

Marking Scheme

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Senior School Certificate Examination, 2025

SUBJECT NAME BIOLOGY

Q.No.	EXPECTED ANSWER / VALUE POINTS	Marks	Total Marks
SECTION - A			
1	(a) TT x tt	1	
2	(d) Preventing implantation	1	
3	(b) Artificial active immunity	1	
4	(b) The lac genes would be constitutively expressed.	1	
5	(c) Phosphodiester bonds	1	
6	(b) Species richness	1	
7	(b) 30%	1	
8	(c) Be halved	1	
9	(d) Population diversity	1	
10	(c) Endometrium	1	
11	(c) Catabolism	1	
12	(c) Synergid, Zygote, and Primary Endosperm Nucleus	1	
13	(d) The Corpus Luteum would degenerate, leading to abortion	1	
14	(c) Social inequality, racial hierarchy, and lack of support for marginalized groups.	1	
SECTION - B			
15	Number of functional female gametophytes (embryo sacs) = 10 (1 functional embryo sac per MMC) Structure missing between nucellus and embryo sac's origin: Megaspore	1 1	2
16	Hardy-Weinberg Principle: A population will not evolve if there is no mutation, no gene flow migration, no genetic drift, random mating, and no natural selection. Innovative way to study evolution: Study Genetic Drift (specifically the Bottleneck Effect or Founder Effect) by tracking allele frequency changes in the small surviving population of 15 birds over generations.	1 1	2
17	Option: Both A and R are true, and R is the correct explanation of A. Reason: The Lactobacillus bacteria multiply and perform optimal metabolism (lactic acid conversion) at a specific, warmer temperature, and their activity slows down significantly in cold conditions.	1 1	2
18	Reason for absence of Ectotherms in polar regions: Ectotherms cannot regulate their body temperature internally; they would be unable to sustain metabolic activity or survive freezing temperatures without an external heat source.	1	2

	Crucial ecological role of parasitic microbes and fungi: They perform Decomposition / Nutrient Recycling / Population Regulation.	1	
19	Option: A is true, but R is false. Reason: Assertion A is correct Cryopreservation is used for pollen. Reason R is incorrect because Orchids typically have short viability (like rice and wheat), but the Cryopreservation technique is not used only because viability is short-lived, but to preserve genetic diversity long-term.	1 1	2
20	Societal/Ethical Consequences: 1. Potential for Genetic Discrimination (e.g., in insurance or employment based on genetic predisposition). 2. Violation of Genetic Privacy and misuse of personal medical/genetic data by third parties.	1 1	2
SECTION - C			
21	Organism controlled and mechanism: Nematode (Meloidegyne incognita) controlled by RNA interference (RNAi) or gene silencing. Primary advantage of plant bioreactor: Plants can perform Post-translational modifications (PTMs) like glycosylation that are often essential for the function of human pharmaceutical proteins, which bacteria cannot perform.	1 2	3
22	Role of Cyclosporin A: It is an immunosuppressive agent. It selectively inhibits the activation and proliferation of T-lymphocytes (-cells), which are responsible for the cell-mediated immune response and organ rejection. Why derived from fungus: It is a secondary metabolite produced naturally by the fungus (Trichoderma polysporum). It is a complex peptide whose chemical synthesis would be highly difficult, complex, and cost-prohibitive compared to fermentation natural production.	1 2	3
23	Scientifically Flawed: The sex of the child is determined by the father's sperm (which carries either X or Y chromosome). The mother always contributes only the X chromosome (XX genotype), so she has no role in determining the gender. Socially Flawed: Blaming the mother is unethical and societally harmful (sensitive judgment). It perpetuates gender bias and reinforces social practices like female foeticide or persecution of women for bearing female children.	1 2	3
24	(a) Type of mutation: Substitution (Specifically, Point Mutation). (b) Codon change: The mRNA codon for Glutamic Acid (Glu) is GAA or GAG. The changed codon for Valine (Val) is GUG. (c) Consequence: The substitution causes the haemoglobin molecule to undergo polymerization and aggregate under low oxygen tension. This distortion changes the RBC shape from biconcave to an elongated sickle-shape, leading to blockages and anemia.	1 1 1	3

25	Principle of Insertional Inactivation: The foreign DNA is inserted at the BamH I site, which is located within the tet^R gene. This insertion inactivates the tet^R gene (it is no longer functional expressed). Screening Steps: 1. All cells are plated on a medium containing Ampicillin (amp^R gene is still functional) → only transformants (both recombinants and non-recombinants) survive. 2. These surviving colonies are then replica plated on a medium containing Tetracycline. → Non-recombinants (intact tet^R) survive. → Recombinants (inactivated tet^R) do not survive/die. 3. The colonies that survived Ampicillin but died on Tetracycline are the desired recombinants.	1 2	3
26	(a) Chemical Conversion: Nitrogen fixation (Conversion of atmospheric N₂ into NH₃) (b) Enzyme and Challenge: Key enzyme is Nitrogenase. The enzyme is highly sensitive to oxygen (O₂); O₂ irreversibly inactivates the enzyme. (c) Chemical conversion step: Ammonia (NH₃) must be converted into Ammonium salts (NH₄⁺) or Nitrates (NO₃⁻) via ammonification nitrification for stable storage and plant assimilation.	1 1 1	3
27	(a) Advantage of barrier methods: They provide protection against STIs (Sexually Transmitted Infections), which surgical methods do not. (b) Critical limitation of Lactational Amenorrhea: It is effective only up to a maximum of 6 months post-parturition (after delivery), AND only if intensive breastfeeding is maintained; its effectiveness rapidly decreases after this time, making it unreliable long-term. (c) Specific ART technique: ZIFT (Zygote Intra Fallopian Transfer).	1 1 1	3
28	Large migratory animals require large territories habitat ranges to find food, mates, and move seasonally. Fragmentation (roads/dams) acts as a physical barrier that divides/splits their habitat, restricting their movement and access to resources. This increases their vulnerability to predation/accidents} (roadkill) or isolation of populations. Small, stationary organisms are less affected as their ecological needs can often be met within the smaller, remaining fragments.	1 1 1	3
SECTION - D			
29	(a) Mechanism of Bt toxin action 1. The insect ingests the Cry protein which exists as an inactive protoxin. 2. The alkaline pH (first specific change) of the insect midgut solubilizes the inactive crystal proteins. 3. Solubilized protoxin is activated by the gut proteases (enzymes) (second specific change) into the active toxin}. 4. The activated toxin binds to specific receptors on the surface of midgut epithelial cells. 5. The toxin creates pores (holes) in the membrane (final structural consequence), causing cell swelling and lysis, leading to the death of the insect. (b) Rationale for cDNA: 1. Bt bacterium is a prokaryote, and its gene lacks introns (non-coding sequences). 2. Plant cells are eukaryotes and possess the cellular machinery to splice out introns from mRNA. 3. If the bacterial DNA was used directly, the plant machinery might	2 2	5

	incorrectly splice the bacterial transcript (mistaking parts for introns), resulting in a non-functional protein. 4. Converting to cDNA (which is intron-free) ensures the correct and functional protein is translated by the plant machinery. (c) Other Crop and Pest: Crop: Bt Brinjal (or Bt Corn etc.). Pest: Fruit and Shoot Borer (or Corn Borer etc.).	1	
30	(a) DNA Replication Process and Semi-conservative Nature: The two parental DNA strands separate (unwind), and each parental strand acts as a template for the synthesis of a new complementary strand. (Semi-conservative: Each daughter DNA molecule ends up with one old (parental) strand and one newly synthesized strand. (b) Enzymes for Elongation: 1. DNA Polymerase III: Catalyzes the polymerization of deoxyribonucleotides along the template in the 5' → 3' direction. 2. DNA Ligase: Joins the Okazaki fragments (on the lagging strand) by forming phosphodiester bonds. (c) Roles of tRNA in Translation: 1. Amino Acid Activation/Transfer: It acts as an adaptor molecule that specifically binds to a particular amino acid (at the 3' acceptor end) and carries it to the ribosome. 2. Codon Recognition: It reads the genetic code on the mRNA through its anticodon loop, which base-pairs with the codon on the mRNA to ensure the correct amino acid is added.	1 2 2	5
31	(a) Hypothesized Adaptations: Population A (Hot, Dry Plain): Physical: Lighter fur color (or less body fat) Behavioral: Nocturnal activity (or burrowing) to escape heat. Population B (Cool, Resource-rich Valley): Physical: Denser darker fur (or larger body size) Behavioral: Diurnal activity (or less aggressive foraging). (b) Evolutionary Forces and Gene Flow: Three Primary Forces: 1. Natural Selection (divergent selection pressures in A and B). 2. Genetic Drift (especially if initial populations are small). 3. Mutation (source of new variation). Gene Flow as Critical Factor: Gene Flow (migration between populations) is the most critical factor because the impassable canyon completely eliminates it. The lack of Gene Flow ensures the genetic differences accumulated due to Selection and Drift are not diluted, thus accelerating speciation. (c) Post-zygotic Isolation Mechanism: Hybrid Inviability (The hybrid zygote/embryo dies during early development).	1 3 1	5
32	(a) Ecological Process and Effect: Process: Eutrophication (Excessive nutrient enrichment of the water body). Sequential Effect: Nutrient loading (Nitrate/Phosphate) causes massive algal bloom (surface growth). As algae die, decomposers (bacteria) consume them, resulting in a sharp increase in BOD (Biochemical Oxygen Demand). This increased consumption of dissolved oxygen leads to a sharp drop in DO (Dissolved Oxygen), causing fish mortality due to asphyxiation. (b) Most Stable Ecological Pyramid: Pyramid of Energy. (It is always upright and accurately reflects energy transfer, unlike Biomass or Number). (c) Analysis using Ecosystem Services and Solution: Analysis (Broadly Utilitarian): The factory undervalues the life-sustaining Ecosystem	2 1 2	5

	Service of Biodiversity (fish population) and the river's natural purification capacity. This is Broadly Utilitarian because the healthy river provides the resource base and ecological stability essential for local livelihoods and the survival of future generations. Propose a Solution: The factory must utilize Microbial Sewage Treatment or Bioremediation (e.g., using activated sludge containing aerobic microbes) in an Effluence Treatment Plant (ETP) to significantly reduce the BOD and nutrient load before discharge into the river.		
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