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Your JEE Guide

CBSE Class XII · Biology (044)

Sample Question Paper 3 · Session 2026-27

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

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This is an original practice paper written to the official CBSE 2026-27 design; it is not issued by CBSE.

General instructions:

1. All questions are compulsory.
2. The question paper has five sections and 33 questions.
3. Section A has 16 questions of 1 mark each; Section B has 5 questions of 2 marks each; Section C has 7 questions of 3 marks each; Section D has 2 case-based questions of 4 marks each; and Section E has 3 questions of 5 marks each.
4. There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
5. Wherever necessary, neat and properly labelled diagrams should be drawn.

Section A

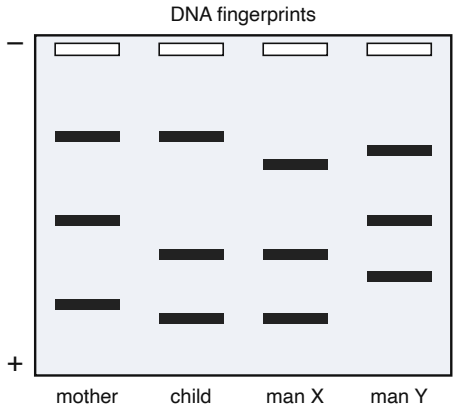
1.	The male gametophyte of an angiosperm is the: (A) anther (B) microspore mother cell (C) pollen grain (D) tapetum	1
2.	The filiform apparatus, which guides the pollen tube, is found in the: (A) antipodals (B) synergids (C) egg cell (D) central cell	1
3.	The seed coat develops from the: (A) integuments (B) funicle (C) nucellus (D) synergids	1
4.	In the human female, the second meiotic division of the oocyte is completed: (A) before birth (B) at puberty (C) at the start of menstruation (D) when a sperm enters it	1
5.	The blastocyst gets implanted in the: (A) endometrium of the uterus (B) fallopian tube (C) ovary (D) cervix	1
6.	Which of the following sexually transmitted infections is caused by a bacterium? (A) genital herpes (B) syphilis (C) AIDS (D) hepatitis B	1

7.	The cross AaBb × aabb, for two unlinked genes, gives the phenotypic ratio: (A) 1 : 2 : 1 (B) 3 : 1 (C) 9 : 3 : 3 : 1 (D) 1 : 1 : 1 : 1	1
8.	Down's syndrome is caused by: (A) an extra X chromosome in a male (B) a point mutation (C) trisomy of chromosome 21 (D) the absence of one X chromosome	1
9.	In eukaryotes, RNA polymerase III transcribes: (A) tRNA, 5S rRNA and snRNAs (B) only mRNA (C) the precursor of mRNA (hnRNA) (D) 28S, 18S and 5.8S rRNAs	1
10.	Which of the following is an example of convergent evolution? (A) forelimbs of a whale and of a bat (B) wings of a butterfly and of a bird (C) hearts of different vertebrates (D) thorn of Bougainvillea and tendril of Cucurbita	1
11.	Which of the following diseases is caused by a helminth? (A) malaria (B) typhoid (C) ascariasis (D) amoebiasis	1
12.	During gel electrophoresis, DNA fragments move towards the: (A) cathode (negative electrode) (B) centre of the gel only (C) wells (D) anode (positive electrode)	1
13.	**Assertion (A):** The primary endosperm nucleus is triploid. **Reason (R):** It is formed by the fusion of a male gamete with the two polar nuclei. (A) Both A and R are true, and R is the correct explanation of A. (B) Both A and R are true, and R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.	1
14.	**Assertion (A):** Okazaki fragments are formed on the lagging strand during replication. **Reason (R):** DNA ligase joins the Okazaki fragments. (A) Both A and R are true, and R is the correct explanation of A. (B) Both A and R are true, and R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.	1
15.	**Assertion (A):** Penicillin is an antibiotic produced by a bacterium. **Reason (R):** Antibiotics kill or retard the growth of disease-causing microbes. (A) Both A and R are true, and R is the correct explanation of A. (B) Both A and R are true, and R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.	1

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16.	**Assertion (A):** The number of trophic levels in a food chain is limited to a few. **Reason (R):** The amount of energy increases at each successive trophic level. (A) Both A and R are true, and R is the correct explanation of A. (B) Both A and R are true, and R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.	1

Section B

17.	Draw a labelled diagram of an anatropous ovule. **OR** What is the tapetum? State its function.	2
18.	Why are the testes located outside the abdominal cavity in human males?	2
19.	The DNA fingerprints of a mother, her child and two men are shown. Which man is likely to be the biological father? Give a reason.  **OR** What is PCR? Name the enzyme used in it and state why it is suitable.	2
20.	What is biopiracy? Give one example. **OR** Expand GEAC. State one of its functions.	2
21.	Distinguish between in situ and ex situ conservation, giving one example of each.	2

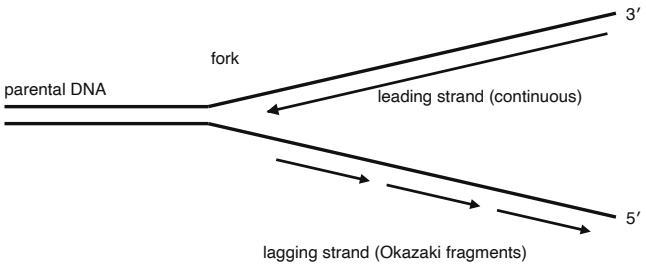
Section C

22.	What is meant by pollen–pistil interaction? Trace the path of a compatible pollen tube from the stigma to the egg apparatus.	3
23.	State one developmental change in the human foetus by (a) the end of the first month, (b) the end of the second month and (c) the end of the first trimester of pregnancy.	3
24.	(a) How do oral contraceptive pills prevent pregnancy? (b) What is “Saheli”? (c) How do copper-releasing IUDs act?	3

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25.	Explain how sex is determined in human beings. Why is it wrong to blame the mother for the sex of the child? How does this differ in birds?	3
26.	Describe the three steps of translation, after the charging of tRNA, in prokaryotes.	3
27.	Describe how HIV multiplies in the human body, leading to AIDS. Name a test used to diagnose it.	3
28.	Describe the steps of decomposition of detritus.	3

Section D

29.	**Case study.** The figure shows a replication fork in a DNA molecule. The two new strands are made in different ways.  (i) Which new strand is made continuously? *[1]* (ii) Which enzyme joins the Okazaki fragments? *[1]* (iii) Why is the lagging strand made in short pieces? *[2]* **OR** (iii) In which phase of the cell cycle does DNA replication take place in eukaryotes? What happens if replication is not followed by cell division? *[2]*	4
30.	**Case study.** In a grassland, the producers fix 20 000 kJ m^{-2} of energy in a year (gross primary productivity), and use 8 000 kJ m^{-2} of it in respiration. (i) Calculate the net primary productivity. *[1]* (ii) What is secondary productivity? *[1]* (iii) If about 10 per cent of the energy passes from one trophic level to the next, how much energy will reach the herbivores and the primary carnivores? *[2]* **OR** (iii) What shape would the pyramid of numbers have for a single large tree, the insects feeding on it and the small birds eating the insects? Explain. *[2]*	4

Section E

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31.	(a) Name the four wall layers of a microsporangium and state the function of any two. (b) What does the sporogenous tissue form? (c) How can pollen grains be stored for years? (d) Name a weed whose pollen causes allergy in India. **OR** (a) Describe the events in the human embryo from fertilisation up to implantation. (b) Name the structures formed from the trophoblast and the inner cell mass.	5
32.	(a) Describe Morgan's experiments with Drosophila that led to the ideas of linkage and recombination. (b) Why did he get different recombination frequencies for different pairs of genes? (c) Who proposed the chromosomal theory of inheritance? **OR** (a) Describe the structure of a nucleosome. (b) Distinguish between euchromatin and heterochromatin. (c) A human diploid cell has 6.6×10^9 bp of DNA. If the distance between two consecutive base pairs is 0.34 nm, find the length of this DNA.	5
33.	(a) Explain the convention for naming restriction endonucleases, taking EcoRI as an example. (b) What is a palindromic nucleotide sequence? Give an example. (c) How are DNA fragments separated, seen and recovered after gel electrophoresis? **OR** (a) Describe the four types of barriers of innate immunity, with one example of each. (b) What is an allergy? Name the antibody and the chemicals involved.	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

1. **(C)** pollen grain. *Working:* The pollen grain (with its vegetative and generative cells) is the male gametophyte.

2. **(B)** synergids. *Working:* Special cellular thickenings at the micropylar tip of the synergids.

3. **(A)** integuments. *Working:* The integuments harden into the protective seed coat.

4. **(D)** when a sperm enters it. *Working:* Entry of the sperm induces completion of meiosis II, forming the ovum and the second polar body.

5. **(A)** endometrium of the uterus. *Working:* The trophoblast attaches to the endometrium.

6. **(B)** syphilis. *Working:* Syphilis is caused by a bacterium; the other three are viral.

7. **(D)** 1 : 1 : 1 : 1. *Working:* A dihybrid test cross: AaBb forms four types of gametes in equal proportion.

8. **(C)** trisomy of chromosome 21. *Working:* An additional copy of chromosome 21.

9. **(A)** tRNA, 5S rRNA and snRNAs. *Working:* Pol I makes the large rRNAs, Pol II makes hnRNA and Pol III makes tRNA, 5S rRNA and snRNAs.

10. **(B)** wings of a butterfly and of a bird. *Working:* Analogous organs: different structures performing similar functions.

11. **(C)** ascariasis. *Working:* Ascaris is an intestinal roundworm.

12. **(D)** anode (positive electrode). *Working:* DNA is negatively charged.

13. **(A)** Both A and R are true, and R is the correct explanation of A. *Working:* 1n + 1n + 1n = 3n.

14. **(B)** Both A and R are true, and R is not the correct explanation of A. *Working:* Both are true, but the fragments form because DNA polymerase works only in the 5′→3′ direction; ligase only joins them.

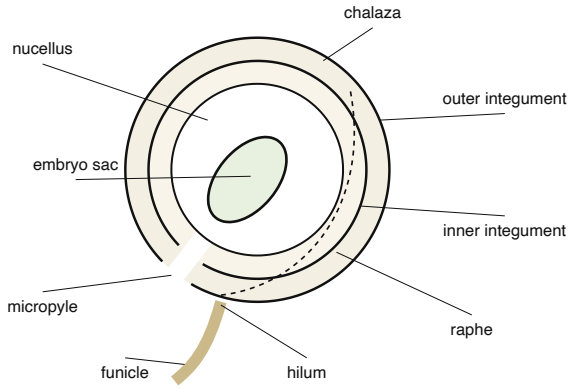
15. **(D)** A is false but R is true. *Working:* A is false: penicillin is produced by the mould Penicillium notatum. R is true.

16. **(C)** A is true but R is false. *Working:* A is true. R is false: energy decreases at each level (only about 10% is passed on), which is why food chains are short.

Section B

17. Labels: funicle, hilum, micropyle, outer and inner integuments, nucellus, embryo sac, chalaza (2), as shown below.

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OR The tapetum is the innermost wall layer of the microsporangium; its cells have dense cytoplasm and generally more than one nucleus (1). It nourishes the developing pollen grains (1).

18. The scrotum keeps the testes at a temperature about 2–2.5 °C lower than the normal internal body temperature (1). This lower temperature is necessary for spermatogenesis (1).

19. Man X (1). Every band of the child must come from either the mother or the father; the child's bands that are not present in the mother match those of man X, not man Y (1).

OR Polymerase chain reaction: amplification of a chosen segment of DNA in vitro using two primers and repeated cycles of denaturation, annealing and extension (1). Taq polymerase, from the bacterium Thermus aquaticus; it is thermostable and stays active at the high temperatures used to denature DNA (1).

20. The use of bio-resources by multinational companies and other organisations without proper authorisation from, and compensatory payment to, the countries and people concerned (1). Example: in 1997 an American company got patent rights on Basmati rice through the US Patent and Trademark Office (1).

OR Genetic Engineering Approval Committee (1). It decides on the validity of GM research and on the safety of introducing GM organisms for public services (1).

21. In situ: protecting species in their natural habitat, e.g. national parks, wildlife sanctuaries, biosphere reserves or sacred groves (1). Ex situ: protecting threatened species outside their natural habitat, e.g. zoological parks, botanical gardens, seed banks or cryopreservation of gametes (1).

Section C

22. The pistil recognises whether the pollen is compatible (of the right type) through a continuous dialogue mediated by chemical components of the pollen and the pistil; it accepts compatible pollen and rejects incompatible pollen by preventing germination or pollen-tube growth (1). A compatible pollen grain germinates on the stigma, producing a pollen tube through a germ pore; the tube grows through the tissues of the stigma and style and reaches the ovary (1). It enters the ovule through the micropyle and then one of the synergids, guided by the filiform apparatus, and releases the male gametes (1).

23. (a) The heart is formed (1). (b) The foetus develops limbs and digits (1). (c) Most of the major organ systems are formed, and the limbs and external genital organs are well developed (1).

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24. (a) They inhibit ovulation and implantation and alter the quality of the cervical mucus to prevent or slow down the entry of sperms (1). (b) A once-a-week, non-steroidal oral contraceptive pill developed by CDRI, Lucknow (1). (c) The copper ions released suppress sperm motility and the fertilising capacity of sperms (1).

25. Females are XX and produce only one type of ovum (X); males are XY and produce two types of sperm, X and Y, in equal proportion (male heterogamety) (1). An ovum fertilised by an X sperm gives a girl and by a Y sperm a boy, so the sex of the child is decided by the father's sperm, not the mother (1). In birds the female is heterogametic (ZW) and the male homogametic (ZZ), so the female gamete decides the sex (1).

26. Initiation: the small subunit of the ribosome binds the mRNA, and the initiator tRNA (carrying methionine) recognises the start codon AUG; the large subunit then joins (1). Elongation: aminoacyl-tRNAs bind codon by codon, peptide bonds form between adjacent amino acids (catalysed by the 23S rRNA, a ribozyme, in bacteria) and the ribosome moves along the mRNA (1). Termination: when a stop codon (UAA, UAG or UGA) is reached, a release factor binds and the polypeptide is released from the ribosome (1).

27. After entering the body, HIV infects macrophages; its RNA genome is copied into viral DNA by reverse transcriptase, which is incorporated into the host DNA and directs the cell to make new viruses, so macrophages act as an HIV factory (1). HIV also enters helper T-lymphocytes (TH cells), multiplies, and the progeny attack more TH cells; their number falls progressively, so the person cannot fight even common infections (1). ELISA (1).

28. Fragmentation: detritivores such as earthworms break detritus into small particles. Leaching: water-soluble inorganic nutrients move down into the soil and get precipitated as unavailable salts (1). Catabolism: bacterial and fungal enzymes degrade the detritus into simpler inorganic substances (1). Humification forms humus, a dark amorphous substance highly resistant to microbial action, which decomposes very slowly and acts as a reservoir of nutrients; mineralisation, the further degradation of humus by some microbes, releases inorganic nutrients (1).

Section D

29. (i) The leading strand.
(ii) DNA ligase.
(iii) DNA polymerase can add nucleotides only in the 5′→3′ direction. On one template (polarity 3′→5′) it can follow the opening fork, but on the other (5′→3′) template it has to work away from the fork, so synthesis occurs in short Okazaki fragments. **OR** In the S phase. If cell division does not follow, the chromosome number increases and polyploidy results.

30. (i) NPP = GPP − R = 20 000 − 8 000 = 12 000 kJ m^{-2} per year.
(ii) The rate of formation of new organic matter by consumers.
(iii) Herbivores: 10% of 12 000 = 1 200 kJ m^{-2}; primary carnivores: 10% of 1 200 = 120 kJ m^{-2} per year. **OR** It would not be upright: one tree (producer) supports a very large number of insects, which support fewer birds, so the base is narrow and the middle broad (inverted or spindle-shaped).

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Section E

31. (a) Epidermis, endothecium, middle layers and tapetum (1). The outer three layers protect the anther and help in its dehiscence to release pollen; the tapetum nourishes the developing pollen grains (1). (b) Each cell of the sporogenous tissue is a potential pollen mother cell, which undergoes meiosis to form a microspore tetrad (1). (c) In liquid nitrogen at −196 °C, in pollen banks (1). (d) Parthenium (carrot grass) (1).

OR (a) The zygote undergoes mitotic divisions (cleavage) as it moves through the isthmus of the oviduct towards the uterus, forming 2, 4, 8, 16 daughter cells called blastomeres (1). The embryo with 8 to 16 blastomeres is a morula (½), which continues to divide and becomes a blastocyst, with an outer trophoblast layer and an inner cell mass (1). The blastocyst becomes embedded in the endometrium; the uterine cells divide rapidly and cover it (implantation) (½). (b) The trophoblast attaches to the endometrium and forms the chorionic villi, which with the uterine tissue form the placenta (1). The inner cell mass differentiates into the embryo (1).

32. (a) Morgan crossed yellow-bodied, white-eyed females with brown-bodied (wild type), red-eyed males and intercrossed the F_1 progeny; the F_2 ratios deviated greatly from the 9 : 3 : 3 : 1 expected for independent assortment (1). Both genes lay on the X chromosome and tended to stay together; he called this physical association linkage, and the generation of non-parental combinations recombination (1). (b) The strength of linkage depends on how close the genes are: tightly linked genes (body colour and eye colour) showed about 1.3% recombination, while loosely linked genes (white eye and miniature wing) showed 37.2% (2). (c) Sutton and Boveri (1).

OR (a) A nucleosome is a histone octamer, made of positively charged histones rich in lysine and arginine, around which negatively charged DNA is wrapped; it contains about 200 bp of DNA (1). Nucleosomes repeat to form chromatin, which appears as “beads-on-string” under the electron microscope; non-histone chromosomal proteins are needed for higher-level packaging (1). (b) Euchromatin is loosely packed, stains light and is transcriptionally active; heterochromatin is densely packed, stains dark and is inactive (1). (c) Length = $6.6 \times 10^9 \times 0.34 \times 10^{-9}$ m (1) ≈ 2.2 m (1).

33. (a) E is the genus (Escherichia), co the species (coli), R the strain (RY13), and the Roman numeral I the order in which the enzyme was isolated from that strain (1½). (b) A sequence that reads the same on the two strands when both are read in the same orientation (5′→3′), e.g. 5′-GAATTC-3′ / 3′-CTTAAG-5′ (1½). (c) Fragments are separated by size in an agarose gel, smaller ones moving farther (½); the gel is stained with ethidium bromide and exposed to UV light, when the DNA shows as bright orange bands (1); the bands are cut out from the gel and the DNA extracted (elution) (½).

OR (a) Physical barriers: skin, and mucus coating the respiratory, gastrointestinal and urogenital tracts (1). Physiological barriers: acid in the stomach, saliva, tears (½). Cellular barriers: leukocytes such as neutrophils and monocytes, natural killer lymphocytes and macrophages (1). Cytokine barriers: virus-infected cells secrete interferons, which protect non-infected cells from further viral infection (½). (b) An exaggerated response of the immune system to certain antigens (allergens) in the environment, such as pollen or dust mites (1). IgE antibodies are produced; mast cells release chemicals such as histamine and serotonin (1).

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