Pre-Board Examination (2025-26)
Subject-Biology (044)
Class-XII

MARKING SCHEME

Q.No	Answer	Marks
1	B. 5′–AAUGCUAGGCAC–3′	1
2	B. 200 pollen grains, 50 ovules	1
3	B. RNA world	1
4	B. Metastasis	1
5	B. *Dryopithecus* and *Ramapithecus*	1
6	C. Antiretroviral therapy (ART) completely eliminates HIV from the body in the early stages of infection.	1
7	C. 50%	1
8	B. Melanisation in peppered moth	1
9	A. Megaspore mother cell → 4 Megaspores → Functional megaspore → Embryo sac	1
10	B. Methionine	1
11	D. Ori site	1
12	D. fructose, calcium and certain enzymes.	1
13	B. Both A and R are true and R is not the correct explanation of A.	1
14	C. A is true but R is false.	1
15	B. Both A and R are true but R is not the correct explanation of A.	1
16	C. A is true but R is false.	1
17	***Attempt either option A or B.*** A. Advantage: Desired characters are retained in offspring (progeny) as there is no segregation of characters in offspring (progeny). Seed production is assured even in absence of pollinators. They are economical as they can be used to grow crops year after year. *(Any two)* (1) Disadvantage: Cannot control accumulation of deleterious genetic mutation. These are usually restricted to narrow ecological niches and lack ability to adapt to changing environment. *(Any two)* (1) **OR**	2

	B. Dioecy: Male and female flowers are present on different plants, so self-pollination is naturally prevented. (1) Self-incompatibility: Pollen grains from the same plant fail to germinate on its stigma due to genetic mechanisms. (1)	
18	The negatively charged DNA is wrapped around positively charged histone octamers to form nucleosomes. (1) Nucleosomes coil to form chromatin fibres, which further condense into chromosomes, ensuring efficient packaging of DNA inside the nucleus. (1)	2
19	A. The patient is suffering from allergic response (hypersensitivity). Mechanism: High levels of IgE antibodies sensitize mast cells and basophils. On exposure to allergen, these cells degranulate and release histamine, serotonin, etc., causing inflammation and allergic symptoms. (1) B. Anti-histamine, adrenalin and steroid. *(Any two)* (1)	2

20.	***Attempt either option A or B.*** A. The genetically engineered lymphocytes are not immortal; hence the patient requires periodic infusion. (½) There could be a permanent cure if the gene isolated from bone marrow cells producing ADA is introduced into cells at early embryonic stages. (1½) **OR** B. Micro-injection: Recombinant DNA is directly injected into the nucleus of an animal cell. (½ + ½) Biolistic or gene gun: Plant cells are bombarded with high-velocity microparticles of gold or tungsten coated with DNA. (½ + ½) Heat shock: Recombinant DNA is forced into bacterial cells by incubating the cells with recombinant DNA on ice, followed by brief heating at 42°C (heat shock), and then placing them back on ice. (½ + ½) (*Any two*)	2
21.	***Attempt either option A or B.*** A. (i) Region Y (tropical) will have greater biodiversity because there is more solar energy available in the tropics, which contributes to higher productivity; this in turn might contribute indirectly to greater diversity. (1) (ii) Correct Flow chart NCERT (1) --- ***For visually impaired students*** (i) Primary production is defined as the amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis. The primary productivity varies in different types of ecosystems because it depends on the plant species inhabiting a particular area, variety of environmental factors, availability of nutrients and photosynthetic capacity of plants. (1) (ii) Same as above.	2

	OR B. (i) GPP=NPP+R 45000+40367 85367 kJ m–2 year–1 (1) (ii) Net production is gradually reducing as we move from producers to consumers due to 10%law/respiration (1)	
22.	A. Programme: Reproductive and Child Health (RCH) programme / Awareness campaigns. Justification: Provides sex education, counselling, and awareness about safe sex and STI prevention in rural areas. (1) B. Technology: In Vitro Fertilisation (IVF) with embryo transfer. Justification: When fallopian tubes are blocked, fertilisation is done outside the body in lab conditions, and embryo is transferred to the uterus. (1) C. Technique: Amniocentesis. Justification: Foetal cells from the amniotic fluid are collected and tested to detect chromosomal abnormalities or genetic disorders before birth. (1)	3
23.	A. Fate of sperms 'P', 'Q', and 'R' - Q & R: Fail to penetrate the zona pellucida/corona radiata. (½) P: Successfully penetrates and fuses with the plasma membrane of the ovum (successful fertilizing sperm). (½) B. Role of zona pellucida -Acts as a barrier that allows only one sperm to enter, ensuring species-specific binding and prevention of polyspermy. (½) C. Changes in ovum after entry of sperm = Completion of meiosis II of secondary oocyte to form ovum and second polar body. (½) Cortical reaction → zona pellucida hardens, blocking entry of additional sperms (prevents polyspermy). (½) Male and female pronuclei fuse, initiating zygote formation. (½) --- ***<u>For visually impaired students</u>*** The signals for parturition originate from the fully developed foetus and the placenta which induce mild uterine contractions called foetal ejection reflex. (1) This triggers release of oxytocin from the maternal pituitary. (1) Oxytocin acts on the uterine muscle and causes stronger uterine contractions, which in turn stimulates further secretion of oxytocin. (½) The stimulatory reflex causes stronger and stronger contractions ultimately causing expulsion of the baby out of the uterus through the birth canal – parturition. (½)	3
24.	The cross is FfBb × FfBb, where *F* = long fur, *f* = short fur, *B* = black coat, and *b* = brown coat. We need the probability of obtaining offspring with short fur (ff) and brown coat (bb), i.e., genotype ffbb. Step 1: Gametes Each parent can produce four types of gametes: FB, Fb, fB, fb. (½)	3

	Step 2: Punnett Square (1½) | Gametes → ↓	FB	Fb	fB	fb
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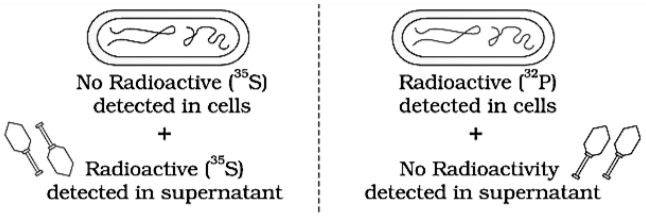
FB	FFBB	FFBb	FfBB	FfBb
Fb	FFBb	FFbb	FfBb	Ffbb
fB	FfBB	FfBb	ffBB	ffBb
fb	FfBb	Ffbb	ffBb	ffbb | Step 3: Result • Only 1 out of 16 boxes shows the ffbb genotype. • Therefore, the probability of obtaining an offspring with short fur and brown coat is: Probability=1/16 (1)	
25.	A. Hardy – Weinberg Equilibrium. p2 + 2pq + q2 = 1 (½) AA + 2Aa + aa = 1 -Since Frequency of grey snakes in the population = 9% = 9 /100=0.09 q2 = .09 q = 0.3 (½) -Since p + q = 1 p = 1 – q p = 1 – 0.3 -p = 0.7 -The frequency of homozygous dominant (AA) is equal to p2 = 0.49 (½) Or the % frequency of homozygous dominant = 49% -The frequency of heterozygous dominant (Aa) is equal to 2pq = 2 *0.7 * 0.3 = 0.42 Or % frequency of Aa = 42% (½) B. Natural selection (1) --- ***<u>For visually impaired students</u>*** A. The fossils are the remains of past organisms preserved in sedimentary rocks/Different aged rock sediments contain fossils of different life forms, who died during the formation of the particular sediment. Fossils provide a chronological record of past life forms, depicting changes overtime. (1) (B) Oparin and Haldane proposed that life originated on earth spontaneously from non-living matter through chemical processes, i.e. organic molecules. SL Miller conducted an experiment, which provided experimental evidence for chemical evolution. He created conditions similar to primitive atmosphere, in the laboratory such as high temperature, reducing atmosphere consisting of CH_4, NH_3, etc. When he created an electric discharge in the flask containing all the above stated components at 800°C, organic molecules, e.g. amino acids were formed. Results indicated that the first non-cellular forms of life were created about 3 billion years ago. (2)	3
26.	Composition of biogas: It mainly contains methane (50–70%), carbon dioxide (30–40%), and small amounts of hydrogen, nitrogen, and hydrogen sulphide.	3

	(1½) Methanogenic archaea and correct explanation (1½)	
27.	RNAi is a gene-silencing mechanism where double-stranded RNA (dsRNA) prevents the expression of a specific gene. (1) The dsRNA is processed into small interfering RNAs (siRNAs), which bind to complementary mRNA and degrade it, preventing translation. (1) In plants, RNAi is used to develop resistance against nematodes (e.g., *Meloidegyne incognitia/Meloidogyne incognita*) by introducing DNA sequences that produce dsRNA of nematode genes, thus silencing them.(1)	3
28.	A. a and d represent increase of population and b and c represent decrease of population. (1) B. N(t+1)= Nt +[(B+I) - (D+E)] (½) C. Here, Nt = 30; I=5; E=7; D=6; B=8 Putting the value in : N(t+1)= Nt + [(B+I) - (D+E)] N(t+1)= 30+[(8+5) - (6+7)] N(t+1)= 30+[13-13] N(t+1)= 30+0 N(t+1)= 30 rats (1) D. Immigration contributes the most. (½) --- ***For visually impaired students*** A. For example, sparrow is primary consumer when it eats seeds and secondary consumer when feeds on insects and worms (1) B., C. and D. same as above.	3
29.	A. One primary spermatocyte → 4 spermatozoa One primary oocyte → 1 functional secondary oocyte (1) B.(i) R (Corpus luteum) is responsible Corpus luteum secretes progesterone, which maintains endometrium for pregnancy (ii) Event: Q (Release of secondary oocyte during ovulation**)** (2) ***Attempt either subpart C or D:*** C**.** LH acts at the Leydig cells and stimulates synthesis and secretion of androgens. Androgens, in turn, stimulate the process of spermatogenesis. (1) **OR** D. Spermatogenesis is initiated at puberty in human males. Oogenesis is initiated at foetal / embryonic stage in human females (1)	4

30	A. During the initial time, i.e. at the first 1 hour of alcohol consumption, the concentration of alcohol will be highest in blood. As the time increases like after few hours of alcohol consumption, the concentration of alcohol will keep on decreasing in blood. (1) B. Addiction is a psychological attachment to certain effects –such as euphoria and a temporary feeling of well-being–associated with alcohol. (½) These drive people to take them even when these are not needed, or even when their use becomes self-destructive. (½) With repeated use of drugs, the tolerance level of the receptors present in our body increases. (½) Consequently the receptors respond only to higher doses of drugs or alcohol leading to greater intake and addiction. (½) ***<u>Attempt either subpart C or D:</u>*** C. The body processes the alcohol at its average rate of approx. one ounce per hour. Liver. (1) **OR** D. Drop in academic performance, unexplained absence from school/college, lack of interest in personal hygiene, withdrawal, isolation, depression, fatigue, aggressive and rebellious behaviour, deteriorating relationships with family and friends, loss of interest in hobbies, change in sleeping and eating habits, fluctuations in weight, appetite, etc. (*Any two*) (1) --- ***<u>For visually impaired students</u>*** A. Alcohol provides calories like other nutrients but does not provide growth, maintenance and repair supporting nutrients like carbohydrates, proteins, vitamins etc. (1) B. Same as above. ***<u>Attempt either subpart C or D:</u>*** C. Dependence is the tendency of the body to manifest a characteristic and unpleasant withdrawal syndrome if regular dose of drugs/alcohol is abruptly discontinued. (1) **OR** D. Same as above.	4
31	A.  (2) B. Bacteria that were infected with viruses that had radioactive proteins were not radioactive. This indicates that proteins did not enter the bacteria from the viruses. (1) Bacteria which were infected with viruses that had radioactive DNA were radioactive, indicating that DNA was the material that passed from the virus to the bacteria. DNA is therefore the genetic material that is passed from virus to bacteria. (1)	5

	C. ^{32}P is radioactive and if hypothetically ^{15}N is radioactive, then its presence would be seen both inside the cell as it gets incorporated in the DNA as a nitrogenous base and also as a supernatant as it gets incorporated in the amino acids. (1) --- ***For visually impaired students*** A. When lactose is absent, *i* gene regulates and produces repressor mRNA which translates into repressor protein which binds to the operator region of the operon and prevents RNA polymerase to bind to the operon and the operon is switched off. (2) B. Same as above. C. Same as above. **OR** A. Contribution of Meselson and Stahl They proved the semi-conservative model of DNA replication using *E. coli* grown in ^{15}N medium and transferring to ^{14}N medium, then analyzing DNA density by CsCl density gradient centrifugation. Result: Each new DNA molecule had one old (parental) and one new (daughter) strand. (1½) B. Building blocks: dNTPs supply nucleotides (A, T, G, C) required for the synthesis of the new DNA strand. (½) Energy source: Breaking of high-energy phosphate bonds of dNTPs provides energy for polymerisation. (½) Enzyme: DNA polymerase uses dNTPs to elongate the DNA strand in the 5′ → 3′ direction. (½) C. (i) X = Leading strand (½) Y = Lagging strand (Okazaki fragments) (½) (ii) Strand Y is synthesised in fragments (Okazaki fragments) because DNA polymerase works only in the 5′ → 3′ direction, which is opposite to the fork opening. (1) --- ***For visually impaired students*** A and B as above C.(i) Expressed Sequence Tags (ESTs) This method focuses on identifying all the genes that are expressed as RNA. (½) Sequence annotation - This method involves the sequencing of whole set of genome (that contained all coding and non-coding sequence) and then assigning different regions in the sequence with functions. (½) (ii) YAC - Yeast Artificial Chromosomes. (½) (iii) Chromosome 1. (½)	
32.	A. Bacterium: *Escherichia coli* (½) Source of several restriction endonucleases (e.g., EcoRI, HindIII) (½) Significance: Used to cut DNA at specific recognition sites for cloning (½) B. Treating the bacterial cells with the enzymes such as lysosome to remove the cell wall. (½)	5

	RNA can be removed by treating them with ribonuclease and proteins are removed by treating them with enzymes proteases. (1) Finally chilled ethanol is added to precipitate the purified DNA. (½) (C) (i) Resistance to tetracycline lost (½) (ii) The recombinants will grow in ampicillin containing medium but not on that containing tetracycline. But, non recombinants will grow on the medium containing both the antibiotics. (1) **OR** (A) Principle: DNA fragments migrate under electric field through agarose gel due to the sieving effect of agarose gel according to size (smaller fragments move faster and farther). (1) (B) Diagram with any four labellings: wells, agarose gel, cathode, anode, DNA bands (2) (C) Visualization - bright orange coloured bands of DNA visible in ethidium bromide stained gel exposed to UV light (1) Recovery: cutting and eluting DNA from gel (1)	
33.	A. Predators prevent dominance of one species, maintain diversity (e.g., *Pisaster* starfish) (1) B. Prey adaptations: camouflage, mimicry, chemical defence, alarm calls (e.g., Monarch butterfly) (1) C. Parasites reduce host health/reproduction (e.g., *Plasmodium, Cuscuta*) (1) D. Example: Orchids growing on mango trees get space and light (benefit), while the tree is neither harmed nor benefited. In commensalism, one partner benefits and the other remain unaffected.(1) E. Example: Orchid *Ophrys* flower resembles female bee in shape and colour; male bee attempts pseudocopulation → pollination achieved. (1) *(Any other correct answers with examples)* **OR** A. Interaction: Brood parasitism (1) Co-evolution: Host (crow) evolves ability to reject dissimilar eggs; parasite (cuckoo) evolves resemblance to escape rejection. (1) B. (i) Deer, since it is closest to its carrying capacity. (1) (ii) 10000x10%=1000; New population size = 11000 (1) (iii) Populations rarely exceed K due to resource limitation, competition, predation, disease, or accumulation of waste**.** (1)	5

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