



National  
Qualifications  
2023

**X807/76/12**

**Biology  
Paper 1 — Multiple choice**

THURSDAY, 27 APRIL

9:00 AM – 9:40 AM

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**Total marks — 25**

Attempt ALL questions.

**You may use a calculator.**

Instructions for the completion of Paper 1 are given on *page 02* of your answer booklet X807/76/02.

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

Space for rough work is provided at the end of this booklet.

Before leaving the examination room you must give your answer booklet to the Invigilator; if you do not, you may lose all the marks for this paper.



**Total marks — 25**  
**Attempt ALL questions**

1. Which statement about rRNA is true?

- A It contains deoxyribose
- B It has two strands
- C It is a component of ribosomes along with protein
- D It is not transcribed from DNA

2. A single strand of DNA in a gene contains 24% adenine, 16% cytosine, 29% guanine and 31% thymine.

Which row in the table shows the percentage of each base in an mRNA transcript of this gene?

	Adenine	Cytosine	Guanine	Thymine	Uracil
A	24	16	29	31	0
B	24	16	29	0	31
C	31	29	16	24	0
D	31	29	16	0	24

3. A section of DNA from a human cell was sequenced and compared to a database of sequences of human genes. The sequence did not match the sequence for any protein coding genes in the human genome.

This section of DNA may be involved in the production of

- A tRNA
- B proteins
- C exons
- D mRNA.

4. One cause of the genetic disease phenylketonuria (PKU) is a mutation in a gene, which causes all the codons after the mutation to change.

This is an example of a

- A nonsense mutation
- B duplication mutation
- C translocation mutation
- D frame-shift mutation.

5. Natural selection involves a
- A random increase in frequency of DNA sequences that increase survival
  - B random decrease in frequency of DNA sequences that decrease survival
  - C non-random increase in frequency of DNA sequences that increase survival
  - D non-random decrease in frequency of DNA sequences that increase survival.

6. Which statement about transfer of genes is true?

- A Bacteria use horizontal transfer only.
- B Bacteria use horizontal and vertical transfer.
- C Plants use horizontal transfer only.
- D Plants use horizontal and vertical transfer.

7. Warfarin is a drug that reduces the risk of blood clots.

Alleles for two genes, 1 and 2, affect how quickly Warfarin is metabolised.

Alleles for gene 1 can be G or A.

Alleles for gene 2 can be C<sub>1</sub>, C<sub>2</sub> or C<sub>3</sub>.

The table shows the recommended Warfarin dose for patients with each genotype.

Gene 1 genotypes	Warfarin dose (mg/day)					
	Gene 2 genotypes					
	C <sub>1</sub> C <sub>1</sub>	C <sub>1</sub> C <sub>2</sub>	C <sub>1</sub> C <sub>3</sub>	C <sub>2</sub> C <sub>2</sub>	C <sub>2</sub> C <sub>3</sub>	C <sub>3</sub> C <sub>3</sub>
GG	6.0	6.0	3.5	3.5	3.5	1.2
GA	6.0	3.5	3.5	3.5	1.2	0.8
AA	3.5	3.5	1.2	1.2	1.2	0.5

A patient is known to have the GA genotype for gene 1 and is homozygous for the C<sub>3</sub> allele.

What is the recommended Warfarin dose for this patient?

- A 0.8 mg/day
- B 1.2 mg/day
- C 3.5 mg/day
- D 6.0 mg/day

[Turn over

8. In which of the following domains of life are microorganisms found?

- A Bacteria only
- B Archaea only
- C Bacteria and archaea only
- D Bacteria, archaea and eukaryotes

9. The enzyme catalase increases the rate of the reaction shown.



An experiment was carried out to investigate the effect of copper nitrate concentration on catalase activity. The catalase activity was determined by measuring the time taken to collect 10 cm<sup>3</sup> of oxygen in the presence of different concentrations of copper nitrate.

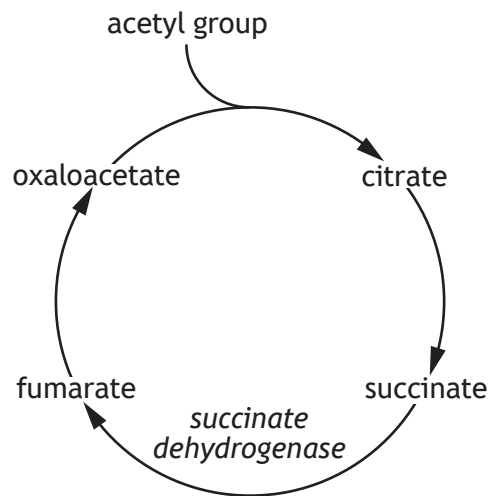
The results are shown in the table.

Copper nitrate concentration (mol l <sup>-1</sup> )	Time taken to collect 10 cm <sup>3</sup> oxygen (seconds)
0.2	8
0.3	12
0.4	15
0.6	18
0.8	19
1.0	20

The conclusion for this experiment is, as copper nitrate concentration increased the

- A time taken to collect 10 cm<sup>3</sup> oxygen increased
- B time taken to collect 10 cm<sup>3</sup> oxygen decreased
- C catalase activity increased
- D catalase activity decreased.

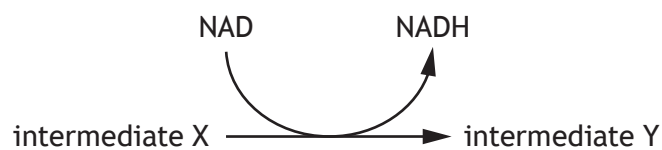
10. Succinate dehydrogenase is an enzyme that catalyses a reaction in the citric acid cycle as shown in the diagram.



Malonate is a competitive inhibitor of succinate dehydrogenase.

Which statement about succinate dehydrogenase is correct?

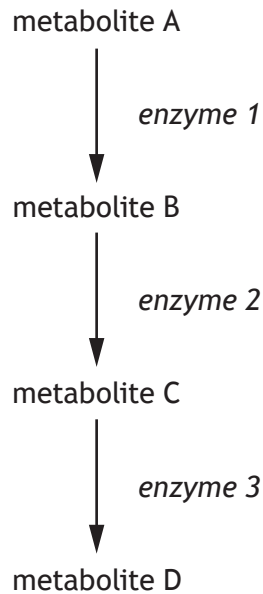
- A Succinate and malonate have a higher affinity than fumarate for the active site of succinate dehydrogenase.
  - B Increasing the concentration of fumarate would reverse the inhibition of succinate dehydrogenase.
  - C Increasing the concentration of succinate would have no effect on the inhibition of succinate dehydrogenase.
  - D Malonate and succinate bind to different sites on succinate dehydrogenase.
11. The diagram shows a reaction that occurs in respiration.



Which row in the table names the enzyme that catalyses this reaction and a location in the cell where it takes place?

	Enzyme	Cytoplasm	Inner mitochondrial membrane
A	dehydrogenase	no	yes
B	dehydrogenase	yes	no
C	ATP synthase	no	yes
D	ATP synthase	yes	no

12. The stages of an enzyme-controlled metabolic pathway are shown.



In feedback inhibition

- A enzyme 3 binds with enzyme 1
- B enzyme 3 binds with metabolite A
- C metabolite D binds with enzyme 1
- D metabolite D binds with metabolite A.

13. Mammals use several mechanisms to regulate their body temperature.

Which statement describes responses to a decrease in body temperature of a mammal?

- A Vasodilation and an increase in metabolic rate
- B Vasodilation and a decrease in metabolic rate
- C Vasoconstriction and an increase in metabolic rate
- D Vasoconstriction and a decrease in metabolic rate

14. The bar-tailed godwit is a species of bird that migrates from Alaska to New Zealand each autumn. A satellite tracker was used to study one bar-tailed godwit on this migration.

The bird completed the 11 000 km journey in 9 days.

The average speed of the bar-tailed godwit during migration was

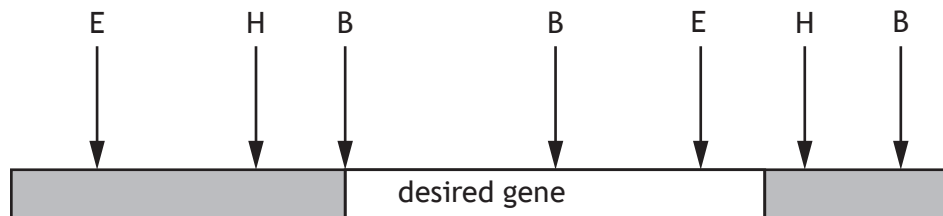
- A 0.02 km/hr
- B 50.93 km/hr
- C 458.33 km/hr
- D 1222.22 km/hr

15. An experiment was carried out to investigate the effectiveness of a sunscreen on the survival of yeast cells.

Yeast was added to a Petri dish containing agar. Sunscreen was spread across the lid before the dish was exposed to UV light.

A valid conclusion, relating to the aim, could be drawn by setting up a control experiment without

- A yeast
  - B sunscreen
  - C yeast and no exposure to UV light
  - D sunscreen and no exposure to UV light.
16. DNA recombinant technology can involve the insertion of a desired gene into a plasmid. The diagram shows restriction sites on a chromosome containing the desired gene. The restriction sites are H (HindIII), E (EcoR1) and B (BamH1).



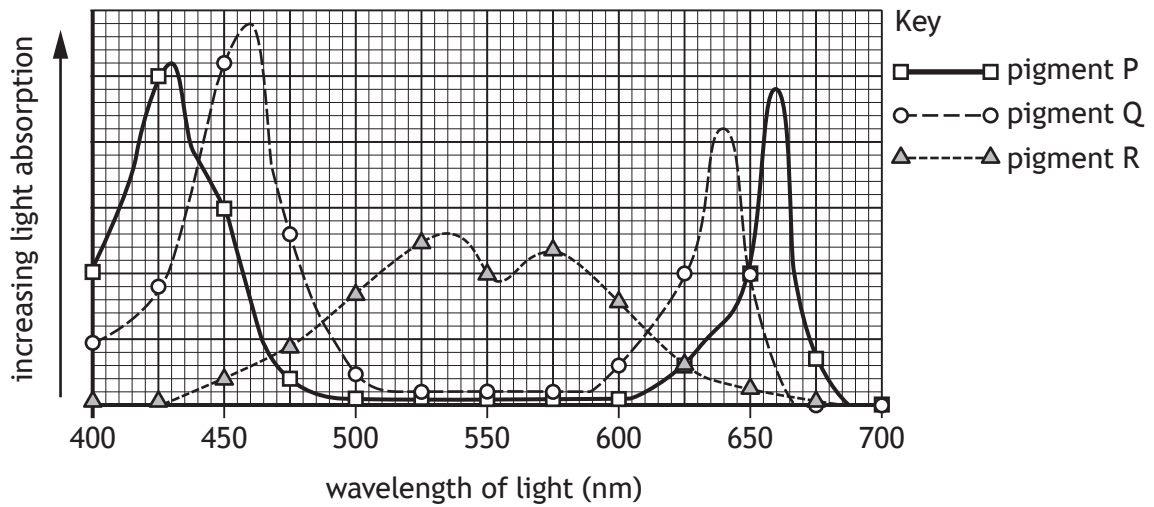
The desired gene should be removed with

- A HindIII
- B EcoR1
- C BamH1
- D BamH1 and HindIII.

[Turn over

17. Water lilies are found on the water surface and algae live below them. Water lilies absorb mostly blue light (400–475 nm) and red light (625–700 nm).

The graph shows the absorption spectra of the three photosynthetic pigments.



To survive below the water lilies, the algae would be expected to have a high concentration of

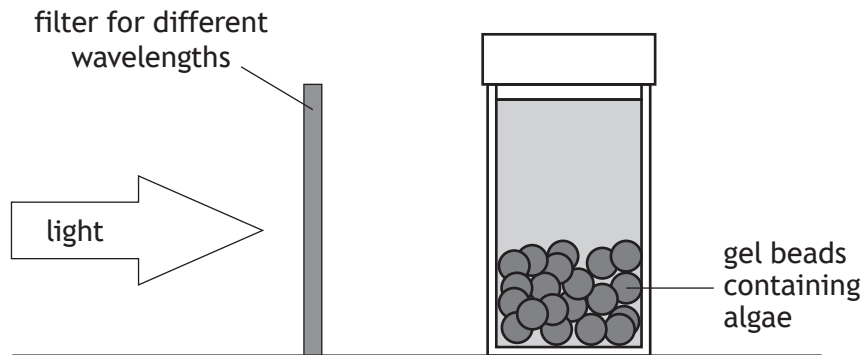
- A pigment P
  - B pigment Q
  - C pigment R
  - D pigments P and Q.
18. The following statements were made about an enzyme involved in photosynthesis:
1. RuBP changes shape to better fit RuBisCO.
  2. RuBisCO converts G3P to glucose.
  3. RuBisCO catalyses fixation of carbon dioxide.

Which of these statements are correct?

- A 2 only
- B 3 only
- C 1 and 2 only
- D 1 and 3 only



19. An experiment into the effect of wavelength of light on the rate of photosynthesis was carried out using algae and an indicator. The indicator changes colour as the algae use up carbon dioxide in the solution and can be used to measure the rate of photosynthesis. Gel beads containing algae were placed in bottles with indicator. Each was exposed to a different wavelength of light as shown.



The time taken for the colour of the indicator to change was recorded.

The validity of this experiment could be ensured by

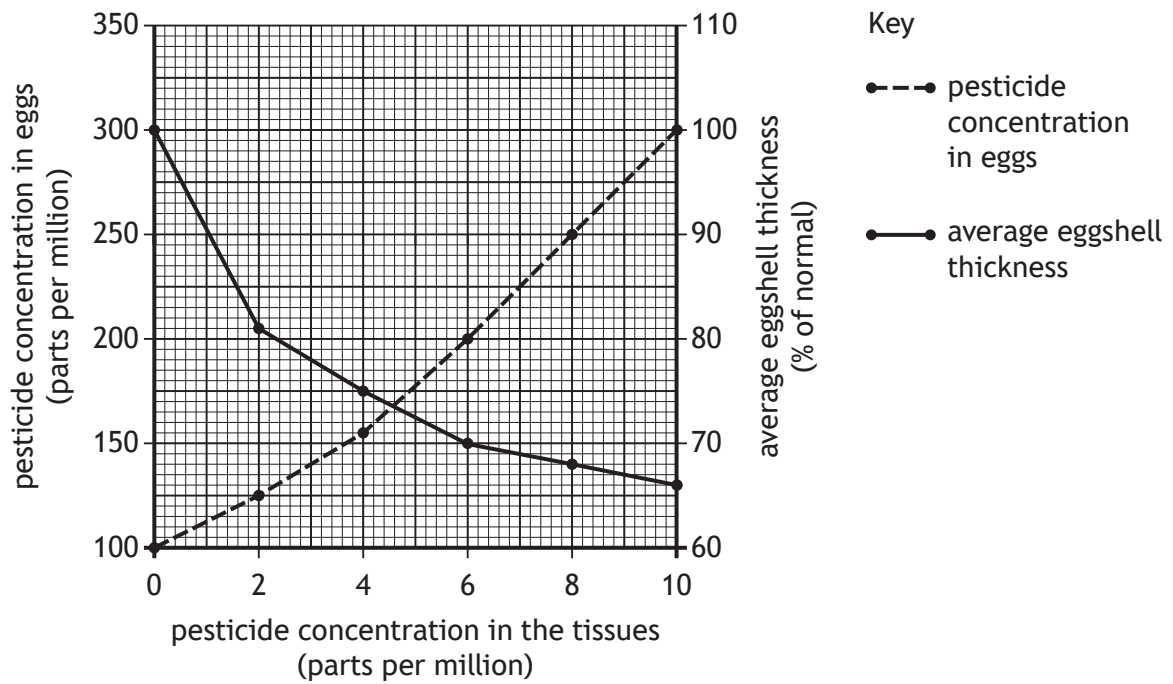
- A repeating the experiment three times
  - B placing a heat shield between the light source and the bottle
  - C increasing the number of gel beads containing algae
  - D using a colorimeter to determine the colour after 10 minutes.
20. The following are features of weeds that compete with crop plants:
1. Storage organs
  2. Vegetative reproduction
  3. Short life cycle

Which are features of perennial weeds?

- A 1 and 2 only
- B 1 and 3 only
- C 2 and 3 only
- D 1, 2 and 3

[Turn over

21. The graph shows how the pesticide concentration in the tissues of birds of prey affects the pesticide concentration in their eggs and the average eggshell thickness.



Predict the pesticide concentration in eggs if the pesticide concentration in the tissues increased to 12 parts per million.

- A 64
- B 110
- C 120
- D 350

22. Examples of recombinant DNA technology used to increase yield in crop plants are listed:
1. Insertion of Bt toxin gene into cotton plants.
  2. Insertion of glyphosate resistance gene into maize plants.
  3. Insertion of drought resistance gene into wheat plants.

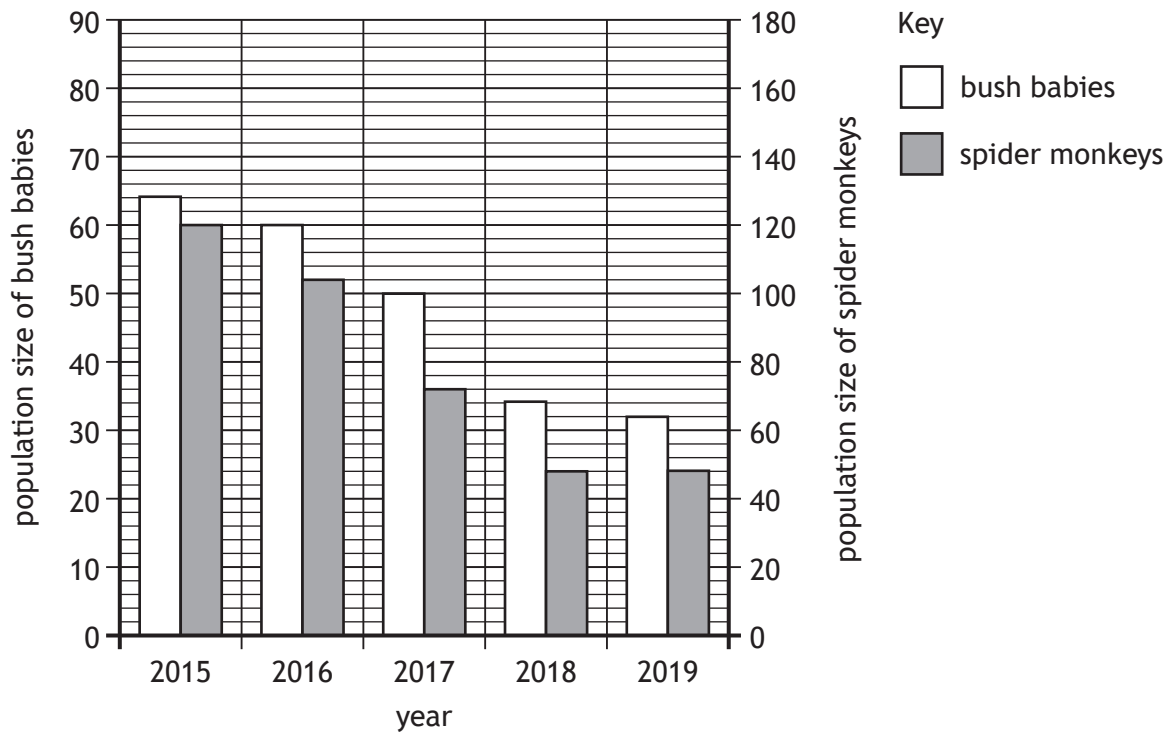
Which of these examples would **decrease** the use of chemicals?

- A 1 only  
B 2 only  
C 1 and 2 only  
D 1 and 3 only
23. Most food in Scotland is produced using intensive farming to increase yield and profit.  
Which row in the table identifies the costs and benefits of converting an intensive farm into a free-range farm?

	Cost	Benefit
A	requires more land	less labour intensive
B	requires more land	animals sold at higher price
C	more labour intensive	requires less land
D	animals sold at lower price	requires less land

[Turn over

24. The graph shows the population sizes of bush babies and spider monkeys in a tropical rain forest between 2015 and 2019.



Which statement is supported by the data?

- A The population sizes of both bush babies and spider monkeys decreased every year.
- B The population size of bush babies is always greater than that of spider monkeys.
- C The population size of spider monkeys in 2015 was 2.5 times greater than in 2018.
- D The lowest population size of bush babies was 32 and spider monkeys was 44.

25. Many animals live in social groups and have behaviours that are adapted to group living. Which row in the table matches a type of behaviour with an example of this behaviour?

	Type of behaviour	Example of behaviour
A	cooperative hunting	vampire bats giving a blood meal to other bats
B	reciprocal altruism	herring forming large groups to confuse predators
C	cooperative hunting	killer whales (Orca) working together to kill seals
D	social defence	killer whales (Orca) working together to kill seals

[END OF QUESTION PAPER]

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SPACE FOR ROUGH WORK

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