

BIOLOGY – CODE NO. 044
SAMPLE QUESTION PAPER*
CLASS – XII (2026-27)

Maximum Marks: 70

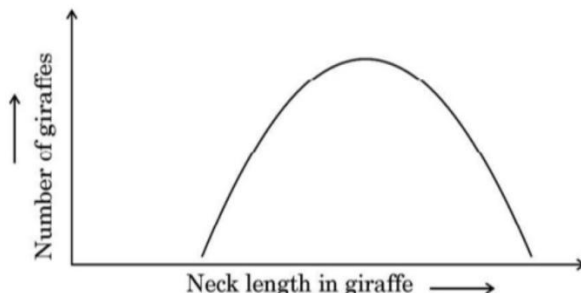
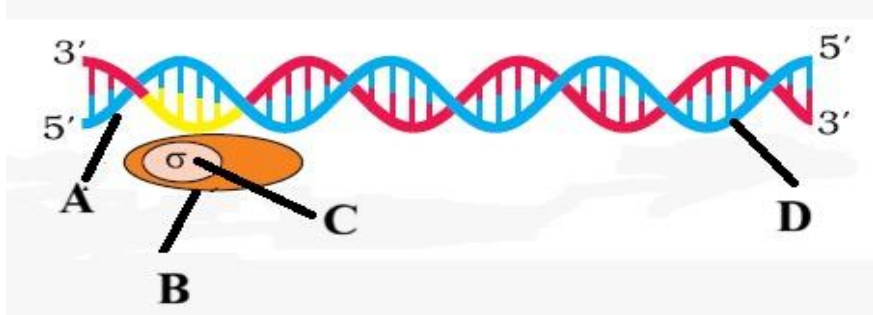
Time: 3 hours

General Instructions:

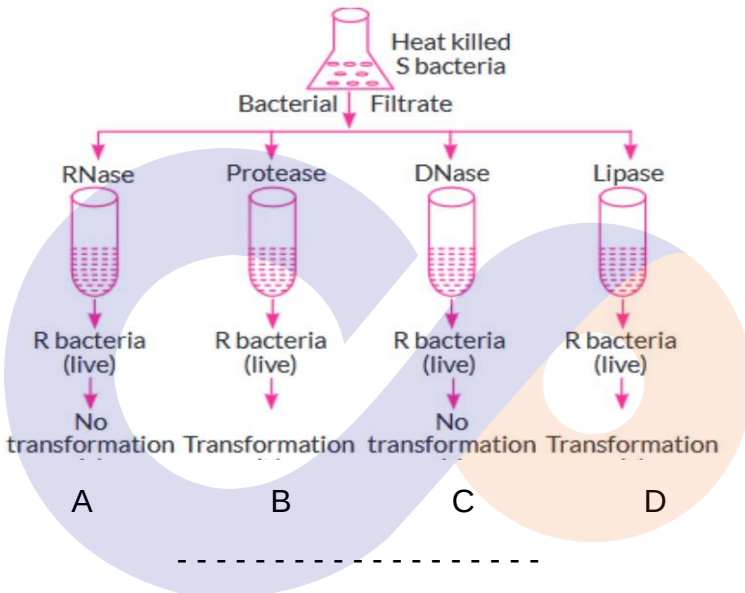
- (i) All questions are compulsory.
- (ii) The question paper has five sections and 33 questions.
- (iii) Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E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

Section – A Q. Nos. 1 to 12 are multiple choice questions. Only one of the choices is correct. Select and write the correct choice as well as the answer to these questions.		
Q. No.	Question	Marks
1	A researcher observes that in a particular flowering plant, the pistil matures several days before the stamens in all flowers of the plant. What is the most significant consequence of this timing difference? A. It guarantees self-pollination B. It promotes autogamy C. It ensures cross-pollination D. It leads to geitonogamy	1
2	A male patient undergoes a medical procedure where a small section of the vas deferens is cut and tied at both ends. Which of the following effects is the intended and direct result of this procedure? A. Blockage of sperm transport into the ejaculatory duct and urethra. B. Inhibition of testosterone production by the testes. C. Suppression of the formation of seminal plasma by accessory glands. D. Prevention of spermatogenesis in the seminiferous tubules.	1
3	During the early stage of human embryonic development, the blastomeres are arranged into an outer layer and an inner group of cells known as the Inner Cell Mass (ICM). What is the fundamental significance of the outer layer, the trophoblast? A. It is responsible for forming the primary germ layers (ectoderm, mesoderm, endoderm).	1

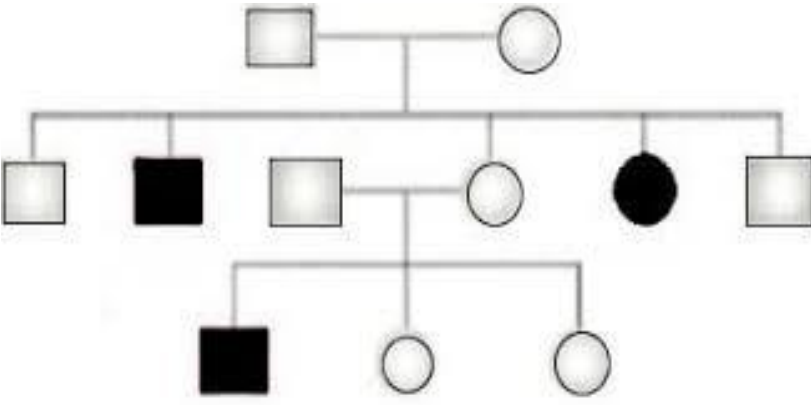
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	B. It provides essential nutrients to developing embryo and helps in its implantation. C. It secretes colostrum which contains antibodies. D. It gives rise to all the organs of the future embryo (organogenesis).	
4	Select the option that gives the correct description of the process of natural selection with respect to the length of the neck of the giraffe.  A. Stabilising selection as giraffes with longer neck lengths are selected further. B. Disruptive selection as giraffes with smaller and longer neck lengths are selected. C. Directional selection as giraffes with longer neck lengths are selected. D. Stabilising selection as giraffes with medium neck lengths are selected. ----- <u>For Visually impaired students</u> Evolution of antibiotic-resistant bacterial population signifies the information that A. Acquired traits are inherited. B. Nature selects for fitness. C. Genetic variations are not a prerequisite factor for natural selection. D. The theory of spontaneous generation of life holds true.	1
5	The initiation step during the process of transcription in bacteria is shown below. Identify A, B, C and D by selecting the option:  A. A-RNA polymerase, B-Promoter, C-Sigma factor, D-DNA helix B. A-Promoter, B-Sigma factor, C-RNA polymerase, D-DNA helix C. A-Promoter, B-RNA polymerase, C-DNA helix, D-Sigma factor D. A-Promoter, B-RNA polymerase, C-Sigma factor, D-DNA helix	1

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	----- <u>For Visually impaired students</u> The promoter site and the terminator site for transcription are located at: A. 3' (downstream) end and 5' (upstream) end, respectively of the transcription unit B. 5' (upstream) end and 3' (downstream) end, respectively of the transcription unit C. the 5' (upstream) end D. the 3' (downstream) end	
6	Given below is the illustration of the different steps of experiments conducted by MacLeod, McCarty and Avery to find the chemical nature of the 'transforming principle' as DNA. Select the option that incorrectly depicts the step of the experiment.  ----- <u>For Visually impaired students</u> In the Griffith experiment, which of the following, when injected into mice, did not cause pneumonia? A. Heat-killed S strain only B. Live R strain only C. Both (A) and (B) D. Live S strain only	1
7	A scientist was culturing <i>E.coli</i> in a $^{15}\text{NH}_4\text{Cl}$ medium initially, then he shifted <i>E.coli</i> to a $^{14}\text{NH}_4\text{Cl}$ medium. The DNA was extracted from <i>E.coli</i> after 60 minutes of transfer to $^{14}\text{NH}_4\text{Cl}$ Medium and performed density gradient centrifugation to check the isotope distribution in newly replicated DNA. What will be the densities of DNA molecules formed? A. 25% hybrid and 75% light B. 50% hybrid and 50% light C. 75% hybrid and 25% light D. 85% hybrid and 15% light	1

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8	Study the given pedigree and identify the disease represented  A. Myotonic Dystrophy B. Sickle cell anaemia C. Haemophilia D. Colour blindness ----- <u>For Visually impaired students</u> If a genetic disease is transferred from a phenotypically normal but carrier female to only some of the male progeny the disease is: A. Autosomal dominant B. Autosomal recessive C. Sex-linked dominant D. Sex-linked recessive	1
9	A patient with fever, chest pain, cough and breathing difficulty undergoes a chest X-ray. The film shows patchy opacities and reduced clarity of lung fields. Which observation best supports pneumonia? A. Enlarged heart size B. Inflammation or fluid buildup in the lungs C. Fractured ribs D. Air pockets in the lungs	1
10	A stretch of an euchromatin has 200 nucleosomes, how many base pairs (bp) will be there in the stretch and what would be the length of the typical euchromatin? A. 20,000 bp and $13,000 \times 10^{-9}$ m B. 10,000 bp and $10,000 \times 10^{-9}$ m C. 40,000 bp and $13,600 \times 10^{-9}$ m D. 40,000 bp and $13,900 \times 10^{-9}$ m	1
11	A biotechnology company grew <i>Streptomyces</i> in a fermenter to produce an antibiotic. It was observed that Day 7 onwards, the actual yield drops sharply, even though nutrient level, temperature, and aeration remain	1

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	unchanged. Also, Microscopy revealed new colonies of bacteria which were not present in the original culture. So the fermenter was stopped. What measures should be taken to prevent the fall in yield in future fermentations? A. Increasing temperature only at the end of fermentation to kill contaminants. B. Adding antibiotics to the culture so unwanted microbes cannot grow. C. Ensuring sterile handling, sterilised equipment, and aseptic transfer before and during fermentation. D. Using a genetically modified strain designed to grow faster than contaminants.	
12	A rice farmer's field, which typically thrives in waterlogged conditions and requires soil rich in nutrients like phosphorus, is experiencing a severe drought this year. The crop is also susceptible to root infestation by pathogens. Which of the following techniques is best to address all these issues? A. Adding nitrogen-fixing bacteria to the soil B. Applying chemical fertilizers C. Adding spores of <i>Glomus</i> to the soil D. Flooding the field artificially to mimic normal conditions	1
Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below: 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.		
13	Assertion (A): Spermatogenesis is an ongoing process throughout the reproductive life of a human male, while oogenesis is a discontinuous process. Reason (R): Oogenesis begins during the embryonic stage, gets arrested at prophase-I, resumes after puberty, and is arrested again at metaphase-II.	1
14	Assertion (A): There is no variation in the percentage recombination due to loosely or tightly linked genes. Reason (R): Linked genes result in occurrence of higher proportion of parental gene combinations.	1
15	Assertion (A): The primary goal of sewage treatment is to eliminate all organic matter from the effluent. Reason (R): High BOD indicates a low level of organic matter in the water, which can lead to increased oxygen consumption by microorganisms, potentially harming aquatic life.	1
16	Assertion (A): Tissue culture is used when traditional breeding technique is insufficient to keep pace with the demand of crop improvement.	1

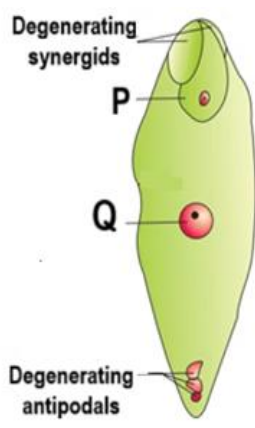
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	Reason (R): Totipotency is the ability of a single plant cell or explant to regenerate into a whole plant under sterile conditions in nutrient media.																															
Section - B																																
17	<u>Attempt either option A or B.</u> A. Geitonogamy can be compared with cross-pollination as well as self-pollination. Comment. OR B. Mohit wants to produce hybrid seeds in a plant in his field in which male and female flowers mature at the same time and are close together. Suggest one strategy to promote only desired cross pollination and justify your answer.	2																														
18	The movement of landmasses over geological time changed the distribution and evolution of animals. Explain this idea using two examples from different regions of the world.	2																														
19	The following is a realistic example dataset and not a real world patient dataset: <table><tr><th>Sample ID</th><th>Tumor size (mm³)</th><th>Glucose level mM/litre</th><th>Oxygen level (mmHg)</th><th>Neighboring cell's viability/vitality (%)</th></tr><tr><td>1</td><td>150</td><td>2.0</td><td>15</td><td>60</td></tr><tr><td>2</td><td>50</td><td>4.5</td><td>30</td><td>85</td></tr><tr><td>3</td><td>200</td><td>1.3</td><td>10</td><td>50</td></tr><tr><td>4</td><td>100</td><td>3.0</td><td>20</td><td>70</td></tr><tr><td>5</td><td>250</td><td>0.9</td><td>7</td><td>40</td></tr></table> A. Interpret the relationship between tumor size and glucose level. B. Evaluate the data to determine how tumor progression may affect the viability/vitality of neighboring cells. Provide a brief explanation.	Sample ID	Tumor size (mm ³)	Glucose level mM/litre	Oxygen level (mmHg)	Neighboring cell's viability/vitality (%)	1	150	2.0	15	60	2	50	4.5	30	85	3	200	1.3	10	50	4	100	3.0	20	70	5	250	0.9	7	40	2
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20	<u>Attempt either option A or B.</u> A. The table below shows hypothetical data comparing α-lactalbumin concentration in three types of milk, including that of Rosie, a transgenic cow designed to express human milk proteins. <table><tr><th>Source of Milk</th><th>α-lactalbumin Content approximately (g/L)</th></tr><tr><td>Normal cow's milk</td><td>0.1</td></tr><tr><td>Rosie cow's milk</td><td>2.4</td></tr><tr><td>Human milk</td><td>3.5</td></tr></table>	Source of Milk	α-lactalbumin Content approximately (g/L)	Normal cow's milk	0.1	Rosie cow's milk	2.4	Human milk	3.5	2																						
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	I. Assuming all other nutritional components are identical, which milk would provide the lowest nutritional contribution from α-lactalbumin?. II. If further genetic modification increases α-lactalbumin levels in Rosie to 3.5 g/L, predict one ethical concern that might arise from such a development. OR B. A farmer replaces the GM crop with a conventional variety. Predict any two challenges she/he may face. Support your answer with two reasons.																																						
21	<u>Attempt either option A or B.</u> A. The table below is a hypothetical data on Seasonal Temperatures seen over two different zones <table><tr><th>Region</th><th>Temp. in Spring (°C)</th><th>Temp. in Summer (°C)</th><th>Temp. in Autumn (°C)</th><th>Temp. in Winter (°C)</th><th>Primary Productivity (GPP) (g/m²/year)</th><th>Respiration (R) (g/m²/year)</th></tr><tr><td>Region X</td><td>27</td><td>28</td><td>27</td><td>26</td><td>3500</td><td>1300</td></tr><tr><td>Region Y</td><td>12</td><td>20</td><td>14</td><td>4</td><td>2000</td><td>800</td></tr></table> I. Justify which region will have greater species diversity based on the given data? II. Calculate the net primary productivity (NPP) of the region mentioned in (I) and give its significance? OR B. Following is a hypothetical data on Plant Pollinator interaction <table><tr><th>Plant</th><th>Main Pollinator</th><th>Seed set (%) with pollinator</th><th>Seed set (%) without pollinator</th></tr><tr><td>P1</td><td>H1 (Bee)</td><td>80</td><td>40</td></tr><tr><td>P2</td><td>H2 (Butterfly)</td><td>75</td><td>45</td></tr><tr><td>P3</td><td>H3 (Moth)</td><td>85</td><td>35</td></tr></table> I. From the data above, justify which plant shows the highest dependence on its main pollinator? II. What kind of ecological interaction is shown in the table above? Define it in one sentence.	Region	Temp. in Spring (°C)	Temp. in Summer (°C)	Temp. in Autumn (°C)	Temp. in Winter (°C)	Primary Productivity (GPP) (g/m ² /year)	Respiration (R) (g/m ² /year)	Region X	27	28	27	26	3500	1300	Region Y	12	20	14	4	2000	800	Plant	Main Pollinator	Seed set (%) with pollinator	Seed set (%) without pollinator	P1	H1 (Bee)	80	40	P2	H2 (Butterfly)	75	45	P3	H3 (Moth)	85	35	2
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Section - C																																							
22	A couple, A and B, visit a fertility clinic. Examination reveals that female A has a blockage in her fallopian tubes, but her ovaries can produce viable ova. Male B produces sperm with a very low sperm count, making natural fertilization unlikely. Which two different Assisted Reproductive Technologies (ARTs) would a doctor	3																																					

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	most likely recommend for this couple to increase their chances of conceiving? Justify your selection by briefly stating the principle behind each chosen technique concerning the couple's specific issues.	
23	In the post-fertilization embryo sac shown in figure, structure 'P' results from the fusion of one male gamete with the egg cell, and structure 'Q' results from the fusion of the other male gamete with the polar nuclei.  Figure: Fertilised embryo sac in a flowering plant A. Identify structure 'P' and structure 'Q' and state their ploidy. B. Evaluate the following statement: "The division of 'P' always precedes the division of 'Q'." Justify your evaluation based on the nutritional requirements for seed development. C. Which characteristic feature of endosperm helps in its nutritive role? ----- <u>For Visually impaired students</u> A. Which two products are formed after double fertilization in the embryo sac of a flowering plant? B. State the ploidy of these two structures. C. Which of these two structures develops first during embryonic development? State its significance.	3
24	In mice, the traits for running ability and hair colour assort independently. Running (R) is dominant over walking in circles (r). Black hair (B) is dominant over brown hair (b). A heterozygous running, brown-haired female mouse was artificially inseminated using sperm from a heterozygous running, heterozygous black male. A. Write the genotypes of both parents and draw a Punnett square showing all possible offspring combinations. (1) B. Using the Punnett square, state the phenotypic ratio for: Running–Black, Running–Brown, Walking–Black, Walking–Brown. (1) C. If 64 offspring were produced, calculate how many would be expected to show the Running–Black phenotype. (1)	3

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25	How can a single gene defect caused by the mutation result in Phenylketonuria (PKU)? Explain the molecular mechanism underlying pleiotropy.	3
26	Drug-use disorders often begin with occasional consumption but may progress into a compulsive state. Analyse how addiction differs from dependence in both origin and consequence, and justify why long-term drug intake forces the user to increase dose over time.	3
27	Pathogens are often considered harmful, yet they have been adapted as powerful tools in genetic engineering. Explain how pathogens have been modified into useful vectors. Describe the role of a similarly modified plant vector and animal vector.	3
28	The nematode <i>Myrmeconema neotropicum</i> lives inside the abdomen of certain tropical ants (<i>Cephalotes atratus</i>). Inside the ant's body, the nematode develops slowly without killing it. Once mature, it changes the color of the ant's abdomen to bright red, making it resemble a berry. Birds, mistaking it for a fruit, eat the ant. The nematode's eggs survive in the bird's digestive system and pass out in droppings, which other ants contact while foraging, starting the cycle again. A. Why would harming the ant too early be disadvantageous for the nematode? (1) B. How is natural selection playing a vital role in maintaining this interaction? (1) C. What kind of ecological interaction is seen between nematode and ant? Define it in one sentence. (1)	3
Section - D		
29	Madhuri, a 17-year-old girl, has been experiencing irregular periods for the past one year. Sometimes, her cycles are as short as 20 days and sometimes as long as 45 days. She occasionally has very heavy bleeding that lasts over a week, causing fatigue and weakness. A doctor reviews her menstrual diary and explains that these changes can be linked to hormonal fluctuations in the hypothalamic-pituitary-ovarian (HPO) axis. He shows Madhuri the lack of a clear ovulation peak and low progesterone levels in her recent cycles. A. Madhuri experiences heavy bleeding lasting over a week causing fatigue. What possible complication could arise from this condition? (1) B. Examine how the absence of a distinct LH (luteinizing hormone) surge in the menstrual cycle might explain both the irregularity and heaviness of Madhuri's periods. (2) <u>Attempt either subpart C or D.</u> C. Madhuri's cycles vary between 20 and 45 days. What might this irregularity indicate about her ovarian function? (1)	4

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	OR D. If a doctor suspects hypothalamic-pituitary dysfunction in Madhuri, which hormone secretion pattern would you expect to be disrupted? (1)	
30	A tribal farmer is cultivating <i>Brassica oleracea</i> (cabbage) in a forest region rich in pollinators and rare butterflies. Recently, his crops have been heavily damaged by cabbage looper caterpillars. To manage the pest outbreak, he applies Nucleopolyhedrovirus (NPV). After a few weeks, the pest population decreases significantly without affecting other insects or animals in the area. A. Justify with reasons why the use of Nucleopolyhedrovirus (NPV) was a suitable choice for controlling cabbage looper caterpillars. (1) B. Suggest another IPM strategy suitable for controlling caterpillar pests, and briefly describe its mode of action. (2) <u>Attempt either subpart C or D.</u> C. Name the group of pathogens to which <i>Nucleopolyhedrovirus</i> belong. (1) OR D. Justify why the use of NPV is considered a biocontrol method. (1)	4
Section - E		
31	<u>Attempt either option A or B.</u> A. A short stretch of DNA strand that codes for a polypeptide is shown below: 3'—TACAAAAGAAGAAAAAGAGATT--5' Due to exposure to harmful UV radiation two different types of errors occurred during DNA replication affecting their sequences of bases in the DNA in two different cells. I. What is the term given to a segment of DNA that codes for a polypeptide? II. Which type of mutation could have occurred in each of the following due to the error during replication? a) 3'-- TACAAAAGAAGAAAAAGAAAATT--5' b) 3'-- TACAAAAGAAGAAAAAGAGATT--5' III. If DNA strand (a) codes for Methionine and sequences of Phenylalanine, mention the sequence of amino acids that will constitute the polypeptide chain after translation. How many amino acids will be translated from this strand? IV. If all the codons of the stretch code for Phenylalanine excluding the initiator codon which feature does it depict? OR B. I. If GUA is an intron how many amino acids will be translated from the mature or processed RNA. Pick out the untranslated region from the following messenger RNA and mention their location and sequence.	5

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	What is its significance? 5'ACGUCGAUGACCGUAGCGUUUGUAUCUUUAGUAGUGGUAAUUA GUAGGCUAAAAA3' II. If AAA is the anticodon of phenylalanine, draw the tRNA adaptor molecule, Mention the position of amino acid Phenylalanine in the sequence of polypeptide counting the triplet codons.	
32	<u>Attempt either option A or B.</u> A. A scientist is screening bacterial transformants engineered with DNA fragments of the β-globin gene. A radioactive DNA probe complementary to the normal β-globin sequence is used. After autoradiography: - Plates A and C show strong and weak radioactive signals respectively. - Plate B shows no radioactivity. Answer the following: - Why does plate B fail to show radioactivity, while A and C do? (2) - How can this experiment help in distinguishing a normal individual, a carrier, and a patient of sickle cell anaemia? (2) - Name one other commonly used technique (apart from autoradiography) to differentiate recombinants from non-recombinants. (1) OR B. A student placed DNA from three different sources: bacteria, plant tissue, and fungal cells in a test tube A, B and C respectively. During the process of isolating and purifying DNA, the student added cellulase to all test tubes. - Predict and explain in which trial(s) DNA isolation would fail, and why? Also suggest how it could be corrected. (2) - After rectifying the mistake made in 'a', outline the steps to obtain visible spooled DNA from the sample. (2) - Suggest one application of the spooled DNA in biotechnology. (1)	5
33	<u>Attempt either option A or B.</u> A. A Green Valley X, home to rare medicinal plants and several migratory bird species, is facing multiple environmental challenges. - A luxury brand of cosmetics with little regulation has been sourcing wild medicinal plants from the valley. - The company has introduced an ornamental grass species from another country, which has taken over large areas of native grassland. - There is also a reported drastic decline in the endemic trees. - Large scale forest fire in a part of the valley. - From the above hypothetical case, identify and explain the four major biodiversity threats. (4) - Suggest one in-situ conservation practice that could help protect the biodiversity of Green Valley X, and justify your choice. (1)	5

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OR

B. At a composting ground, after a community clean-up drive, large amounts of vegetable peels, garden leaves, and other organic waste are piled up. Over the next few weeks, the volume of the waste decreases noticeably.

I. Explain the sequence of processes that could have led to this transformation, and name the major organisms involved at each step. (4)

II. If a prolonged dry spell occurs during this composting period, explain how it could affect the rate of the above processes. (1)



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