



BK BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
SENIOR SECONDARY CO-ED DAY CUM BOYS' RESIDENTIAL SCHOOL
MID TERM EXAMINATION 2024-25
BIOLOGY MARKING SCHEME (044)



Date: 25/09/2024

Max. Marks: 70

SECTION-A

1. (d) 2 thecae, 4 sporangia 1
2.

	Number of cells at chalazal end	Number of cells at micropylar end	Number of nuclei left in central cell	
(b)	3	3	2	1
3. (c) Estrogen secretion increases. 1
4. (b) Completion of meiosis II. 1
5. (c) IUT 1
6. (d) Aa x aa 1
7. (d) (i), (ii) and (iv) 1
8. (b) It is a single stranded DNA. 1
9. (a) Lysine and Arginine 1
10. (a) Common set of functions in groups of different ancestry. 1
11. (d) AIDS 1
12. (c) A-iv, B-iii, C-ii, D-i 1
13. (b) Both A and R are true, and R is not the correct explanation of A. 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) True Fruits: Develop from the ovary after fertilization. Example: Mango. 1
False Fruits: Develop from parts other than the ovary, such as the receptacle. Example: Apple.
- b) Perisperm: Nutritive tissue in seeds, derived from the nucellus. Example: Black Pepper. 1
Pericarp: The wall of the fruit developed from the ovary, consisting of three layers (exocarp, mesocarp, endocarp). Example: Mango.
18. 1. Use contraceptives. ½ X4
2. Regular STD screenings.
3. Maintain monogamous relationships
4. Educate about safe sex practices
19. Mother: Carrier (XX^C), Father: Normal (XY) ½ X 4
Offspring: X^CY (Color blind son)
Sex of Child: Male
20. Homologous Organs: These are organs that have the same basic structure and origin but may perform different functions. Example: The forelimbs of humans, wings of bats, and flippers of whales are homologous organs. They have similar bone structures but are adapted for different functions like grasping, flying, and swimming. 2

Analogous Organs: These organs perform similar functions but have different structures and origins. Example: The wings of birds and the wings of insects are analogous organs. They both help in flying but have different structural designs and evolutionary origins.

21. Bioactive Molecules: These are molecules that have an effect on living organisms, tissues, or cells. They are often used in pharmaceuticals, nutraceuticals, and agriculture. Examples: Penicillin: An antibiotic used to kill bacteria. 1

OR

Use of Biofertilisers

Biofertilisers are substances that contain living microorganisms which, when applied to seeds, plants, or soil, promote growth by increasing the availability of nutrients. They are an eco-friendly alternative to chemical fertilizers and help in sustainable agriculture.

SECTION-C

22. (a) Corn: Pollinated by wind (anemophily). Adaptations include lightweight pollen that is easily carried by the wind and long feathery stigmas to catch the pollen. 1
(b) Water Hyacinth: Pollinated by insects (entomophily). Adaptations include brightly colored flowers and nectar to attract insects. 1
(c) Vallisneria: Pollinated by water (hydrophily). Male flowers detach and float on water to reach the female flowers. 1
23. (a) Scrotum: Maintains the temperature of the testes slightly lower than body temperature, which is necessary for sperm production. 1
(b) Leydig Cells: Located in the testes, these cells produce testosterone, the male sex hormone. 1
(c) Male Accessory Glands: Include seminal vesicles, prostate gland, and bulbourethral glands. They produce seminal fluid that nourishes and protects sperm. 1
24. Contraceptive Methods
Barrier Methods: Such as condoms, which prevent sperm from reaching the egg. 1
Hormonal Methods: Such as birth control pills, which regulate or stop ovulation. 1
Intrauterine Devices (IUDs): Placed inside the uterus to prevent fertilization or implantation. 1
25. Chromosomal Theory of Inheritance 1
Chromosomal Theory: Proposed by Sutton and Boveri, it states that genes are located on chromosomes, and the behavior of chromosomes during meiosis accounts for inheritance patterns.
Linkage and Recombination 2
Linkage: Genes located close together on the same chromosome tend to be inherited together.
Recombination: The process by which linked genes can be separated during meiosis due to crossing over, leading to genetic diversity.
26. (a) The Tasmanian wolf, or thylacine, evolved through convergent evolution, where it developed similar traits to wolves due to similar environmental pressures, despite not being closely related. 1
(b) Process: Convergent evolution. 1
(c) Comparison: Both animals developed similar body structures and hunting behaviors, but they belong to different taxonomic groups (marsupials vs. placental mammals). 1
27. Transcription Process: Initiation, Elongation and Termination (explanation) 3

OR

Repetitive DNA: Consists of sequences that are repeated multiple times in the genome.

Satellite DNA: A type of repetitive DNA that forms large arrays of tandem repeats and is often found in centromeres. VNTR (Variable Number Tandem Repeats) are useful in genetic fingerprinting.

28. A biogas plant uses anaerobic digestion to convert organic waste into biogas (a mixture of methane and carbon dioxide) and biofertilizer. The plant consists of an inlet for organic waste, a digester where microbes break down the waste, and an outlet for the biogas and slurry (biofertilizer). Biogas can be used for cooking, heating, or electricity generation, while the slurry is used as a nutrient-rich fertilizer. (A diagram should be drawn to show the components of a biogas plant.)

SECTION-D

29. (a) If the active site of permease is blocked by an inhibitor, lactose cannot be transported into the bacterial cell. Without lactose entering the cell, the lac operon will not be induced because lactose (or its isomer allolactose) is needed to inactivate the repressor protein that binds to the operator region. This means the genes for β -galactosidase, permease, and transacetylase will not be expressed, preventing lactose metabolism.
- (b) Impact of Abnormal Repressor: If the repressor protein is abnormal, it may either fail to bind to the operator (leading to constitutive expression of the operon, even in the absence of lactose) or bind permanently (preventing operon expression even when lactose is present). In either case, lactose metabolism will be disrupted.
- (c) Operon Expression in the Presence of Galactose: No, the operon will not be expressed. The lac operon is specifically responsive to lactose (or allolactose, its inducer). Galactose does not act as an inducer for the lac operon. Therefore, in the presence of only galactose, the operon remains repressed and the genes responsible for lactose metabolism will not be transcribed.

OR

Negative Regulation of Lac Operon:

Mechanism: In the absence of lactose, the repressor protein is active and binds to the operator, preventing the transcription of the operon. When lactose is present, it binds to the repressor, causing a conformational change that inactivates the repressor, allowing transcription to proceed. This is an example of negative regulation because the default state is repression until an inducer (lactose) inactivates the repressor.

30. (a) Farmers prefer biofertilisers because they are eco-friendly, sustainable, and improve soil health without causing environmental harm. Unlike chemical fertilizers, biofertilisers enhance soil fertility by increasing nutrient availability, promoting microbial activity, and reducing soil degradation.
- (b) Anabaena: A cyanobacterium fixes atmospheric nitrogen into a form that plants can absorb, enriching the soil with essential nutrients.
- Mycorrhiza: A symbiotic association between fungi and plant roots. Mycorrhiza enhances nutrient and water absorption by increasing the surface area of roots and helping plants access nutrients.
- (c) Enzyme: Streptokinase.
- Importance in Medical Science: Streptokinase is used as a clot-busting drug in the treatment of myocardial infarction (heart attack) and other conditions involving blood clots.
- (d) Genus: Baculoviruses belong to the genus *Nucleopolyhedrovirus*.
- Role in Integrated Pest Management (IPM): Baculoviruses are used as biological control agents in IPM programs. They are specific to insects and are harmless to plants, animals, and

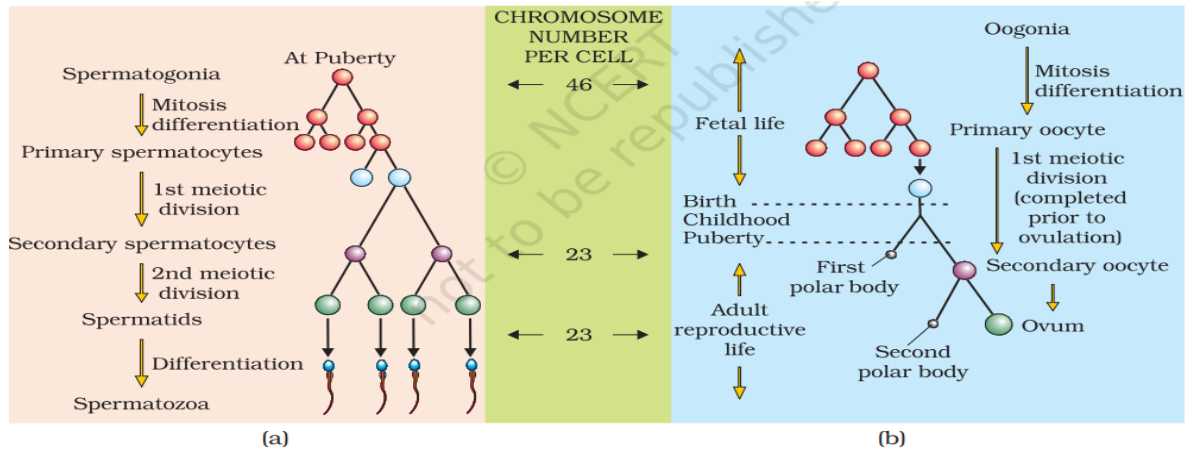
humans. Baculoviruses infect and kill insect pests, reducing the need for chemical pesticides and helping maintain ecological balance in agricultural systems. Name the genus to which baculoviruses belong. Describe their role in the integrated pest management programmes.

OR

Lactic acid bacteria (LAB) play a crucial role in human health beyond curd production. They are used in the fermentation of various foods, enhancing flavor, texture, and nutritional value. LAB produce inhibit harmful bacteria, and they help maintain a healthy gut microbiome, improving digestion and boosting immunity.

SECTION-E

31.



5

Figure 3.8 Schematic representation of (a) Spermatogenesis: (b) Oogenesis

OR

Parturition is induced by a complex neuroendocrine mechanism. The signals for parturition originate from the fully developed foetus and the placenta which induce mild uterine contractions called foetal ejection reflex. This triggers release of oxytocin from the maternal pituitary. Oxytocin acts on the uterine muscle and causes stronger uterine contractions, which in turn stimulates further secretion of oxytocin. The stimulatory reflex between the uterine contraction and oxytocin secretion continues resulting in stronger and stronger contractions. This leads to expulsion of the baby out of the uterus through the birth canal – parturition.

32.

(a) Chemical nature of the coat 'A' - Protein

1

(b) The enzyme 'B' is reverse transcriptase. It acts on 'X', which is the viral RNA, to produce molecule 'C', which is complementary DNA (cDNA).

2

Macrophages

(c) Macrophages and T cells

1

(d) HIV: Human Immunodeficiency Virus

1

AIDS: Acquired Immunodeficiency Syndrome

OR

(a) Some viruses, known as oncogenic viruses, cause cancer in humans by integrating their genetic material into the host cell's genome, which can lead to the activation of oncogenes or inactivation of tumor suppressor genes, resulting in uncontrolled cell division.

(b) Benign tumors turn malignant when they acquire mutations that allow them to invade surrounding tissues and metastasize to other parts of the body. Malignant tumors harm the body by destroying normal tissues, disrupting organ function, and spreading to vital organs, which can be fatal.

(c) Cancer can be detected and diagnosed through various methods, including imaging techniques like MRI and CT scans, biopsy and histopathological examination, blood tests for tumor markers, and molecular diagnostic tests.

(d) Cancer treatment options include surgery to remove tumors, chemotherapy to kill cancer cells, radiation therapy to target and destroy cancerous tissue, and immunotherapy to boost the body's immune response against cancer.

33. (a) Sickle cell anemia is named for the characteristic sickle or crescent shape of the red blood cells in affected individuals, which results from a mutation in the hemoglobin gene. 1
2

(b) Sickle cell anemia is caused by a point mutation in the gene encoding the β -globin chain of hemoglobin, where the amino acid glutamic acid is replaced by valine at position 6. This mutation causes hemoglobin molecules to stick together under low oxygen conditions, leading to the formation of sickle-shaped cells. 2

(c) If both parents are carriers (heterozygous, HbA HbS) of the sickle cell trait, there is a 25% chance with each pregnancy that they will have a child with sickle cell anemia (HbS HbS).

Result: 1 normal (HbA HbA), 2 carriers (HbA HbS), 1 sickle cell anemic (HbS HbS).

OR

(a) Cause and Effect of Thalassemia: Thalassemia is caused by mutations in the genes responsible for the production of hemoglobin chains (α or β globin). The effect is the reduced synthesis of one of the hemoglobin chains, leading to anemia, fatigue, and other complications due to the destruction of red blood cells. 3

(b) Phenylketonuria (PKU) is a genetic disorder caused by a deficiency of the enzyme phenylalanine hydroxylase, which converts the amino acid phenylalanine into tyrosine. The accumulation of phenylalanine in the body leads to intellectual disability, seizures, and other neurological problems if not managed by a strict diet low in phenylalanine. 2