

रोल नं.
Roll No.

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें।

Candidates must write the Q.P. Code on the title page of the answer-book.

जीव विज्ञान (सैद्धान्तिक)
BIOLOGY (Theory)

निर्धारित समय : 3 घण्टे

Time allowed : 3 hours

अधिकतम अंक : 70

Maximum Marks : 70

नोट	NOTE
(I) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 27 हैं।	(I) Please check that this question paper contains 27 printed pages.
(II) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें।	(II) Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
(III) कृपया जाँच कर लें कि इस प्रश्न-पत्र में 33 प्रश्न हैं।	(III) Please check that this question paper contains 33 questions.
(IV) कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में यथा स्थान पर प्रश्न का क्रमांक अवश्य लिखें।	(IV) Please write down the Serial Number of the question in the answer-book at the given place before attempting it.
(V) इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है। प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा। 10.15 बजे से 10.30 बजे तक परीक्षार्थी केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे।	(V) 15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the candidates will read the question paper only and will not write any answer on the answer-book during this period.

General Instructions :

Read the following instructions carefully and follow them :

- (i) *This question paper contains **33** questions. **All** questions are **compulsory**.*
- (ii) *Question paper is divided into **five** sections – Sections **A, B, C, D** and **E**.*
- (iii) ***Section A** – questions number **1** to **16** are Multiple Choice Type Questions. Each question carries **1** mark.*
- (iv) ***Section B** – questions number **17** to **21** are Very Short Answer Type Questions. Each question carries **2** marks.*
- (v) ***Section C** – questions number **22** to **28** are Short Answer Type Questions. Each question carries **3** marks.*
- (vi) ***Section D** – questions number **29** and **30** are Case-Based questions. Each question carries **4** marks. Each question has subparts with internal choice in one of the subparts.*
- (vii) ***Section E** – questions number **31** to **33** are Long Answer Type Questions. Each question carries **5** marks.*
- (viii) *There is no overall choice. However, an internal choice has been provided in Sections **B, D** and **E** of the question paper. A candidate has to write answer for only **one** of the alternatives in such questions.*
- (ix) *Kindly note that there is a separate question paper for Visually Impaired Candidates.*
- (x) *Wherever necessary, neat and properly labelled diagrams should be drawn.*

SECTION A

*Questions no. **1** to **16** are Multiple Choice Type Questions, carrying **1** mark each. Choose the best option.*

16 × 1 = 16

1. Foetal ejection reflex in human female triggers the release of which hormone ?
- (A) Oxytocin from foetal pituitary gland
 - (B) hCG from placenta
 - (C) Progesterone from corpus luteum
 - (D) Oxytocin from maternal pituitary gland

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

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

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

<i>Column I</i>	<i>Column II</i>
a. Primers	i. β -galactosidase
b. Insertional inactivation	ii. To separate and purify products
c. Bioreactor	iii. Chemically synthesized oligonucleotides
d. Downstream processing	iv. Large scale production of specific product of activity of microbes

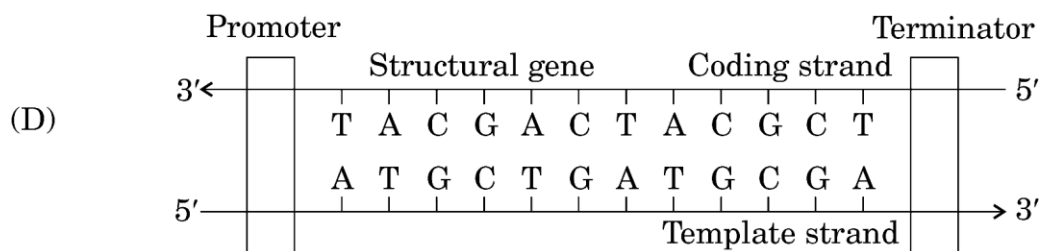
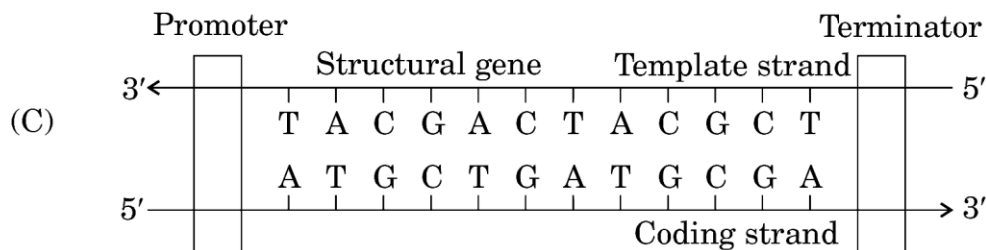
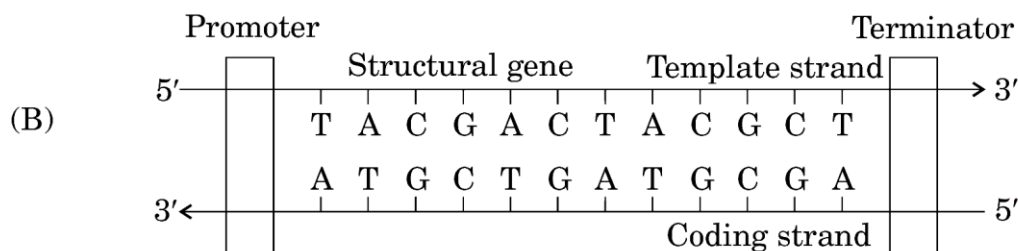
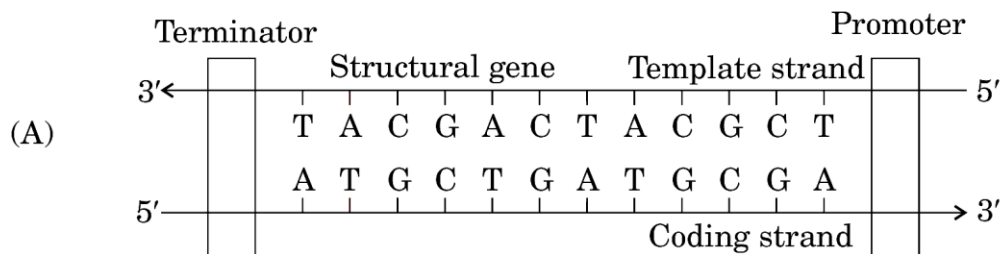
Options :

- (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

4. 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

5. Four different transcription units are shown below. Choose the option with the correct image.



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

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

7. 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.

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

8. Which of the following is **not** a symptom of Ascariasis ?

- (A) Intestinal blockage
- (B) Muscular pain and fever
- (C) Anaemia
- (D) Skin ulcers

9. Every trophic level has a certain mass of living material at a particular time. What is it called ?

- (A) Standing crop
- (B) Primary productivity
- (C) Standing state
- (D) Ecological efficiency

10. The smallest part of DNA molecule that can be changed by point mutation is :

- (A) Oligonucleotide
- (B) Codon
- (C) Gene
- (D) Nucleotide

11. 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

12. Select the correct option for the pair of plants pollinated by water.

- (A) *Vallisneria* and *Hydrilla*
- (B) *Zostera* and Water lily
- (C) Water lily and *Parthenium*
- (D) Water hyacinth and Water lily

For Questions number **13** to **16**, two statements are given – one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given 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.

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

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

14. 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.

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

Reason (R) : DNA is a hydrophilic molecule.

16. Assertion (A) : Repetitive sequences are stretches of DNA sequences that are thought to have no direct coding functions.

Reason (R) : They shed light on chromosome structure, dynamics and evolution.

SECTION B

17. (a) A person complains of persistent itching in the groin region and scalp. The person also shows dry and scaly lesions on skin, nails, etc.

(i) Identify the disease.

(ii) Name its two causative agents.

(iii) Mention its mode of transmission.

$$\frac{1}{2} + 1 + \frac{1}{2} = 2$$

OR

- (b) A girl develops sneezing, watery eyes and difficulty in breathing every time she visits a flower garden.
- Identify the condition.
 - Name the immune component responsible for this condition.
 - Name the chemical released.
 - State one medicine used to treat such a condition. $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 2$

18. (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 :
- Brain capacity 900 cc, probably ate meat.
 - First human-like with brain capacity 650 – 800 cc. $1 + \frac{1}{2} + \frac{1}{2} = 2$

OR

- (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 :

- Frequency of allele B
- Percentage of heterozygous individuals
- Percentage of individuals that are homozygous dominant

(Working to be shown) $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 2$

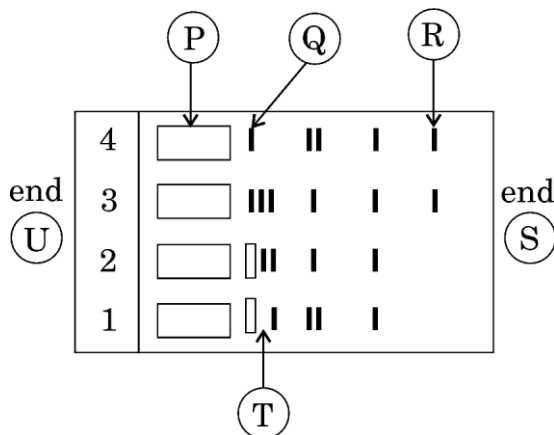
19. What did Henking observe in his experiments on insects that led to the discovery of sex chromosome ? How did his observation contribute to our understanding of sex determination ?

2

20. (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 ? 1+1=2

OR

- (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. 1+1=2

21. GEAC is a regulatory body under the Ministry of Environment, Forest and Climate Change in India.

(a) Write the full form of GEAC.

(b) Mention two of its important functions related to biotechnology. 1+1=2

SECTION C

22. 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. 2+1=3

23. (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. 1+2=3

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

- (b) Explain the growth curve that takes this capacity into account. 1+2=3

25. *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. 2+1=3

26. Draw a neat diagram of a maize grain showing the internal structure and label any five parts. 3

27. Cow dung and water are mixed and fed into a biogas plant to allow digestion of biowastes. The person performing this process says that there is no need to provide an inoculum.

- (a) Do you agree with him ? Justify your answer.
- (b) What happens to the biowaste inside the digester ?
- (c) Name the useful by-products obtained from this process and mention how they are used. 1+1+1=3

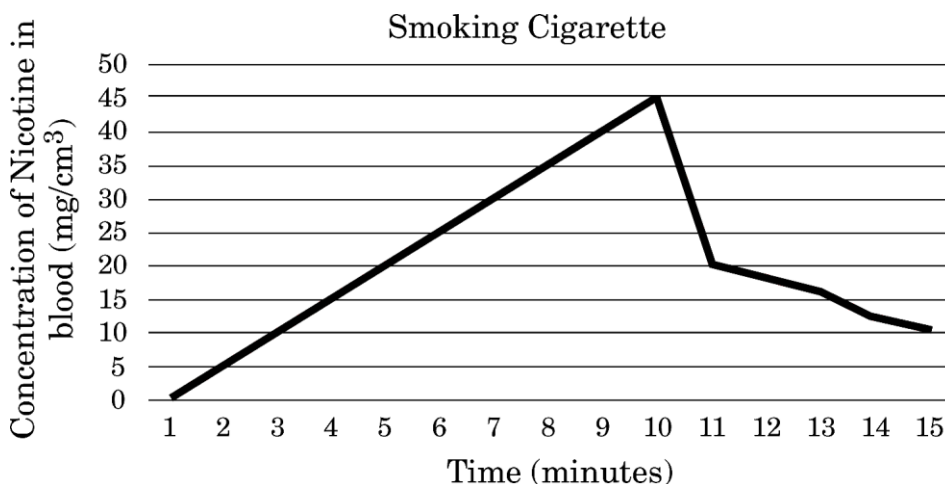
28. (a) Describe the experiment conducted by T.H. Morgan on *Drosophila melanogaster* involving eye colour and body colour.
- (b) How did the results deviate from Mendelian inheritance pattern ?
- (c) Explain the two genetic terms used by Morgan for his observations. 1+1+1=3

SECTION D

Questions No. 29 and 30 are Case-Based questions. Each question has 3 sub-questions with internal choice in one sub-question.

29. Read the following passage and answer the question that follow : 4

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



- (a) (i) With reference to the above graph, explain the concentration of nicotine in the blood at 10 minutes. 1

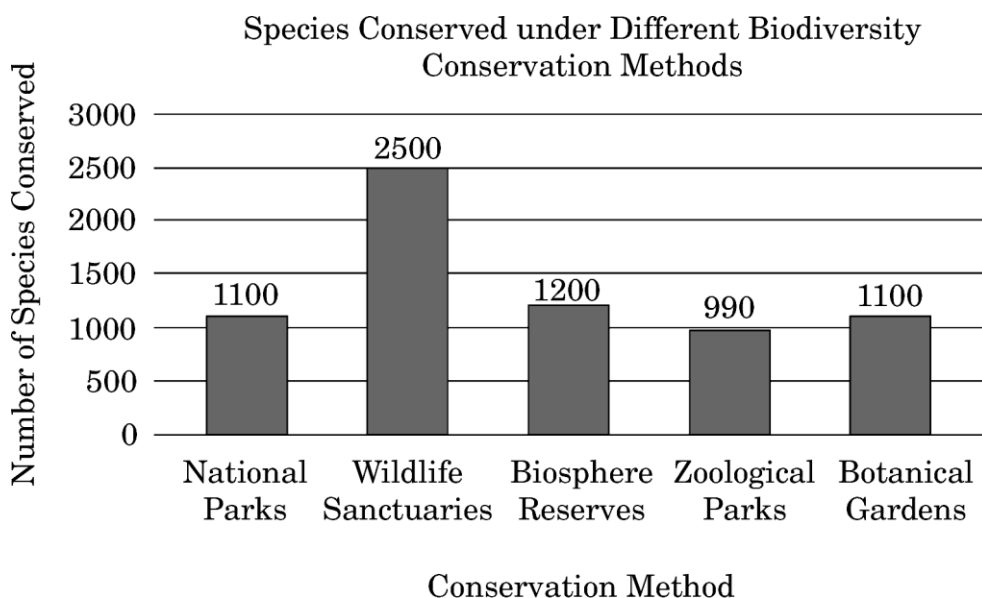
OR

- (a) (ii) How will this affect the concentration of carbon monoxide and haem-bound oxygen at 10 minutes ? 1
- (b) How does cigarette smoking result in high blood pressure and increase in heart rate ? 1
- (c) To which class of compounds does nicotine belong ? Name one other drug from the same class. 2

30. Read the following passage and answer the questions that follow : 4

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.

- (a) Which method conserves the highest number of species ? Is it *ex situ* or *in situ* conservation ? 1

- (b) 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 ? 2
- (c) (i) Write two features of Biodiversity hotspots. 1

OR

- (c) (ii) To which category do sacred groves belong and how do they help in bio-conservation ? 1

SECTION E

31. (a) (i) Describe the series of experiments conducted by Frederick Griffith. Comment on the significance of the result obtained.
- (ii) State the contribution of Avery, MacLeod and McCarty. 3+2=5

OR

- (b) The following questions are based on haemophilia.
- (i) Work out the crosses between :
- (I) Normal female and Haemophilic male
- (II) Carrier female and Normal male
- (III) Carrier female and Haemophilic male
- (ii) Write the conclusions you draw from these crosses. Comment on the type of inheritance of the disease.
- (Use : X – Normal, X^h – Haemophilic) 1+1+1+2=5

32. (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. 2+3=5

OR



- (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. 2+3=5

- 33.** (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. 4+1=5

OR

- (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 ? $1+1\frac{1}{2}+1\frac{1}{2}+1=5$