National Qualifications 2026

X807/77/02

Biology
Section 1 — Questions

TUESDAY, 28 APRIL

9:00 AM – 12:00 NOON

Instructions for the completion of Section 1 are given on *page 02* of your question and answer booklet X807/77/01.

Record your answers on the answer grid on *page 03* of your question and answer booklet.

You must leave your answer booklet on your desk; if you do not, you could lose all the marks for this paper.

Qualifications Scotland
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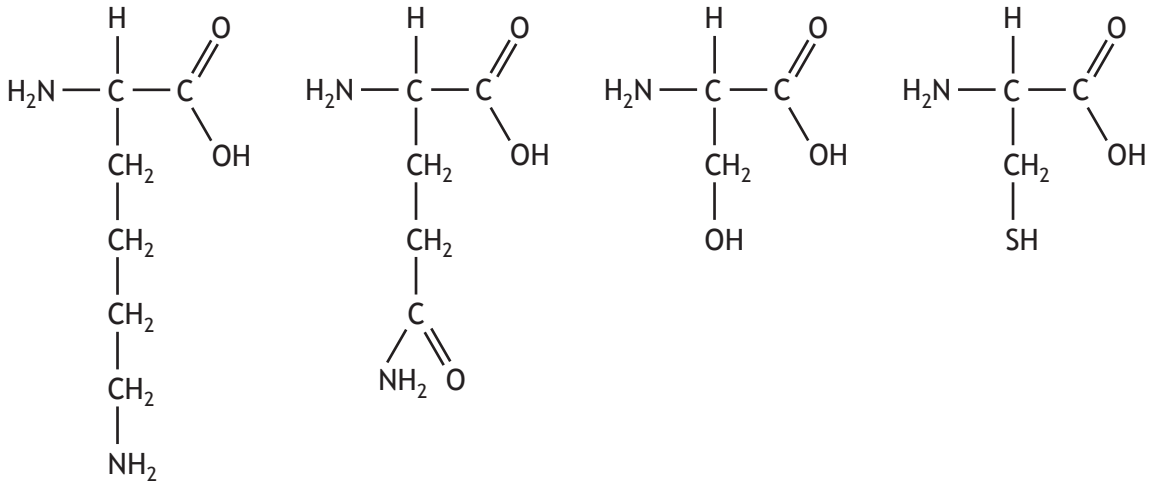
A/PB

SECTION 1 — 20 marks

Attempt ALL questions

1. Four amino acids are shown.



1 2 3 4

Which of the amino acids could form a hydrogen bond with another amino acid in the chain to stabilise the secondary structure?

A 1 and 3 only

B 1, 2 and 3 only

C None of above

D All of the above

2. Which statement is **not** correct for bright-field microscopy?

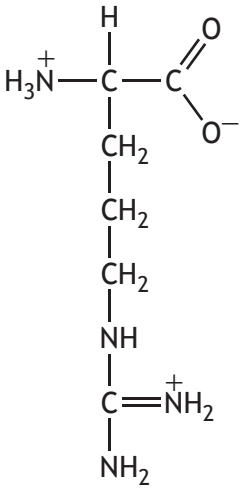
A Can be used to visualise some whole organisms or parts of organisms.

B Can be used to visualise cells in culture.

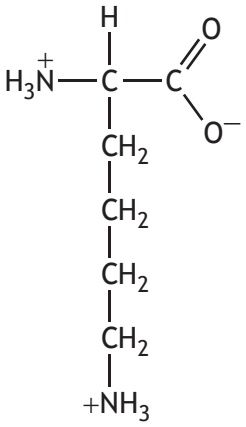
C Uses only visible light for illumination.

D Can be used to visualise fluorescently labelled molecules in thin sections of dissected tissue.

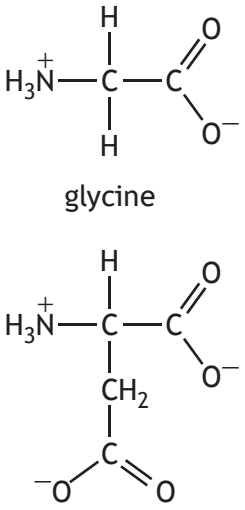
3. A solution containing the peptide **arg–asp–gly–lys** was treated with peptidases to release the amino acids.



arginine



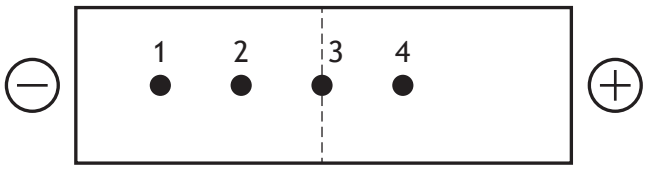
lysine



glycine

aspartate

The amino acids were separated using native gel electrophoresis. The amino acids were all loaded at the central dashed line in the diagram.

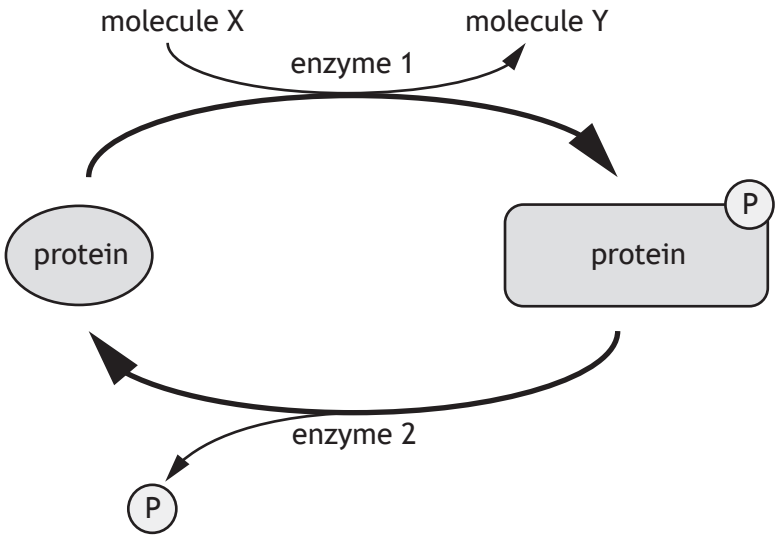


Which row in the table identifies the amino acids?

	Amino acid			
	Lysine	**Arginine**	**Glycine**	**Aspartate**
A	1	2	3	4
B	2	1	3	4
C	2	4	1	3
D	4	3	2	1

[Turn over

4.



In the figure

A enzyme 1 is a phosphatase, enzyme 2 is a kinase, molecule X is ATP

B enzyme 1 is kinase, molecule Y is ATP, molecule X is ADP

C enzyme 2 is a phosphatase, molecule Y is ADP, molecule X is ATP

D enzyme 2 is a kinase, enzyme 1 is a phosphatase, molecule Y is ATP.

5. DDT was widely used in the UK as an insecticide from the 1940s to the 1960s.

Experiments have shown that DDT causes a neuron to be depolarised for longer during an action potential.

This observation could be explained by DDT

A blocking voltage-gated sodium channels

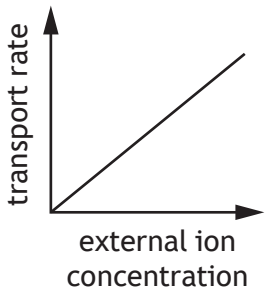
B inhibiting the inactivation of voltage-gated sodium channels

C increasing the opening of voltage-gated potassium channels

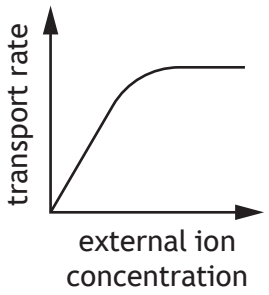
D activating the sodium-potassium pump.

6. Which graph best represents ion transport through open membrane channels when the number of channels is not affecting the transport rate?

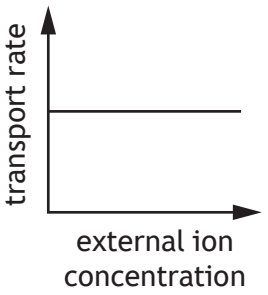
A



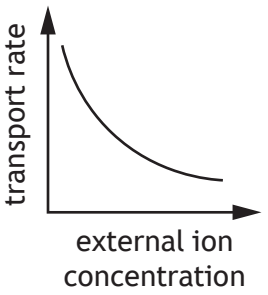
B



C



D



7. *Water potential* quantifies the tendency of water to move from one area to another by osmosis. In plants, the water potential of a cell (Ψ) can be calculated using the equation:

$$\textbf{water potential } (\Psi) = \textbf{solute potential } (\Psi_s) + \textbf{pressure potential } (\Psi_p)$$

Solute potential (Ψ_s): water potential of solute in vacuole

Pressure potential (Ψ_p): pressure caused by cell wall pressing inwards against cytoplasm

Pure water has a water potential of zero, and water will always diffuse from a region of higher water potential to a region of lower water potential.

Two plant cells, which are next to each other, have the solute and pressure potentials shown in the table.

	Solute potential (Ψ_s) (kPa)	**Pressure potential (Ψ_p) (kPa)**
Cell 1	−640	390
Cell 2	−660	340

Which statement describes the relationship between the two cells?

A The difference in water potential between the cells is 30 kPa, and water will move from cell 1 to cell 2.

B The difference in water potential between the cells is 30 kPa, and water will move from cell 2 to cell 1.

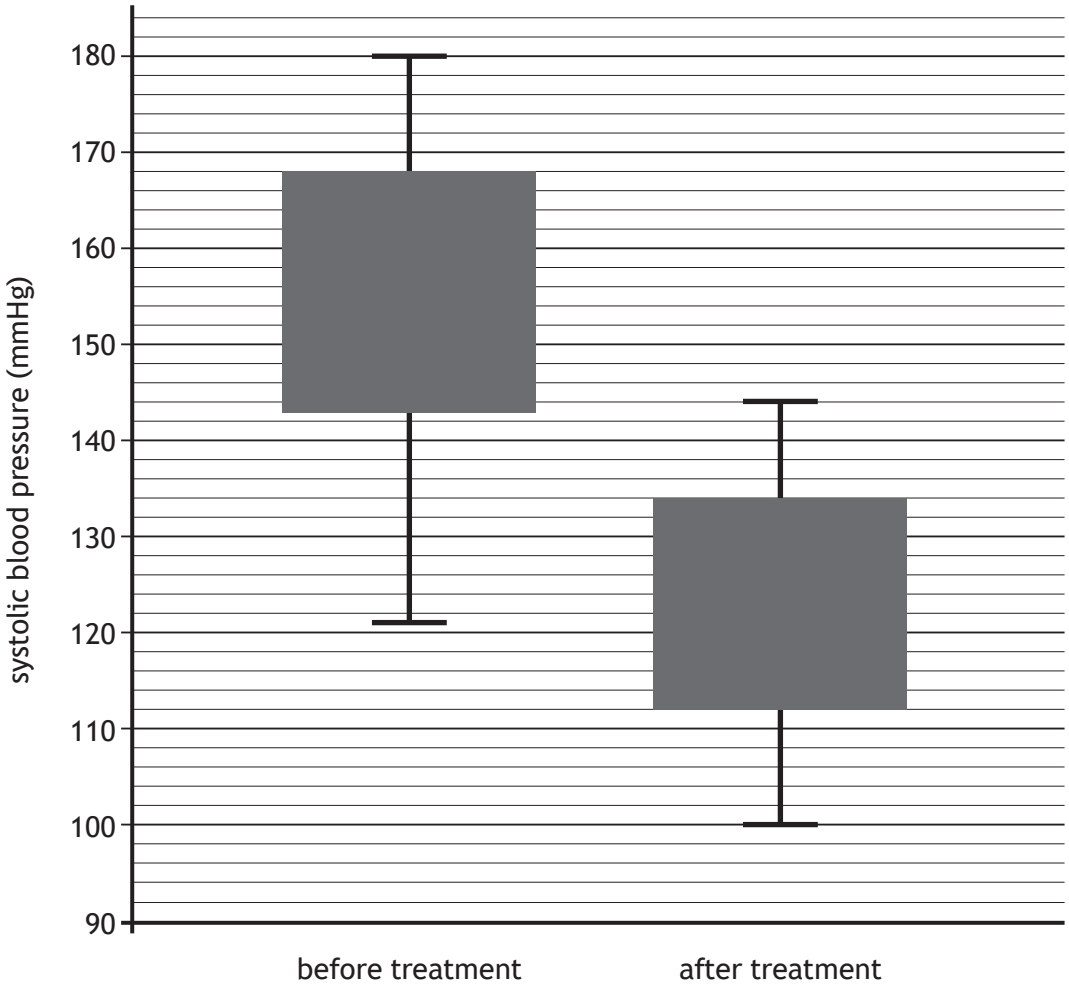
C The difference in water potential between the cells is 70 kPa, and water will move from cell 1 to cell 2.

D The difference in water potential between the cells is 70 kPa, and water will move from cell 2 to cell 1.

[Turn over

8. Systolic pressure is one of the components of a blood pressure measurement.

The box plot shows the values of systolic blood pressure for a sample of patients before and after a treatment designed to reduce blood pressure.



Which statement is correct for the data shown?

A Following treatment, the mean systolic blood pressure dropped from approximately 155 mmHg to approximately 121 mmHg.

B There is more error associated with the data for before treatment than after treatment.

C Following treatment, the lower quartile for systolic blood pressure dropped from 121 mmHg to 100 mmHg.

D There is no overlap between the interquartile ranges for before and after treatment.

9. Scientists can use phylogenetics to determine the evolutionary relationships that exist between different species.

Which of the following is used to determine these relationships?

A Analysis of protein structures within the organisms.

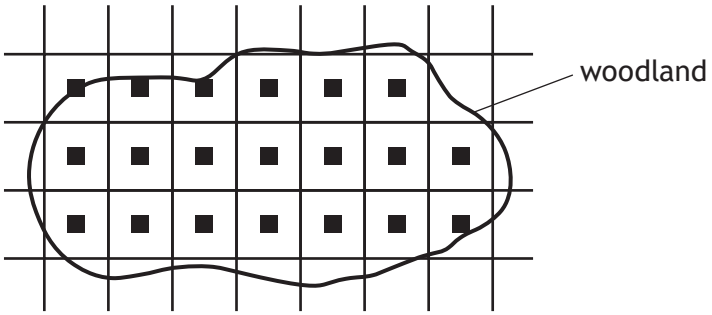
B The ecological niche inhabited by the organisms.

C The behaviours observed in the organisms.

D The physiology of the internal organs of the species.

10. As part of a survey into the population density of woodland species, investigators developed the sampling strategy shown in the map.

Each black square represents a sampling point.



The term used to describe this sampling strategy is

A random

B systematic

C stratified

D representative.

11. An event that occurs during Meiosis II is

A crossing over

B separation of sister chromatids

C independent assortment of chromosomes

D pairing of homologous chromosomes.

12. In the fruit fly *Drosophila melanogaster*, a gene affecting body colour is sex-linked. In this species, sex chromosomes for males are XY and females are XX.

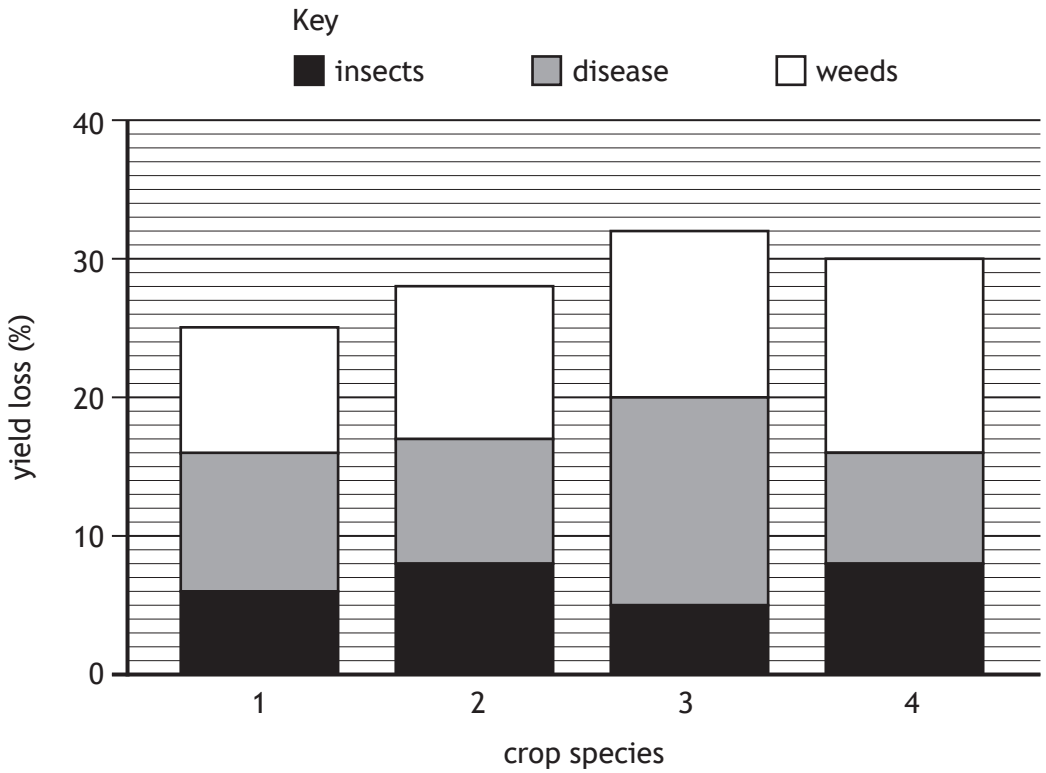
The allele for tan body is dominant to the allele for yellow body.

A cross was performed between a yellow-bodied female and a tan-bodied male to give an F_1 generation. A male and a female from the F_1 generation were, in turn, crossed to give an F_2 generation.

Which row in the table shows the predicted phenotypic ratio of the F_2 generation?

	Tan-bodied female	**Yellow-bodied female**	**Tan-bodied male**	**Yellow-bodied male**
A	1	1	1	1
B	2	0	1	1
C	2	0	0	2
D	1	1	0	2

13. The chart shows the percentage loss in yield due to insects, disease, and weeds for four crop species.



Which of the following statements is correct for the data shown?

A Crop species 4 is likely to show the smallest improvement in yield if chemicals that kill insects and weeds are applied.

B Overall, using measures to prevent disease would have the greatest single benefit for yield.

C Losses from insects and disease account for at least half of all losses for all four crop species.

D Losses due to disease and weeds are greater than losses due to insects and weeds for all four crop species.

14. Which row in the table describes **costs** of internal and external fertilisation?

	Internal fertilisation	**External fertilisation**
A	fewer eggs needed	few offspring survive
B	requires direct transfer of gametes between partners	very large number of offspring can be produced
C	a mate must be located	many gametes predated
D	higher offspring survival rate	limited parental care

15. Identify an example of the specific immune response.

A The destruction of bacterial cell walls by hydrolytic enzymes in chemical secretions.

B Natural killer cells identifying and attaching to cells infected with viruses and inducing apoptosis.

C Damaged cells releasing cytokines leading to the accumulation of white blood cells at the site of infection.

D Initial exposure to a parasitic antigen leading to the production of memory lymphocyte cells.

16. In 2024 scientists reported that a strain of influenza virus, Yamagata type B, has been eliminated from the human population. No new cases have been reported since March 2020 when the coronavirus, COVID-19, became widespread and public health measures including lockdowns and successful design of coronavirus vaccination were introduced.

The most likely reason for the elimination of Yamagata type B is

A herd immunity

B reduced virulence

C reduced transmission

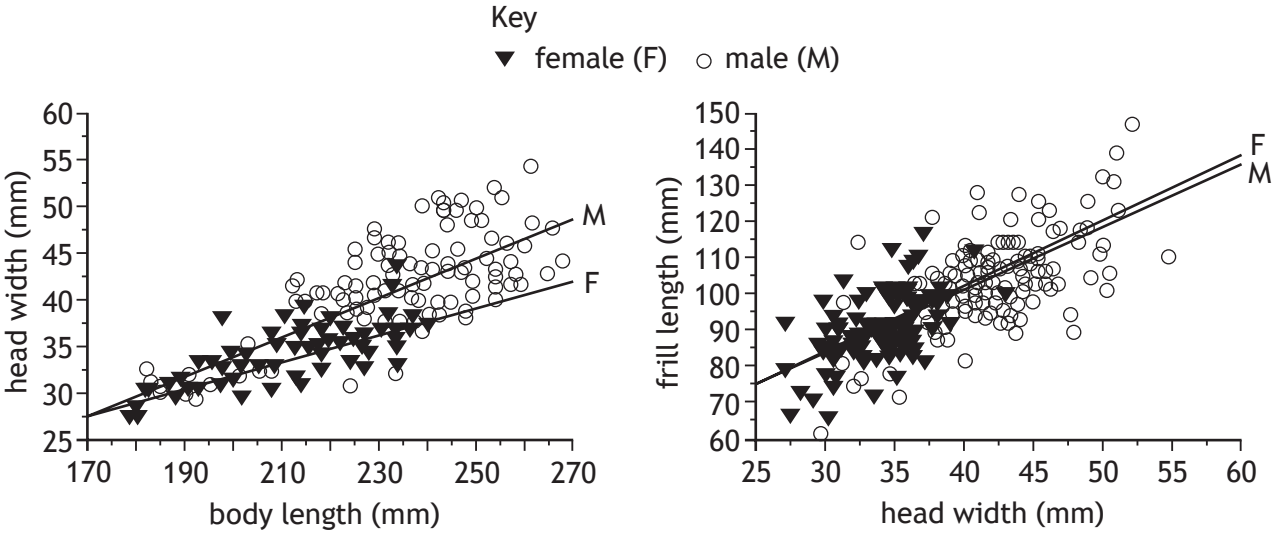
D effectiveness of coronavirus vaccination.

[Turn over

17. The frill-neck lizard (*Chlamydosaurus kingii*) is abundant throughout its range in the tropical savannahs of northern Australia.

These lizards are characterised by a fold of skin (frill), which is kept folded back against the body but can be erected during threat displays and social interactions. As part of a larger investigation, morphological data from 231 mature individuals were analysed.

These data are shown in the graphs.



Which statement drawn from these data is correct?

A The male with the longest body length has the longest frill.

B Males have a greater degree of variation in frill length than females.

C There is a weaker positive correlation between body length and head width in females than males.

D There is a stronger positive correlation between head width and frill length in males than females.

18. In a study of division of labour in four colonies of desert ants, the following data were collected.

Colony	Colony size	Number of workers engaged in a specific task	Number of random workers
P	1387	135	55
Q	1037	130	55
R	738	68	52
S	536	51	55

Which row in the table is a summary of the results obtained?

	Colony with greatest proportion of task-specific workers	Colony with greatest proportion of random workers
A	P	S
B	Q	S
C	P	R
D	Q	R

[Turn over

19. The following statements describe the main stages in the life history of *Schistosoma mansoni*, a parasite that causes the human disease schistosomiasis. Some terms have been replaced by letters P, Q, R, and S.

P reproduction occurs in the human Q

↓

Fertilised eggs are passed into water

↓

Fertilised eggs develop into larvae that then infect water snails

↓

R reproduction occurs

↓

This produces motile larvae that leave the snails

↓

Larvae infect humans in the water, entering the S

Which row in the table identifies the terms for P, Q, R and S?

	P	Q	R	S
A	asexual	intestine	sexual	intestine
B	sexual	bloodstream	asexual	intestine
C	asexual	bloodstream	sexual	bloodstream
D	sexual	intestine	asexual	bloodstream

20. The following statements were made by students evaluating laboratory work they had undertaken.

Which statement **cannot** be justified from the information given?

A When measuring catechol oxidase activity in bananas, a negative control was included. This control always showed zero activity, which shows confounding variables were adequately controlled.

B A refractometer was used to measure salinity of different rockpool samples. The instrument was calibrated each day using known salt concentrations, which helped ensure accurate data were collected.

C In the pilot studies, 200 μl of water was dispensed from a micropipette 10 times. The mass dispensed each time was measured and ranged from 0.26–0.28 g. This showed the pipette was precise, but not accurate.

D The abundance of different lichen species in a woodland location was observed and ranked from 1 to 5, with 1 being rare, or absent, and 5 being very common. This means both the dependent and independent variables were qualitative.

[END OF SECTION 1. NOW ATTEMPT THE QUESTIONS IN SECTION 2 OF YOUR QUESTION AND ANSWER BOOKLET.]

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