CBSE EXAMINATION PAPER-2022

BIOLOGY

(Solved)

Time allowed : 3 hours | Maximum Marks : 61

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **31 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 13** are multiple choice questions

v. **Section C** – questions number **14 to 21** are very short answer

vi. **Section D** – questions number **22 to 28** are short answer

vii. **Section E** – questions number **29 to 31** are long answer

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

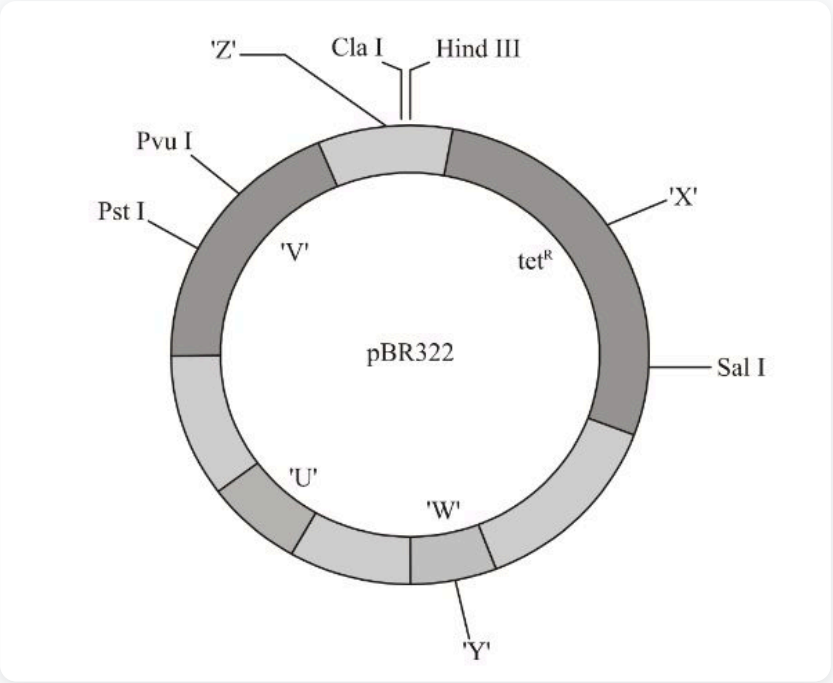
ix. Use of calculator is NOT allowed.

Section A

Question 1.

Question 2.

Cloning of genes, play a very significant role in genetic engineering, helping the transfer of desirable foreign genes into different hosts. The scientists, to make this process easier and effective are creating engineered vectors in such a way that they help easy linking of foreign DNA and selection of recombinants from non recombinants. 'pBR322' is one such engineered vectors developed by scientists. A diagram of an engineered vector pBR322 is given below :



(1)

Name the host for this cloning vector.

[1 Marks]

(2)

Identify 'Rop' and 'Ori' in the diagram from 'U', 'V', 'W', 'X', 'Y'and 'Z'. Write their functions.

[2 Marks]

(3)

Draw the fragments that will be formed by the action of 'Z'(marked in the diagram) on the specific site of the DNA segment given below :

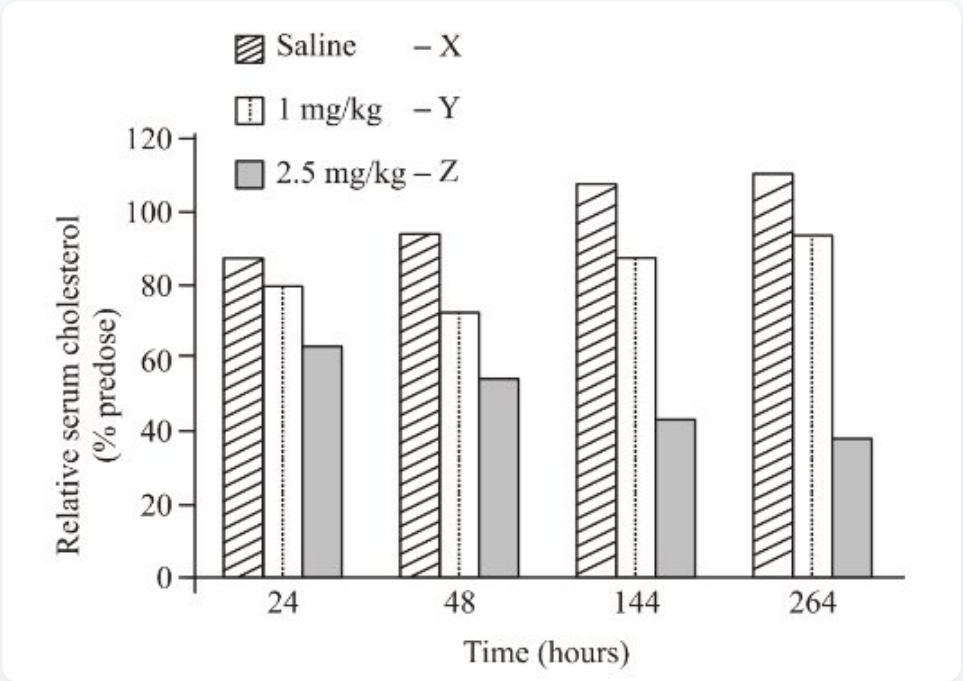
5' --- GTACGAATTCCTGA---3'

3'---CATGCTTAAGGACT---5'

[2 Marks]

Question 3.

RNA interference (RNAi) holds great potential as a therapeutic agent for the treatment of human diseases and as biocontrol agents in controlling pests in the field of agriculture. An experiment was carried 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. One group of monkeys were given RNAi treatment (small interfering RNAs, SiRNAs) (doses 1 mg/kg SiRNAs), second group of monkeys were given RNAi treatment (doses 2.5 mg/kg SiRNAs) and third group of monkeys were injected with saline. The results of the study are depicted in the graph below :



(1)

How does the treatment with 2.5 mg/kg brings an effect on cholesterol metabolism when compared from 24 hours and 144 hours.

[1 Marks]

(2)

Write any two natural sources from where dsRNA molecule couldbe obtained for silencing the specific mRNA.

[2 Marks]

(3)

How is RNAi used in controlling the infection on the roots of tobacco plants by the nematode Meloidogyne incognitia.

[2 Marks]

Section B

Question 4.

Which two genera of fungi are known to cause ringworm in humans?

[1 Marks]

(A) Aspergillus and Penicillium

(B) Microsporum and Trichophyton

(C) Rhizopus and Mucor

(D) Candida and Claviceps

Question 5.

Why can't human excreta slurry be used directly instead of cow dung in a typical biogas plant?

[1 Marks]

(A) It lacks sufficient microbes

(B) It is too dry

(C) It produces less gas

(D) It contains harmful pathogens

Question 6.

What is the mode of action of cocaine on the human body?

[1 Marks]

(A) It increases heart rate by acting on the cerebellum

(B) It inhibits dopamine reuptake at synapses

(C) It blocks insulin release

(D) It stimulates GABA secretion

Question 7.

In a sewage treatment plant, what is the next step after BOD is significantly reduced?

[1 Marks]

(A) Chlorination

(B) Filtration

(C) Transfer to anaerobic sludge digesters

(D) Aeration

Question 8.

What method is best to measure the population density of a single Banyan tree?

[1 Marks]

(A) Quadrat method

(B) Direct counting

(C) Biomass measurement

(D) Percent cover

Question 9.

What did Connell's barnacle field experiment demonstrate?

[1 Marks]

(A) Predation among barnacles

(B) Competitive exclusion principle

(C) Temperature adaptation

(D) Mutualism in rocky areas

Question 10.

Why does an HIV patient die from infections and not directly from AIDS?

[1 Marks]

(A) HIV damages the heart

(B) HIV causes severe dehydration

(C) HIV causes brain hemorrhage

(D) HIV weakens the immune system, allowing opportunistic infections

Question 11.

What is the name of the drug given lifelong after organ transplant?

[1 Marks]

(A) Cyclosporin A

(B) Morphine

(C) Penicillin

(D) AZT

Question 12.

What does 'S' represent in the equation S = CA^Z in ecology?

[1 Marks]

(A) Area

(B) Slope

(C) Carbon content

(D) Species richness

Question 13.

What is the function of the 'Ori' site in the pBR322 vector?

[1 Marks]

(A) Antibiotic resistance

(B) Initiation of replication

(C) Transcription termination

(D) Site of gene insertion

Section C

Question 14.

Ringworm is one of the most common infectious fungal disease in humans. Name any two genera of fungi which cause ringworm and state any of its two symptoms.

[2 Marks]

Question 15.

Can we use slurry of human excreta instead of cowdung slurry to produce biogas in a typical biogas plant? Support your answer giving reasons.

[2 Marks]

Question 16.

State the mode of action of cocain on human body. Write the scientific name of the source plant it is obtained from.

[2 Marks]

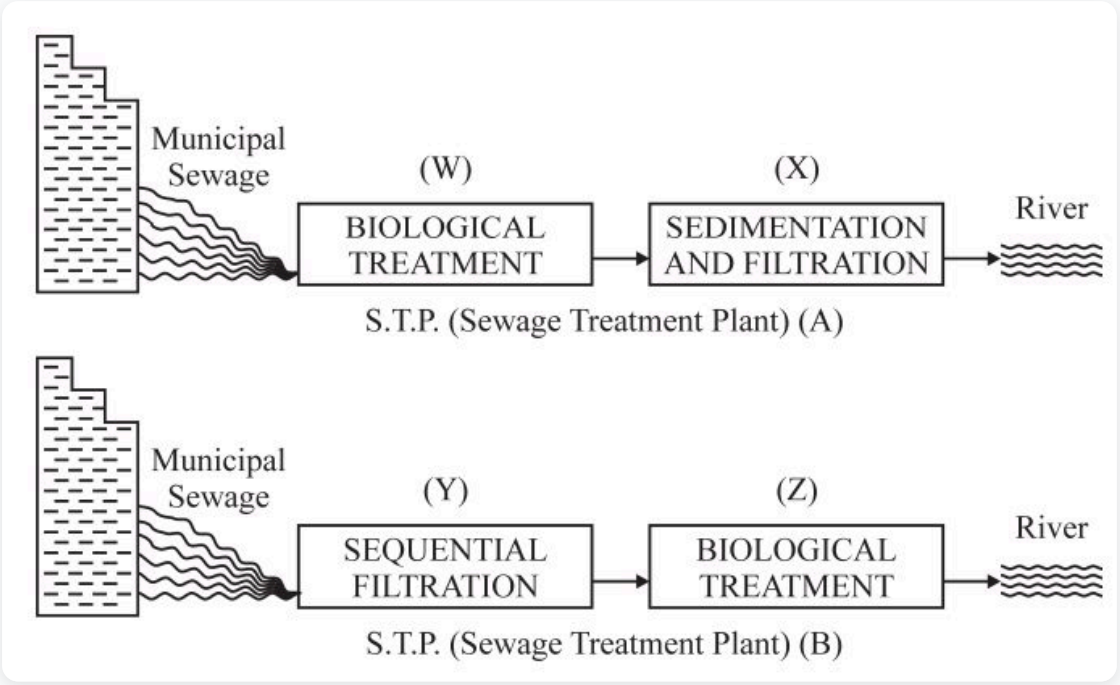
Question 17.

Study the given diagram of Sewage Treatment Plant (S.T.P.) and answer the questions that follow :

(a) Which one of the two 'S.T.P.' (A) or (B) will be more effective in treating the human excreta in the municipal waste?

(b) Write the steps followed in carrying the treatment of the sewage in step (Z), once the BOD of sewage is reduced significantly till it is passed on to the "anaerobic sludge digesters".

[2 Marks]



Question 18.

Write the best method to measure the population density of a single Banyan tree in comparison to 20 Parthenium weeds in a forest by an ecologist. Explain and justify your answer.

[2 Marks]

Question 19.

(i) Write the observations made at the end of Connell's field experiment on barnacles on the rocky sea coasts of Scotland.

(ii) Name any two categories of organisms that in general are adversely affected by competition.

[2 Marks]

Question 20.

Enumerate four most common warning signs of drug and alcohol abuse amongst the youth.

[2 Marks]

Question 21.

The graphs (X) and (Y) given below depict the diurnal variations in the solar radiations in the month of June (Summer) and in December (Winters) :

(i) Which of the two graphs depicts tropical region and temperate regions respectively ?

(ii) Which of the two regions (X) or (Y) will show high biological diversity and why?

[2 Marks]

Section D

Question 22.

'An HIV patient normally doesn't die of 'AIDS', but death is caused due to many other infections.' Do you agree with the statement ? Give explanatory reasons in support of your answer.

[3 Marks]

Question 23.

(a) Why do doctors have to carry many tests for selecting a person to be a suitable donor for someone who is going for an organ transplant and not take the organ from just anybody ? Explain giving reason.

(b) Name the drug a patient who has undergone a successful organ transplant, has to take all his/her life.

[3 Marks]

Question 24.

A cell free method of amplifying DNA first developed in the mid 1980's revolutionized the field of biotechnology. Name the method and explain the basic steps of the technique involved.

[3 Marks]

Question 25.

Given below is an equation describing the Species-Area relationship between species richness and area for a wide variety of taxa as angiosperm plants, birds, bats etc.

$$S = CA^Z$$

(i) Give a graphical representation of the given equation showing Species-Area relationship.

(ii) What does 'S' represent in the given equation ?

(iii) What is the value of 'Z' (regression coefficient) for frugivorous birds and mammals in the tropical forests of different continents ?

[3 Marks]

Question 26.

(a) How does a gene therapy involving direct modification of the cells, in order to achieve a therapeutic goal is used in the treatment of ADA deficiency ? Explain.

(b) A host cell must be made competent, before it is able to receive an rDNA. Justify.

[3 Marks]

Question 27.

(a) Enlist two criteria that are used to identify a region for maximum protection as 'Biodiversity hotspots'.

(b) Name any two "hotspot" regions in our country.

[3 Marks]

Question 28.

Given below is a 'pie chart' representing the global biodiversity : proportionate number of species of major taxa.

(i) Identify (X) and (Y) in the given 'pie chart'.

(ii) "Extinction of species across taxa are not random." Which group amongst the vertebrates is more vulnerable to extinction.

(iii) Give one example each of recent extinctions of species in Russia, Mauritius and Australia.

[3 Marks]

Section E

Question 29.

Explain Darwin’s theory of natural selection. What are the main postulates and evidences supporting the theory of evolution?

[5 Marks]

Question 30.

Describe the steps involved in recombinant DNA technology. What are its applications in medicine and agriculture?

[4 Marks]

Question 31.

Describe the structure and function of a neuron. How does the transmission of nerve impulse occur through synapse?

[5 Marks]