly attack a person suffering from AIDS.
- (iii) Write the full form of the name of the widely used diagnostic test for AIDS.

OR

6(b). In spite of the statutory warning on cigarette packets against 'smoking' and its injurious effects on health, smoking is still prevalent in the society. Enumerate four important health hazards to a smoker.

Section B

7. With the advent of sophisticated techniques of genetic engineering, we can now readily purify and isolate DNA. Name and explain the different steps involved in the separation and isolation of DNA fragments once cut by restriction endonucleases.

8. (a) Development of recombinant DNA technology has made the expression of protective protein antigens (to be used as 'vaccines') in heterologous systems/bacteria or any other organism. Give an example of a vaccine developed by such a technology and the host used.

(b) Explain how a humoral immunity system gets into action when a foreign antigen enters into a human body.

9(a). "Some species in an ecosystem exert greater influence in driving major ecosystem services than others." How did Paul Ehrlich explain this concept in his 'rivet popper hypothesis'?

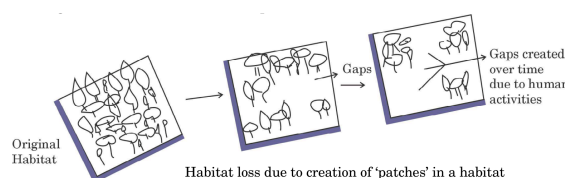
OR

9(b). (i) How has the introduction of Nile Perch into Lake Victoria in East Africa had a devastating effect on the indigenous species in the lake?

(ii) Name two invasive weed species which have posed a threat to the existence of our native species.

10. When *Plasmodium* sp. (malarial parasite) enters the human body, it reproduces asexually and increases its number. During this course, the affected person suffers from malaria. After a number of asexual cycles, the parasite, in order to complete its life cycle, enters the sexual phase of its life. Trace the sexual stages in the life cycle of *Plasmodium* in a female *Anopheles* mosquito, when it bites an infected person, up to the formation of mature infective stages of the parasite.

11. Given below is a picture of a natural large habitat that is being continuously broken into smaller patches. This process is continuing, increasing and expanding over time due to human impact, thereby posing a great risk to the existence of species in the habitat.



(a) Do you agree with the above statement? Give two suitable reasons in support of your answer.

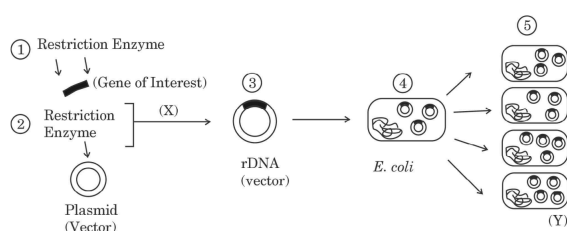
(b) Write the ecological term used for such patches formed in an original habitat.

12. An application of biotechnology in agriculture involves production of pest resistant plants using 'cry' genes from a bacterium, *Bacillus thuringiensis*.

(a) Proteins coded by which specific Bt toxin genes control corn borer?

(b) How does Bt toxin produced by the bacteria kill the insect? Explain.

13(a). Development of recombinant DNA technology has opened gates to many breakthroughs in the fields of medicine and agriculture. This has enabled scientists to isolate, sequence and manipulate individual genes obtained from diverse living or dead cells. Given below is a diagram showing the basic steps involved in genetically modifying an organism. Study the given diagram and answer the questions that follow:



(i) Are two different types of restriction endonucleases used, one to cut the vector DNA and another to cut the desired DNA to be cloned? Support your answer, giving reason.

(ii) Which enzyme is used at step (X) to integrate the foreign DNA with the vector DNA?

(iii) What is the term used for step (Y) showing multiple copies of the foreign DNA being formed in transformed *E. coli*?

(iv) Draw a diagram of *E. coli* cloning vector pBR322 to show the following:

(I) Any one restriction endonuclease site in tetracycline resistance gene

(II) Any one restriction endonuclease site in ampicillin resistance gene

(III) 'ori' site

(v) What does "rop" code for in plasmid pBR322?

OR

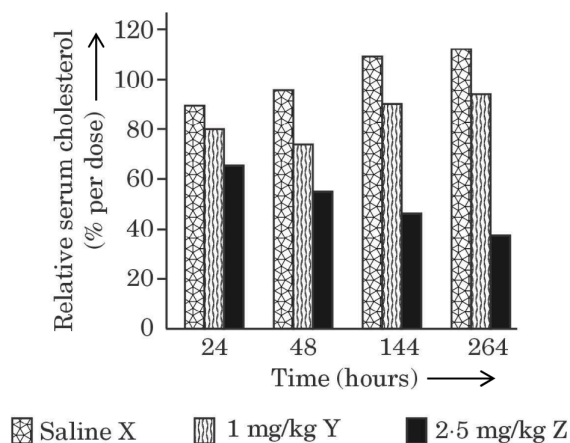
13(b). RNA interference (RNAi) holds great potential as a therapeutic agent for the treatment of human diseases and as a biocontrol agent for controlling pests in the agricultural fields. An experiment was conducted to study the use of 'RNAi' for the potential treatment of disorders of cholesterol metabolism. Some people possess genetic mutations with elevated levels of 'ApoB' gene which predisposes them to coronary artery diseases.

Lowering the amount of 'ApoB' can reduce the number of lipoproteins and lower the blood cholesterol.

Tracy Zimmerman and her colleagues used RNAi in 2006 to reduce the level of 'ApoB' in non-human primates *Cynomolgus* monkeys. (i) One group of monkeys were given RNAi treatment (Small interfering RNAs, SiRNAs) (doses 1 mg/kg SiRNAs), (ii) Second group of monkeys were given RNAi treatment (doses 2.5 mg/kg SiRNAs), and (iii) Third group of monkeys were injected saline as control.

The results of the experiments are illustrated in the graph given below.

13(b). (continued)



- End of Question Paper -

(i) What do you interpret from the bars (X and Z) obtained after 264 hours of treatment of monkeys with saline and 2.5 mg/kg SiRNAs treatment?

(ii) Name the category of organisms in the living world, where RNA interference (RNAi) takes place. Why?

(iii) What is the basic principle involved in RNA interference (RNAi) in silencing the preferred genes?