

Question Paper

Conducted by the Central Board of Secondary Education (CBSE)



Time Allowed: 3 Hours

Maximum Marks: 70

General Instructions

- (i) This question paper contains **33 questions**. All questions are compulsory.
- (ii) Section A: Questions 1 to 16 carry 1 mark each.
- (iii) Section B: Questions 17 to 21 carry 2 marks each.
- (iv) Section C: Questions 22 to 28 carry 3 marks each.
- (v) Section D: Questions 29 to 30 carry 4 marks each.
- (vi) Section E: Questions 31 to 33 carry 5 marks each.
- (vii) Attempt one alternative where an internal choice is provided. Follow the instructions within each question.
- (viii) Draw neat, properly labelled diagrams wherever necessary.

Section A

1. Which part of the ovule hardens to form seed coat of a seed?

- (A) Funicle (B) Chalaza
(C) Nucellus (D) Integuments

2. Some statements regarding drugs and alcohol are given below :

- (i) Adolescents are more vulnerable to peer pressure.
(ii) Drug addiction leads to increased tolerance level of the receptors present in our body.
(iii) Alcohol affects the central nervous system.
(iv) Excessive use of drugs helps to increase energy.
(v) Anabolic steroids decrease aggressiveness.

Choose the option with correct statement(s).

- (A) Statements (i), (iv) and (v) are correct (B) Statements (i), (ii) and (iii) are correct
(C) Only statements (i) and (v) are correct (D) Only statement (iii) is correct

3. Appearance of antibiotic-resistant bacteria is an example of evolution due to:

- (A) Adaptive radiation (B) Divergent evolution
(C) Artificial selection (D) Anthropogenic action

4. Consider the following statements and choose the correct option:

Statement I: Using vaccination and immunization programmes, we have been able to eradicate smallpox.

Statement II: Vaccines are available for diphtheria and polio.

- (A) Both Statements I and II are false. (B) Both Statements I and II are true.
(C) Only Statement I is true. (D) Only Statement II is true.

5. Taylor and colleagues performed an experiment on which of the following organisms to provide proof for semi-conservative replication of DNA in chromosomes?

- (A) Garden pea (B) Escherichia coli
(C) Vicia faba (D) Drosophila

6. Which of the following is not a functional unit of an ecosystem?

- (A) Energy flow (B) Decomposition
(C) Stratification (D) Productivity

7. Golden rice is a promising transgenic crop. When released for cultivation, it will help in:

- (A) Producing petrol-like fuel (B) Reduction of Vitamin A deficiency in humans
(C) Pest resistance (D) Herbicide tolerance

8. Which cells are responsible for producing antibodies in a human body?

- (A) Macrophages (B) Helper T-Lymphocytes
(C) Cytotoxic T-Cells (D) B-Lymphocytes

9. Which of the following is a secondary consumer?

- (A) Grasshopper (B) Cow
(C) Fish (D) Hawk

10. Match Column I with Column II and select the correct option:

Column I: a. Primers, b. Insertional inactivation, c. Bioreactor, d. Downstream processing

Column II: i. β -galactosidase, ii. To separate and purify products, iii. Chemically synthesized oligonucleotides, iv. Large scale production of specific product of activity of microbes

- (A) a-iii, b-i, c-iv, d-ii (B) a-iii, b-i, c-ii, d-iv
(C) a-i, b-iii, c-iv, d-ii (D) a-i, b-iv, c-ii, d-iii

11. Identify the statements that correctly describe Darwin's Theory of Evolution.

- (i) Overproduction of organisms leads to competition.
- (ii) Variation is inherited and causes evolution.
- (iii) Acquired characters are inherited.
- (iv) Survival depends on favourable traits.
- (v) New species arise due to accumulation of favourable variations.

Choose the correct option.

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|---|-------------------------------------|
| (A) (i), (ii), (iv) and (v) are correct | (B) (i), (iii) and (iv) are correct |
| (C) All are correct | (D) Only (i) and (iv) are correct |

12. The method of contraception that is hormone-based and prevents ovulation is:

- | | |
|----------------|-----------------|
| (A) Oral Pills | (B) Copper-T |
| (C) Condom | (D) Lippes loop |

13. For Questions 13 to 16, two statements are given - one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer from the codes below.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

Assertion (A): Ecosystems require a constant supply of energy to synthesize the molecules they require.

Reason (R): This is to counteract the universal tendency towards increasing disorderliness as per Second Law of Thermodynamics.

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|--|---|
| (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). | (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A). |
| (C) Assertion (A) is true, but Reason (R) is false. | (D) Assertion (A) is false, but Reason (R) is true. |

14. **Assertion (A):** DNA cannot pass through cell membrane of a bacterial cell.

Reason (R): DNA is a hydrophilic molecule.

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|--|---|
| (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). | (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A). |
| (C) Assertion (A) is true, but Reason (R) is false. | (D) Assertion (A) is false, but Reason (R) is true. |

15. **Assertion (A):** Activated sludge contains large population of bacteria.

Reason (R): These bacteria help in anaerobic digestion of human waste in biogas plant.

- | | |
|--|---|
| (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). | (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A). |
| (C) Assertion (A) is true, but Reason (R) is false. | (D) Assertion (A) is false, but Reason (R) is true. |

16. **Assertion (A):** Hardy-Weinberg principle says that allele frequencies in a population are stable.

Reason (R): Hardy-Weinberg principle is applicable only when genetic drift does not occur.

- | | |
|--|---|
| (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). | (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A). |
| (C) Assertion (A) is true, but Reason (R) is false. | (D) Assertion (A) is false, but Reason (R) is true. |

Section B

17(a). A patient reports a high fever, chills and sweating. His blood shows the presence of a toxic substance.

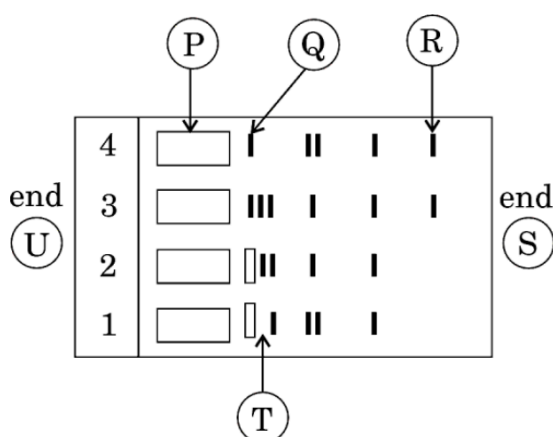
- (i) Identify the disease and the causative organism.
- (ii) Explain why this disease shows recurring pattern of fever.

OR

17(b). Give the microbial source and mode of action of the following bioactive molecules:

- (i) Cyclosporin-A
- (ii) Streptokinase

18(a). (i) Given below is the schematic representation of the process of electrophoresis. Identify the alphabets representing the:



- (I) Anode end, and
 - (II) Lightest/Smallest DNA in matrix.
- (ii) What is Agarose gel and why is it used in this process?

OR

18(b). After performing gel electrophoresis, a student observes that DNA fragments are not visible.

- (i) Suggest a reason for this and explain how fragments can be made visible.
- (ii) Also explain how a specific DNA fragment can be collected from the gel for further use.

19. State any four reasons why Mendel succeeded in his genetic hybridisation experiments on garden peas.

20(a). (i) Mention any two characteristics of Neanderthal man that lived near East and Central Asia.

(ii) Identify the following hominids with respect to human evolution:

- (I) Brain capacity 900 cc, probably ate meat.
- (II) First human-like with brain capacity 650 - 800 cc.

OR

20(b). The allele for brown eyes (B) is dominant over blue eyes (b). In a population, 36% of individuals have blue eyes. Assuming Hardy-Weinberg equilibrium, calculate:

- (i) Frequency of allele B
 - (ii) Percentage of heterozygous individuals
 - (iii) Percentage of individuals that are homozygous dominant
- (Working to be shown)

21. A foreign company patented the medicinal use of turmeric already known to Indian households.

- (a) Name and define this unethical practice.
- (b) What has the Indian Government done to check this?

Section C

22. (a) Describe the experiment conducted by T.H. Morgan on *Drosophila melanogaster* involving eye colour and body colour.

(b) How did the results deviate from Mendelian inheritance pattern?

(c) Explain the two genetic terms used by Morgan for his observations.

23. In vitro fertilization (IVF) is a popular method these days that is helping childless couples to bear a child.

(a) Write the different steps that are carried out in this technique.

(b) Would you consider gamete intra fallopian transfer as a type of IVF? Justify your answer.

24. Answer the following questions:

(a) Explain the different ways by which apomictic seeds can be developed.

(b) Mention one advantage of apomictic seeds for farmers.

25. Draw a neat diagram of a maize grain showing the internal structure and label any five parts.

26. (a) What is meant by translation in protein synthesis?

(b) Explain charging of tRNA (aminoacylation of tRNA) and mention its importance in the process of translation.

27. (a) Who discovered Penicillin and how? Explain.

(b) Why is this discovery considered accidental?

(c) In what way did it prove to be a 'milestone' in the field of medicine?

28. (a) What is the carrying capacity of a species in a habitat?

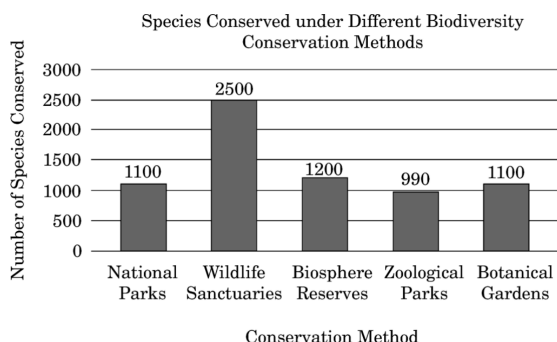
(b) Explain the growth curve that takes this capacity into account.

Section D

29(a). Read the following passage and answer the questions that follow:

India is one of the megadiverse countries housing around 8.1 per cent of global species diversity, although its land area is only 2.4 per cent of the world's land area. Many of the species are highly threatened due to human activities like deforestation, mining and habitat fragmentation. Laws like Wildlife (Protection) Act, 1972 were enacted by the Government of India to preserve our biological wealth. Various conservation measures are being implemented to save the threatened species.

The following bar graph shows the number of species conserved under different biodiversity conservation methods.



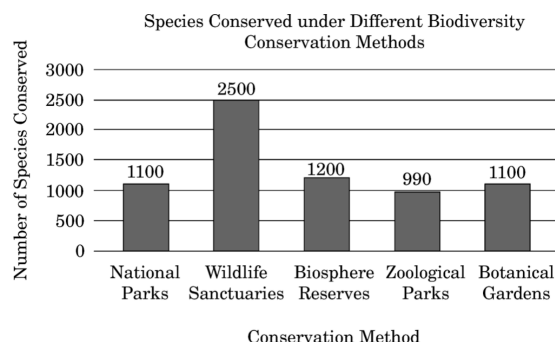
Study the graph and answer the questions.

Which method conserves the highest number of species? Is it ex situ or in situ conservation?

29(b). Read the following passage and answer the questions that follow:

India is one of the megadiverse countries housing around 8.1 per cent of global species diversity, although its land area is only 2.4 per cent of the world's land area. Many of the species are highly threatened due to human activities like deforestation, mining and habitat fragmentation. Laws like Wildlife (Protection) Act, 1972 were enacted by the Government of India to preserve our biological wealth. Various conservation measures are being implemented to save the threatened species.

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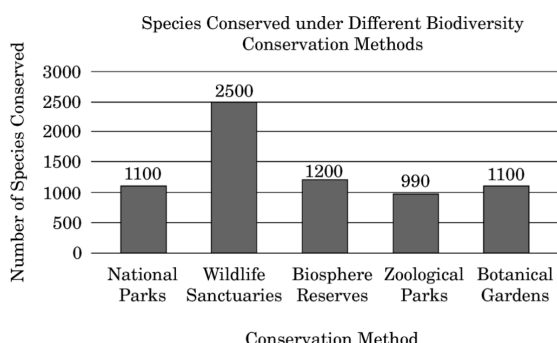
Study the graph and answer the questions.

Which other methods shown in the diagram are opposite to the one identified by you in question (a)? How are these two conservation approaches different?

29(c)(i). Read the following passage and answer the questions that follow:

India is one of the megadiverse countries housing around 8.1 per cent of global species diversity, although its land area is only 2.4 per cent of the world's land area. Many of the species are highly threatened due to human activities like deforestation, mining and habitat fragmentation. Laws like Wildlife (Protection) Act, 1972 were enacted by the Government of India to preserve our biological wealth. Various conservation measures are being implemented to save the threatened species.

The following bar graph shows the number of species conserved under different biodiversity conservation methods.



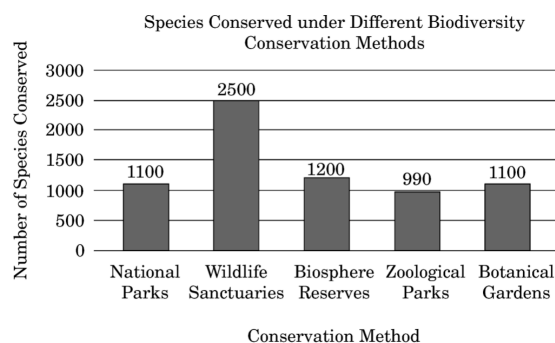
Study the graph and answer the questions.
Write two features of Biodiversity hotspots.

OR

29(c)(ii). Read the following passage and answer the questions that follow:

India is one of the megadiverse countries housing around 8.1 per cent of global species diversity, although its land area is only 2.4 per cent of the world's land area. Many of the species are highly threatened due to human activities like deforestation, mining and habitat fragmentation. Laws like Wildlife (Protection) Act, 1972 were enacted by the Government of India to preserve our biological wealth. Various conservation measures are being implemented to save the threatened species.

The following bar graph shows the number of species conserved under different biodiversity conservation methods.

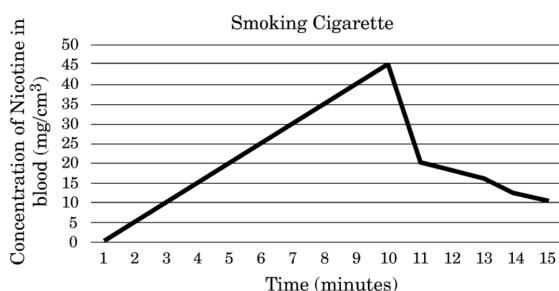


Study the graph and answer the questions.

To which category do sacred groves belong and how do they help in bio-conservation?

30(a)(i). Read the following passage and answer the question that follow:

The data below shows the concentration of nicotine smoked by a smoker taking 10 puffs/minute.

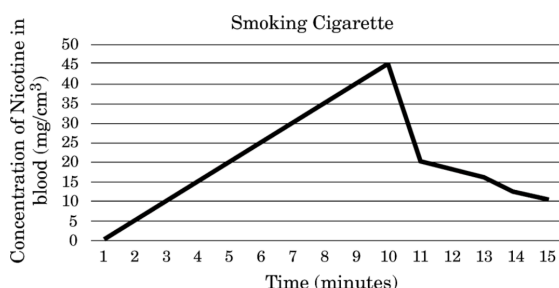


With reference to the above graph, explain the concentration of nicotine in the blood at 10 minutes.

OR

30(a)(ii). Read the following passage and answer the question that follow:

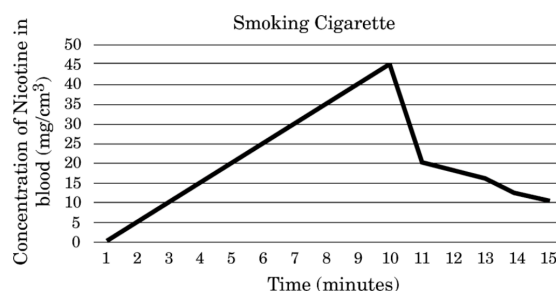
The data below shows the concentration of nicotine smoked by a smoker taking 10 puffs/minute.



How will this affect the concentration of carbon monoxide and haem-bound oxygen at 10 minutes?

30(b). Read the following passage and answer the question that follow:

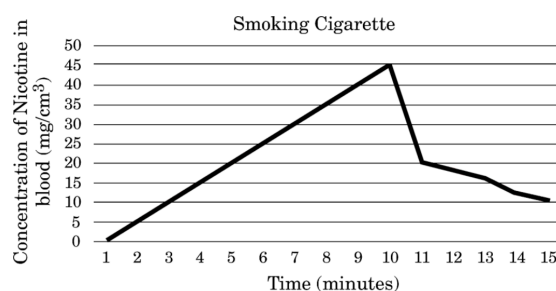
The data below shows the concentration of nicotine smoked by a smoker taking 10 puffs/minute.



How does cigarette smoking result in high blood pressure and increase in heart rate?

30(c). Read the following passage and answer the question that follow:

The data below shows the concentration of nicotine smoked by a smoker taking 10 puffs/minute.



To which class of compounds does nicotine belong? Name one other drug from the same class.

Section E

31(a). The following questions are based on the classic experiment conducted by Hershey and Chase.

- (i) Why were bacteriophages chosen by the scientists?
- (ii) Name the radioactive isotopes used and state the reason for using them.
- (iii) Describe the steps of the experiment.
- (iv) Why is this experiment considered a major breakthrough in the field of molecular biology?

OR

31(b). (i) What are multiple alleles? How do they differ from simple dominant-recessive allele pairs?

- (ii) Explain the concept of multiple alleles with the help of a human trait studied by you.
- (iii) Mention all possible genotypes with their corresponding phenotypes of the human trait as explained by you.
- (iv) Comment on the type of inheritance pattern involved in the example explained by you.

32(a). Oogenesis is a discontinuous process that begins before birth and is completed after puberty.

- (i) Trace the development of a gamete mother cell till its release from the ovary during ovulation.
- (ii) Name the two pituitary hormones that play an important role in the process.

OR

32(b). (i) Draw a labelled two-celled structure of male gametophyte of an angiosperm.

- (ii) Name the three layers that surround the cytoplasm of a male gametophyte starting from innermost to outermost layer.
- (iii) Which organic material makes the outermost layer? Mention its advantage.
- (iv) Why is the outermost layer of male gametophyte not continuous?

33(a). (i) Explain any two basic principles/core techniques on which biotechnology is based.

- (ii) Describe any three key tools used in Recombinant DNA technology.

OR

33(b). “Early and accurate diagnosis of diseases is vital in medical technology.”

- (i) Name the conventional methods of diagnosis and their disadvantages.
- (ii) Which three diagnostic techniques have been developed through Biotechnology? Explain how each one helps in detecting diseases.

- End of Question Paper -