CBSE EXAMINATION PAPER-2022

BIOLOGY

(Solved)

Time allowed : 3 hours | Maximum Marks : 58

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **29 questions.** All questions are **compulsory.**

ii. This question paper is divided into **5 sections.**

iii. **Section A** – questions number **1 to 3** are case based questions

iv. **Section B** – questions number **4 to 12** are multiple choice questions

v. **Section C** – questions number **13 to 20** are very short answer

vi. **Section D** – questions number **21 to 26** are short answer

vii. **Section E** – questions number **27 to 29** are long answer

viii. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.

ix. Use of calculator is NOT allowed.

Section A

Question 1.

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 ?

Question 2.

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 :

(1)

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.

[1 Marks]

(2)

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

[1 Marks]

(3)

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

[1 Marks]

(4)

What does rop code for in plasmid pBR322 ?

[1 Marks]

(5)

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

[1 Marks]

Question 3.

RNA interference (RNAi) holds great potential as a therapeutic agent for the treatment of human diseases and as a bicontrol 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:

(1)

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 ?

[1 Marks]

(2)

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

[2 Marks]

(3)

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

[2 Marks]

Section B

Question 4.

What is the scientific name of one bacterium that mainly attacks a person suffering from AIDS?

[1 Marks]

(A) Escherichia coli

(B) Staphylococcus aureus

(C) HIV

(D) Mycobacterium tuberculosis

Question 5.

What is the full form of the name of the widely used diagnostic test for AIDS?

[1 Marks]

(A) Antibody Test

(B) Enzyme-Linked Immunosorbent Assay

(C) Polymerase Chain Reaction

(D) Antigen Test

Question 6.

What does rop code for in plasmid pBR322?

[1 Marks]

(A) Replication of plasmid

(B) Antibiotic resistance

(C) Protein synthesis

(D) Gene expression

Question 7.

What is the ecological term used for patches formed in an original habitat?

[1 Marks]

(A) Habitat loss

(B) Fragmentation

(C) Biodiversity

(D) Ecosystem services

Question 8.

What is the scientific name of one helminth worm causing filariasis?

[1 Marks]

(A) Wuchereria bancrofti

(B) Taenia solium

(C) Ascaris lumbricoides

(D) Plasmodium falciparum

Question 9.

What is one chronic manifestation of filariasis?

[1 Marks]

(A) Fever

(B) Headache

(C) Nausea

(D) Lymphatic obstruction

Question 10.

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

[1 Marks]

(A) Cloning

(B) Transcription

(C) Translation

(D) Replication

Question 11.

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

[1 Marks]

(A) Ligase

(B) DNA polymerase

(C) RNA polymerase

(D) Restriction endonuclease

Question 12.

What is one important health hazard to a smoker?

[1 Marks]

(A) Improved lung capacity

(B) Increased risk of cancer

(C) Better cardiovascular health

(D) Enhanced immune response

Section C

Question 13.

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.

[2 Marks]

Question 14.

"Curd is easier to digest by humans than milk." Justify, giving two suitable reasons.

[2 Marks]

Question 15.

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.

[2 Marks]

Question 16.

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.

[2 Marks]

Question 17.

Explain the two physiological attributes which enable a kangaroo rat to survive in desert conditions.

[2 Marks]

Question 18.

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.

[2 Marks]

Question 19.

In spite of the statutory warning on cigarette packets against 'smoking' and its injourius effect on health smoking is still prevalent in the society. Enumerate four important health hazards to a smoker.

[2 Marks]

Question 20.

(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 te importance of 'prey- predator ' relationship in a habitat.

[2 Marks]

Section D

Question 21.

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.

[3 Marks]

Question 22.

(a) Name and state the type of immunity that acts as a biological shield' to the developing foetus against many infections in the mother's womb.

(b) A large proportion of infants remain free from potent infections at least three months after birth, or even longer if breast fed. Explain, giving suitable reasons.

[3 Marks]

Question 23.

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.

[3 Marks]

Question 24.

"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'?

[3 Marks]

Question 25.

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.

[3 Marks]

Question 26.

An application of biotechnology in agriculture involves production of pest resistant plants using 'cry' genes from a bacterium. Name the bacterium. Explain why the 'cry' gene kills the pest but not the bacterium itself.

[3 Marks]

Section E

Question 27.

Describe the process of fertilization and implantation in humans.

[5 Marks]

Question 28.

Describe the process of sexual reproduction in flowering plants.

[5 Marks]

Question 29.

Describe the menstrual cycle and its hormonal regulation

[5 Marks]