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Your JEE Guide

ISC Class XII · Biology Paper 1 (Theory)

Sample Question Paper 2 · 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)** A flowering plant has 24 chromosomes in its leaf cells. The number of chromosomes in its endosperm cells is: (a) 36 (b) 48 (c) 12 (d) 24	1
	(ii) Down's syndrome is caused by: (a) an extra X chromosome in a male (b) trisomy of chromosome 21 (c) a point mutation in the β-globin gene (d) monosomy of the X chromosome	1
	(iii) Which of the following is a selectable marker in the vector pBR322? (a) the BamHI site (b) ori (c) amp^R (d) rop	1
	(iv) In which technique is a single sperm injected directly into the egg? (a) IUI (b) ZIFT (c) GIFT (d) ICSI	1

	(v) Which of the following is a method of ex-situ conservation? (a) a national park (b) cryopreservation of gametes (c) a sacred grove (d) a biosphere reserve	1
	(vi) Given below are two statements marked Assertion and Reason. Read both the statements carefully and choose the correct option. **Assertion:** The genetic code is said to be degenerate. **Reason:** Some amino acids are coded by more than one codon. (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:** Morphine is used as a sedative and painkiller after surgery. **Reason:** Morphine is obtained from the latex of the poppy plant, 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) Name the cells of the seminiferous tubules that nourish the developing sperms.	1
	(ix) Where in the female reproductive tract does fertilisation normally take place?	1
	(x) What is a test cross?	1
	(xi) Which enzyme is used to break open fungal cells when isolating their DNA?	1
	(xii) State the role of “ori” in a cloning vector.	1
	(xiii) Who proposed the theory of natural selection independently of Charles Darwin?	1
	(xiv) Name the drug obtained from the coca plant, Erythroxylum coca.	1
	(xv) Name the virus that causes the common cold.	1
	(xvi) An orchid grows as an epiphyte on a mango branch. Name the type of interaction.	1
	(xvii) Expand MALT.	1
	(xviii) Name the type of bioreactor most commonly used in industry.	1

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	(xix) The gross primary productivity of an ecosystem is 1500 kcal m^{-2} y^{-1}, and 600 kcal m^{-2} y^{-1} is used in respiration. Calculate the net primary productivity.	1
	(xx) What is meant by the ecological niche of a species?	1

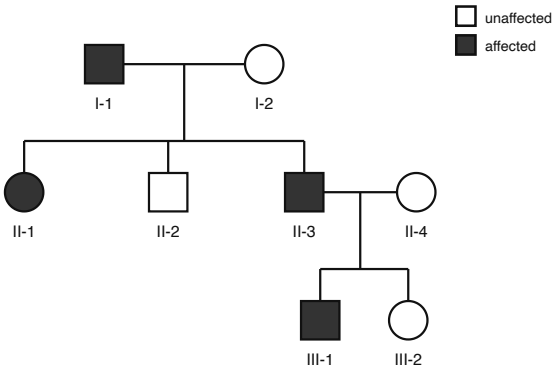
Section B (14 marks)

2.	In snapdragon, a cross between red-flowered (RR) and white-flowered (rr) plants gives pink-flowered F_1 plants. Explain this result and give the phenotypic ratio of the F_2 generation.	2
3.	What is double fertilisation? Name the products formed. **OR** Why is an apple called a false fruit? What is a parthenocarpic fruit?	2
4.	Why are restriction enzymes called molecular scissors? How do sticky ends help in forming recombinant DNA?	2
5.	Distinguish between benign and malignant tumours.	2
6.	What is adaptive radiation? Give one example. **OR** What is genetic drift? Why are its effects greater in small populations?	2
7.	Give two ways in which prey species defend themselves against predators.	2
8.	What are transgenic animals? Give two ways in which they are useful.	2

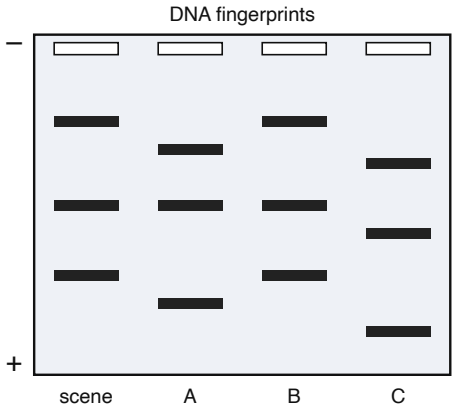
Section C (21 marks)

9.	Draw a labelled diagram of the longitudinal section of an anatropous ovule, and name the parts that develop into (a) the seed coat, (b) the seed. **OR** Draw a labelled diagram of the cloning vector pBR322 showing its antibiotic-resistance genes, the origin of replication and two restriction sites.	3
10.	Explain how the lac operon of E. coli is (a) switched off when lactose is absent, (b) switched on when lactose is present.	3

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11.	The pedigree below shows the inheritance of a trait (shaded symbols) in a family. (a) Is the trait dominant or recessive? Is it autosomal or X-linked? Give one reason each. (b) Write the genotypes of I-1 and II-2. (c) What is the probability that the next child of II-3 and II-4 will show the trait?  	3
12.	Distinguish between the roles of B-lymphocytes and T-lymphocytes in immunity. How does the secondary immune response differ from the primary response?	3
13.	How does Bt cotton resist attack by bollworms? **OR** Describe how gene therapy was first used to treat a child with adenosine deaminase (ADA) deficiency.	3
14.	Draw and describe the three kinds of age pyramid of a human population, and state what each predicts about population growth.	3
15.	Name three sexually transmitted infections and state three ways of preventing them.	3

Section D (15 marks)

16.	(a) State three salient features of the human genome revealed by the Human Genome Project. *[3]* (b) DNA from a crime scene and from three suspects (A, B and C) was compared by DNA fingerprinting, as shown below. Which suspect's DNA matches? On what feature of DNA is the technique based? *[2]*  	5

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17.	(a) Describe microsporogenesis and the structure of a mature pollen grain. *[3]* (b) How long do pollen grains of rice and wheat remain viable after release? *[1]* (c) What are pollen banks? *[1]* **OR** (a) Describe the stages of spermatogenesis, stating the chromosome number at each stage. *[3]* (b) How do FSH and LH regulate spermatogenesis? *[1]* (c) What is the function of the acrosome? *[1]*	5
18.	(a) Describe the three types of natural selection: stabilising, directional and disruptive. *[3]* (b) Explain industrial melanism in the peppered moth. *[2]* **OR** (a) Describe how biogas is produced in a biogas plant from cattle dung. *[3]* (b) Give two examples of microbes used as biocontrol agents, and what each controls. *[2]*	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) **(a)** 36. *Working:* The endosperm is triploid (3n), formed by fusion of a male gamete with two polar nuclei; n = 12.

(ii) **(b)** trisomy of chromosome 21. *Working:* The other options describe Turner's syndrome, Klinefelter's syndrome and sickle-cell anaemia.

(iii) **(c)** amp^R. *Working:* The ampicillin-resistance gene allows transformants to be selected; ori and rop control replication.

(iv) **(d)** ICSI. *Working:* Intra-cytoplasmic sperm injection.

(v) **(b)** cryopreservation of gametes. *Working:* Ex-situ conservation protects species outside their natural habitat.

(vi) **(a)** Both Assertion and Reason are true, and Reason is the correct explanation for Assertion. *Working:* That is exactly what degeneracy of the code means.

(vii) **(b)** Both Assertion and Reason are true, but Reason is not the correct explanation for Assertion. *Working:* Both statements are true, but the source of the drug does not explain its medical use.

(viii) Sertoli cells.

(ix) In the ampullary region of the Fallopian tube (oviduct).

(x) A cross between an organism showing the dominant phenotype and a homozygous recessive individual, to find the unknown genotype.

(xi) Chitinase.

(xii) It is the origin of replication, where replication starts; it also controls the copy number of the linked DNA.

(xiii) Alfred Russel Wallace.

(xiv) Cocaine.

(xv) Rhinovirus.

(xvi) Commensalism.

(xvii) Mucosa-associated lymphoid tissue.

(xviii) The stirred-tank bioreactor.

(xix) NPP = GPP − R = 900 kcal m^{-2} y^{-1}.

(xx) Its functional role in the community, including the range of conditions it tolerates and the resources it uses.

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Section B (14 marks)

2. Neither allele is completely dominant, so the heterozygote has an intermediate phenotype: incomplete dominance (1). F_2: red : pink : white = 1 : 2 : 1, the same as the genotypic ratio (1).

3. One male gamete fuses with the egg (syngamy), forming the diploid zygote (1). The other fuses with the two polar nuclei (triple fusion), forming the triploid primary endosperm nucleus (1).

OR The fleshy part develops from the thalamus as well as the ovary (1). A fruit formed without fertilisation, and so without seeds, e.g. banana (1).

4. They cut DNA at specific recognition sequences (1). Many cut the two strands a little away from the centre of the palindrome, leaving single-stranded overhangs; these pair with complementary overhangs on DNA cut by the same enzyme, and DNA ligase seals the joints (1).

5. A benign tumour stays at its original site and causes little damage (1). Malignant cells grow and divide rapidly, invade nearby tissues and spread to distant sites through blood and lymph (metastasis) (1).

6. The evolution of many different forms from one ancestral form, as it spreads into different habitats (1). E.g. Darwin's finches of the Galapagos Islands, or the Australian marsupials (1).

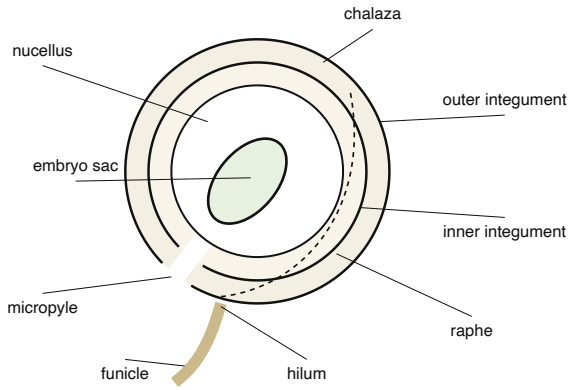
OR A change in allele frequencies that happens by chance (1). In a small population, chance events affect a large proportion of the gene pool (1).

7. Camouflage (cryptic colouring), as in some frogs and insects (1). Being poisonous or distasteful, e.g. the monarch butterfly, which takes in a chemical from its food plant; many plants make poisonous chemicals such as cardiac glycosides (Calotropis) or have thorns (1).

8. Animals whose DNA has been altered to carry and express an extra (foreign) gene (1). Any two: studying normal physiology and development; models for human diseases; producing biological products such as α-1-antitrypsin (or the cow Rosie, whose milk had human α-lactalbumin); testing the safety of vaccines and chemicals (1).

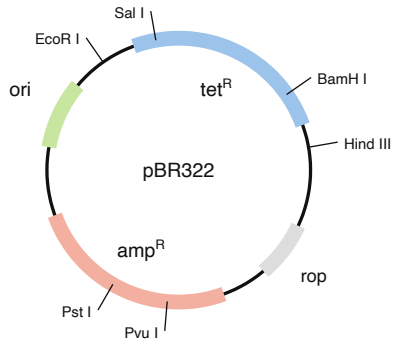
Section C (21 marks)

9. Diagram showing the funicle, hilum, integuments, micropyle, nucellus, embryo sac and chalaza (2). (a) The integuments; (b) the whole ovule (½ each).

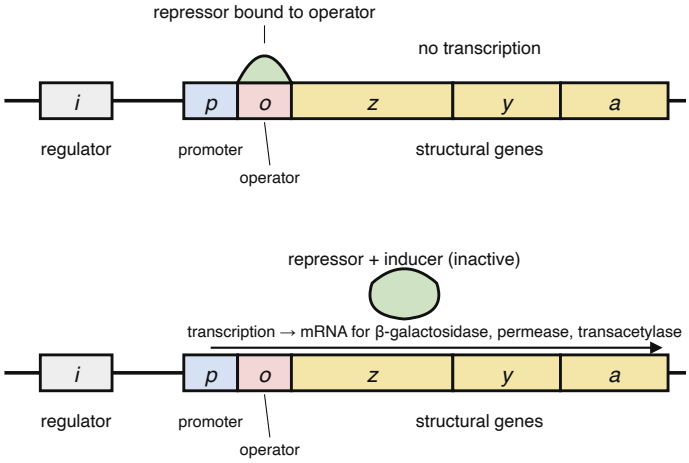


OR Diagram showing amp^R and tet^R, ori, rop and sites such as EcoRI, BamHI, HindIII, PstI or PvuI (3).

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10. The regulator gene i makes a repressor protein (½). (a) Without lactose the repressor binds the operator and prevents RNA polymerase from transcribing the structural genes z, y and a (1). (b) Lactose (the inducer) binds the repressor and changes its shape so that it cannot bind the operator; the genes are transcribed (1½).



11. (a) Dominant: it appears in every generation and every affected child has an affected parent (½). Autosomal: it passes from father (II-3) to son (III-1), which cannot happen with an X-linked trait (½). (b) I-1: Aa (he has an unaffected son); II-2: aa (1). (c) Aa × aa gives ½ affected (1).

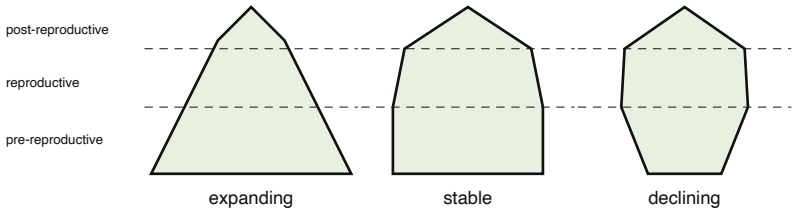
12. B-lymphocytes produce antibodies (humoral immunity) (1). T-lymphocytes do not secrete antibodies but help B cells and bring about cell-mediated immunity, such as graft rejection (1). The secondary response, on a later meeting with the same antigen, is faster and much stronger because of memory cells (1).

13. The cry genes (e.g. cryIAc and cryIIAb) from Bacillus thuringiensis make an inactive protoxin in the plant (1). In the alkaline gut of the insect larva the protoxin becomes the active toxin (1). It binds to the cells lining the midgut and creates pores, so the cells swell and burst and the larva dies (1).

OR Lymphocytes were taken from the patient's blood and grown in culture (1). A functional ADA cDNA was introduced into them using a retroviral vector (1). The cells were returned to the patient; since they are not immortal, the treatment must be repeated periodically (1).

14. Expanding (triangular, broad base): many young people, the population will grow (1). Stable (bell-shaped): a steady population (1). Declining (urn-shaped, narrow base): fewer young people, the population will fall (1).

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15. Any three of gonorrhoea, syphilis, genital herpes, chlamydiasis, trichomoniasis, genital warts, hepatitis B, HIV/AIDS (1½). Avoid sex with unknown or multiple partners; always use condoms; consult a doctor early if in doubt and get full treatment (1½).

Section D (15 marks)

16. (a) Any three: it has about 3×10^9 base pairs; less than 2% of it codes for proteins; the average gene has about 3000 bases; chromosome 1 has the most genes and Y the fewest; about 1.4 million single-base differences (SNPs) were identified (3). (b) Suspect B: all of its bands match those of the crime-scene sample (1). It is based on variable number tandem repeats (VNTRs), which differ between individuals (1).

17. (a) Each microspore mother cell in the anther divides by meiosis to form a tetrad of haploid microspores (1). The pollen grain has a hard outer exine of sporopollenin with germ pores, and an inner intine of cellulose and pectin (1); when mature it contains a large vegetative cell and a small generative cell (1). (b) About 30 minutes (1). (c) Stores where pollen grains are kept for years in liquid nitrogen (–196 °C) for use in crop breeding (1).

OR (a) Spermatogonia (2n = 46) multiply by mitosis; some become primary spermatocytes (2n) (1). These complete meiosis I to form secondary spermatocytes (n = 23), which complete meiosis II to form spermatids (n) (1). Spermatids change into spermatozoa (spermiogenesis) (1). (b) LH stimulates Leydig cells to secrete androgens, which stimulate spermatogenesis; FSH acts on Sertoli cells, which aid spermiogenesis (1). (c) Its enzymes help the sperm to penetrate the ovum (1).

18. (a) Stabilising selection favours the average phenotype and removes extremes (1); directional selection favours one extreme, so the mean shifts (1); disruptive selection favours both extremes, so two peaks may form (1). (b) Before industrialisation, white-winged moths on pale lichen-covered trees were better hidden from birds and were common (1). When soot darkened the tree trunks, dark-winged moths were hidden and survived better, so they became more common (1).

OR (a) A slurry of dung is fed into a concrete tank (digester) (1). Anaerobic bacteria break down the organic matter; methanogens such as Methanobacterium produce a gas mainly of methane with CO_2 (1). The gas is collected under a floating cover and piped for cooking and lighting; the spent slurry is used as manure (1). (b) Trichoderma, a fungus, controls plant pathogens in the soil (1); baculoviruses (Nucleopolyhedrovirus) attack insects and other arthropods (1).

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