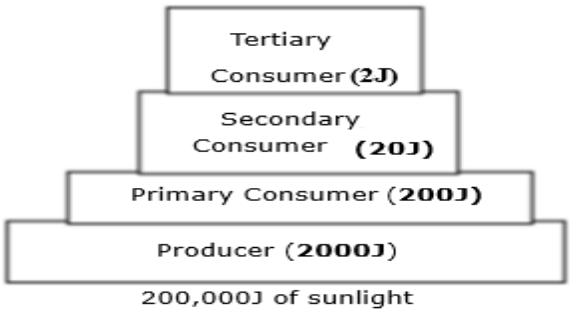
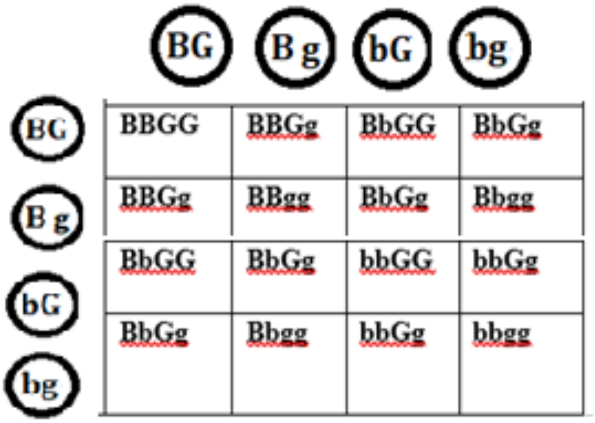
BIOLOGY Code no. 044
MARKING SCHEME
CLASS – XII (2025–26)

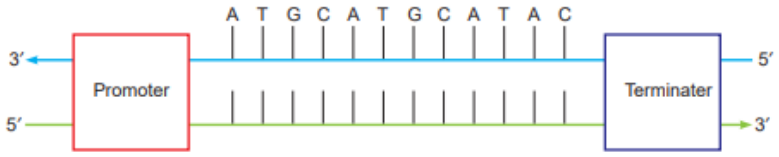
Q. No.	Answer	Marks
	Section - A	
1	C. Mitotic division of nucleus of generative cell	1
2	B. A male gamete and two polar nuclei	1
3	C. FSH and LH	1
4	C. Frederick Griffith	1
5	A. Probes	1
6	C. Hardy-Weinberg principle says that phenotype frequencies in a population are stable and are constant from generation to generation.	1
7	B. 25%	1
8	D. The leg mutation might lead to reproductive isolation and speciation due to an effect on the mating call.	1
9	D. Sporozoites, Liver infection, Erythrocyte infection, Gametocytes	1
10	B AUGAGACGGACUGCAUUCCCAACCUGA	1
11	A. Lysozyme, ribonuclease, protease, chilled ethanol	1
12	C. Both I and II	1
13	C. A is true but R is false	1
14	A. Both A and R are true and R is the correct explanation of A	1
15	A. Both A and R are true and R is the correct explanation of A	1
16	C. A is true but R is false	1
	Section - B	
17	A. It is achieved by emasculation and bagging techniques. If the female parent bears bisexual flowers, removal of anthers from the flower bud before the anther dehisces using a pair of forceps is necessary. This step is referred to as emasculation. Emasculated flowers have to be covered with a bag of suitable size, generally made up of butter paper, to prevent contamination of its stigma with unwanted pollen. This process is called bagging. (1 x 2 = 2) **OR** B. In pea plants, manual emasculation is easier and pollen grains are viable for months as it belongs to Leguminosae. In wheat flowers (spikelets) pollen grain loses its viability half an hour after release. (1 x 2 = 2)	2

18	In a transcription unit, the activity of RNA polymerase at a given promoter is regulated by accessory proteins that have an ability to recognise start sites. (1) These regulatory proteins can act both positively (activators) and negatively (repressors) with the operator which is adjacent to the promoter in an operon unit. (1)	2
19	A. Innate immunity/ non-specific type of defense/immunity present at the time of birth is effected. It provides different types of barriers to the entry of the foreign agents into our body/destroys microbes/ prevents microbial growth. (1) B. Cellular barrier-monocytes is with least count and it can phagocytose and destroy microbes. (1)	2
20	Anyone who can use/modify any living organism or their products using technology is considered to be a biotechnologist. (1) Thus, cheese maker can be a biotechnologist as he uses microbes like bacteria, fungi to make cheese for commercial purpose (1) **OR** Selection of recombinants due to inactivation of antibiotics is a cumbersome procedure because it requires simultaneous plating on two plates having different antibiotics. (1) In insertional inactivation method, insertion of recombinant DNA within the coding sequence of the enzyme beta galactosidase results into inactivation of this enzyme and the colonies do not produce any colour. The presence of a chromogenic substrate gives blue coloured colonies in absence of an insert. (1)	2
21	A. (i) The first (upright) pyramid of biomass corresponds to a terrestrial ecosystem. Producers have maximum biomass, decreasing with herbivores (primary consumer), secondary consumer and tertiary consumer. Second (inverted) pyramid refers to a small standing crop of phytoplankton supporting a large standing crop of zooplankton/aquatic ecosystem. (1) (ii)  (1) - - - - - - - - - - - - - - - - - - - *For Visually impaired students* (Answer same as (i) and (ii) above) **OR** B.	2

	(i) 3000+1300+427+427+378= 5532 (1) (ii) (a) Animals are mobile and can migrate to escape harsh conditions or explore new areas. (b) Animals have adapted to changing environments, developing complex nervous systems and receptors. Their responses are adaptive and ensure survival. Iii. Plants, being fixed, have fewer evolutionary adaptations for water, minerals, and sunlight. (Anyone, 1)	
Section – C		
22	(i) Condoms; these act by blocking the entry of microbes and sperms in the cervix. (ii) Surgical methods such as Tubectomy by her or vasectomy by her husband as these are highly effective but irreversible methods. (iii) Oral pills containing progestogens or progestogen – estrogen combination are very effective and can be repeated as long as the female derives to prevent conception. (1 x 3 =3)	3
23	(i) (a) ovum is haploid (n) and (c) – blastomeres are diploid(2n). (ii) If the trophoblast (L) does not attach to the endometrium properly, it can lead to implantation failure, pregnancy loss, and other pregnancy complications. (iii) In case X, the cells of these embryos will have identical genome as they have developed from the same zygote. (1 x 3 =3) - - - - - - - - - - - - - - - - - - - <u>*For Visually impaired students*</u> • The mitotic division called cleavage starts as the zygote moves through the isthmus of the oviduct towards the uterus and forms 2,4,8,16 daughter cells called blastomeres. The embryo with 8 to 16 cell blastomeres is called a morula. (1) • The morula transforms into blastocyst and the blastomeres in the blastocyst are arranged into an outer layer called trophoblast and an inner group of cells attached to trophoblast called the inner cell mass. (1) • The trophoblast layer then gets attached to the endometrium of the uterus and the inner cell mass gets differentiated as the embryo. After attachment, the uterine cells divide rapidly and cover the blastocyst which gets embedded in the endometrium leading to implantation. (1)	3
24	BbGg Male is crossed with BbGg female which are both heterozygous of both the characters for eye and coat colour. (1)	3

	 Punnett square (1) 1/16 or 6.25 % - blue eyes and white coat (1)	
25	A. These animals exhibit convergent evolution, structures that are not anatomically similar are evolved to perform similar functions adapted to the same habitat, the fins of Salmon and Shark, flippers of Dolphins, Seals and whales. One can say that it is the similar habitat that has resulted in selection of similar adaptive features in different groups of organisms but toward the same function: hence, analogous structures are a result of convergent evolution. (2) B. Ichthyosaurs. Some of the land reptiles went back into water to evolve into fish like reptiles probably 200 mya. (1) - - - - - - - - - - - - - - - - - - - *For Visually impaired students* A. Both Lamarck and Darwin believed that living things had hereditary traits, traits they could pass on to their offspring. They believed that some traits were more useful than others, and that over time the more useful trait would become more common. (1) The difference is that Lamarck believed that the changes in an organism experienced during its life could be passed on to succeeding generations/Inheritance of acquired characters. So, for instance Giraffe stretched its neck its entire life to eat leaves on tall plants, it would have longer-necked offspring (or any other example of Lamarckian theory). (1) Darwin believed that small, random and gradual genetic variations followed by natural selection lead to evolution- that some giraffes just naturally had longer necks, and these were the ones who had more children. So over time natural selection led to evolution of Giraffes with long neck were fitter than short-necked. (1)	3
26	'Flocs' and 'activated sludge' in sewage treatment help to reduce the BOD. (i) Flocs: These are masses of bacteria held together by slime and fungal filaments to form mesh-like structures. These are used during the secondary sewage treatment in the aeration tank to increase the rate of decomposition. The microbes digest a lot of organic matter, converting it into microbial biomass and releasing a lot of minerals. As a result, the	3

	BOD of sewage is reduced. As the BOD of waste is reduced to 1% of raw sewage. it is passed into the settling tank. In these tanks, flocs are allowed to undergo sedimentation. (ii) Activated sludge: The sediment of the settling tank is called activated sludge. A part of it is used as an inoculum in aeration tanks. The remaining part is passed into a large tank called an anaerobic sludge digester. In these tanks, anaerobic microbes are present that digest the organic mass as well as aerobic microbes of activated sludge. The remaining sludge is used as manure or compost.	
27	ELISA-Enzyme Linked Immunosorbent Assay. (1) ELISA is based on antigen-antibody interaction. (1) The ways to detect the presence of infection or disease by ELISA are as follows: The presence of antigens (proteins, glycoproteins, etc.) is detected. / Antibodies produced against the pathogens are detected. (1)	3
28	1950 – Expanding - The population structure in 1950 exhibits a broad-based pyramid with a wider base, indicating a higher percentage of young individuals. This suggests a population with a higher birth rate. (1) 2007 – Stable - The narrowing of the pyramid towards the top signifies a lower proportion of elderly individuals. By 2007, the population was more stable with the number of pre reproductive and reproductive age nearly being the same. Bell shape indicates static population. (1) 2050– Declining - By 2050 urn shaped pyramid shows a declining population where birth rates are very less and the populations of elderly people will increase. (1) - - - - - - - - - - - - - - - - - - <u>*For Visually impaired students*</u> Answer same as above	3
Section – D		
29	A. One embryo sac is present in each ovule and one egg is present in each embryo sac when the embryo sac is developed from a single megaspore. (1) B. (i) P exhibits polyembryony due to occurrence of more than one embryo in a seed. Embryos developed from nucellar cells by apomixis, a form of asexual reproduction, don't show genetic variation. (1) (ii) Cells of embryos developed from diploid nucellar cells are diploid (2n) as these are formed by apomixis, a form of asexual reproduction. (1) <u>*Student to attempt either subpart C or D.*</u> C. Q, because this fruit is developed without fertilisation and will thus be seedless. (1) **OR** D. Fruit S is a true fruit with seeds. True fruits develop from the ripened ovary after fertilisation and fertilised ovules mature into seeds. (1)	4

30	A. Passive immunity – Ready made antibodies from colostrum / less effective / transient / no memory cells involved Active Immunity – Made by host's immune system/ Lag phase/ memory based/ largely effective. (1) B. Active immunity. As the vaccine contains a weakened or inactivated form of the pathogen (microbe), which is harmless but still recognized by the immune system as foreign. The immune system responds by activating lymphocytes, which produce specific antibodies to fight the pathogen. This process also leads to the creation of memory cells, which provide long-term protection by "remembering" to fight this pathogen if the person is exposed again. (2) *Attempt either subpart C or D.* C. This passive immunity peaks at day 1 and declines as the calf ag as the antibodies are used up to develop immunity against diseases/no memory. (1) **OR** D. Active immunity is slow, and it takes time to give its full effective response. (1) - - - - - - - - - - - - - - - - - - - *For Visually impaired students* Same answers as given in parts A - D.	4
Section – E		
31	A.  B. (2) • Transcription in eukaryotes involves one of three types of polymerases, depending on the gene being transcribed. RNA polymerase II transcribes all of the protein-coding genes, whereas RNA polymerase I transcribes rRNA genes, and RNA polymerase III transcribes rRNA, tRNA, and small nuclear RNA genes. (1) • The primary transcripts contains the coding region, exon, and non-coding region, intron, hnRNA undergoes a process where the introns are removed and exons are joined to form mRNA by the process called splicing. (1) • The hnRNA undergoes two additional processes called capping and tailing. In capping, an unusual nucleotide, methyl guanosine triphosphate, is added to the 5′-end of hnRNA. In tailing, adenylate residues (about 200–300) are added at 3′-end in a template independent manner. (1) - - - - - - - - - - - - - - - - - - - *For visually impaired students* A. If both strands act as a template, they will code for RNA molecules with	5

different sequences as complementarity does not mean the strands are identical and hence, the sequence of amino acids in the proteins would be different. Hence, one segment of the DNA would be coding for two different proteins, and this would complicate the genetic information transfer machinery. (1)

The two RNA molecules if produced simultaneously would be complementary to each other, hence would form a double stranded RNA. This would prevent RNA from being translated into protein and the exercise of transcription would become a futile one. (1)

B. Transcription in eukaryotes involves one of three types of polymerases, depending on the gene being transcribed. RNA polymerase II transcribes all of the protein-coding genes, whereas RNA polymerase I transcribes rRNA genes, and RNA polymerase III transcribes rRNA, tRNA, and small nuclear RNA genes. (1)

The primary transcripts contain the coding region, exon, and non-coding region, intron, hnRNA undergoes a process where the introns are removed and exons are joined to form mRNA by the process called splicing. (1)

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OR

A. Aminoacylation is the process by which amino acids become activated by binding with its aminoacyl tRNA synthetase in the presence of ATP. If two charged tRNAs come close during translation process the formation of peptide bond between them is energetically favourable. (1)

B. The cellular factory responsible for synthesising proteins is the ribosome. In its inactive state it exists as two subunits: a large subunit and a small subunit. When the small subunit encounters an mRNA the process of translation of the mRNA to protein begins. There are two sites in the large subunit for subsequent amino acids to bind to and thus be close enough to each other for the formation of a peptide bond. The ribosome also acts as a catalyst 23S rRNA in bacteria is the enzyme-ribozyme for the formation of peptide bonds. (2)

C. ARGININE, THREONINE, HISTIDINE, LEUCINE, PROLINE, GLYCINE, PROLINE PROLINE, PROLINE, LEUCINE SERINE (1)

Stop codon UGA/UAG/UAA (1)

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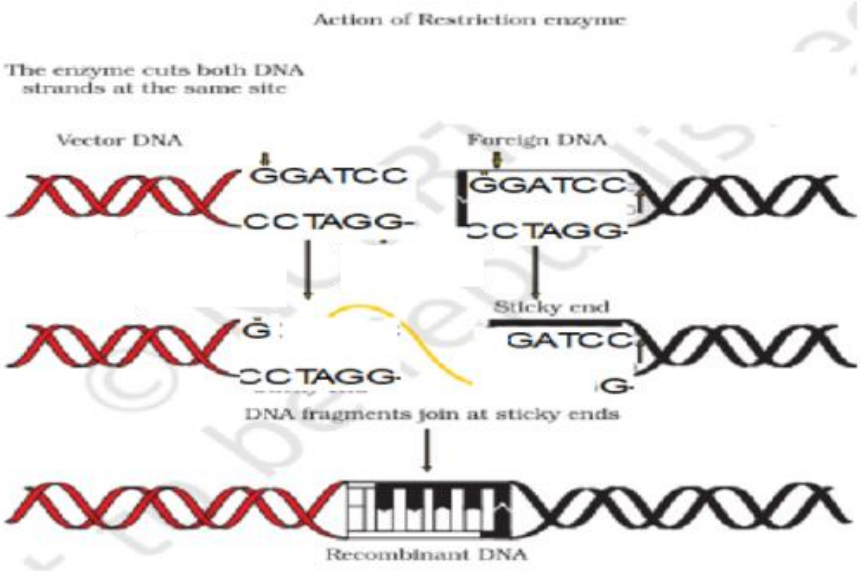
For visually impaired students

A and B as above

C. Insertion or deletion of one or two bases changes the reading frame from the point of insertion or deletion. Such mutations are referred to as frame-shift mutations. Insertion or deletion of three or multiple of three bases does not alter the frame. However, the mutation takes place. This proves that codon is a triplet and it is read in a contiguous manner. (2)

32	A. Retrovirus in animals and *Agrobacterium tumefaciens* can transform normal cells into cancerous cells/*Agrobacterium tumefaciens* is responsible for causing crown gall disease/ it can transfer its T-DNA to transform normal plant cell into tumorous cells (1). They are used as cloning vectors to deliver desirable genes into animal/plant cells. (1) B. restriction enzyme and ligase. (1). C. (i) Biolistic/ gene guns can be used. The plant cells are bombarded with high velocity micro particles of gold or tungsten coated with DNA. (1) (ii) the cry gene will create Bt toxin inside the pest which will get activated in the alkaline gut of the pest and cause the gut epithelial lining to disintegrate. (1) **OR** A. 5' - GGATCC - 3'. 3'- CCTAGG-5' (1) B. drawing and labelling (2)  C. If ampicillin is added, the bacteria will show resistance as the gene is intact and will survive; if tetracycline is added, the bacteria will die as it will show insertional inactivation/ gene is not functional owing to insertion of the gene of interest in the tetracycline region of selectable marker. (2)	5
33	A. Totally unrelated species could also compete for the same resource. For instance, in some shallow South American lakes, visiting flamingoes and resident fishes compete for their common food, the zooplankton in the lake. (1) B. Resources need not be limiting for competition to occur; in interference competition, the feeding efficiency of one species might be reduced due to the interfering and inhibitory presence of the other species, even if resources (food and space) are abundant. (1) C. Gause and other experimental ecologists believed when resources are limited the competitively superior species will eventually eliminate the other species. The Abingdon tortoise in Galapagos Islands became	5

extinct within a decade after goats were introduced on the island, apparently due to the greater browsing efficiency of the goats. (1)

D. One such mechanism is 'resource partitioning'. If two species compete for the same resource, they could avoid competition by choosing, for instance, different times for feeding or different foraging patterns. MacArthur showed that five closely related species of warblers living on the same tree were able to avoid competition and co-exist due to behavioural differences in their foraging activities. (1)

E. A species whose distribution is limited to a smaller area because of the presence of a competitively superior organism, is found to increase its range when the competing species is experimentally removed. For example, in the coasts of Scotland the superior barnacle (*Balanus*) dominates the intertidal region and excludes the smaller barnacle from that zone. (1)

OR

A. Food chain and the first law of thermodynamics. The solar energy trapped by the plants is transformed to chemical energy through the process of photosynthesis. When the plants are consumed by the animals, the organic matter (chemical energy) is transferred to the animal, some amount of this organic matter is lost as heat through the process of respiration. Death of the producers or consumers will result in the organic matter getting transferred to detritivores. As demonstrated, energy is not created nor destroyed but transformed from one form to another. (2)

B. Greater diversity is seen in regions closer to equator/ tropics (latitudinal range of 23.5° N to 23.5° S) harbour more species. (1)

Reasons for this greater diversity are: (Any two reason)

- Speciation is generally a function of time, unlike temperate regions subjected to frequent glaciations in the past, tropical latitudes have remained relatively undisturbed for millions of years and thus, had a long evolutionary time for species diversification
- Tropical environments, unlike temperate ones, are less seasonal, relatively more constant and predictable. Such constant environments promote niche specialisation and lead to a greater species diversity
- There is more solar energy available in the tropics, which contributes to higher productivity; this in turn might contribute indirectly to greater diversity. (2, any two)

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