Roll No. ☐☐☐☐☐☐☐☐

Q.P. Code 57/1/1

BIOLOGY (THEORY)

CBSE Class XII Board Examination 2023

Time allowed: 3 hours **Maximum Marks: 70**

General Instructions:

1. The paper has 33 questions in five sections (A to E); all of them must be answered.
2. Section A: Q1–16, multiple choice and Assertion-Reason, 1 mark each.
3. Section B: Q17–21, very short answer, 2 marks each.
4. Section C: Q22–28, short answer, 3 marks each.
5. Section D: Q29–30, case-based, 4 marks each.
6. Section E: Q31–33, long answer, 5 marks each.
7. There is no overall choice, but one question in Section B, one in Section C, both in Section D and all three in Section E offer an internal choice (OR). Calculators are not allowed.

SECTION A

Q1–16 are multiple choice questions of 1 mark each (Q13–16 are Assertion-Reason).

1. Which of the processes listed below give rise to recombinants in the next generations? **1**

(i) Mutation

(ii) Independent assortment during meiosis I

(iii) Independent assortment during meiosis II

(iv) Crossing over between homologous chromosomes of a bivalent

(A) (iv) only **(B)** (ii) and (iv)

(C) (i), (ii) and (iii) **(D)** (i), (ii), (iii) and (iv)

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2. A schematic of transcription in a prokaryote shows a DNA double helix. The region 'X' is the stretch of DNA at the start of the transcription unit where the enzyme first sits; 'Y' is a small factor attached to the enzyme; 'Z' is the large enzyme sitting on the DNA. Identify X, Y and Z (Region X / Factor Y / Enzyme Z). **1**

(A) Terminator / Sigma (σ) / RNA polymerase

(B) Promoter / Rho (ρ) / RNA polymerase

(C) Promoter / Sigma (σ) / RNA polymerase

(D) Promoter / Sigma (σ) / DNA polymerase

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3. An age pyramid of a human population has a narrow base (pre-reproductive group), becomes widest in the middle (reproductive group) and narrows again at the top (post-reproductive group). What does this pyramid show about the population? **1**

(A) Declining population **(B)** Stable population

(C) Expanding population **(D)** Extinct population

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4. Biology students measured two quantities at points along a river flowing past their city and plotted them against distance along the river. In the graph, the dissolved-oxygen curve starts low and steady, begins to rise just after point (i), reaches a peak between points (iii) and (iv), and falls again after (iv). The mineral-ion curve starts high, begins to fall just after point (i), reaches its lowest value near (iii), and rises again to a high level after (iv). At which point does untreated sewage enter the river? **1**

(A) Point (i) **(B)** Point (ii)

(C) Point (iii) **(D)** Point (iv)

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5. Match the enzymes (Column I) with their functions (Column II). **1**

Column I: P. DNA ligase; Q. Restriction exonuclease; R. Taq polymerase; S. Restriction endonuclease

Column II: i. Removes nucleotides from the ends of DNA; ii. Extends the primer on a DNA template; iii. Joins DNA fragments; iv. Cuts DNA at a specific position

(A) P-i, Q-ii, R-iv, S-iii **(B)** P-iv, Q-iii, R-ii, S-i

(C) P-i, Q-iv, R-iii, S-ii **(D)** P-iii, Q-i, R-ii, S-iv

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6. DNA fingerprinting was done for a child X and three individuals 1, 2 and 3. Every band in the child's lane matches a band present either in individual 1 or in individual 3; individual 2's bands do not account for the child's bands. Which option shows the possible parents of child X? **1**

(A) 1 and 2 **(B)** 2 and 3

(C) 1 and 3 **(D)** Only individual 3

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7. A graph of number of giraffes (y-axis) against neck length (x-axis) is shown as a single bell-shaped curve. Choose the option that correctly describes natural selection with respect to neck length in giraffes. **1**

(A) Stabilising selection, as giraffes with longer necks are selected further

(B) Disruptive selection, as giraffes with both shorter and longer necks are selected

(C) Directional selection, as giraffes with longer necks are selected

(D) Stabilising selection, as giraffes with medium neck lengths are selected

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8. 325 microspore mother cells go through microsporogenesis. How many pollen grains are formed? **1**

(A) 325 **(B)** 650

(C) 1300 **(D)** 975

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9. Match the contraceptives (Column I) with their modes of action (Column II). **1**

Column I: P. Lippes loop; Q. Multiload 375; R. Subcutaneous Norplant; S. Saheli

Column II: i. Inhibits ovulation; ii. Phagocytosis of sperms inside the uterus; iii. Thickens the cervical mucus; iv. Makes the cervix hostile to sperms

(A) P-ii, Q-iv, R-iii, S-i **(B)** P-i, Q-ii, R-iii, S-iv

(C) P-iii, Q-i, R-iv, S-ii **(D)** P-iv, Q-iii, R-ii, S-i

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10. Which option correctly matches an endocrine source with its hormone and function? (Gland – Hormone – Function) **1**

(A) Sertoli cells – Testosterone – Development of secondary sexual characters

(B) Placenta – Estrogen – Starts secretion of milk

(C) Leydig cells – Androgen – Starts the production of sperms

(D) Ovary – FSH – Stimulates follicular development

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11. In 1972 Stanley Cohen and Herbert Boyer made the first recombinant DNA. Which organism's plasmid/gene was used? **1**

(A) E. coli

(B) Salmonella typhimurium

(C) Agrobacterium tumefaciens

(D) Bacillus thuringiensis

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12. Who challenged the patent granted to a US university (on the wound-healing use of turmeric, a traditional Indian remedy)? **1**

(A) Mr. Ajay Phadke

(B) Ms. Vandana Shiva

(C) Dr. Venugopalan

(D) Dr. R.A. Mashelkar

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13. Assertion (A): A patient with ADA deficiency treated by gene therapy needs repeated infusions of genetically engineered lymphocytes. **1**
Reason (R): Lymphocytes are immortal.

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

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

(C) A is true but R is false.

(D) A is false but R is true.

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14. Assertion (A): Cattle egrets living closely with grazing cattle are a classic example of commensalism. **1**
Reason (R): As the cattle walk through the vegetation they disturb and flush out insects that the egrets would otherwise find hard to locate and catch.

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

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

(C) A is true but R is false.

(D) A is false but R is true.

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15. Assertion (A): In non-albuminous (ex-albuminous) seeds the endosperm is fully used up during embryo development. **1**

Reason (R): Castor, pea and beans are all non-albuminous seeds.

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

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

(C) A is true but R is false.

(D) A is false but R is true.

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16. Assertion (A): In birds such as the pigeon, females are heterogametic and males are homogametic. **1**

Reason (R): Female pigeons carry Z and W sex chromosomes while males carry ZZ.

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

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

(C) A is true but R is false.

(D) A is false but R is true.

SECTION B

Q17–21 are very short answer questions of 2 marks each.

17. A diagram shows an early human embryo: a hollow ball of cells with an outer single layer of flattened cells (labelled X) and a cluster of cells attached to the inside of this layer at one side (labelled Y). **2**

(a) Name this embryonic stage.

(b) Where exactly is it found in a normal pregnancy?

(c) Give one function each of X and Y.

18. (a) Through which end of the ovule does the pollen tube enter the embryo sac of a Hibiscus flower, and how is it guided in? **2**

(b) What happens to the two male nuclei carried by the pollen tube?

19. Two structures are shown: A – a small circular double-stranded DNA ring; B – a virus with a polygonal head containing DNA, a tail sheath and tail fibres (the kind that infects bacteria). **2**

(i) Identify A and B.

(ii) Why are they important in biotechnology experiments?

OR

Explain how a bacterial cell is made 'competent' to take up foreign DNA using divalent cations and a temperature treatment.

20. Ecological pyramids are useful but have limitations. State any two of them. **2**

21. India is the seventh largest country of the world by area. What percentage of the world's land area does India have? Then state what makes India one of the 12 mega-diversity countries. **2**

SECTION C

Q22–28 are short answer questions of 3 marks each.

22. Using a schematic diagram only, show in three steps how recombinant DNA is formed by the action of the restriction enzyme EcoRI and DNA ligase. **3**

23. Pedigree: Generation I – a normal female and a normal male (parents). Generation II – their children: son 1 (normal), son 2 (affected), daughter 3 (normal). Son 1 marries an affected female and has a normal daughter (III-1). Daughter 3 marries a normal male and has an affected son (III-2) and two normal daughters (III-3, III-4). **3**

(a) Is the trait dominant or recessive? Give a reason.

(b) Is it autosomal or sex-linked? Give a reason.

(c) Write the possible genotypes of children 1 and 3 of generation II.

24. (a) State the characteristics of stem cells. **3**

(b) Name sources of stem cells in humans.

(c) Give any two uses of stem cells in treating human diseases.

25. (a) Distinguish between malignant and benign tumours. **3**

(b) Name and explain the most dangerous property of malignant tumours.

26. In a sewage treatment plant, explain: **3**

(a) Primary sludge

(b) Activated sludge

(c) Anaerobic sludge digesters

27. (a) Name the two primate ancestors of modern humans that lived about 15 million years ago. **3**

(b) According to fossil records, when and where did Australopithecines live?

(c) Give two differences between Homo habilis and Homo erectus.

28. (i) Give the full forms of these assisted reproductive technologies: (1) ZIFT (2) ICSI (3) IUT (4) GIFT **3**

(ii) Which one of them cannot be called an IVF procedure? Give a reason.

OR

Distinguish between:

(i) Perisperm and pericarp

(ii) Syncarpous and apocarpous pistil

(iii) Plumule and radicle

SECTION D

Q29–30 are case-based questions of 4 marks each.

29. Jacob (a geneticist) and Monod (a biochemist) explained how bacteria switch genes on and off, using lactose metabolism in E. coli; their 'lac operon' model earned the 1965 Nobel Prize. **4**

(a) Why is the lac operon called a transcriptionally regulated system? (1)

(b) The lac operon is said to work at a very low level in the cell all the time. Justify. (1/2)

(c) Why is the regulator gene of the lac operon called the 'i' gene? (1/2)

(d) Draw a schematic diagram of the lac operon when no inducer is present in the culture medium. (2)

OR

(d) Draw a schematic diagram of the lac operon when the inducer is present in the culture medium of the bacteria.

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30. A diagram of the Earth shows latitude lines 0° (equator), 30°, 60° and 90° N and S. Region A is the band between about 30° N and 30° S around the equator; region B is the band from about 30° S towards the South Pole. **4**

(a) What happens to species diversity as you move from region A to region B? Give two reasons. (3)

(b) Giving the reason, state the approximate number of bird species recorded in India. (1)

OR

(b) Name the region of the world with the greatest biodiversity and say why.

SECTION E

Q31–33 are long answer questions of 5 marks each.

31. Recall the Meselson and Stahl experiment on the mode of DNA replication. **5**

(i) Which two kinds of nitrogen did they use, and why?

(ii) Why were E. coli samples taken at definite time intervals?

(iii) What was the role of the caesium chloride density gradient?

(iv) What did they conclude?

OR

(i) A true-breeding tall pea plant with round seeds is crossed with a dwarf pea plant with wrinkled seeds (recessive for both). Work out the cross up to F_2 and give the phenotypic ratios of F_1 and F_2.

(ii) Which Mendelian principle can be derived only from such a cross?

32. Children in India follow a fixed vaccination schedule from birth to ten years. A graph of antibody concentration in the blood against days after vaccination shows a small rise after the vaccine is given and a much faster, larger rise when the child is later re-infected by the same pathogen. **5**

(i) Why does giving a vaccine raise the antibody concentration?

(ii) If the child is infected by the same pathogen about four months later, the antibody level rises very quickly. Why?

(iii) In a table of immunity types, identify P, Q, R, S and T:

Natural active – antibodies produced: Yes; memory cells: P; mode: Q

Natural passive – antibodies produced: No; memory cells: R; mode: across the placenta in pregnancy / breast feeding

Acquired active – antibodies produced: S; memory cells: Yes; mode: getting a vaccine

Acquired passive – antibodies produced: T; memory cells: No; mode: injection of ready-made antibodies

OR

(i) What is the chemical name of 'smack'? Why is taking smack considered drug abuse?

(ii) Give the source plant and one effect on the body of: (1) Marijuana (2) Cocaine (3) Morphine

33. A diagram shows three modes of pollen transfer: arrow 1 – pollen goes from the anther to the stigma of the same flower; arrow 2 – pollen goes to another flower on the same plant; arrow 3 – pollen goes to a flower of a different plant. **5**

(i) Give the technical terms for methods 1, 2 and 3.

(ii) How are these plants pollinated? (1) Water lily (2) Vallisneria

(iii) Explain one hereditary (genetic) and one physiological device that flowering plants use to avoid inbreeding depression.

OR

A circular diagram of a 28-day human menstrual cycle is shown, with the days numbered 1 to 28.

(i) Give the technical terms for: (1) days 1–7 (2) days 8–12 (3) days 16–28 (4) days 13–15

(ii) Explain the role of ovarian and pituitary hormones during: (1) days 8–12 (2) days 13–15 (3) days 16–28

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Questions restated from the CBSE Class XII Board Examination 2023 (set 57/1/1) for practice. Reading passages and map items are described, not reproduced.