

**PAPER I
BIOLOGY**

For each question, there are **FOUR** responses: **A, B, C** and **D**. Choose the corresponding letter of your response and **CIRCLE** it. If you change your answer, cross out the previous response clearly and circle your new answer. **NO** score will be awarded if you circle more than **ONE** letter.

1. Scientists propose that chloroplasts originated when an ancestral eukaryotic cell engulfed a bacterium capable of making its own food using sunlight. Which characteristics best describe this ancestral bacterium?

- A It obtained energy by breaking down organic matter.
- B It produced its own food through photosynthesis.
- C It relied on a chemical reaction instead of sunlight.
- D It required oxygen only for cellular respiration.

2. A student tests four carbohydrates and records the following information as shown in the table.

Molecule	Description
1	A single sugar molecule is used directly in respiration
2	Single sugar molecule commonly found in fruit
3	Long chain of glucose molecules used for energy storage in animal
4	Two glucose molecule joined together

Which molecule is a polysaccharide?

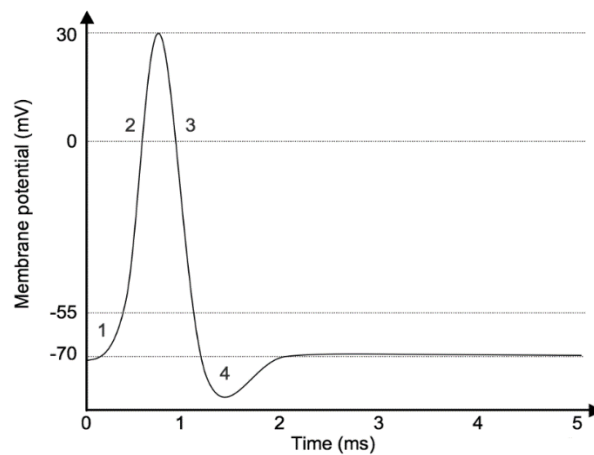
- A 1
 - B 2
 - C 3
 - D 4
3. A patient has normal osteoblast activity but excessive osteoclast activity. Which change is most likely after several years?
- A Bone becomes flexible because collagen production increases.
 - B Bone mass increases because more minerals are deposited.
 - C Bone mass decreases because bone removal exceeds bone formation.
 - D Bone becomes lighter because osteocytes stop functioning
4. A patient has damage to the blood vessels inside the villi but the epithelial cells remain healthy. Which observation would most likely support this diagnosis?
- A Digested nutrients accumulate inside the villi before entering the blood.
 - B Proteins remain undigested in the stomach after a meal.
 - C Lipids are no longer emulsified in the small intestine.
 - D Mucus secretion from goblet cells stops completely.

5. An environmentalist claim; “Socio-economic development always damage the environment.”

Which evidence would refute this claim?

- A Population increases demand for land and natural resources.
- B Urban growth increases pressure on natural habitats and ecosystems.
- C Rise in industry increases waste production and resource consumption.
- D Renewable energy projects reduce emissions while supporting economic growth.

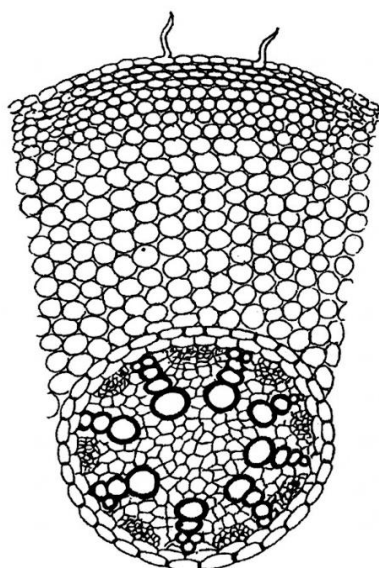
6. The graph shows the action potential of a neuron.



Which statement correctly describes the graph?

- A Na^+ efflux at point 2
 - B Na^+ influx at point 3
 - C K^+ influx at point 3
 - D K^+ efflux at point 4
7. If dialysis fluid had a higher urea concentration than blood, what would happen?
- A Urea would diffuse into the blood
 - B Urea would stay unchanged
 - C Water would move into the blood only
 - D Oxygen diffusion would stop

8. Using figure, identify which part of plant it is.



- A Dicot root
B Dicot stem
C Monocot root
D Monocot stem
9. A researcher investigates the effect of different light conditions on chloroplast activity. The following observations are recorded in table

Experimental Condition	Observation
Light is provided, but carbon dioxide is removed.	ATP production continues, but glucose formation stops.
Light intensity is increased, and electron carriers become highly reduced.	Oxygen production increases, but ATP production shows little change.
A chemical blocks electron flow from photosystem II to photosystem I.	Oxygen release stops, but ATP production continues.

Based on the mechanism of cyclic and non-cyclic photophosphorylation, which conclusion explains these observations?

- A Cyclic photophosphorylation produces oxygen; non-cyclic photophosphorylation produces ATP.
B Cyclic photophosphorylation produces ATP, non-cyclic photophosphorylation produces ATP and oxygen.
C Cyclic photophosphorylation produces glucose, non-cyclic photophosphorylation produces oxygen.
D Cyclic photophosphorylation produces NADPH, non-cyclic photophosphorylation produces ATP.

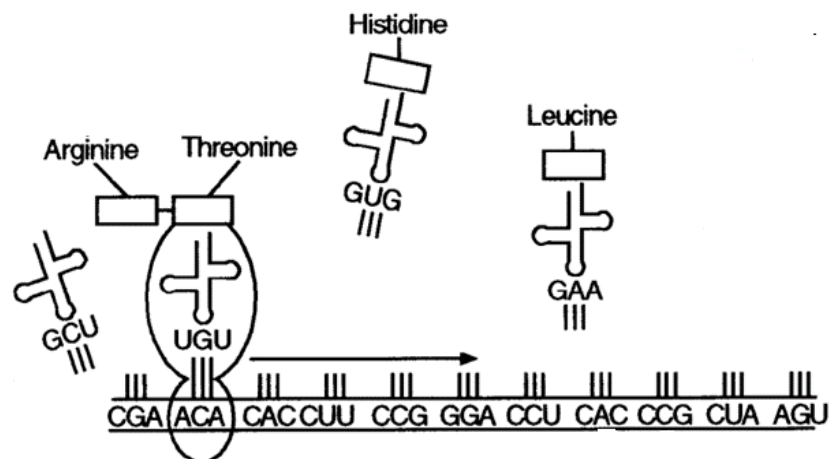
10. Table shows the medical report of a patient obtained from the laboratory.

Metabolites	Reference value (μmol)	Result (μmol)
Glucose	100	90
Pyruvate	25	26
NAD ⁺	75	10
NADH	50	400

Which stage of cellular respiration is likely inhibited in the patient based on the data presented in the table?

- A glycolysis
 - B citric acid cycle
 - C pyruvate oxidation
 - D electron transport chain
11. During respiration, carbon dioxide produced by body cells enters red blood cells. Which sequence correctly explains how carbon dioxide is transported in the blood?
- A $\text{CO}_2 + \text{haemoglobin} \rightarrow \text{oxygen} \rightarrow \text{bicarbonate ion}$
 - B $\text{CO}_2 + \text{oxygen} \rightarrow \text{haemoglobin} \rightarrow \text{carbonic acid}$
 - C $\text{CO}_2 + \text{water} \rightarrow \text{carbonic acid} \rightarrow \text{bicarbonate ion}$
 - D $\text{CO}_2 + \text{plasma proteins} \rightarrow \text{glucose} \rightarrow \text{bicarbonate ion}$
12. A plant is placed in a hot environment with sufficient sunlight but limited water supply. Measurements show that stomata partially close during the afternoon. Why does this response help the plant survive?
- A Partial closure increases excessive water loss while allowing more oxygen release during photosynthesis.
 - B Partial opening prevents water loss while allowing greater carbon dioxide absorption for photosynthesis.
 - C Partial opening decreases carbon dioxide uptake while increasing water conservation during photosynthesis.
 - D Partial closure reduces excessive water loss while allowing some carbon dioxide entry for photosynthesis.
13. A student heats a sample of a solution with Benedict's reagent and observes that the solution remains blue. The student then adds acid to another sample of the same solution. After acid hydrolysis, the solution turns brick-red when heated with Benedict's reagent. Which statement matches this observation?
- A The solution contains glucose.
 - B The solution contains lipid.
 - C The solution contains protein.
 - D The solution contains starch.

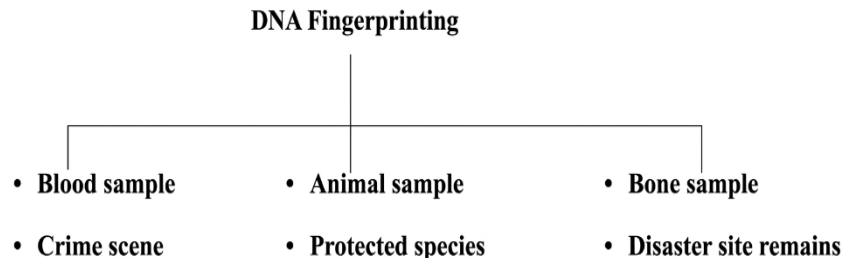
14. Figure below shows the protein synthesis in bacterium cell.



If CUU on mRNA is replaced by UGA due to a mutation, then the amino acid sequence in the protein will be

- A Arginine – Threonine – Histidine
- B Histidine – Threonine – Arginine
- C Arginine – Threonine – Histidine – Leucine
- D Leucine – Histidine – Threonine – Arginine

15. Figure represents DNA fingerprinting used in different situations.



Which statement best explains why the same technique can be used in all three cases?

- A DNA patterns modify samples for identification
- B DNA patterns require living samples only
- C DNA patterns identify individuals and relationships
- D DNA patterns remain identical among individuals

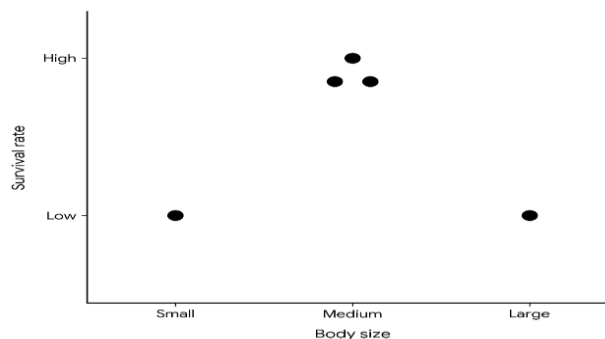
16. The duck-billed platypus is a unique animal that has the following characteristics:

- It has a hairy body and produces milk to feed its young.
- It lays eggs rather than giving birth to its young ones.
- It has a bill and webbed feet like a duck.
- It produces venom similar to that of snakes.

Based on these characteristics, the duck-billed platypus is a connecting link between which two groups?

- A reptiles and birds
- B reptile and mammal
- C reptile and amphibian
- D mammal and amphibian

17. The graph shows the survival rate of fish with different body sizes.



What does this graph suggest about natural selection in this population?

- A No selection is occurring
- B Extreme traits are favoured
- C One extreme trait is favoured
- D Intermediate traits are favoured.

18. A scientist studied a certain gene in a population of birds. This gene has two alleles: a dominant allele (P), and a recessive allele (p). The scientist collected data of the allele frequency for both alleles (P and p) of the given bird population twice over a period of 14 years as given in the table below:

Year	Frequency of allele P	Frequency of allele p
2010	0.19	0.81
2024	0.65	0.35

Identify the most correct interpretation of the above data.

- A A population of birds is evolving.
- B A population of birds is not evolving.
- C Individuals in the bird population are not migrating.
- D Individuals in birds' population are mating randomly.

19. Using table, identify the statement that describes the patient's health.

Parameters	Normal Range	Test Result
Urea	7 – 20 mg/dl	64 mg/dl
Creatinine	0.6 – 1.3 mg/dl	4 mg/dl
Glucose	0 – 0.8 mmol/L	0.9 mmol/L

Which of the following is the most appropriate description of this person's health?

- A increased creatinine in blood and limb swelling
- B decreased creatinine in the blood and frequent urination
- C decreased urea in the blood and frequent urination
- D increased glucose indicating diabetes mellitus

20. A muscle fibre is repeatedly stimulated until fatigue occurs. Electron microscopy shows that the sarcomeres remain short even after stimulation stops.

Which structure is most likely affected?

- A Length of myosin filament.
- B Length of an A band during contraction
- C Attachment of actin to Z line
- D Restoring filament arrangement.

21. A hibernating animal such as a bear survives for several months without eating by relying on stored energy.

Explain why triglycerides are more suitable than carbohydrates for long-term energy storage in this situation.

- A They are soluble in water.
- B They contain many hydrogen bonds.
- C They form hydrogen bonds with water.
- D They have many C-H bonds to store energy.

22. During vigorous exercise, more oxygen is released from haemoglobin. Which mechanism explains this?

- A osmosis
- B chloride shift
- C diffusion
- D Bohr shift

23. During gel electrophoresis, in which direction do DNA fragments move?

- A towards the positive electrodes because DNA is positive charged
- B towards the positive electrodes because DNA is negatively charged
- C towards the negative electrodes because DNA is positively charged
- D towards the negative electrodes because DNA is negatively charged

24. A scientist concludes that cheetahs are more closely related to wolves than to sharks because cheetahs and wolves share several characteristics, including fur, four-chambered hearts, and differentiated teeth.

Which evidence best supports the scientist's conclusion that cheetahs and wolves share a more recent common ancestor than either does with sharks?

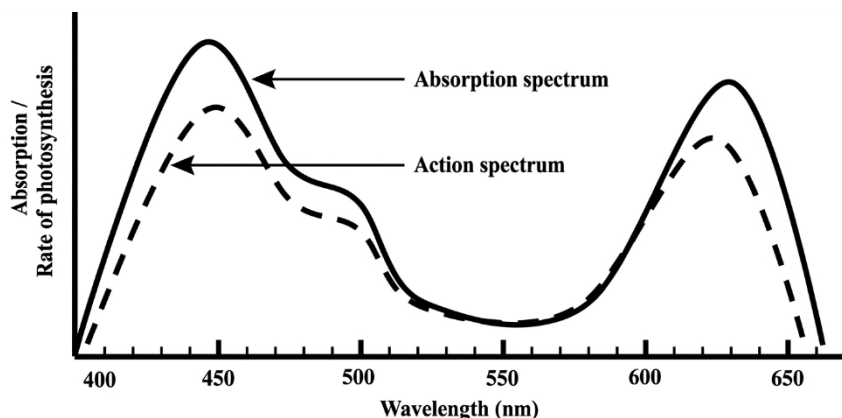
- A Cheetahs and wolves are more closely related because they are both warm-blooded predators, whereas sharks are cold-blooded.
- B Cheetahs and wolves have similar diets and occupy similar ecological niches, so they evolved the same characteristics independently.
- C Cheetahs and wolves inherited these homologous characteristics from a more recent common ancestor.
- D Sharks are less complex organisms than mammals, so they are less closely related to cheetahs and wolves.

25. During a storm, several Galápagos finches from one island are blown to a neighbouring island, where they survive and breed with the resident population. After several generations, alleles that were previously absent are found in the neighbouring population.

Which evolutionary mechanism best explains this change in allele frequency?

- A Genetic drift, because the allele frequencies change due to random chance within the population.
- B Gene flow, because alleles are introduced into a population through migration.
- C Mutation, because new alleles are produced when organisms colonise a new habitat.
- D Natural selection, because individuals become better adapted to the new environment.

26. The figure shows a graph of absorption and action spectrum which affects the rate of photosynthesis.



Which options explains the relationship between absorption spectrum and action spectrum?

- A Action and absorption spectrum are interchangeable.
- B Action spectrum is directly proportional to absorption spectrum.
- C Action spectrum is inversely proportional to absorption spectrum.
- D Action spectrum is constant while the absorption spectrum changes.

27. During vigorous exercise, the rate of oxygen and glucose delivery to muscle cells increases to meet the higher demand for respiration.

Which feature of capillaries most directly enables this increased exchange of substances between the blood and muscle cells?

- A Narrow lumen that increases the velocity of blood flow through the capillaries.
- B Presence of valves that prevent the backflow of blood during circulation.
- C One-cell-thick walls that minimise the diffusion distance for substances.
- D Thick muscular walls that maintain high blood pressure within the capillaries.

28. A researcher compares two DNA molecules of equal length. DNA molecule X contains a higher proportion of guanine-cytosine (G-C) base pairs than DNA molecule Y. When heated, DNA molecule X requires a higher temperature to separate its two strands.

Which type of bonding between guanine and cytosine best explains this observation?

- A Triple hydrogen bonds
- B Triple phosphodiester bonds
- C Double hydrogen bonds.
- D Double phosphodiester bonds.

29. A botanist examines an unknown flowering plant and observes that its leaves have parallel veins, its roots are fibrous, and its flowers are arranged in multiples of three. Which observation provides the evidence that the plant is a monocot?

- A Parallel leaf venation
- B Fibrous root system
- C Floral parts arranged in multiples of three.
- D Presence of chlorophyll-containing leaves.

30. A student investigated the effect of temperature on an enzyme-catalysed reaction. The reaction rate increased as the temperature increased from 20°C to 40°C but decreased rapidly at 60°C.

The student concluded that "*enzymes work best at higher temperatures because molecular movement always increases.*"

Which statement supports the student's conclusion?

- A Higher temperatures increase collisions, but not all enzymes remain functional.
- B Enzymes lose the shape of their active site above the optimum temperature.
- C Higher temperatures reduce the frequency of enzyme-substrate collisions.
- D Enzymes require lower temperatures to maintain activation energy.

31. A section of the **template strand** of a DNA molecule has the following nucleotide sequence: **3' AGTAGATAGCCA 5'**. During transcription, RNA polymerase uses this strand to synthesise mRNA.

Which sequence represents the mRNA produced?

- A 5' TCATCTATCGGT 3'
- B 3' AGTAGATAGCCA 5'
- C 5' UCAUCUAUCGGU 3'
- D 5' AGUAGAUAGCCA 3'

32. A conservation team uses DNA fingerprinting to analyse individuals in an endangered animal population before starting a captive breeding programme.

How can the results of DNA fingerprinting help the conservation team?

- A by selecting genetically diverse individuals to reduce inbreeding
- B by introducing beneficial novel mutations to increase adaptability
- C by cloning genetically identical individuals to expand population size
- D by restricting natural genetic variations to stabilize specific traits

33. A student is investigating why the glomerulus is effective at ultrafiltration.

Which feature most directly increases filtration rate?

- A high hydrostatic pressure in glomerular capillaries
- B low solute concentration in efferent arteriole
- C narrow collecting duct
- D presence of microvilli in Bowman's capsule

34. A scientist observes that after heavy rainfall, a lake shows a rapid increase in algal growth followed by fish death.

Which statement explains this observation?

- A decreased decomposition leading to stable oxygen levels
- B increased oxygen levels due to algal photosynthesis
- C increased fish reproduction due to nutrient availability
- D increased nitrates causing eutrophication and oxygen depletion

35. The species composition of a community was recorded in **Table 1.6**.

Calculate the Simpsons index of diversity (D) for the given community.

Table 1.6

Name of species	Number of individuals
A	9
B	10
C	11
Total	30

- A 0.31
- B 0.43
- C 0.57
- D 0.69

36. A patient with chronic kidney disease has reduced ability to remove urea and excess ions from the blood. The patient is advised to undergo dialysis. Why is dialysis recommended for this patient?
- A To stimulate cellular repair and permanently restore damaged tissues in the kidneys.
 - B To accelerate fluid filtration and increase the overall rate of urine formation in kidneys.
 - C To remove waste products and maintain the balance of substances in the blood.
 - D To minimise the metabolic strain and reduce excessive use of oxygen for respiration.
37. Codon UCU, UCG and UCA code for the same amino acid. What is this system of coding known as?
- A unambiguous system
 - B degenerate system
 - C triplet system
 - D universal system
38. According to Darwin, organisms compete and struggle for resources such as food and space. Cannibalism is a type of struggle for food in which one individual eats another from the same species. What type of struggle does cannibalism represent?
- A interspecific struggle
 - B intraspecific struggle
 - C struggle for existence
 - D struggle with environment
39. A scientist wants to produce genetically identical copies of a high-yield crop plant. Which experimental approach would achieve this goal and ensure large-scale production of identical plants?
- A expose seeds to radiation to produce random genetic variation
 - B develop a method of cross-breeding high-yield plants to combine desirable traits
 - C grow plants under different environmental conditions to select the best phenotype
 - D use tissue culture techniques to clone plant cells under sterile conditions
40. Which sequence correctly describes the early stages of oogenesis?
- A Primary oocyte → Oogonia → Secondary oocyte → Ovum
 - B Oogonia → Primary oocyte → Secondary oocyte → Ovum
 - C Oogonia → Secondary oocyte → Primary oocyte → Ovum
 - D Oogonia → Ovum → Primary oocyte → Secondary oocyte

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