SUGGESTED MARKING SCHEME
SEPTEMBER 'VACCINE' 2024
SECTION A

Q	Answer	Q	Answer	Q	Answer	Q	Answer
1	D	11	A	21	A	31	A
2	B	12	D	22	C	32	C
3	C	13	B	23	D	33	D
4	D	14	C	24	D	34	B
5	C	15	B	25	A	35	A
6	B	16	C	26	A	36	D
7	D	17	D	27	A	37	C
8	A	18	B	28	C	38	B
9	D	19	A	29	A	39	D
10	D	20	A	30	B	40	B

SUMMARY: A: 11 B: 9 C: 8 D: 12

SECTION B

41. (a)
- DNA polymerase synthesizes new DNA strands by adding new nucleotides**;**
- Following the base pairing rules (A-T, G-C)/ complementary to the template strands in the 5' to 3' direction **;**

(b)
- Prokaryotic DNA is circular, while eukaryotic DNA is linear.
- Eukaryotic DNA has proteins/ histone wrapped around, while prokaryotic DNA lacks these proteins.

(c)
- While the overall base composition of their DNA is similar, the specific sequence of nucleotides determines the proteins that are produced.
- These proteins, in turn, influence the development, structure, and function of an organism.

42. (a)
(i) Generator potential is a graded change in membrane potential in sensory receptors that varies with stimulus strength, while **action potential** is a rapid, all-or-nothing electrical impulse that travels along a neuron, triggered when the membrane potential reaches a threshold.

(ii) Visual acuity is the sharpness/ clarity of vision, indicating the ability to see fine details, while **visual sensitivity** is the ability to detect low levels of light and perceive dim objects.

(b)
- When the sympathetic nerves are cut, the heart rate decreases, indicating that the sympathetic nervous system normally increases heart rate [by releasing neurotransmitters like norepinephrine, which stimulate the heart].
- When the parasympathetic nerves are cut, the heart rate increases, suggesting that the parasympathetic nervous system, [through the vagus nerve], slows down the heart rate by releasing acetylcholine.

(c)
- The graph suggests that when the sympathetic nervous system is stimulated, for instance, during physical activity to meet the increased demand for oxygen and nutrients, the heart rate increases.
- When the sympathetic nerve is cut, the heart rate returns to a lower level, suggesting that the sympathetic nervous system is primarily responsible for increasing heart rate during exercise.

43.
(a) Ecosystem: A natural unit comprising living organisms and their physical environment interacting to maintain a self-sustaining system.

(b) Energy transfer in a food chain is inefficient due to:
- Heat loss/ Organisms use energy for metabolic processes, releasing heat as a byproduct.
- Undigested material/ Some food is not fully digested and excreted, losing energy.
- Energy used for life processes/ Organisms use a substantial part of the energy they consume for reproduction, and maintenance, which reduces the energy available to the next trophic level.

(c) Human activities affect energy flow in terrestrial ecosystems by:
(i) Deforestation, pollution, and climate change can reduce primary productivity by affecting plant growth and photosynthesis.
(ii) Overhunting, habitat destruction, and invasive species can disrupt consumer populations, affecting energy flow through the food chain.
(iii) Pollution and habitat destruction can reduce decomposer activity, slowing down the recycling of nutrients and affecting energy flow.

44. (i) Isolating mechanism: Any factor that prevents different species or populations from interbreeding and producing fertile offspring.
These mechanisms can be prezygotic (occurring before fertilization, such as temporal or behavioural isolation) or postzygotic (occurring after fertilization, such as hybrid invariability or sterility).

(ii) Allele frequency: Allele frequency is the relative proportion of a specific allele (variant of a gene) within a population. It is expressed as a fraction or percentage of the total number of alleles for that gene in the population.

(b) Three causes of allele frequency change in a population include:
Natural selection: Favouring certain alleles that enhance survival and reproduction, leading to changes in their frequencies.
Genetic drift: Random fluctuations in allele frequencies due to chance events, especially in small populations.
Gene flow: The movement of alleles between populations through migration, which can introduce new alleles or alter existing allele frequencies.
Mutation: Changes in the DNA sequence that can create new alleles.

(c) How isolating mechanisms operate:
- **Prezygotic barriers:** These prevent mating or fertilization.
  - E.g., temporal isolation: Species may breed at different times.
  - Behavioural isolation: Differences in mating rituals or behaviours (e.g., specific calls or dances that attract only certain mates).

- **Postzygotic barriers:** These occur after fertilization but prevent the development of viable, fertile offspring.
  - E.g., Hybrid inviability: Hybrid embryos may not develop properly or fail to reach maturity.
  - Hybrid sterility: Hybrids may be viable but sterile (e.g., mules, the offspring of a horse and donkey), preventing further gene flow between the species.

45.
(a) (i)
- By having a tracheal system that directly delivers oxygen to cells and removes carbon dioxide.
- This system has a network of tubes that extends throughout the body, ensuring efficient gas exchange.

(ii)
- By using gill lamellae with a large surface area and a thin epithelium, allowing for efficient diffusion of gases between the water and the blood.
- Countercurrent flow, where water flows in the opposite direction to blood, maximizes the exchange of gases.

(b) (i)
- The wall between alveoli is thin and surrounded by capillaries to facilitate efficient gas exchange.
- This structure allows for rapid diffusion of oxygen from the alveoli into the blood and carbon dioxide from the blood into the alveoli.

(ii)
- The wall between alveoli is elastic to enable ventilation movements.
- This elasticity allows the alveoli to expand and contract during inhalation and exhalation, ensuring adequate airflow and gas exchange.

(c)
- The higher surface area-to-volume ratio in smaller mammals than larger mammals increases heat loss to the environment.
- To compensate for this heat loss, smaller mammals need to generate more heat through increased metabolic activity.

(d) Many small animals exhibit faster respiratory and heart rates, allowing for quicker oxygen uptake and distribution throughout the body.

46.
(a) (i) Curve A represents the digestion of carbohydrates.
Carbohydrate digestion starts in the mouth, when salivary amylase digests starch to form maltose, indicated by curve **A** decrease in the mouth.

(ii) Curve B represents the digestion of protein.
Only proteins are digested in the stomach, by the enzyme pepsin to form polypeptides. This slow digestion is reflected in the gradual decline of undigested protein along the stomach.

(iii) Curve C represents the digestion of fats. Fat digestion begins in the small intestine with the enzyme lipase digesting fats to form fatty acids and glycerol.

(b)
- Pancreatic amylase breaks down complex carbohydrates into simple sugars like maltose that are further digested by maltase, to form glucose.
  - These sugars are then absorbed into the bloodstream.

- Pancreatic enzymes like trypsin and chymotrypsin break down proteins into smaller peptides.
  - Further digestion by enzymes like aminopeptidase and dipeptidase results in amino acids, which are absorbed into the bloodstream.

(c)
- The amount of undigested food is low and constant.
- This indicates that most of the food was digested and absorbed before the small intestines.
- Any remaining undigested material awaits elimination.

END.