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Your JEE Guide

MP Board Class XII · Biology

Sample Question Paper 4 · Session 2026-27

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

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This is an original practice paper written to the MPBSE 2027 sample question paper pattern; it is not issued by MPBSE.

General instructions:

1. All questions are compulsory.
2. Questions 1 to 5 are objective questions (28 in all): choose the correct option, fill in the blanks, true/false, match the columns and answer in one word or sentence. Each sub-question carries 1 mark.
3. Questions 6 to 12 are very short answer questions of 2 marks each. Answer each in about 30 words.
4. Questions 13 to 16 are short answer questions of 3 marks each. Answer each in about 75 words.
5. Questions 17 to 20 are long answer questions of 4 marks each. Answer each in about 120 words.
6. Internal options are given in questions 13 to 20.
7. Draw neat and labelled diagrams wherever necessary.

1.	**(i)** *Choose the correct option and write it:* After release, the pollen grains of rice and wheat remain viable for about: (a) one week (b) 10 years (c) several months (d) 30 minutes	1
	(ii) The corpus luteum mainly secretes: (a) LH (b) FSH (c) progesterone (d) oxytocin	1
	(iii) In a cross Tt × Tt, the proportion of heterozygous offspring is: (a) $\frac{1}{2}$ (b) 1 (c) $\frac{1}{4}$ (d) $\frac{3}{4}$	1
	(iv) Which of the following diseases is caused by a protozoan? (a) common cold (b) amoebiasis (c) ringworm (d) typhoid	1
	(v) When DNA is isolated from bacterial cells, the cell wall is broken down with: (a) chitinase (b) lysozyme (c) ribonuclease (d) cellulase	1

	(vi) In an ecosystem, the producers are the: (a) herbivores (b) decomposers (c) green plants (d) carnivores	1
2.	**(i)** *Fill in the blanks:* After fertilisation, the ovule develops into the _____.	1
	(ii) The middle piece of a sperm contains many _____, which supply energy for movement.	1
	(iii) Mendel carried out his experiments on the garden _____.	1
	(iv) The start codon AUG codes for the amino acid _____.	1
	(v) Typhoid fever is confirmed by the _____ test.	1
	(vi) Plasmids are small, circular, _____ DNA molecules found in bacteria.	1
3.	**(i)** *Write True or False:* Cleistogamous flowers do not open at all.	1
	(ii) The human egg is fertilised in the uterus.	1
	(iii) Haemophilia is an autosomal disorder.	1
	(iv) Vaccination gives passive immunity.	1
	(v) PCR stands for polymerase chain reaction.	1
	(vi) Parasites always kill their hosts.	1
4.	Match each genetic disorder in column A with its cause in column B:	5

Column A	Column B
(i) Sickle-cell anaemia	(a) XXY sex chromosomes
(ii) Down's syndrome	(b) XO sex chromosomes
(iii) Klinefelter's syndrome	(c) a recessive gene on the X chromosome
(iv) Turner's syndrome	(d) a single base change in the β-globin gene
(v) Haemophilia	(e) trisomy of chromosome 21

5.	**(i)** *Answer in one word or one sentence:* By which agent is Vallisneria pollinated?	1
	(ii) Which hormone causes strong uterine contractions during childbirth?	1
	(iii) How many kinds of gametes does a plant of genotype AaBb produce?	1
	(iv) Who proposed the double helix model of DNA?	1
	(v) Name the main gas present in biogas.	1

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6.	What is parthenocarpy? Give one example.	2
7.	What is implantation? Where and at what stage does it occur?	2
8.	What is a test cross? Why is it done?	2
9.	What are introns and exons?	2
10.	What is an allergy? Name two common allergens.	2
11.	Name one vector used for introducing genes into plants and one into animal cells.	2
12.	What is an ecological pyramid? Name its three types.	2
13.	Describe the structure of a typical anther. **OR** Give three reasons why the formation of seeds is an advantage to flowering plants.	3
14.	What is polygenic inheritance? Explain it using human skin colour. **OR** What is pleiotropy? Explain with the example of phenylketonuria.	3
15.	Name the pathogen of pneumonia. How does it spread and what are its symptoms? **OR** How is cancer detected, and how is it treated?	3
16.	Explain, with the example of the prickly pear cactus in Australia, how predators keep prey populations under control. **OR** Distinguish between commensalism and amensalism, with one example of each.	3
17.	Describe the structure of the human male reproductive system. **OR** Describe the hormonal control of the menstrual cycle, with a graph of hormone levels.	4
18.	Describe the process of DNA replication with the help of a diagram of the replication fork. **OR** Describe the technique of DNA fingerprinting. The DNA fingerprints of a crime-scene sample and two suspects A and B are shown below. Which suspect's DNA matches?	4

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19.	What are transgenic animals? Describe four ways in which they are useful. **OR** What is biopiracy? Why is the Genetic Engineering Approval Committee (GEAC) needed?	4
20.	Explain the species–area relationship, writing its equation. What value of Z is found for very large areas such as whole continents? **OR** Distinguish between national parks, wildlife sanctuaries and biosphere reserves.	4

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Answers and Marking Scheme

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

Question 1

(i) **(d)** 30 minutes. *Working:* Some pollen, e.g. of Rosaceae, stays viable for months.

(ii) **(c)** progesterone. *Working:* Progesterone maintains the endometrium.

(iii) **(a)** $\frac{1}{2}$. *Working:* TT : Tt : tt = 1 : 2 : 1.

(iv) **(b)** amoebiasis. *Working:* Amoebiasis is caused by Entamoeba histolytica.

(v) **(b)** lysozyme. *Working:* Cellulase is used for plant cells and chitinase for fungi.

(vi) **(c)** green plants. *Working:* They make food by photosynthesis.

Question 2

(i) seed.

(ii) mitochondria.

(iii) pea.

(iv) methionine.

(v) Widal.

(vi) extra-chromosomal.

Question 3

(i) True.

(ii) False: fertilisation takes place in the ampullary region of the Fallopian tube.

(iii) False: it is X-linked.

(iv) False: it gives active immunity.

(v) True.

(vi) False: most parasites harm but do not kill their hosts.

4. (i) – (d) a single base change in the β-globin gene; (ii) – (e) trisomy of chromosome 21; (iii) – (a) XXY sex chromosomes; (iv) – (b) XO sex chromosomes; (v) – (c) a recessive gene on the X chromosome

Question 5

(i) Water (hydrophily).

(ii) Oxytocin.

(iii) Four (AB, Ab, aB, ab).

(iv) James Watson and Francis Crick.

(v) Methane.

6. The development of a fruit without fertilisation, giving a seedless fruit (1). Banana (or seedless grapes) (1).

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7. The attachment of the blastocyst to the uterine wall and its embedding there (1). It occurs in the endometrium, at the blastocyst stage (1).

8. A cross between an organism of dominant phenotype and a homozygous recessive one (1). It reveals whether the dominant organism is homozygous or heterozygous (1).

9. Exons are the coding sequences that appear in the mature mRNA (1). Introns are non-coding intervening sequences that are removed by splicing (1).

10. An exaggerated response of the immune system to certain antigens in the environment, involving IgE antibodies and the release of chemicals such as histamine (1). Any two: dust, pollen, mites, animal dander (1).

11. Plants: the Ti plasmid of Agrobacterium tumefaciens (1). Animal cells: a disarmed retrovirus (1).

12. A graphical representation of the relation between trophic levels, with producers at the base (1). Pyramids of number, biomass and energy (1).

13. The anther is bilobed and each lobe has two microsporangia, so it has four in all (dithecous) (1). Each microsporangium has a wall of epidermis, endothecium, middle layers and tapetum (1). The centre has sporogenous tissue, which forms pollen grains (1).

OR Seeds have food reserves for the young seedling (1). They can stay dormant through unfavourable periods and be dispersed to new places (1). Being produced by sexual reproduction, they carry new genetic combinations (1).

14. A trait controlled by three or more genes, each adding a small effect (1). If skin colour depends on three genes A, B and C, AABBCC is darkest and aabbcc lightest (1). Individuals with intermediate numbers of dominant alleles have intermediate shades, giving continuous variation (1).

OR A single gene affecting more than one phenotypic trait (1). In phenylketonuria a mutation in the gene for phenylalanine hydroxylase prevents conversion of phenylalanine (1). This causes mental retardation and reduced pigmentation of hair and skin (1).

15. Streptococcus pneumoniae or Haemophilus influenzae (1). It spreads through droplets or aerosols from an infected person, or by sharing glasses and utensils (1). The alveoli fill with fluid, causing breathing problems, fever, chills, cough and headache; in severe cases the lips and fingernails turn grey to bluish (1).

OR Detection: biopsy and histopathological study of tissue, blood and bone-marrow tests, and imaging such as X-rays, CT and MRI (1½). Treatment: surgery, radiation therapy, chemotherapy, and immunotherapy with biological response modifiers such as α-interferon (1½).

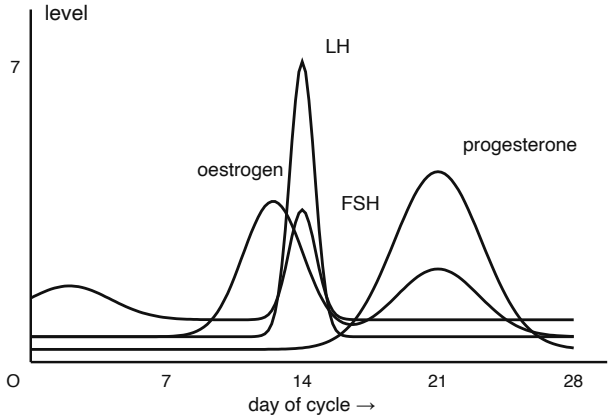
16. The prickly pear cactus, introduced into Australia in the early 1920s, spread rapidly over millions of hectares because it had no natural predator there (1). A cactus-feeding moth was brought from its native area (1). The moth larvae fed on the cactus and brought it under control, showing how predators regulate prey populations (1).

OR Commensalism: one species benefits and the other is unaffected, e.g. an orchid growing on a mango branch (1½). Amensalism: one species is harmed and the other is unaffected, e.g. Penicillium preventing the growth of bacteria (1½).

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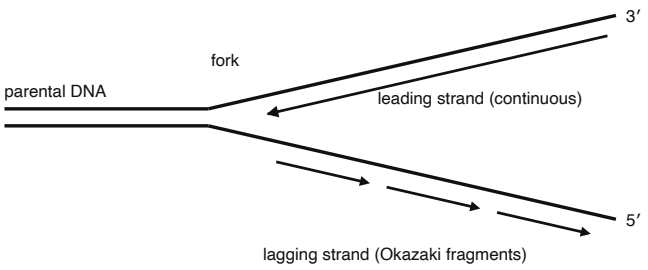
17. A pair of testes in the scrotum, each with seminiferous tubules lined by spermatogonia and Sertoli cells, and Leydig cells between them (1). Accessory ducts: rete testis, vasa efferentia, epididymis, vas deferens and urethra (1). Accessory glands: seminal vesicles, prostate and bulbourethral glands, whose secretions form seminal plasma (1). The penis, the external genital organ (1).

OR Graph (1):



In the follicular phase, FSH and LH stimulate the growth of follicles, which secrete oestrogen that rebuilds the endometrium (1). An LH surge in mid-cycle causes ovulation (1). The corpus luteum secretes progesterone in the luteal phase; without fertilisation it degenerates and menstruation follows (1).

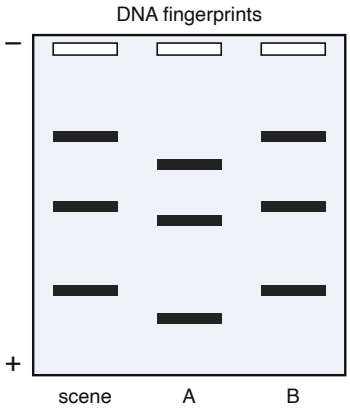
18. Replication begins at the origin, where the strands separate to form a replication fork (1). DNA-dependent DNA polymerase adds nucleotides only in the 5′ → 3′ direction (1). On one template synthesis is continuous (leading strand); on the other it is discontinuous, in Okazaki fragments joined by DNA ligase (1).



Each new molecule has one old and one new strand: semi-conservative (1).

OR DNA is isolated, cut with restriction enzymes and the fragments are separated by electrophoresis (1). They are blotted onto a membrane and hybridised with a labelled VNTR probe; autoradiography shows the band pattern (1). The pattern is different for every individual except identical twins (1).

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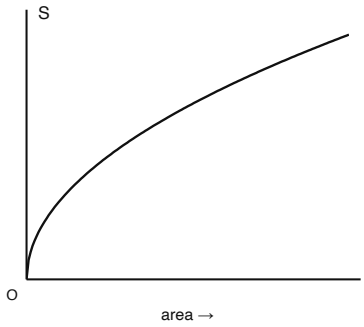


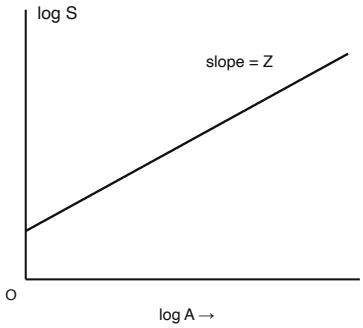
Suspect B: all its bands match the crime-scene sample (1).

19. Animals whose DNA has been altered to carry and express an extra (foreign) gene (1). Studying normal physiology and development; models for human diseases such as cancer and Alzheimer's (1). Producing useful biological products, e.g. α-1-antitrypsin, or Rosie the cow, whose milk contained human α-lactalbumin (1). Testing the safety of vaccines and the toxicity of chemicals (1).

OR The use of bioresources and traditional knowledge of other countries by organisations without proper permission or payment (1). E.g. attempts to patent basmati rice varieties, turmeric and neem uses (1). GEAC decides on the validity of GM research (1) and the safety of releasing GM organisms for public use (1).

20. Alexander von Humboldt observed that species richness increases with the area explored, but only up to a limit (1). $S = CA^Z$, or $\log S = \log C + Z \log A$, where S is species richness, A area, C the intercept and Z the slope (1).





For small regions Z is about 0.1–0.2 (1). For very large areas such as continents Z is much steeper, about 0.6–1.2 (1).

OR National parks protect wildlife and their habitats strictly, and no human activities are allowed (1⅓). Wildlife sanctuaries protect animals, but some human activities such as collecting forest products may be allowed (1⅓). Biosphere reserves have a core zone, a buffer zone and a transition zone, and conserve the whole ecosystem along with local people's ways of life (1⅓).

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