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Your JEE Guide

ISC Class XII · Biology Paper 1 (Theory)

Sample Question Paper 3 · Session 2026-27

Time allowed: 3 hours (plus 15 minutes reading time) **Maximum marks: 70**

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This is an original practice paper written to the CISCE 2027 specimen paper format; it is not issued by CISCE.

General instructions:

1. You are allowed an additional fifteen minutes for only reading the question paper. You must NOT start writing during the reading time.
2. The paper has eighteen questions in all. Answer all questions.
3. There are four sections: A, B, C and D. Internal choices have been provided in two questions each in Sections B, C and D.
4. Section A consists of one question with twenty subparts of one mark each.
5. While answering Multiple Choice Questions in Section A, you are required to write only one option as the answer.
6. Section B consists of seven questions of two marks each. Section C consists of seven questions of three marks each. Section D consists of three questions of five marks each.
7. Diagrams should be drawn wherever necessary, using a pencil only.
8. The intended marks for questions are given in brackets [ ].

Section A (20 marks)

1.	**(i)** Which part of a human sperm contains numerous mitochondria? (a) the tail (b) the middle piece (c) the head (d) the acrosome	1
	(ii) In the F_2 generation of a dihybrid cross between true-breeding parents, the proportion of plants homozygous for both genes is: (a) $\frac{9}{16}$ (b) $\frac{1}{16}$ (c) $\frac{1}{4}$ (d) $\frac{1}{2}$	1
	(iii) The step of PCR in which the two DNA strands are separated by heating is: (a) denaturation (b) annealing (c) ligation (d) extension	1
	(iv) Which of the following diseases is caused by a helminth? (a) typhoid (b) ringworm (c) malaria (d) ascariasis	1

	(v) Which of the following is NOT one of the "evil quartet" causes of biodiversity loss? (a) alien species invasions (b) over-exploitation (c) habitat loss and fragmentation (d) in-situ conservation	1
	(vi) Given below are two statements marked Assertion and Reason. Read both the statements carefully and choose the correct option. **Assertion:** A person with blood group AB can receive blood of any ABO group. **Reason:** People with blood group AB have neither anti-A nor anti-B antibodies in their plasma. (a) Both Assertion and Reason are true, and Reason is the correct explanation for Assertion. (b) Both Assertion and Reason are true, but Reason is not the correct explanation for Assertion. (c) Assertion is true and Reason is false. (d) Both Assertion and Reason are false.	1
	(vii) Given below are two statements marked Assertion and Reason. Read both the statements carefully and choose the correct option. **Assertion:** Cannabinoids affect the cardiovascular system of the body. **Reason:** Cannabinoids are obtained from the latex of Papaver somniferum. (a) Both Assertion and Reason are true, and Reason is the correct explanation for Assertion. (b) Both Assertion and Reason are true, but Reason is not the correct explanation for Assertion. (c) Assertion is true and Reason is false. (d) Both Assertion and Reason are false.	1
	(viii) What is the ploidy of the cells of the nucellus?	1
	(ix) Name the hormone that causes milk to be ejected from the mammary glands.	1
	(x) What is emasculation?	1
	(xi) Which type of RNA carries amino acids to the ribosome?	1
	(xii) Which of Mendel's laws can be established only from a dihybrid cross?	1
	(xiii) Name the bacterium that converts milk into curd.	1
	(xiv) What is meant by downstream processing?	1
	(xv) Name the insect that transmits dengue and chikungunya.	1
	(xvi) What is a biodiversity hotspot?	1
	(xvii) Producers in an ecosystem trap 20 000 J of energy. Using the 10 per cent law, how much energy reaches the secondary consumers?	1
	(xviii) Name the first restriction endonuclease to be isolated.	1
	(xix) What is apomixis?	1

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	(xx) Who first described the “transforming principle” in experiments with Streptococcus pneumoniae?	1

Section B (14 marks)

2.	The placenta acts as an endocrine organ. Name four hormones it produces.	2
3.	Explain codominance with the help of the ABO blood groups in humans.	2
4.	How is the primary transcript (hnRNA) of a eukaryote processed before it can be translated? **OR** State the role of each of the three types of RNA in protein synthesis.	2
5.	What is a bioreactor? Why is the stirred-tank bioreactor commonly used?	2
6.	How do interferons help protect the body against viral infections?	2
7.	What is brood parasitism? Give an example and one adaptation that helps it succeed. **OR** What is resource partitioning? Explain with the example studied by MacArthur.	2
8.	In a population of 5000 in Hardy–Weinberg equilibrium, the frequency of the dominant allele is 0.8. Calculate (i) the frequency of heterozygotes, (ii) the number of homozygous recessive individuals.	2

Section C (21 marks)

9.	Draw a labelled diagram of an antibody molecule. Name the chains it is made of and mark the antigen-binding sites.	3
10.	A true-breeding tall pea plant is crossed with a true-breeding dwarf one. All F_1 plants are tall, and the F_2 shows tall and dwarf plants in a 3 : 1 ratio. Explain these results with a Punnett square, and state the two laws they illustrate. **OR** State the chromosomal theory of inheritance. What did Morgan conclude from his dihybrid crosses in Drosophila?	3
11.	Describe how DNA is isolated from a plant cell for genetic engineering.	3
12.	State three warning signs of drug or alcohol abuse in adolescents and three measures that help prevent it.	3
13.	Distinguish between primary and secondary productivity. Why is the primary productivity of a tropical rain forest much higher than that of a desert?	3

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14.	Explain how each of the following gives evidence for evolution: (a) the rise of herbicide- and antibiotic-resistant organisms, (b) fossils, (c) comparative anatomy of the forelimbs of mammals. **OR** What is saltation? How does Hugo de Vries' idea of evolution differ from Darwin's?	3
15.	Explain the following assisted reproductive technologies: (a) ZIFT, (b) GIFT, (c) IUI.	3

Section D (15 marks)

16.	(a) Describe the process of translation in a cell, including the charging of tRNA. *[3]* (b) In bacteria, transcription and translation are said to be coupled. What does this mean, and why is it not possible in eukaryotic cells? *[2]*	5
17.	(a) Describe the development of the endosperm and the embryo in a flowering plant after double fertilisation. *[3]* (b) What are the scutellum, coleoptile and coleorhiza in a grass embryo? *[2]* **OR** (a) Describe the events in the human female from fertilisation to implantation. *[3]* (b) What is the role of the trophoblast? *[1]* (c) By the end of which month of pregnancy does the heart of the foetus form? *[1]*	5
18.	(a) Describe how a recombinant DNA molecule is made using the vector pBR322 and the enzyme BamHI, and how recombinant cells are selected. *[3]* (b) What is biopiracy? Give one example. *[2]* **OR** (a) How does the Mediterranean orchid Ophrys get pollinated by "sexual deceit"? *[2]* (b) Describe four adaptations of parasites to their way of life. *[2]* (c) State Gause's competitive exclusion principle. *[1]*	5

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Answers and Marking Scheme

Marks for each step are shown in brackets. Any correct alternative method gets full credit.

Section A (20 marks)

Question 1

(i) **(b)** the middle piece. *Working:* They supply energy for the movement of the tail.

(ii) **(c)** $\frac{1}{4}$. *Working:* Four of the sixteen combinations (RRYY, RRyy, rrYY, rryy) are homozygous for both genes.

(iii) **(a)** denaturation. *Working:* Heating to about 94 °C breaks the hydrogen bonds between the strands.

(iv) **(d)** ascariasis. *Working:* Ascaris is a roundworm; typhoid is bacterial, malaria protozoan and ringworm fungal.

(v) **(d)** in-situ conservation. *Working:* The fourth cause is co-extinction; in-situ conservation protects biodiversity.

(vi) **(a)** Both Assertion and Reason are true, and Reason is the correct explanation for Assertion. *Working:* With no anti-A or anti-B antibodies, donated red cells are not clumped.

(vii) **(c)** Assertion is true and Reason is false. *Working:* Cannabinoids come from the inflorescences of Cannabis sativa; opioids such as morphine come from the poppy.

(viii) Diploid (2n).

(ix) Oxytocin.

(x) Removal of the anthers from a bisexual flower bud before they shed pollen.

(xi) Transfer RNA (tRNA).

(xii) The law of independent assortment.

(xiii) Lactobacillus (lactic acid bacteria).

(xiv) The separation and purification of a product after it has been made in a bioreactor.

(xv) The Aedes mosquito.

(xvi) A region with very high species richness and many endemic species, which is under threat.

(xvii) 20 000 → 2000 → 200 J.

(xviii) Hind II.

(xix) The formation of seeds without fertilisation.

(xx) Frederick Griffith.

Section B (14 marks)

2. Human chorionic gonadotropin (hCG), human placental lactogen (hPL) (1), oestrogens and progesterone (1).

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3. The gene I has three alleles, I^A, I^B and i; I^A and I^B each produce a different sugar on the red blood cells, while i produces none (1). In a person with genotype I^AI^B both sugars are made, so both alleles are expressed and the blood group is AB (1).

4. Splicing removes the introns and joins the exons (1). Capping adds methyl guanosine triphosphate at the 5′ end, and tailing adds adenylate residues (poly-A tail) at the 3′ end (1).

OR mRNA provides the template (codons) (½). tRNA reads the code and brings specific amino acids (adapter molecule) (½). rRNA has a structural role in ribosomes and a catalytic role: the 23S rRNA of bacteria acts as peptidyl transferase (a ribozyme) (1).

5. A large vessel in which raw materials are converted into products by cells or enzymes under controlled conditions (1). Its stirrer mixes the contents evenly and improves oxygen supply; temperature, pH, foam and oxygen can be controlled, and samples taken (1).

6. Cells infected by a virus secrete proteins called interferons (1), which protect neighbouring non-infected cells from further viral infection (1).

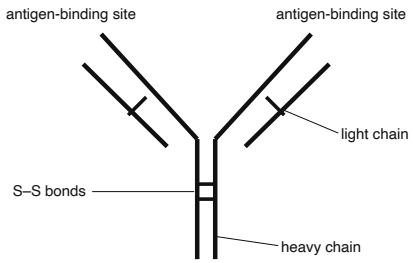
7. One species lays its eggs in the nest of another, which incubates them and rears the young (1). The koel (cuckoo) lays its eggs in a crow's nest; its eggs look like the host's eggs in colour and size, so the crow does not detect and throw them out (1).

OR Competing species avoid competition by using the same resource in different ways, at different times or in different places (1). MacArthur found that five closely related warbler species living on the same tree avoided competition by feeding in different parts of the branches (1).

8. (i) $q = 0.2$; $2pq = 2 \times 0.8 \times 0.2 = 0.32$ (1). (ii) $q^2 = 0.04$; $0.04 \times 5000 = 200$ (1).

Section C (21 marks)

9. Diagram with two heavy and two light chains joined by disulphide bonds (1½), the antigen-binding sites at the tips of the arms (variable regions) (1), and the constant regions (½).



10. TT × tt gives all Tt (tall), because T is dominant: law of dominance (1). F_1 gametes are T and t in equal numbers; the Punnett square gives TT, 2Tt and tt, i.e. 3 tall : 1 dwarf (1). The alleles separate into gametes without blending: law of segregation (1).

OR Genes are carried on chromosomes; chromosomes, like genes, occur in pairs that segregate and assort independently at meiosis (1). Morgan found far fewer recombinants than expected (e.g. 1.3% for body colour and eye colour but 37.2% for eye colour and wing size) (1). He concluded that genes on the same chromosome are linked, and that the closer they are, the less often they recombine (1).

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11. The cells are broken open with enzymes such as cellulase (for the cell wall) (1). RNA is removed with ribonuclease and proteins with protease (1). Chilled ethanol is added and the purified DNA precipitates out as fine threads, which are spooled out (1).

12. Any three: falling grades or absence from school; loss of interest in hygiene and hobbies; withdrawal and isolation; aggressive behaviour; changes in sleep and eating habits (1½). Any three: avoid undue peer pressure; education and counselling; seeking help from parents and peers; looking for danger signs early; professional and medical help (1½).

13. Primary productivity is the rate at which producers form organic matter (biomass) by photosynthesis (1); secondary productivity is the rate at which consumers form new organic matter (1). The rain forest has plenty of water, high temperature and sunlight all year and a large plant cover, all of which favour photosynthesis; in a desert, water is the main limiting factor (1).

14. (a) Human use of chemicals has selected resistant varieties within a few years: evolution by natural selection can be seen happening (1). (b) Fossils in rocks of different ages show different life forms, some extinct, with changes over time (1). (c) The forelimbs of whales, bats, cheetahs and humans have the same bones but different functions, showing descent from a common ancestor (1).

OR Saltation is a single large step of mutation that can give rise to a new species (1). De Vries, working on evening primrose, held that evolution is caused by sudden large mutations, which are random and directionless (1). Darwin held that evolution is gradual, through small, directional variations favoured by natural selection (1).

15. (a) Zygote intra-fallopian transfer: an embryo with up to eight blastomeres, formed by in-vitro fertilisation, is transferred into the Fallopian tube (1). (b) Gamete intra-fallopian transfer: an ovum from a donor is transferred into the Fallopian tube of a woman who cannot produce one but can provide suitable conditions for fertilisation (1). (c) Intra-uterine insemination: semen from the husband or a donor is introduced into the uterus (1).

Section D (15 marks)

16. (a) Each amino acid is activated with ATP and joined to its specific tRNA (charging of tRNA) (1). The small ribosomal subunit binds the mRNA at the start codon AUG, the initiator tRNA (methionine) pairs with it, and the large subunit joins (1). Charged tRNAs enter one after another according to the codons; peptide bonds form and the ribosome moves along the mRNA until a stop codon (UAA, UAG or UGA) is reached, when a release factor frees the polypeptide (1). (b) Bacteria have no nuclear membrane, so translation can begin on an mRNA while it is still being transcribed (1). In eukaryotes transcription occurs in the nucleus and the transcript must be processed and moved to the cytoplasm before translation (1).

17. (a) The primary endosperm nucleus divides repeatedly; often many free nuclei form first and cell walls form later (free-nuclear endosperm, as in the coconut, whose water is free-nuclear endosperm) (1½). The zygote divides to form a pro-embryo, which passes through globular and heart-shaped stages to the mature embryo (1½). (b) The scutellum is the single cotyledon (1); the coleoptile is the sheath round the plumule and the coleorhiza the sheath round the radicle (1).

OR (a) Fertilisation in the ampulla forms the zygote, which divides by mitosis (cleavage) as it moves towards the uterus (1). It becomes a morula of 8–16 blastomeres and then a blastocyst,

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with an outer trophoblast and an inner cell mass (1). The trophoblast attaches to the endometrium and the blastocyst becomes embedded in it: implantation (1). (b) It attaches the blastocyst to the uterus and later forms part of the placenta (chorionic villi) (1). (c) The first month (1).

18. (a) The vector and the foreign DNA are cut with BamHI, giving matching sticky ends, and joined with DNA ligase; the BamHI site lies in the tetracycline-resistance gene (1). The DNA is introduced into E. coli made competent with Ca^{2+} ions and a heat shock (1). Cells are grown on ampicillin (all transformants grow) and replica-plated on tetracycline; recombinants grow on ampicillin but not on tetracycline, because insertion has inactivated tet^R (1). (b) The use of bioresources of other countries by organisations without proper permission or payment (1). E.g. a US patent on a new variety of basmati rice derived from Indian varieties, or attempts to patent uses of turmeric and neem (1).

OR (a) One petal looks like a female bee in size, colour and markings (1); the male bee tries to mate with it (pseudocopulation) and is dusted with pollen, which it carries to another flower (1). (b) Loss of unnecessary sense organs; hooks and suckers to cling to the host; loss of the digestive system; very high reproductive capacity (any four, ½ each). (c) Two closely related species competing for the same resources cannot coexist indefinitely; the weaker one is eventually eliminated (1).

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