



National
Qualifications
2026

X807/76/12

Biology
Paper 1 — Multiple choice

TUESDAY, 28 APRIL

9:00 AM – 9:40 AM

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.

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



Total marks — 25 marks

Attempt ALL questions

1. Which row in the table identifies the type of chromosome in the nucleus, chloroplasts and mitochondria of a plant cell?

	Nucleus	Chloroplasts	Mitochondria
A	linear	circular	circular
B	linear	linear	linear
C	circular	linear	linear
D	circular	circular	circular

2. The statements refer to mutations.

1. A gene is added to the DNA strand.
2. A nucleotide is added to the DNA strand.
3. Only one amino acid in the protein is changed.
4. It has a major effect on the protein produced.

Which statements about insertion mutations are correct?

- A 1 and 3 only
- B 1 and 4 only
- C 2 and 3 only
- D 2 and 4 only

3. A primary mRNA transcript is shown in the diagram.

Exon 1	Intron 1	Exon 2	Intron 2	Exon 3	Intron 3	Exon 4
--------	----------	--------	----------	--------	----------	--------

After alternative RNA splicing, which of the following mature transcripts could be produced?

1.

Exon 1	Exon 2	Exon 4
--------	--------	--------
2.

Exon 1	Exon 4
--------	--------
3.

Exon 2	Exon 1	Exon 3	Exon 4
--------	--------	--------	--------
4.

Intron 1	Intron 2	Intron 3
----------	----------	----------

- A 1 and 2 only
B 1 and 3 only
C 1, 2 and 3 only
D 4 only

4. Oysters are a species of small mollusc and live on the seabed. Their shell colour ranges from light to dark. Oysters with light coloured shells are camouflaged on sandy seabeds in shallow water. Oysters with dark coloured shells are difficult to see in the low light intensities in deeper water. Oysters with intermediate coloured shells are more easily seen in both areas, so are more commonly eaten by predators.

The populations of light and dark coloured oysters are increasing as a result of

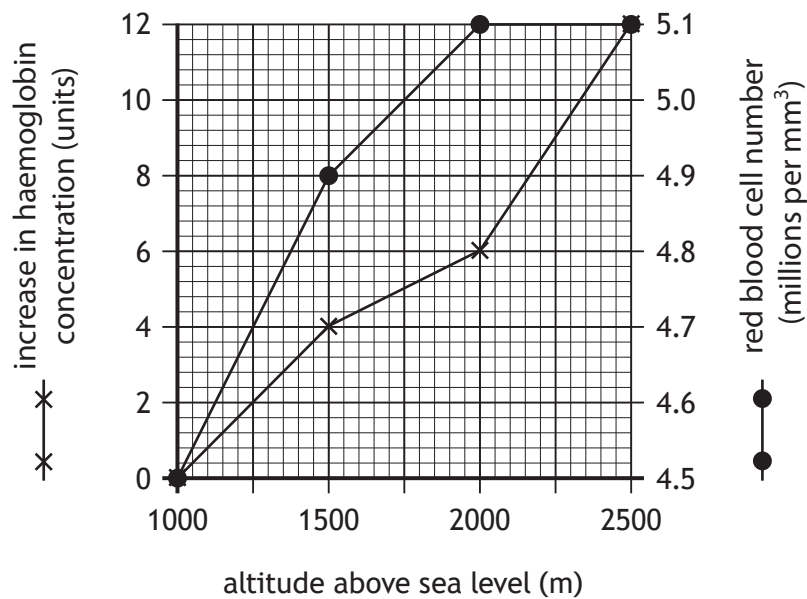
- A directional selection
B disruptive selection
C stabilising selection
D random selection.

5. Why can evolution by natural selection be more rapid in prokaryotes than in eukaryotes?

- A Prokaryotes do not exchange genetic material.
B Eukaryotes can exchange genetic material vertically.
C Eukaryotes can exchange genetic material horizontally.
D Prokaryotes can exchange genetic material horizontally.

[Turn over

6. Which of the following is a description of phylogenetics?
- A The changes in organisms over generations as a result of genomic variations.
 - B The use of computers and statistical analysis to compare sequence data.
 - C The study of evolutionary history and relationships.
 - D The analysis of genomes to predict the likelihood of developing certain diseases.
7. An investigation was carried out to determine the effect of altitude on the number of red blood cells and the increase in haemoglobin concentration of human blood.
- The results are shown in the graph.



What is the red blood cell number when the increase in haemoglobin concentration is 50% of its maximum?

- A 4.8 million per mm³
- B 5.1 million per mm³
- C 6.0 million per mm³
- D 12.0 million per mm³

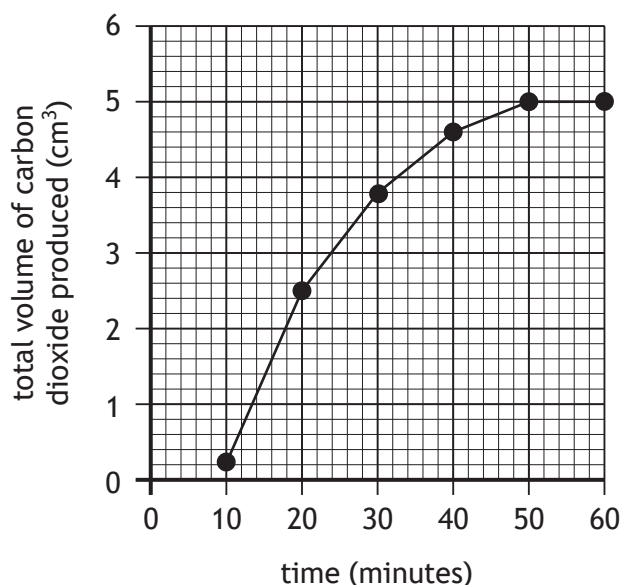
8. Which row in the table identifies the location and the number of ATP molecules used and produced during the fermentation of one molecule of glucose?

	Location	Number of ATP used	Number of ATP produced
A	cytoplasm	4	2
B	cytoplasm	2	4
C	mitochondria	2	4
D	mitochondria	4	2

9. An experiment was carried out into the rate of fermentation in yeast.

5 g of yeast was added to a glucose solution, and the total volume of carbon dioxide produced was recorded every 10 minutes for 1 hour.

The results are shown in the graph.



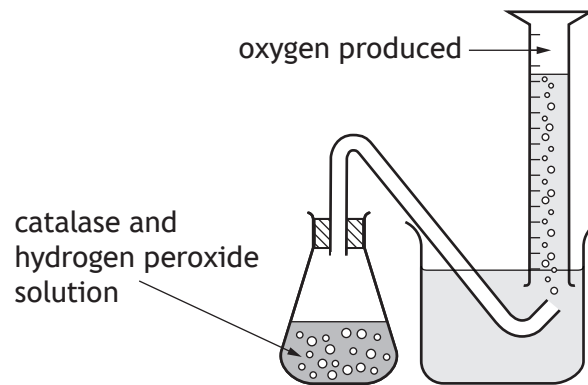
Based on the trend shown, predict the volume of carbon dioxide collected, **per gram of yeast added**, if the experiment had been allowed to run for another 10 minutes.

- A 0.1 cm³
- B 1.0 cm³
- C 4.5 cm³
- D 5.0 cm³

[Turn over

10. Catalase breaks down hydrogen peroxide into oxygen and water.

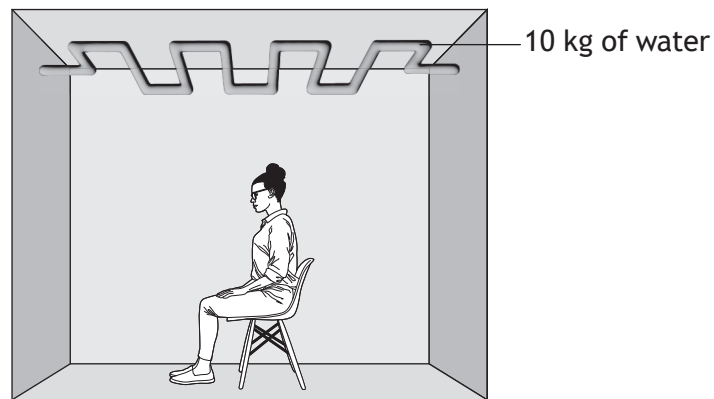
The diagram shows an experiment set up to investigate the effect of catalase concentration on the rate of breakdown of hydrogen peroxide. The experiment was repeated with different catalase concentrations.



The dependent variable for this experiment is

- A the rate of breakdown of hydrogen peroxide
- B the concentration of catalase
- C the volume of hydrogen peroxide
- D the concentration of hydrogen peroxide.

11. The metabolic rate of humans can be measured using a calorimeter as shown in the diagram.



human in calorimeter

The heat generated by the human caused a rise in the temperature of water in the pipe. The difference in water temperature over a 2-hour period was recorded and used to calculate metabolic rate.

Energy used can be calculated using the formula:

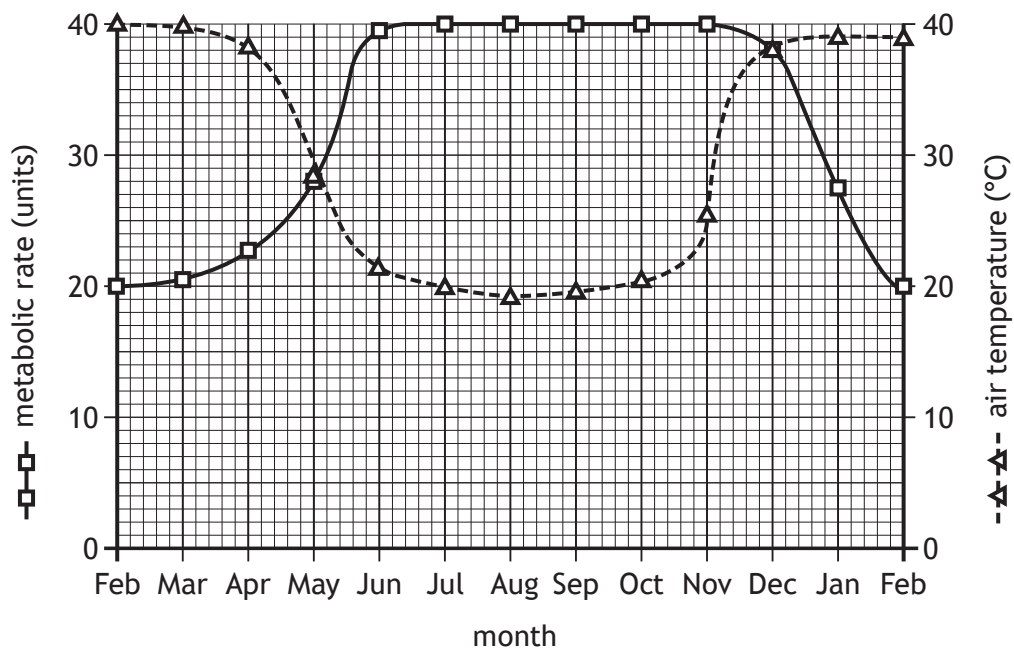
$$\text{energy (kJ)} = 4.2 \times \text{mass of water (kg)} \times \text{change in temperature (}^{\circ}\text{C)}$$

If the water temperature increased by 12 °C over 2 hours, calculate the metabolic rate of a 50 kg human.

- A 5.04 kJ/kg/hour
- B 10.08 kJ/kg/hour
- C 252.00 kJ/kg/hour
- D 504.00 kJ/kg/hour

[Turn over

12. The graph shows the metabolic rate of an Australian green striped burrowing frog and the air temperature during one year.



Identify the type of dormancy and behaviour displayed by the frog.

	Type of dormancy	Type of behaviour
A	predictive	aestivation
B	consequential	aestivation
C	predictive	hibernation
D	consequential	hibernation

13. Which behaviour do animals use to avoid metabolic adversity?

- A Daily torpor
- B Hibernation
- C Migration
- D Aestivation

14. 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

15. Many bacteria produce secondary metabolites during their growth.

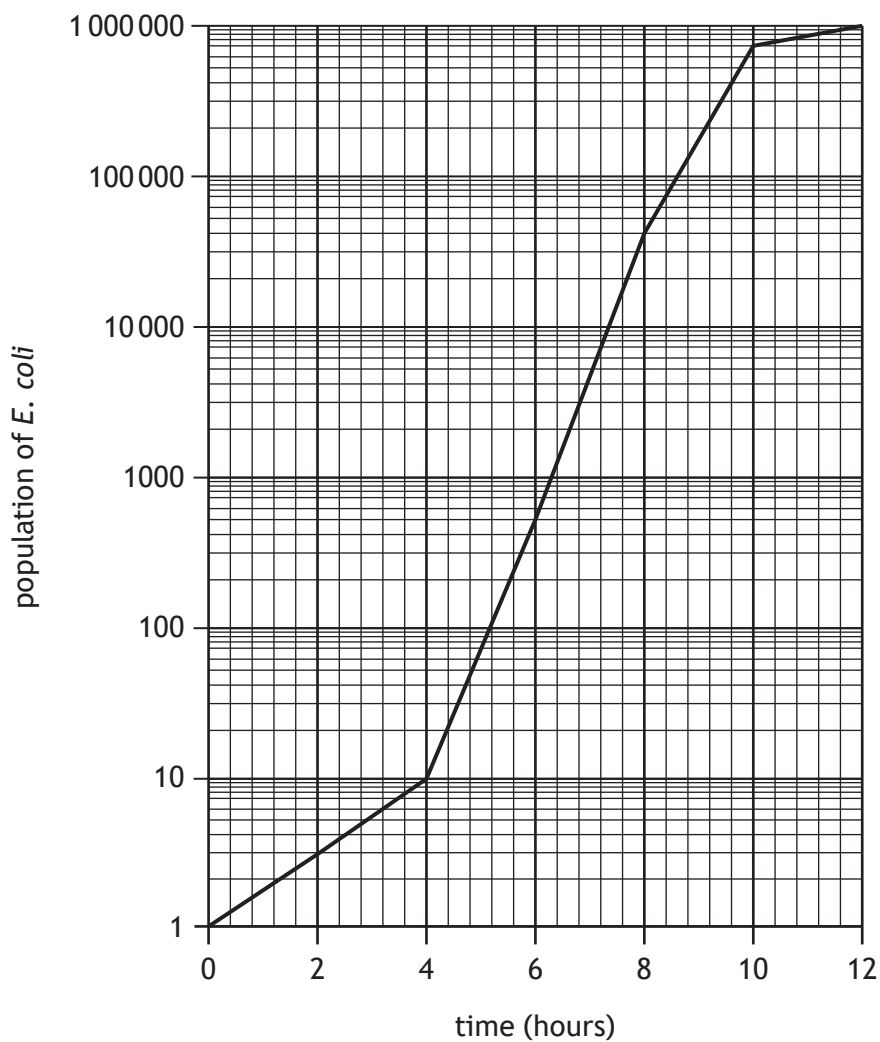
Which row in the table identifies the phase of growth when secondary metabolites are produced and a possible advantage to the bacteria?

	Growth phase	Advantage
A	log phase	reduced toxic metabolites
B	log phase	reduced competition from other bacteria
C	stationary phase	reduced toxic metabolites
D	stationary phase	reduced competition from other bacteria

[Turn over

16. *E. coli* bacteria can be grown in culture in the lab. The number of *E. coli* cells growing in culture was recorded every two hours over a 12-hour period.

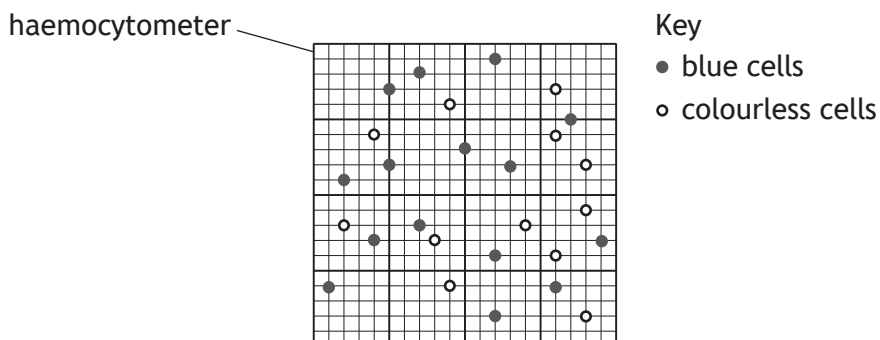
The results are shown in the graph.



Which row in the table identifies the increase in population between 6 and 8 hours and the growth phase in which this increase occurs?

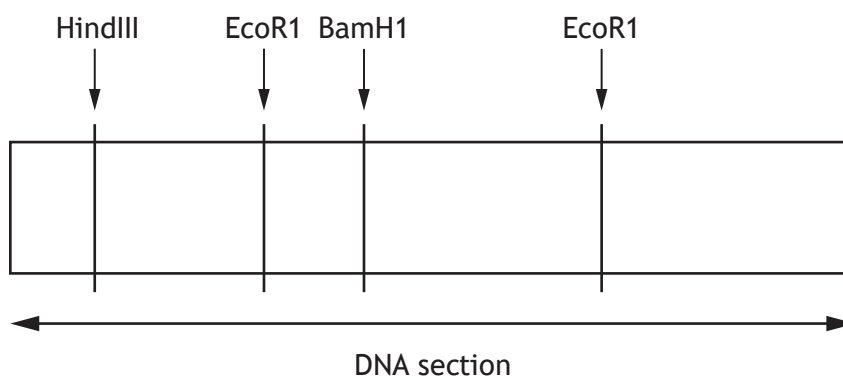
	Increase in population	Growth phase
A	12 860	lag
B	12 860	log
C	39 500	log
D	39 500	lag

17. A sample of cultured cells was treated with a blue dye to determine if the cells were alive or dead. The dead cells appeared blue and living cells were colourless.
- A sample of the culture was added to a haemocytometer as shown.
- The total volume of the sample in this haemocytometer was 0.04 cm^3 .



The viable cell count for this sample in cells per cm^3 is

- A 12
B 15
C 300
D 375.
18. Restriction endonucleases can be used to produce fragments of DNA by cutting at specific restriction sites.
- A section of DNA was cut into fragments using three different restriction endonucleases, HindIII, EcoRI and BamHI.
- The restriction sites for each enzyme are shown in the diagram.



Which combination of the restriction endonucleases would result in only three fragments being produced?

- A EcoRI and BamHI only
B EcoRI and HindIII only
C HindIII and BamHI only
D HindIII, EcoRI and BamHI

19. Which statement relating to food production is **not** correct?
- A Livestock produce less food per unit area than crop plants.
 - B Livestock production is often possible in habitats unsuitable for growing crops.
 - C Less energy is lost in food chains with more trophic levels.
 - D Breeding of higher yielding cultivars can increase crop production.

20. Sheep were divided into two groups. Each group contained 20 newborn lambs and their mothers. Group 1 was fed grass only while group 2 was fed grass and a wheat-based supplement.

The mass of each lamb was recorded over a 14-week period and the average mass in each group is shown in the table.

Age (weeks)	Average mass (kg)	
	Group 1	Group 2
0	5.2	5.1
4	14.1	15.8
8	25.7	27.3
14	34.6	39.4

Over the 14-week period the difference in the average increase in mass between group 1 and group 2 was

- A 0.35 kg per week
 - B 2.00 kg per week
 - C 4.90 kg per week
 - D 107.16 kg per week.
21. The following behaviours of chimpanzees in a zoo were observed.
- 1. Grooming
 - 2. Stereotypy
 - 3. Sexual presentation
 - 4. Misdirected behaviour

Which behaviours indicate poor animal welfare?

- A 1 and 3 only
- B 1 and 4 only
- C 2 and 3 only
- D 2 and 4 only

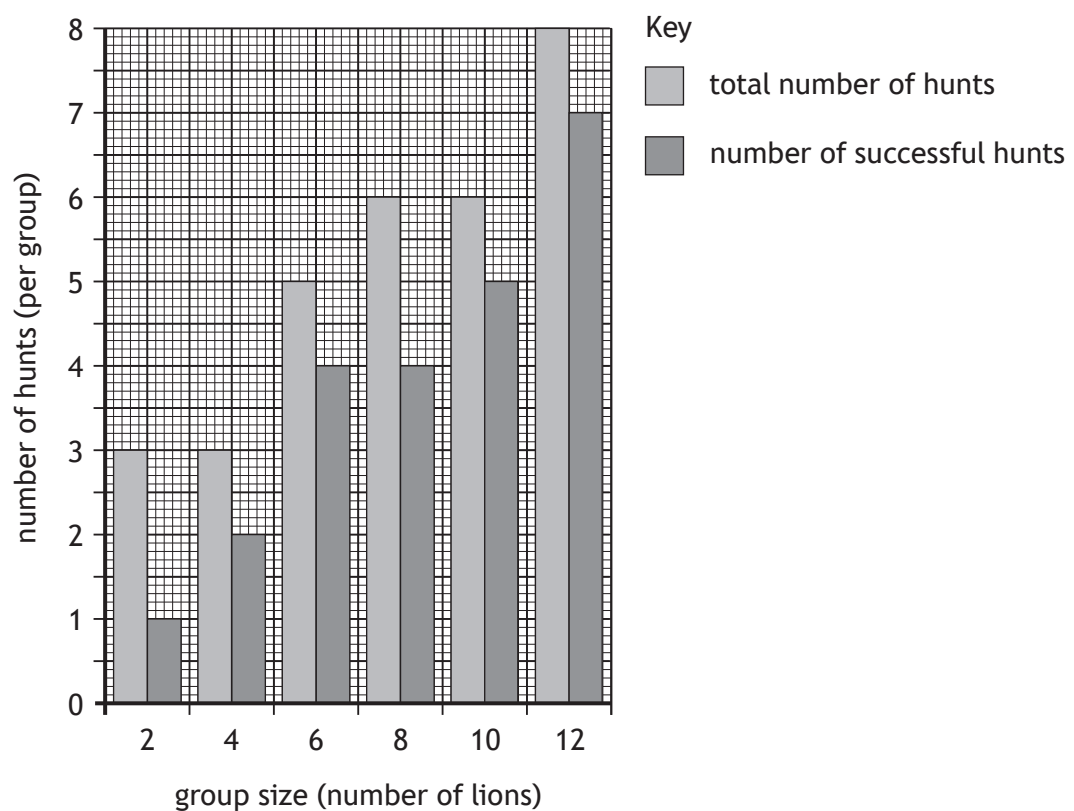
22. Musk oxen are large herbivores that are preyed on by wolves. When threatened by wolves, the adults form a protective circle with their young in the centre.

This is **not** an example of

- A social defence
- B kin selection
- C mutualism
- D altruistic behaviour.

23. Lions are predators that live in social groups and use co-operative hunting.

The bar chart shows the relationship between group size, number of hunts and number of successful hunts.



Which of the following statements is supported by the data shown?

- A As group size increases the total number of hunts increases.
- B Between group size 8 and 10 the number of successful hunts remain the same.
- C The percentage of hunts that were successful is greatest when the group size is 12.
- D Group size of 4 has the most successful hunts per lion.

[Turn over

24. An investigation was carried out into the frequency of feeding on the growth of chickens on a farm.

The table shows the feeding frequency for each group.

Group	Feeding frequency (meals per day)
1	2
2	4
3	6
4	8

Each group was fed the same total mass of corn per day. The chickens were weighed at the start of the investigation and reweighed after four weeks. Their growth rates were then calculated.

Which aspect of this investigation would increase its validity?

- A Feeding the same mass of corn in each meal
 - B Carrying out the investigation across more farms
 - C Increasing the number of chickens in each group
 - D Using the same breed of chicken in all groups
25. The species diversity in four different sample sites in a moorland ecosystem was studied. The number of plants of each species present in each sample site was counted.
- Which sample site has the highest species diversity?

Sample site	Number of plants of each species			
	Cross-leaved heath	Common ling	Bell heather	Purple moor grass
A	0	52	63	48
B	24	57	17	17
C	8	58	12	62
D	22	19	16	17

[END OF QUESTION PAPER]

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK



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National
Qualifications
2026

Mark

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X807/76/01

**Biology
Paper 2**

TUESDAY, 28 APRIL
10:10 AM – 12:30 PM



Fill in these boxes and read what is printed below.

Full name of centre

--

Town

--

Forename(s)

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Surname

--

Number of seat

--

Date of birth

Day

--	--

Month

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Year

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Scottish candidate number

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Total marks — 95

Attempt ALL questions.

You may use a calculator.

Questions 9 and 14 contain a choice.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers and rough work is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting. Any rough work must be written in this booklet. Score through your rough work when you have written your final copy.

Use **blue** or **black** ink.

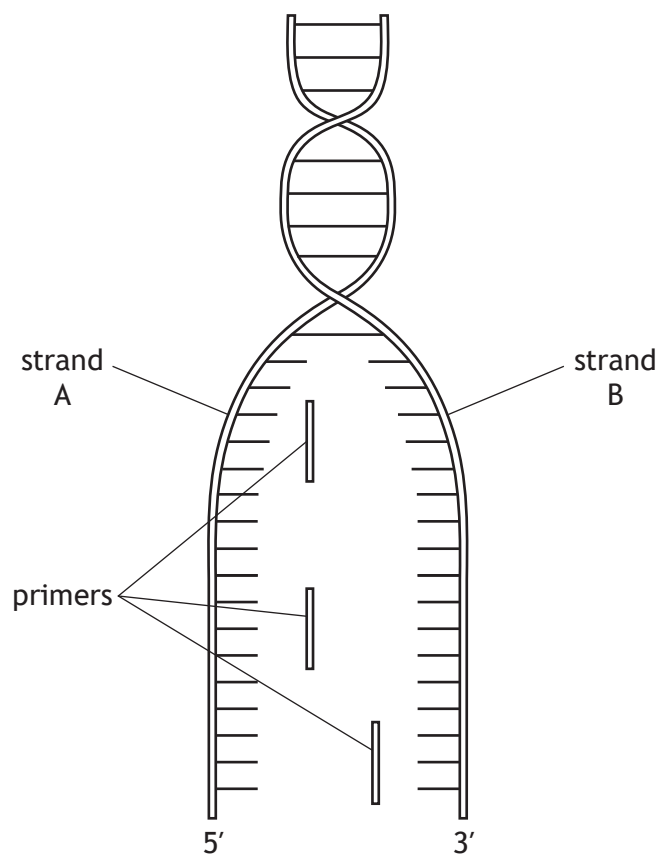
Do not remove any exam materials. You must leave this booklet on your desk; if you do not, you could lose all the marks for this paper.



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Total marks — 95
Attempt ALL questions
Questions 9 and 14 contain a choice

1. The diagram represents a stage in DNA replication.



- (a) (i) State the term used to describe the shape of a DNA molecule. 1

- (ii) Name the part of a nucleotide found at the 5' end of a DNA strand. 1



1. (continued)

(b) Primers are necessary for DNA replication.

(i) State why replication of strand B requires only one primer.

1

(ii) Primers are short strands of **RNA nucleotides**.

The base sequence of DNA on strand B that the primer binds to is shown.

C G A A T C G T

Give the base sequence of this primer.

1

(c) Name one enzyme involved in DNA replication and state its function.

2

Enzyme _____

Function _____

(d) In prokaryotic cells, DNA replicates at a rate of 1000 nucleotides per second. In comparison, eukaryotic DNA can replicate at a rate of 50 nucleotides per second.

Calculate how many times greater the rate of replication is in prokaryotic cells compared to eukaryotic cells.

1

Space for calculation

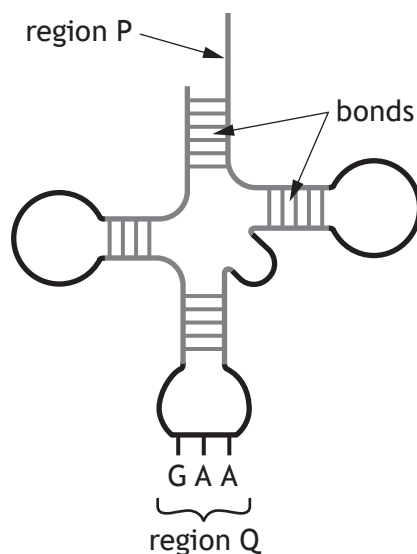
_____ times greater

[Turn over



* X 8 0 7 7 6 0 1 0 3 *

2. tRNA is a single strand of RNA, which has an important role in translation. It is folded into a specific shape as shown in the diagram.



- (a) (i) Name regions P and Q.

2

Region P _____

Region Q _____

- (ii) Name the type of bonds shown in the diagram that hold the tRNA molecule in shape.

1

- (b) Describe the role of tRNA in translation.

2

- (c) Describe the effects of frame-shift and nonsense mutations on the resulting sequence of amino acids in a polypeptide.

2

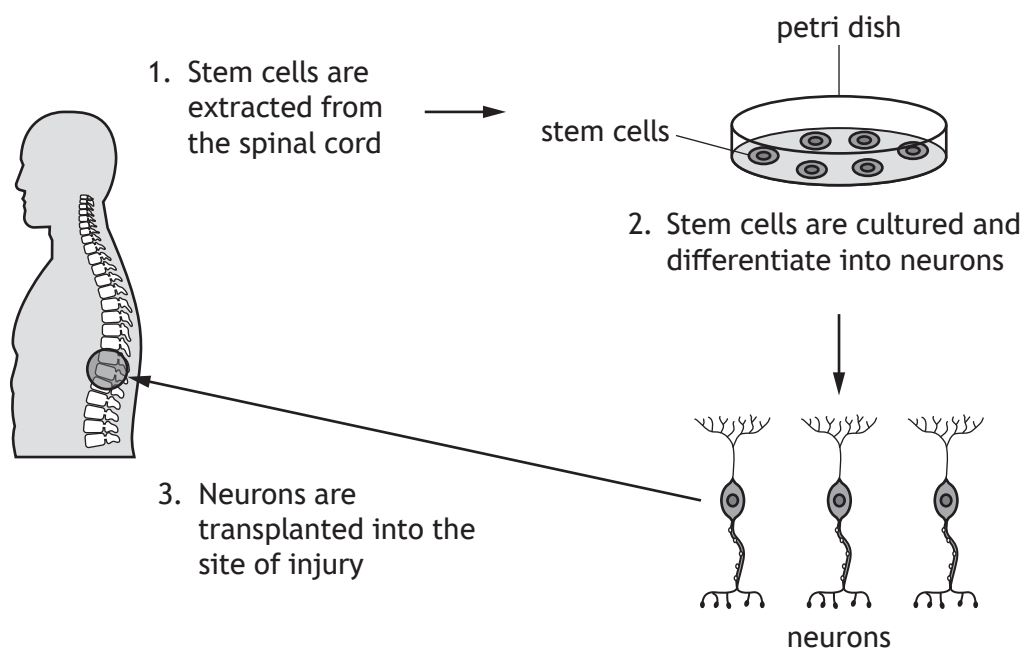
Frame-shift _____

Nonsense _____



3. Damage to the spinal cord can result in changes to body functions below the site of injury.

The diagram shows a therapeutic use of stem cells following a spinal cord injury.



- (a) (i) Describe the process of cell differentiation.

1

- (ii) Using information from the diagram, state why the stem cells from the spinal cord are known as tissue stem cells.

1

- (iii) State why this method is an example of a therapeutic use of stem cells.

1

- (iv) State an ethical reason for using tissue stem cells rather than embryonic stem cells to treat spinal cord injuries.

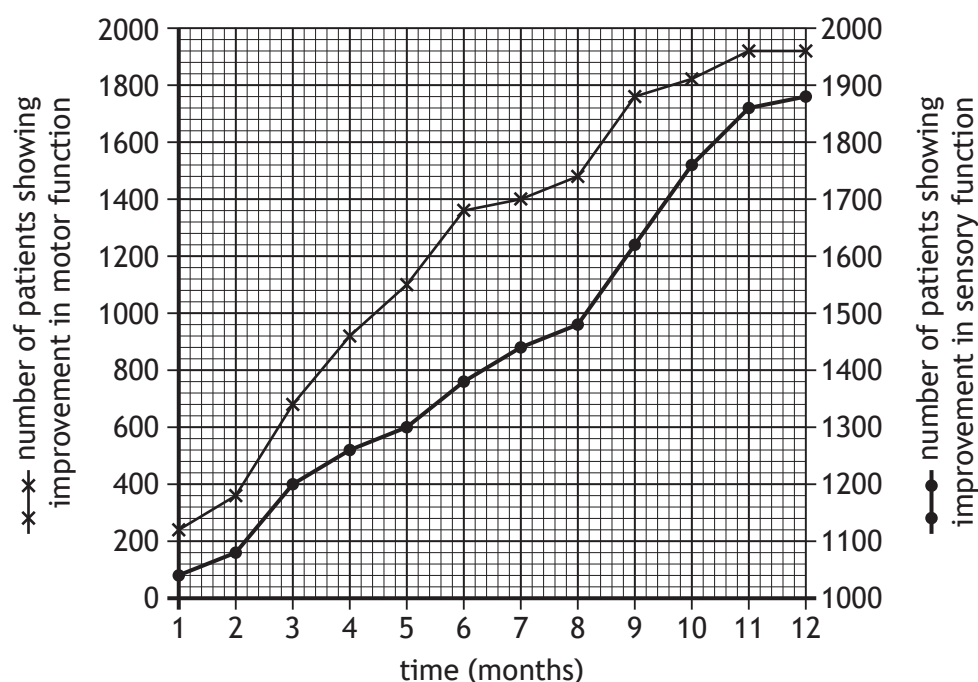
1



3. (continued)

- (b) A clinical study involving 2500 spinal injury patients was carried out to investigate the effectiveness of stem cell therapy.

The graph shows the number of patients showing an improvement in motor function and sensory function over 1 year of treatment.



- (i) State the number of patients showing improvement in motor function at 11 months.

1

- (ii) Calculate the percentage of patients who showed an improvement in motor function at 3 months.

1

Space for calculation

_____ %



3. (b) (continued)

- (iii) State the number of patients showing an improvement in sensory function when the number of patients showing an improvement in motor function is 1400.

1

- (iv) Some patients showed improvement in both motor and sensory function. Use evidence from the graph at 9 months to support this statement.

1

[Turn over



4. Saddleback and domed tortoises are two different sub-species of giant tortoise that live on the Galapagos Islands. Saddleback tortoises have a high shell behind the neck and long front legs, allowing them to eat tall cactus plants. Domed tortoises have a low shell behind the neck, short front legs and feed mainly on grass.



saddleback tortoise



domed tortoise

A population of saddleback tortoises lives on a dry, hot island, and a population of domed tortoises lives on an island with humid forests.

Speciation is thought to be occurring.

- (a) (i) These two populations have been isolated by a geographical barrier.

Explain the importance of this barrier in speciation.

1

- (ii) Name the type of speciation that may occur.

1

- (iii) Describe how it could be proved that the two populations of tortoise were still the same species.

1

- (b) The shells of saddleback tortoises rise upward behind their necks allowing them to feed on tall plants.

Explain how natural selection has led to the increase in frequency of high shells of the saddleback tortoises living on the dry, hot island.

2



4. (continued)

- (c) Giant tortoise numbers on the Galapagos Islands have been estimated and the data are shown in the table.

Year	Estimated population
1600	200 000
1970	2500
2020	17 000

The rapid decline in numbers between 1600 and 1970 was due to human impact. The increase in numbers after 1970 is due to a captive breeding and release programme.

- (i) Calculate the percentage decrease in the population of giant tortoises between 1600 and 1970.

1

Space for calculation

_____ %

- (ii) Assuming numbers increase at the same rate as they have between 1970 and 2020, predict the estimated tortoise number in 2030.

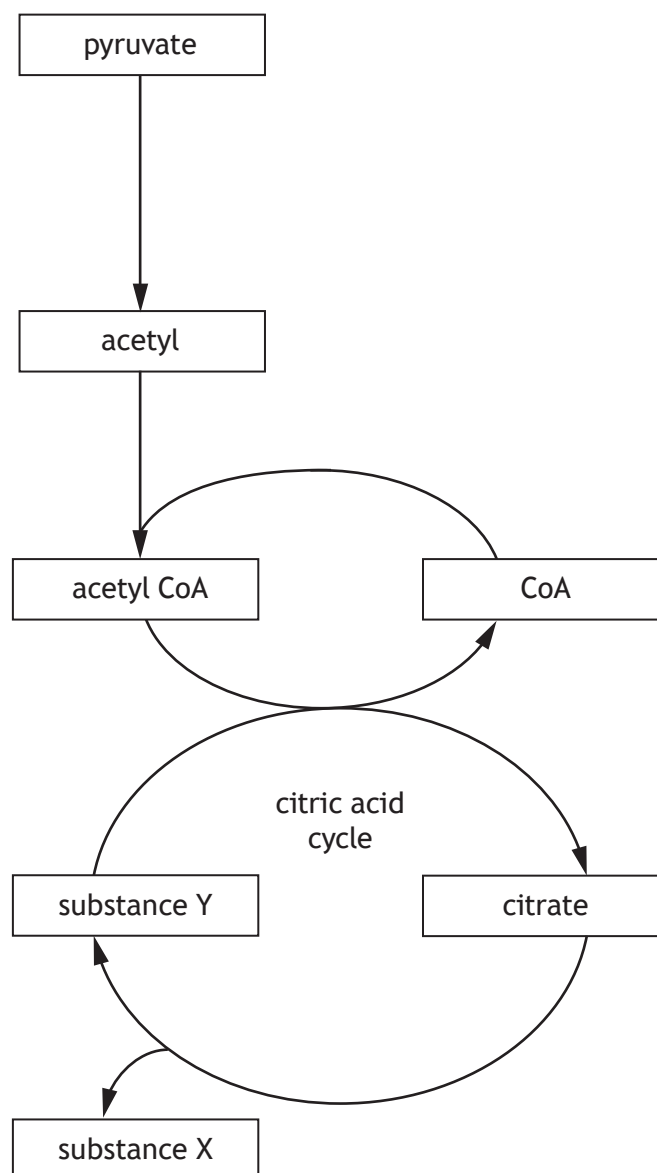
1

Space for calculation

[Turn over



5. The diagram shows stages of aerobic respiration.



(a) Name substances X and Y.

2

X _____

Y _____

(b) State the exact location of the citric acid cycle in yeast cells.

1



5. (continued)

- (c) Describe the role of dehydrogenase and NAD in the citric acid cycle.

2

Dehydrogenase _____

NAD _____

- (d) Fermentation can take place in yeast cells.

- (i) State the conditions required for fermentation to take place.

1

- (ii) Name the products of fermentation in yeast cells.

1

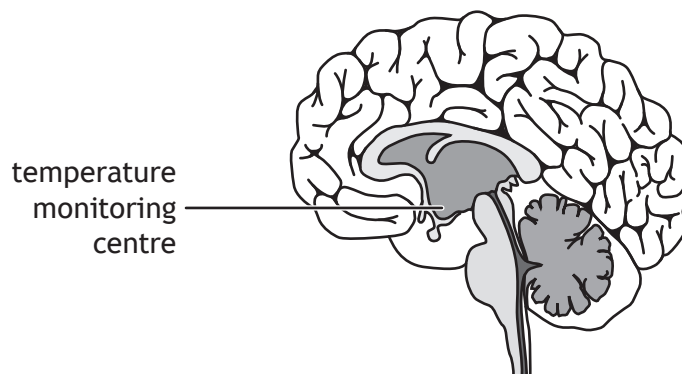
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* X 8 0 7 7 6 0 1 1 1 *

6. In humans, body temperature changes are detected and corrective responses by effectors return the body temperature to normal.

The diagram shows the region of the brain responsible for monitoring body temperature.



- (a) (i) Name the temperature monitoring centre in the brain.

1

- (ii) Describe how information is communicated from the temperature monitoring centre to the effectors.

1

6. (continued)

- (b) Describe one corrective response that would take place in the human body when exposed to low temperatures and explain how this response helps to return body temperature to normal.

2

Corrective response _____

Explanation _____

- (c) Explain the importance of thermoregulation in humans.

2

- (d) Name the mechanism used by humans to achieve homeostasis.

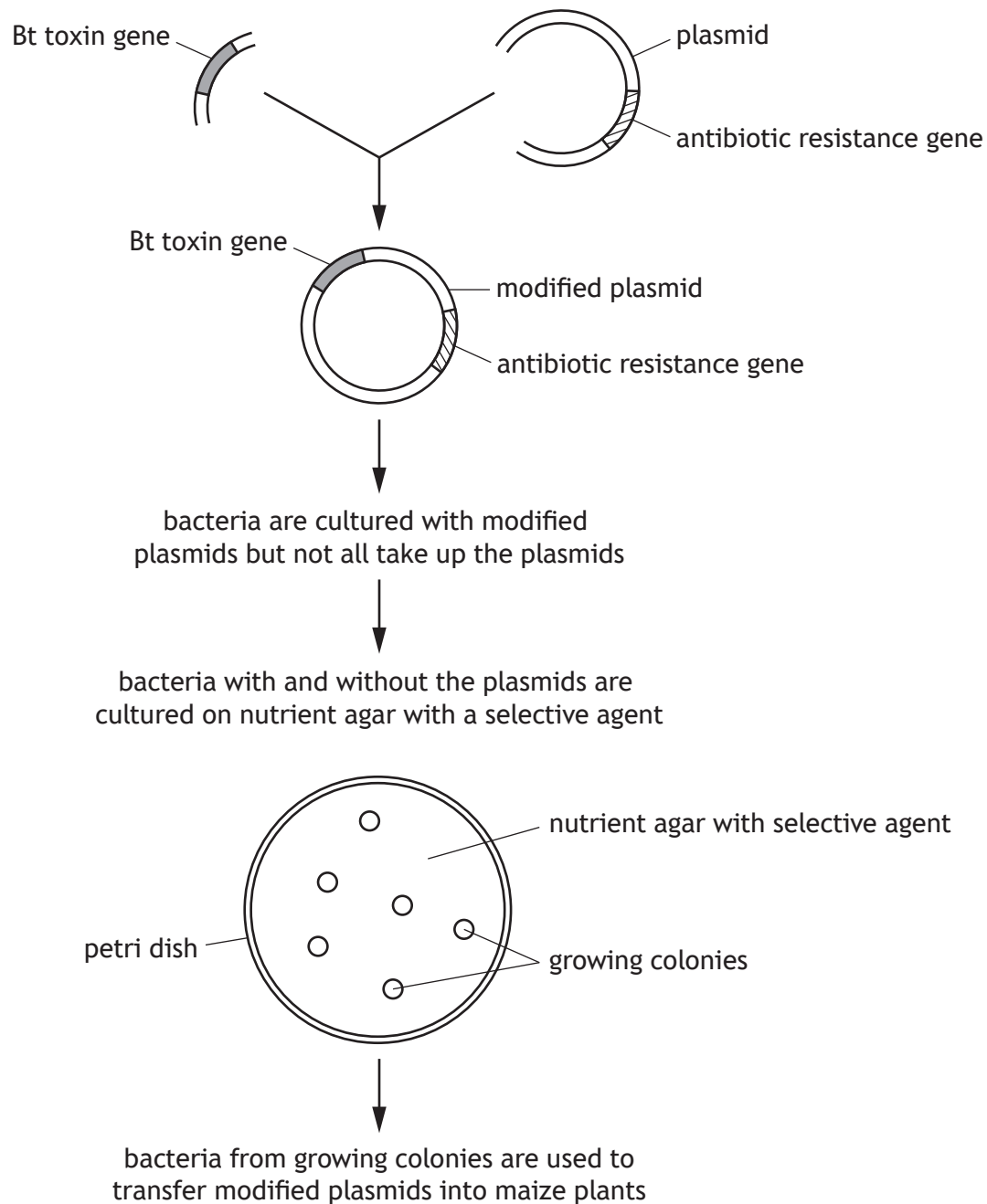
1

[Turn over



7. The food crop maize has been genetically modified to produce a protein called Bt toxin, which kills invertebrate pests that feed on the leaves.

The diagram shows some stages in the production of these plants.



7. (continued)

- (a) Explain why the same restriction endonuclease must be used to remove the Bt toxin gene and to open the plasmid.

1

- (b) Name the enzyme used to seal the Bt toxin gene into the plasmid.

1

- (c) The bacteria were grown on nutrient agar plates containing a selective agent. Name the selective agent and explain the importance of including it in the nutrient agar.

2

Selective agent

Explanation

- (d) Explain why growing maize plants containing the Bt toxin gene results in an increase in yield.

2

[Turn over



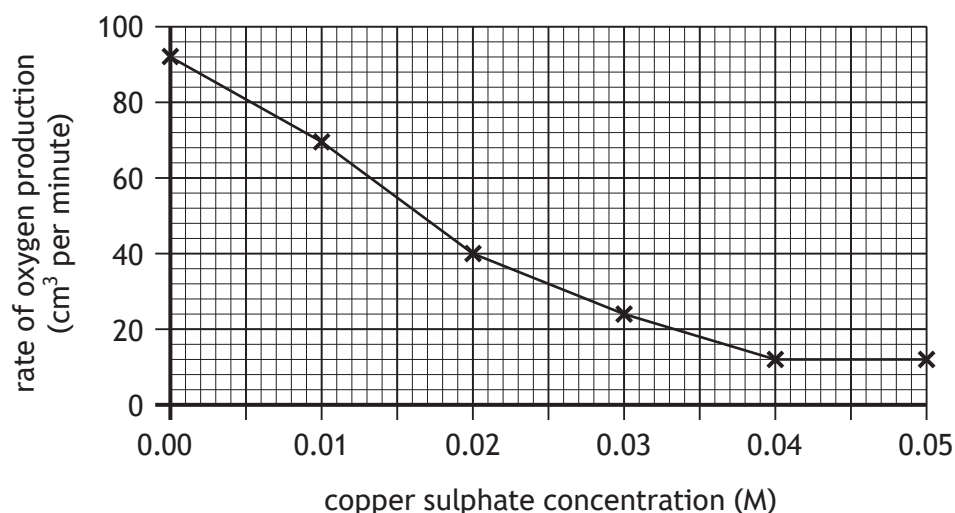
* X 8 0 7 7 6 0 1 1 5 *

8. Catalase is an enzyme that breaks hydrogen peroxide down into oxygen and water. Enzyme activity can be measured by recording the rate of oxygen production during this reaction.

An investigation was carried out into the effect of concentration of the inhibitor copper sulphate on catalase activity.

The results are shown in **Graph 1**.

Graph 1



- (a) Using values from **Graph 1**, describe changes in the rate of oxygen production as copper sulphate concentration increases.

2

- (b) One of the copper sulphate concentrations acted as a control. State the copper sulphate concentration of the control.

1

_____ M



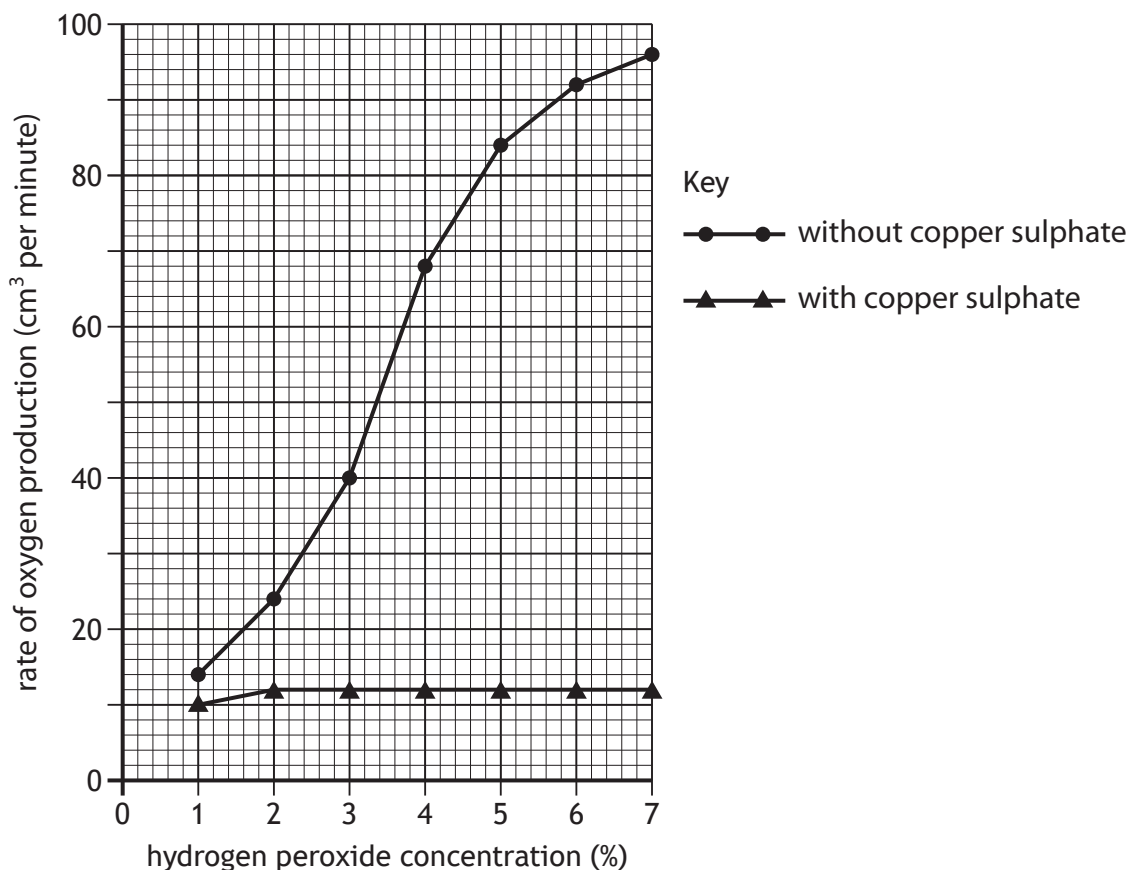
8. (continued)

MARKS
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MARGIN

- (c) The effect of increasing the hydrogen peroxide concentration on the rate of oxygen production was investigated in the presence and absence of copper sulphate.

The results are shown in **Graph 2**.

Graph 2



Name the type of inhibition taking place in this reaction and justify your answer.

2

Type of inhibition _____

Justification _____

- (d) Using information from Graph 1 and Graph 2:

- (i) identify the concentration of hydrogen peroxide used to produce the data shown in **Graph 1**

1

_____ %

- (ii) suggest the concentration of copper sulphate used to produce the data shown in **Graph 2**.

1

_____ M



* X 8 0 7 7 6 0 1 1 7 *

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4	
4	

9. Attempt **either A or B**. Write your answer in the space below.

A Write notes on the electron transport chain in aerobic respiration.

OR

B Write notes on growth media and culture conditions for growing micro-organisms.

You may use labelled diagrams where appropriate.



[Turn over for next question

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* X 8 0 7 7 6 0 1 1 9 *

10. The concentrations of chlorophyll a, chlorophyll b, and the carotenoids xanthophyll and carotene in the cells of two different species of algae were measured.

The results are shown in the table.

Pigment	Concentration (mg/L)	
	Species A	Species B
Chlorophyll a	87	86
Chlorophyll b	35	36
Xanthophyll	31	61
Carotene	24	71

- (a) (i) Calculate the difference in carotenoid concentration in species B relative to species A.

1

Space for calculation

_____ mg/L

- (ii) Algal species A and B grow below the surface of the water.

Suggest why species B would grow better than species A in a pond containing many surface plants.

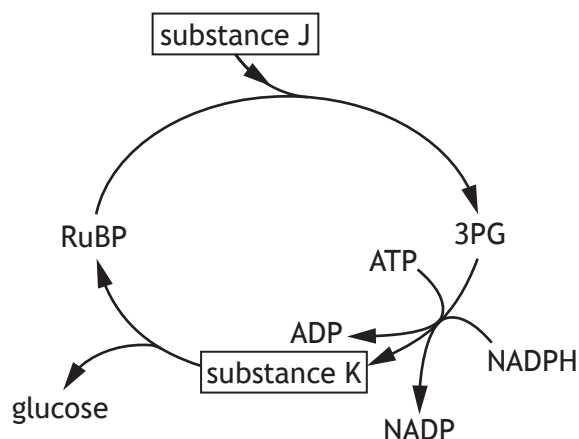
2



10. (continued)

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- (b) The diagram represents the carbon fixation (Calvin cycle) stage of photosynthesis.



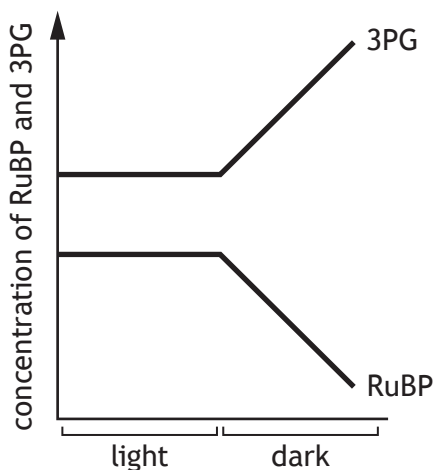
Name substances J and K.

2

J _____

K _____

- (c) In an investigation into the effect of light on photosynthesis, algal cells were exposed to a period of light then dark. The concentrations of RuBP and 3PG were recorded throughout the investigation and are shown in the diagram.



- (i) Explain why the concentration of RuBP remained constant in the light.

1

- (ii) Explain why the concentration of 3PG increased in the dark.

1



11. Rice plants develop structures called spikelets from which rice grains can be harvested. The greater the number of spikelets per plant the greater the rice yield.

A field trial was carried out to test the effect of mass of nitrate fertiliser on the number of spikelets produced. The rice plants were grown in same sized plots with four replicates per mass of nitrate fertiliser. After 16 weeks growth, the number of spikelets per plant was counted.

The results are shown in the table.

Mass of nitrate fertiliser (g per plot)	Average number of spikelets per plant				
	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Overall average
10	23	22	25	26	24
25	52	20	77	55	51
50	69	65	70	68	68
100	77	73	72	74	74
150	79	83	72	82	79
200	81	75	78	82	79

- (a) (i) Name the independent variable. 1

- (ii) Identify one variable in this field trial, not already mentioned, which would have to be kept constant so that a valid conclusion can be made. 1

- (iii) Identify the mass of nitrate fertiliser a farmer should apply to generate the highest profit and justify your answer. 2

Mass of nitrate fertiliser _____ g per plot

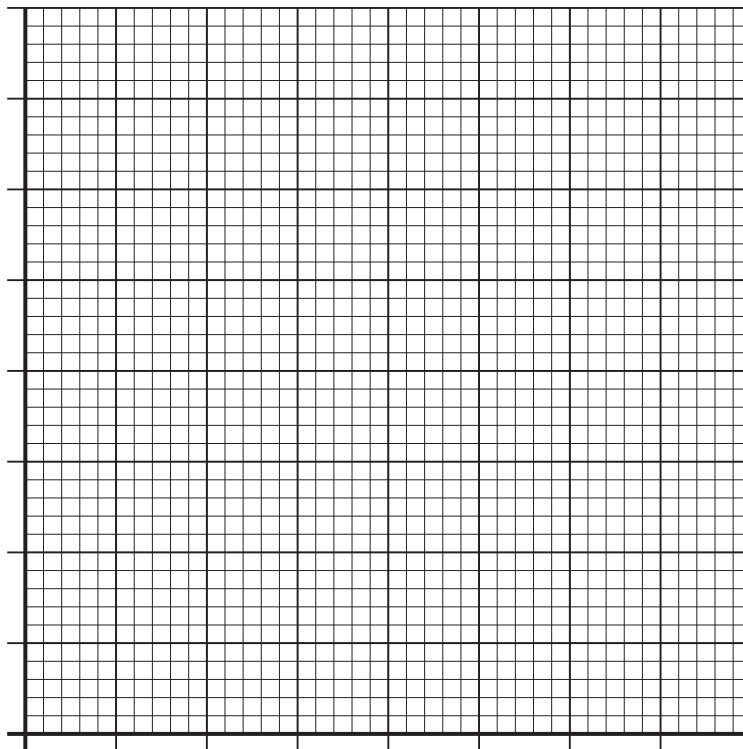
Justification _____



11. (continued)

- (b) On the grid, draw a line graph using the overall average results in the table.
(Additional graph paper, if required, can be found on *page 32*.)

2



- (c) State the conclusion from the results of this field trial.

1

[Turn over



12. The pug is a modern breed of dog, bred for desirable characteristics such as flattened face, curly tail and big eyes. Pugs have been produced by breeding closely related animals for many generations.

(a) Name this type of breeding used to produce pugs.

1

(b) Pugs often suffer from health problems including breathing difficulties and abnormal hip joints.

State the term used to describe the cause of these health problems and explain how it occurs.

2

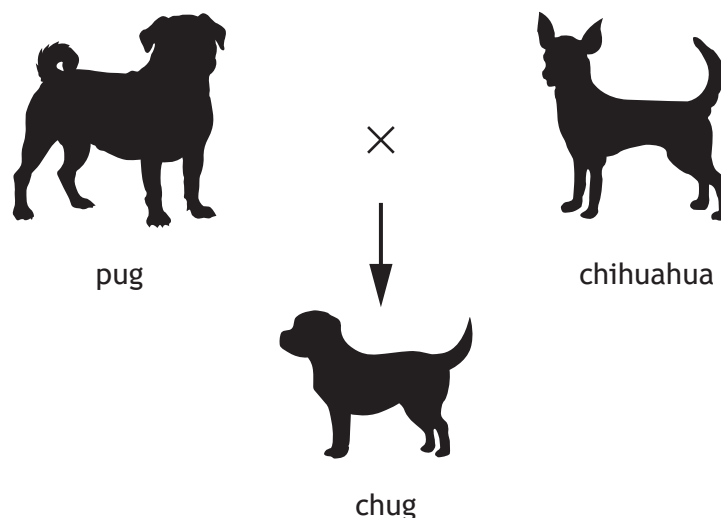
Term _____

Explanation _____



12. (continued)

- (c) Dog breeders have crossed pugs with chihuahuas to produce a F_1 hybrid called a chug.



- (i) Some chugs have improved characteristics compared to their parents. State the term used to describe improved characteristics in chugs. 1
- _____
- (ii) Explain why dog breeders produce chugs by crossbreeding pugs and chihuahuas rather than breeding two chugs together. 1
- _____
- _____
- (d) The allele for long nose is dominant and the allele for flattened nose is recessive. A chihuahua homozygous for a long nose was bred with a pug with a flattened nose. All the F_1 chugs produced had long noses. If one of the F_1 chugs was bred with a pug with a flattened nose, calculate the percentage of their offspring likely to have flattened noses. 1
- Space for calculation*

_____ %



13. Stoats are predators native to the UK. They were introduced to New Zealand in the 1880s by humans to control the rabbit population.

Since their introduction, stoats have spread rapidly, and their population has increased. As a result, the population size of some native species has decreased.



- (a) Name the type of control used to manage the population of rabbits. 1

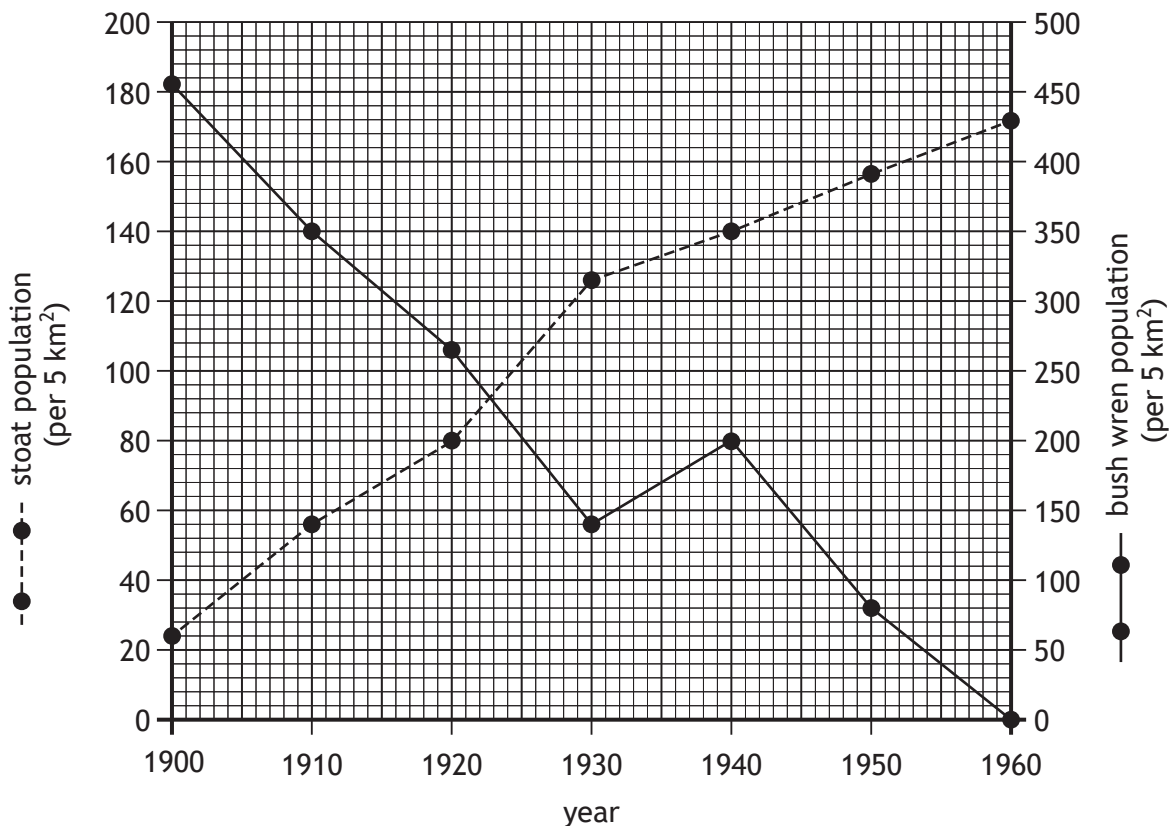
- (b) (i) Suggest why the population size of some native species has decreased. 1

- (ii) State a reason why the population of stoats has increased faster in New Zealand than in their native habitat. 1

13. (continued)

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- (c) Bush wren was a bird species native to New Zealand. The populations of stoats and bush wrens were measured over a 60-year period between 1900 and 1960. The results are shown in the graph.



- (i) Express, as the simplest whole number ratio, the bush wren population to the stoat population in 1940.

1

Space for calculation

_____ : _____
bush wren stoat

- (ii) Using information from the graph, predict what the population of stoats was in 1980.

1

_____ per 5 km²

- (iii) Give evidence from the graph that shows that the stoat population was not the only factor affecting the bush wren population.

1



13. (c) (continued)

(iv) Stoats are an invasive species in New Zealand.

Use evidence from the graph to justify this statement.

1



* X 8 0 7 7 6 0 1 2 8 *

14. Attempt **either A or B**. Write your answer in the space below and on *pages 30 and 31*.

A Write notes on crop productivity under the following headings:

- | | |
|--|---|
| (i) problems with weeds and invertebrate pests | 5 |
| (ii) chemical control. | 3 |

OR

B Write notes on interdependence under the following headings:

- | | |
|----------------------|---|
| (i) parasitism | 5 |
| (ii) social insects. | 3 |

You may use labelled diagrams where appropriate.

[Turn over



ADDITIONAL SPACE FOR ANSWER to question 14

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ADDITIONAL SPACE FOR ANSWER to question 14

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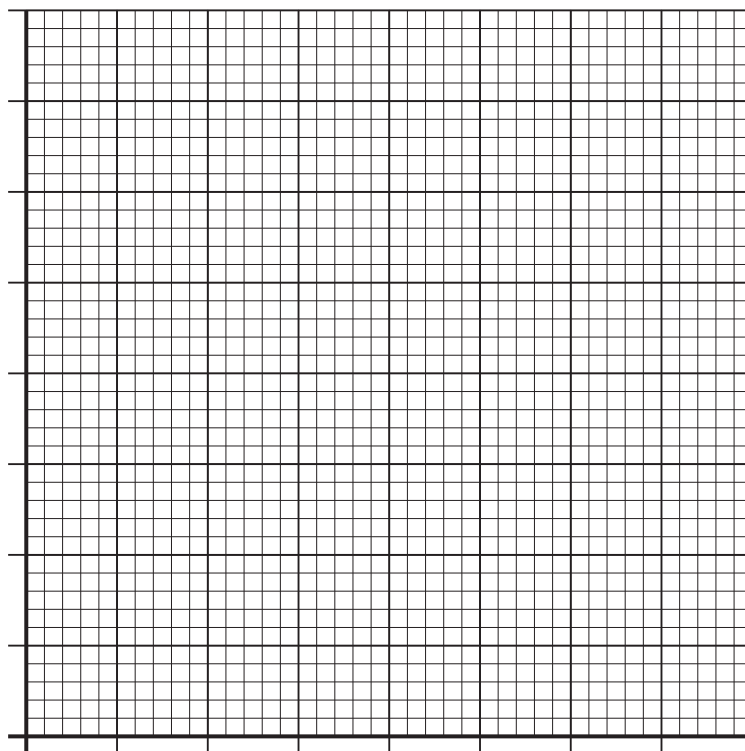
[END OF QUESTION PAPER]



* X 8 0 7 7 6 0 1 3 1 *

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

Additional graph paper for question 11 (b)



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* X 8 0 7 7 6 0 1 3 6 *