

Sample Question Paper

Class XII

Subject: Biology

Max. Marks: 70

Max. Time: 3 Hours

**General Instructions:**

*Read the following instructions carefully and follow them:*

*I. This question paper contains 36 questions. All questions are compulsory.*

*II. This Question Paper has four sections of Section A, B, C, and D.*

*III. Section A has all Multiple-Choice Questions from Q1 to Q14. Each question carries 1 mark and has single correct answer, where you need to choose the most appropriate answer.*

*IV. Section B has Very Short Answer type questions from Q 15 to Q 20. Each question carries 2 marks.*

*V. Section C has Short Answer type questions from Q 21 to Q 28. Each question carries 3 marks.*

*VI. Section D has Long Answer type questions from Q 29 to Q 32. Each question carries 5 marks.*

| S. No.    | Question                                                                                                                                                                                                                                                                                                                                         | Marks |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| SECTION A |                                                                                                                                                                                                                                                                                                                                                  |       |
| 1         | If a cross between two pea plants produced 50% tall and 50% dwarf offspring, the genotypes of the parents must have been:<br>(a) TT x tt<br>(b) Tt x tt<br>(c) TT x Tt<br>(d) Tt x Tt                                                                                                                                                            | 1     |
| 2         | Suppose a highly effective copper-releasing contraceptive device is mistakenly placed in the Fallopian tube instead of the uterus. Which of its primary contraceptive actions would be most significantly reduced?<br>(a) Inhibiting ovulation<br>(b) Making the cervix hostile<br>(c) Suppressing sperm motility<br>(d) Preventing implantation | 1     |
| 3         | Which type of immunity is the body leveraging when a person is injected with pre-formed antibodies (antitoxins) after being bitten by a snake?<br>(a) Natural active immunity<br>(b) Artificial active immunity<br>(c) Natural passive immunity<br>(d) Artificial passive immunity                                                               | 1     |
| 4         | A mutation occurs in the Operator gene of the lac operon such that the repressor protein can no longer bind to it. What would be the immediate and constant consequence on the metabolic activity of E. coli even in the absence of lactose?<br>(a) Transcription of structural genes would be completely shut down.                             | 1     |

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|    | (b) The lac genes would be constitutively expressed.<br>(c) RNA polymerase would bind loosely to the Promoter.<br>(d) The cell would switch to metabolizing glucose.                                                                                                             |   |
| 5  | In the context of Recombinant DNA technology, the enzyme DNA ligase essentially functions by forming which specific type of bond between the foreign DNA and the vector DNA?<br>(a) Hydrogen bonds<br>(b) Ionic bonds<br>(c) Phosphodiester bonds<br>(d) Glycosidic bonds        | 1 |
| 6  | The slope of the Species-Area relationship for a very large geographical area Z value 0.6 to 1.2) suggests that increasing the area will result in a relatively higher increase in:<br>(a) Genetic diversity<br>(b) Species richness<br>(c) Endemism<br>(d) Ecological diversity | 1 |
| 7  | A section of a double-stranded DNA molecule contains 20% Adenine. What is the expected percentage of Guanine in the same section?<br>(a) 40%<br>(b) 30%<br>(c) 60%<br>(d) 10%                                                                                                    | 1 |
| 8  | In a population undergoing Exponential Growth, if the Intrinsic Rate of Natural Increase (r) doubles, the time required for the population size to double will:<br>(a) Also double<br>(b) Remain the same<br>(c) Be halved<br>(d) Increase exponentially                         | 1 |
| 9  | Which of the following is NOT one of the three levels at which Biodiversity is conventionally described?<br>(a) Genetic diversity<br>(b) Species diversity<br>(c) Ecological diversity<br>(d) Population diversity                                                               | 1 |
| 10 | Which of the following layers of the uterus wall undergoes cyclical changes during the menstrual cycle?<br>(a) Perimetrium<br>(b) Myometrium<br>(c) Endometrium<br>(d) Tunica albuginea                                                                                          | 1 |
| 11 | The process of Mineralization during decomposition releases inorganic nutrients into the soil. Which specific microbial action is directly responsible for this final step?<br>(a) Fragmentation<br>(b) Leaching<br>(c) Catabolism<br>(d) Humification                           | 1 |

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| 12        | In a mature, fertilized embryo sac, the structures that are haploid (n), diploid (2n), and triploid (3n), respectively, are:<br>(a) Synergid, Zygote, and Antipodal cell<br>(b) Egg cell, Polar nuclei, and Zygote<br>(c) Synergid, Zygote, and Primary Endosperm Nucleus<br>(d) Antipodal cell, Synergid, and Zygote                                                                                                                                                                                                                                                                                                                                                              | 1 |
| 13        | A medical research team is investigating the hormonal dependence of pregnancy. They administer a drug to a pregnant woman that specifically inhibits the receptors for hCG (Human Chorionic Gonadotropin) during her first month of gestation (pregnancy). What is the most likely and immediate consequence of this intervention?<br>(a) The anterior pituitary would stop secreting LH and FSH.<br>(b) The Graafian follicle would immediately rupture and be released.<br>(c) The developing embryo would fail to implant in endometrium.<br>(d) The Corpus Luteum would degenerate, leading to abortion                                                                        | 1 |
| 14        | The Darwinian concept of 'Survival of the Fittest' refers strictly to an organism's reproductive success in a given natural environment. However, this concept has been historically and socially misused (termed Social Darwinism). The primary ethical and social harm caused by this misapplication has been its use to justify:<br>(a) The modern conservation effort to protect endemic species from extinction.<br>(b) The development of antibiotic resistance in bacterial populations.<br>(c) Social inequality, racial hierarchy, and lack of support for marginalized groups.<br>(d) The process of adaptive radiation following geographic isolation.                  | 1 |
| SECTION B |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |
| 15        | (a) How many functional female gametophytes are formed from 10 Megaspore Mother Cells (MMCs) after megasporogenesis?<br>(b) In the sequential arrangement of parts in an ovule from the outside: Integuments → Nucellus → Embryo sac. What structure is missing between the nucellus and the embryo sac, in terms of its origin?                                                                                                                                                                                                                                                                                                                                                   | 2 |
| 16        | (a) Under what situation does the Hardy-Weinberg principle say that a population will not evolve?<br>(b) After a volcanic eruption, only 15 birds survive on an island. Suggest one innovative way scientists can use this situation to study evolution in real time.                                                                                                                                                                                                                                                                                                                                                                                                              | 2 |
| 17        | ASSERTION (A): To make curd set faster on a cold winter day, one should mix the starter (inoculum) into the milk after slightly warming the milk above room temperature.<br>REASON (R): The Lactobacillus bacteria, responsible for converting lactose sugar into lactic acid and forming the curd, multiply optimally at a specific, warmer temperature and their metabolic activity slows down significantly in cold conditions.<br>Choose the correct option by mentioning the reason behind it.<br>(a) Both A and R are true, and R is the correct explanation of A<br>(b) Both A and R are true, but R is NOT the correct explanation of A.<br>(c) A is true, but R is false. | 2 |

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|             | (d) A is false, but R is true.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |   |
| 18          | <p>(a) Give one reason why Ectotherms are generally absent in the polar regions.</p> <p>(b) Parasitism is viewed as harmful. What is the one crucial ecological role that parasitic microbes and fungi perform that contributes to ecosystem stability?</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2 |
| 19          | <p>ASSERTION (A): The scientist should use the Cryopreservation technique by storing the pollen grains in liquid nitrogen at <math>-196^{\circ}\text{C}</math>.</p> <p>REASON (R): Pollen grains of orchids, unlike the pollen of rice and wheat, often maintain viability for only a short period, typically less than 30 minutes after dispersal.</p> <p>Choose the correct option by mentioning the reason behind it:</p> <p>(a) Both A and R are true, and R is the correct explanation of A.</p> <p>(b) Both A and R are true, but R is NOT the correct explanation of A.</p> <p>(c) A is true, but R is false.</p> <p>(d) A is false, but R is true.</p>                                                                                                                                                                   | 2 |
| 20          | The Human Genome Project (HGP) generated vast amounts of genetic data. State two societal or ethical consequences of making this data publicly available without stringent security protocols.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2 |
| SECTION - C |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |   |
| 21          | <p>(a) In the famous nematode-resistant tobacco plant experiment, which organism was controlled and by what specific silencing mechanism?</p> <p>(b) The Tobacco plant is often chosen for genetic modification to produce pharmaceutical proteins. What is the primary advantage of using a plant as a bioreactor over a bacterial culture?</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3 |
| 22          | Describe the role of Cyclosporin A in organ transplant patients. Why is this drug derived from a fungus and not synthesized chemically?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3 |
| 23          | Why is the statement, "The mother is responsible for the sex of the child," scientifically and socially flawed?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3 |
| 24          | <p>Sickle-cell Anemia is a well-known autosomal disorder caused by a change in a single base pair of the gene encoding the beta-globin chain of haemoglobin. This single change leads to the substitution of the amino acid Glutamic Acid (Glu) by Valine (Val) at the sixth position of the polypeptide chain.</p> <p>(a) Identify the specific type of gene mutation (substitution, insertion, or deletion) that occurs in the DNA base sequence to cause this single amino acid change.</p> <p>(b) Name the codon found on the mRNA for Glutamic Acid (Glu) that is changed to code for Valine (Val) in the defective haemoglobin.</p> <p>(c) What is the consequence of this single amino acid substitution on the final structure of the haemoglobin molecule and, subsequently, the shape of the Red Blood Cell (RBC)?</p> | 3 |
| 25          | You are using the pBR322 vector with tetR (Tetracycline resistance) and ampR (Ampicillin resistance) markers. If you insert a foreign DNA fragment at the BamH I site, explain how you would screen for recombinants using the principle of Insertional Inactivation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3 |

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| 26        | <p>A large fertilizer company is designing a new biological factory to produce ammonia <math>\text{NH}_3</math> under ambient conditions (low temperature and pressure) using microorganisms, mimicking natural processes, instead of the high-energy consuming Haber-Bosch process. They are focusing their research on the specialized enzyme found in Cyanobacteria and Rhizobium.</p> <p>(a) Based on the natural biological process, name the specific chemical conversion that directly yields ammonia <math>\text{NH}_3</math>.</p> <p>(b) Name the key enzyme that the company must successfully isolate and utilize in its low-energy factory, and state why this enzyme poses a major technical challenge due to its sensitivity.</p> <p>(c) After successful industrial production of ammonia, what must the fertilizer company chemically convert the <math>\text{NH}_3</math> into, through a further step, so that the final product is the most stable and readily assimilated form of nitrogen for crops?</p>                                                                                                                                                    | 3     |
| 27        | <p>A public health campaign in a rural area promotes the use of barrier methods for contraception. However, due to low literacy, many people still rely on Lactational Amenorrhea as their primary method. The campaign also advises couples to seek help if they are unable to conceive after one year of unprotected coitus.</p> <p>(a) Give one major advantage of barrier methods over surgical methods from the perspective of STIs.</p> <p>(b) What is the critical limitation of the Lactational Amenorrhea method that makes it a highly unreliable long-term contraceptive choice?</p> <p>(c) Name a specific Assisted Reproductive Technology (ART) technique where the embryo (at the 8-cell stage) is transferred into the Fallopian tube.</p>                                                                                                                                                                                                                                                                                                                                                                                                                       | 3     |
| 28        | <p>The 'Evil Quartet' includes Habitat loss and fragmentation. Explain how the construction of roads or dams (fragmentation) affects large migratory animals more severely than small, stationary organisms.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3     |
| SECTION D |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |
| 29        | <p>A government agricultural research center is facing a strong opposition to the cultivation of Bt cotton and is trying to educate farmers and the public. They explain that the Cry protein produced by the genetically modified plant is highly effective against the cotton bollworm but is completely harmless to humans and livestock. The scientists highlight two major facts:</p> <ol style="list-style-type: none"> <li>1. The Cry gene was converted from a bacterial sequence to a cDNA template before insertion into the plant cell.</li> <li>2. The protein exists as an inactive protoxin in the insect's gut before it begins to kill the pest.</li> </ol> <p>Based on the scenario and your knowledge of biotechnology, answer the following questions:</p> <p>(a) Explain the complete biochemical mechanism of the Bt toxin's action inside the insect's gut after it is ingested. Clearly state the two specific changes that activate the protoxin and the final structural consequence that leads to the death of the insect.</p> <p>(b) Why was the Bt gene first converted into cDNA (Complementary DNA) before being inserted into the plant cell,</p> | 2+2+1 |

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|    | <p>rather than using the original DNA sequence directly from the <i>Bacillus thuringiensis</i> bacterium?</p> <p>(c) Besides cotton, name one other crop variety in India in which the Bt gene has been successfully introduced, and identify the primary insect pest this modification is designed to resist.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |       |
| 30 | <p>Outline the process of DNA Replication in a living cell, highlighting the semi-conservative nature of the process. Name and state the function of the two primary enzymes required for the elongation of the new strand on the leading and lagging templates. Explain the process of Translation (protein synthesis), sequentially describing the two crucial roles performed by the tRNA (Transfer RNA) molecule during this process.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1+2+2 |
| 31 | <p>A population of ground mammals is suddenly split by an impassable canyon: Population A settles on the hot, dry plain, while Population B occupies the cool, resource-rich valley.</p> <p>(a) Hypothesize the most crucial physical and behavioral adaptation likely to evolve in each population due to their divergent selective pressures.</p> <p>(b) Identify the three primary evolutionary forces driving the genetic divergence between text A and B, and explain why Gene Flow is the most immediately critical factor in this scenario.</p> <p>(c) If the canyon disappears and the populations merge, but their offspring die during early embryonic development, what specific mechanism of Post-zygotic Isolation has evolved?</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1+3+1 |
| 32 | <p>A large fertilizer factory is established adjacent to an agricultural region, leading to heavy agricultural and industrial runoff into the nearby Rukmini River. Over time, the river's water turns opaque green, and fishing, a key livelihood for the downstream community becomes impossible due to mass fish mortality. The factory management dismisses the complaints, arguing that the economic production of fertilizer outweighs the loss of an "insignificant" local fish population. Based on the scenario and your knowledge of ecology, answer the following:</p> <p>(a) Identify the primary ecological process caused by the excess runoff of Nitrate and Phosphate from the fertilizer factory. Explain the sequential effect of this nutrient loading on BOD and DO that leads to the death of fish.</p> <p>(b) Name the ecological pyramid (Pyramid of Number, Biomass, or Energy) that would be the most stable representation of energy transfer in the Rukmini River ecosystem before the pollution crisis.</p> <p>(c) Analyse the factory's argument (economic production &gt; fish) using the concept of 'Ecosystem Services'. Argue why the factory is undervaluing a "Broadly Utilitarian" benefit provided by the river before it was polluted. Propose a solution where the factory can demonstrate environmental responsibility by utilizing a natural microbial process on their wastewater before discharge into the river.</p> | 2+1+2 |