National Qualifications 2025

X807/75/02

Biology
Section 1 — Questions

TUESDAY, 27 MAY

1:30 PM – 4:00 PM

Instructions for the completion of Section 1 are given on *page 02* of your question and answer booklet X807/75/01.

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

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

SECTION 1 — 25 marks

Attempt ALL questions

1. Which of the following structures would **not** be found in a typical plant cell?

A Chloroplast

B Cell membrane

C Plasmid

D Mitochondrion

2. Potato cylinders were placed into different concentrations of sucrose solution and any change in mass was recorded.

The table shows the initial sucrose concentrations inside the potato cells and the concentrations of the solutions they were placed in.

Which potato cylinder will gain the most mass?

	Initial sucrose concentration inside potato cells (mol/dm^3)	**Sucrose concentration of solution (mol/dm^3)**
A	0.31	0.45
B	0.35	0.35
C	0.31	0.25
D	0.35	0.21

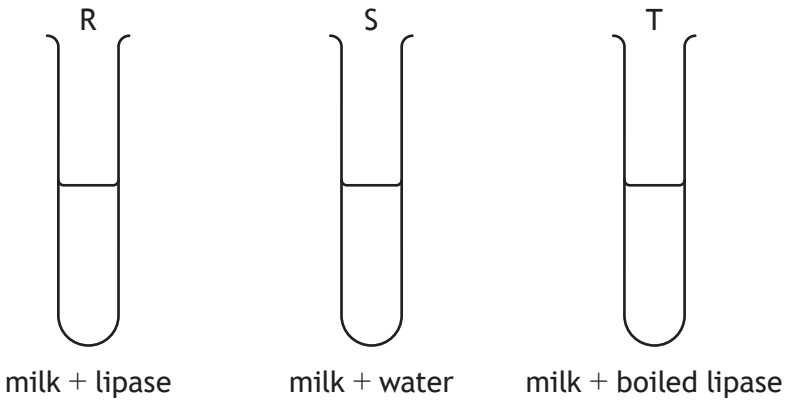
3. In a section of DNA, 34% of the bases are thymine.

Which row in the table shows the percentages of the other bases in this section of DNA?

	Adenine	**Cytosine**	**Guanine**
A	16	34	34
B	34	34	16
C	34	16	16
D	16	16	34

4. Lipase is an enzyme that speeds up the breakdown of fats, producing an acid that decreases the pH.

Three test tubes were set up to investigate the action of lipase on fat in milk.



The pH of each test tube was recorded at the start of the experiment and then again 20 minutes later.

In which of the test tube(s) would the pH stay the same?

A R only

B T only

C R and T

D S and T

5. A 100 g sample of haemoglobin was found to contain 15 g of leucine.

What mass of leucine would be found in a 5 g sample of haemoglobin?

A 0.15

B 0.75

C 20.0

D 75.0

6. A culture of 350 bacterial cells was genetically engineered to produce a human protein.

Only 210 cells successfully produced the protein.

The percentage success was

A 40

B 60

C 67

D 140.

[Turn over

7. Which of the following builds up in animal cells as a result of fermentation?

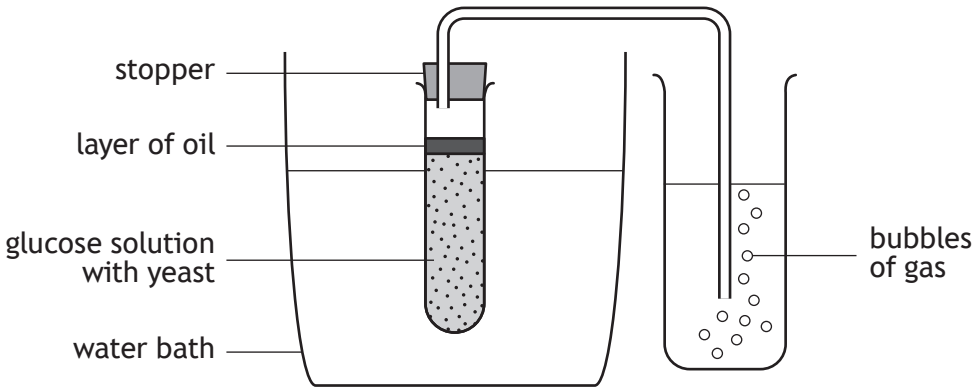
A Lactate

B Ethanol

C Glucose

D Carbon dioxide

8. The apparatus shown was set up to investigate the effect of temperature on fermentation in yeast.



The investigation was carried out at 15 °C and repeated at 20 °C and 30 °C. The number of gas bubbles produced was counted.

Which two variables should be kept constant during the investigation?

A Temperature and time left for

B Type of yeast and time left for

C Temperature and carbon dioxide concentration

D Type of yeast and carbon dioxide concentration

9. During mitosis, which of the following occurs immediately before the cytoplasm divides?

A Nuclear membranes form.

B Chromosomes line up at the equator.

C Pairs of chromatids are separated.

D Chromosomes shorten and thicken.

10. The function of an inter neuron is to carry electrical impulses from

A a motor neuron to a sensory neuron

B an effector to a sensory neuron

C a sensory neuron to a motor neuron

D a motor neuron to an effector.

11. Which row in the table identifies features of the hormone glucagon?

	Site of production	Target organ	Effect
A	pancreas	liver	glycogen → glucose
B	liver	pancreas	glycogen → glucose
C	pancreas	liver	glucose → glycogen
D	liver	pancreas	glucose → glycogen

12. The table shows the number of people recorded as having diabetes in Scotland over a 5-year period.

Year	Number of people with diabetes
1	278 000
2	284 000
3	291 000
4	298 000
5	304 000

Predict the number of people likely to have diabetes in year 10 if the average yearly increase continues.

A 330 000

B 336 500

C 582 000

D 608 000

[Turn over

13. The table gives data on the number of eggs produced and the percentage of eggs surviving to adulthood in three different organisms.

Organism	Number of eggs produced	Number surviving to adulthood	Percentage of eggs surviving to adulthood
Brown trout	3000	270	9
Salmon	2000	150	7.5
Common frog		23	5

The number of eggs produced by the common frog was

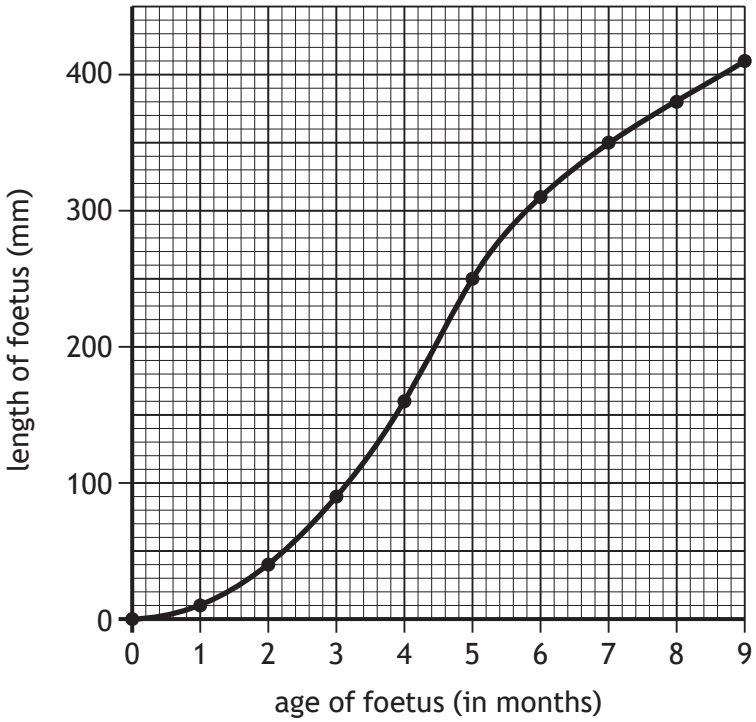
A 28

B 115

C 437

D 460.

14. The graph shows the growth of a foetus.



The average monthly increase in the length of the foetus from month 5 to month 9 is

A 32 mm

B 40 mm

C 160 mm

D 340 mm.

15. In guinea pigs, short coat is dominant to long coat.

A group of heterozygous guinea pigs were crossed and a total of 72 offspring were produced.

Identify how many of the offspring would be expected to have short coats.

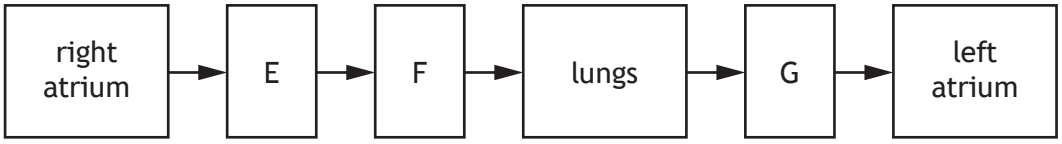
A 18

B 36

C 54

D 72

16. The following sequence shows part of the blood flow through the body.



Which row in the table identifies E, F and G?

	E	F	G
A	right ventricle	pulmonary artery	pulmonary vein
B	right ventricle	pulmonary vein	pulmonary artery
C	pulmonary artery	right ventricle	pulmonary vein
D	pulmonary vein	right ventricle	pulmonary artery

17. Three students carried out an investigation into the effect of exercise on heart rate.

Each student measured their heart rate after completing the same exercises.

After each student's heart rate returned to its resting rate, they repeated the investigation.

Which of the following would improve the reliability of the results?

A Increasing the rest period before repeating the exercise.

B Completing the exercise in a different location.

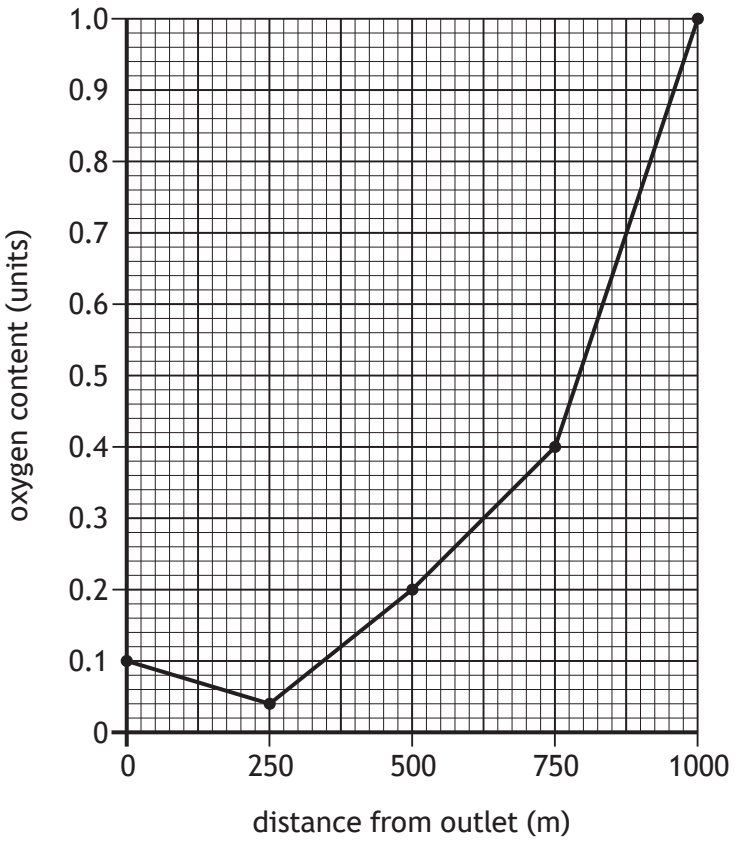
C Changing the type of exercise each time.

D Increasing the number of students exercising.

[Turn over

18. Samples of water were taken from a river at a sewage outlet and at a number of points downstream.

The graph shows the oxygen content of the water at different distances downstream from the outlet.



What is the percentage increase in the oxygen content from 250 m to 1000 m from the outlet?

A 24

B 96

C 2400

D 4900

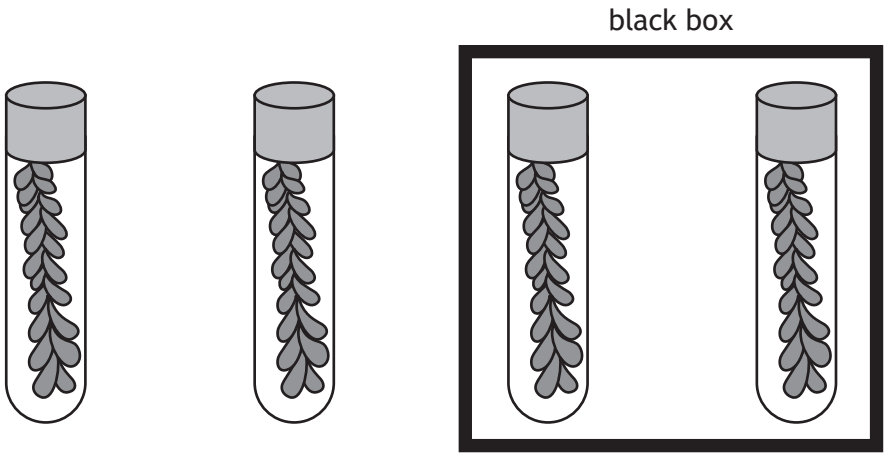
19. Seals and dolphins compete for food.

Which row in the table describes the interaction between these organisms?

	Type of competition	Type of factor
A	intraspecific	biotic
B	intraspecific	abiotic
C	interspecific	biotic
D	interspecific	abiotic

20. The diagram shows an experiment used to investigate the conditions needed for photosynthesis.

All four tubes contained pondweed and water.



Tube:	1	2	3	4
Condition:	light	light	dark	dark
Carbon dioxide concentration:	0.03%	0.3%	0.03%	0.3%

Which two tubes should be compared to show the effect of light on photosynthesis?

A 1 and 2

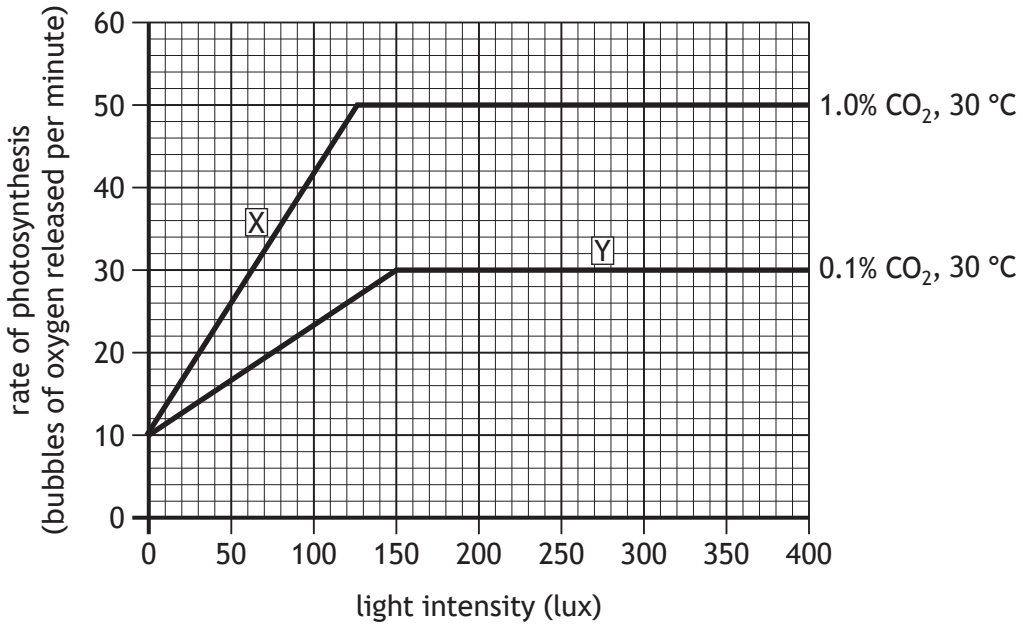
B 1 and 4

C 2 and 3

D 2 and 4

[Turn over

21. The graph shows the effect of limiting factors on the rate of photosynthesis.



Which row in the table identifies the limiting factors at points X and Y on the graph?

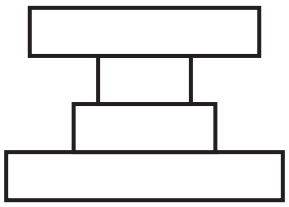
	X	Y
A	light intensity	temperature
B	light intensity	CO_2 concentration
C	temperature	light intensity
D	CO_2 concentration	light intensity

22. The diagrams represent pyramids of numbers.

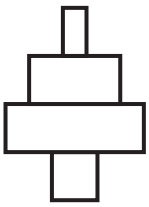
Which pyramid represents the following food chain?

grass ⟶ rabbit ⟶ fox ⟶ fleas

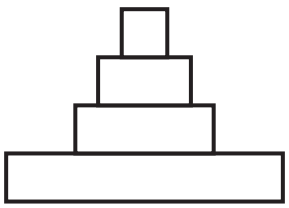
A



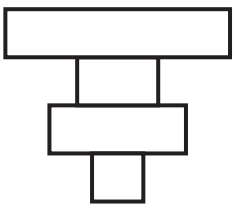
B



C

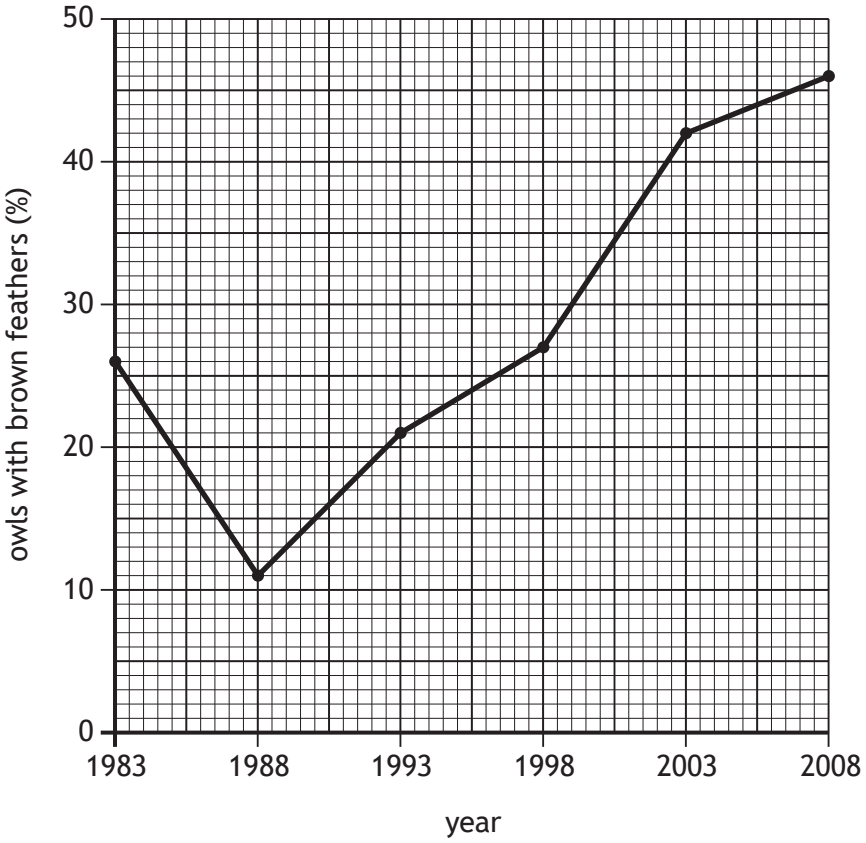


D



23. Researchers investigated natural selection in a population of owls.

The graph shows changes to the percentage of owls with brown feathers over time.



Which of the following statements is correct?

The percentage of owls with brown feathers

A doubles between 1993 and 2003

B increases continually between 1983 and 2008

C increases more between 1988 and 1993 than in any other 5-year period

D increases less between 1993 and 1998 than between 2003 and 2008.

24. Nematode worms are used by farmers to prey upon insects that damage their crops.

This method used to increase crop yield is an example of

A genetic modification

B biological control

C pesticide use

D fertiliser use.

[Turn over

25. The number of light and dark peppered moths in a woodland were counted over a 5-year period.

The results are shown in the table.

Year	Average number of light variety moths	Average number of dark variety moths
1	200	60
2	180	100
3	140	160
4	120	180
5	100	200

The percentage of moths counted in year 4 that were the dark variety was

A 20%

B 40%

C 50%

D 60%.

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

FOR OFFICIAL USE

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National Qualifications 2025

Mark

X807/75/01

Biology
Section 1 — Answer Grid and Section 2

TUESDAY, 27 MAY

1:30 PM – 4:00 PM

X8077501

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day | Month | Year

Scottish candidate number

Total marks — 100

SECTION 1 — 25 marks

Attempt ALL questions.

Instructions for the completion of Section 1 are given on *page 02*.

SECTION 2 — 75 marks

Attempt ALL questions.

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.

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

SQA ©

X807750101

SECTION 1 — 25 marks

The questions for Section 1 are contained in the question paper X807/75/02.

Read these and record your answers on the answer grid on *page 03* opposite.

Use **blue** or **black** ink. Do NOT use gel pens or pencil.

1. The answer to each question is **either** A, B, C or D. Decide what your answer is, then fill in the appropriate bubble (see sample question below).

2. There is **only one correct** answer to each question.

3. Any rough working should be done on the additional space for answers and rough work at the end of this booklet.

Sample question

The thigh bone is called the

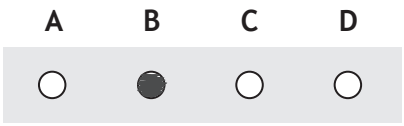
A humerus

B femur

C tibia

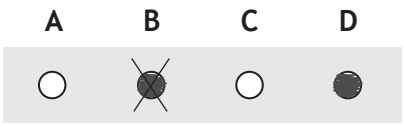
D fibula.

The correct answer is **B** — femur. The answer **B** bubble has been clearly filled in (see below).

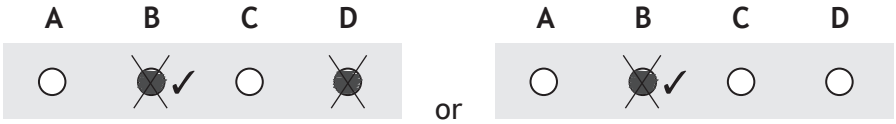


Changing an answer

If you decide to change your answer, cancel your first answer by putting a cross through it (see below) and fill in the answer you want. The answer below has been changed to **D**.



If you then decide to change back to an answer you have already scored out, put a tick (✓) to the **right** of the answer you want, as shown below:



SECTION 1 — Answer grid

0BJ25AD1

	A	B	C	D
1	○	○	○	○
2	○	○	○	○
3	○	○	○	○
4	○	○	○	○
5	○	○	○	○
6	○	○	○	○
7	○	○	○	○
8	○	○	○	○
9	○	○	○	○
10	○	○	○	○
11	○	○	○	○
12	○	○	○	○
13	○	○	○	○
14	○	○	○	○
15	○	○	○	○
16	○	○	○	○
17	○	○	○	○
18	○	○	○	○
19	○	○	○	○
20	○	○	○	○
21	○	○	○	○
22	○	○	○	○
23	○	○	○	○
24	○	○	○	○
25	○	○	○	○

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SECTION 2 — 75 marks

Attempt ALL questions

1. (a) Students carried out an investigation to compare the ultrastructure of typical bacterial and fungal cells.

(i) The table shows their results for fungal cells.

Complete the column for the bacterial cell by placing a tick (✓) in the appropriate boxes. **1**

Structure	Bacterial cell	Fungal cell
Cell wall		✓
Nucleus		✓
Mitochondria		✓
Ribosomes		✓
Plasmid		
Cell membrane		✓
Vacuole		✓

(ii) The structure of the cell wall in the fungal cells was found to be different to that of a plant cell.

Name the structural carbohydrate that makes up a plant cell wall. **1**

_____

[Turn over

1. (continued)

(b) On average, muscle cells contain 2500 mitochondria, liver cells contain 2000 mitochondria and cheek cells have 200.

Calculate the simple whole number ratio of the number of mitochondria in these cells. **1**

Space for calculation

_____ : _____ : _____

muscle cell liver cell cheek cell

(c) Explain why a muscle cell contains a large number of mitochondria. **2**

_____

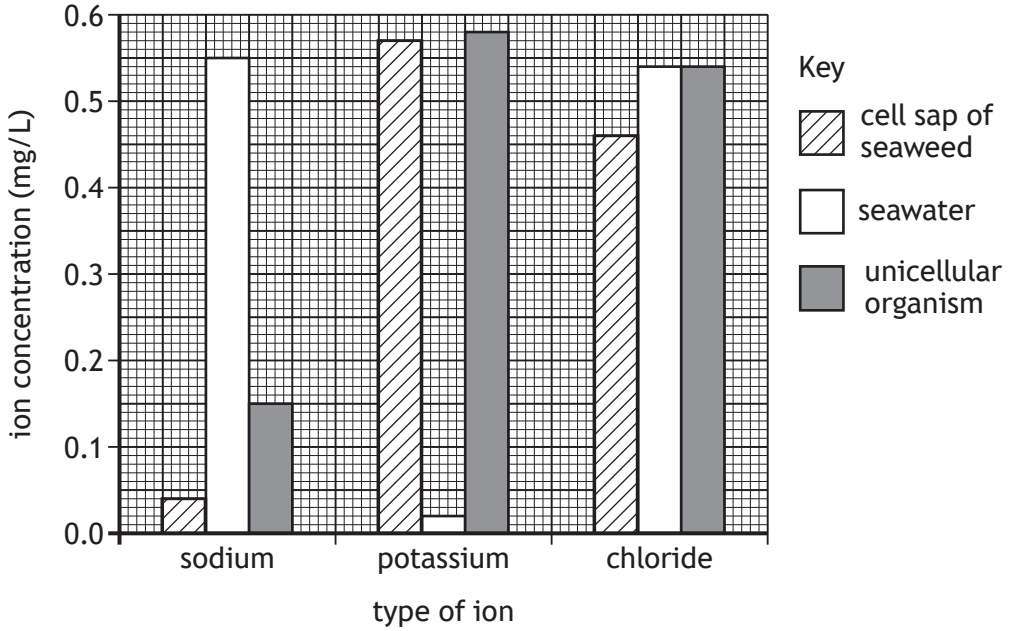
_____

_____

_____

2. The concentration of some ions within the cell sap of seaweed, the surrounding seawater, and a unicellular organism were measured.

The results are shown in the bar chart.



(a) (i) Name the ion that moves from the seaweed into the seawater by diffusion and give a reason for your choice. **2**

Ion _____

Reason _____

_____

_____

_____

(ii) The unicellular organism must always have a sodium ion concentration below 0.25 mg/L.

Name the process that moves excess sodium ions out of the unicellular organism. **1**

_____

(b) The cell sap of the seaweed was tested to measure the concentration of each ion.

Name the structure in seaweed cells that contains cell sap. **1**

_____

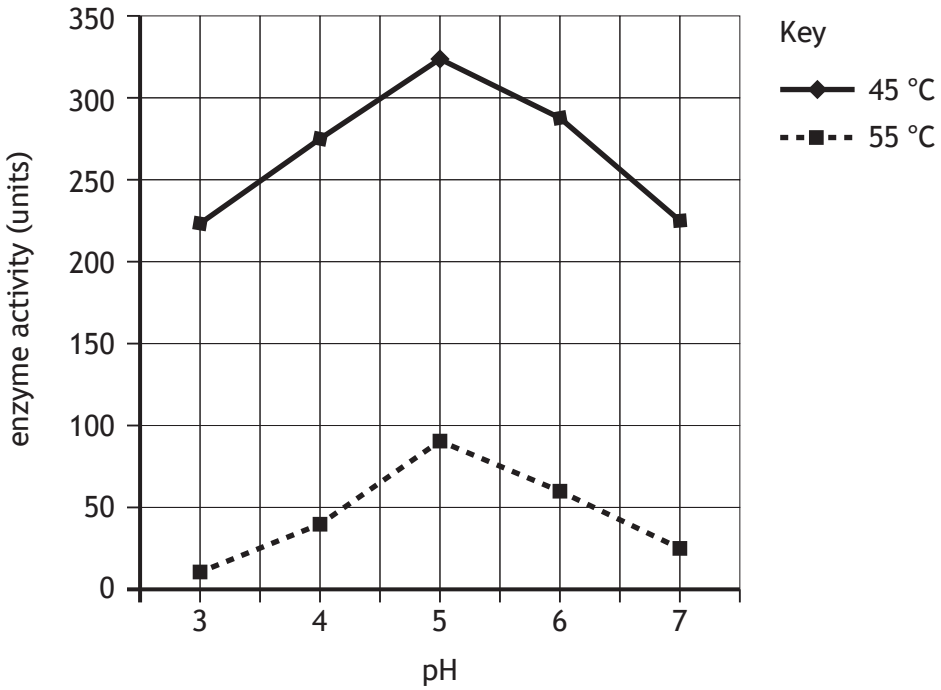
3. The enzyme invertase is commonly used to make soft-centred chocolates.

Invertase speeds up the following reaction:

$$\text{sucrose} \xrightarrow{\text{invertase}} \text{glucose} + \text{fructose}$$

(a) An investigation into the effect of pH on invertase at different temperatures was carried out.

The results are shown in the graph.



(i) Identify the temperature at which invertase was most active. **1**

_____ °C

(ii) State the optimum pH of invertase. **1**

pH _____

3. (a) (continued)

(iii) Predict what would happen to the enzyme activity if the investigation was repeated at 75 °C. **1**

(iv) Describe how this investigation could be changed to find a more exact optimum temperature of invertase. **1**

(b) A different enzyme speeds up the following reaction:

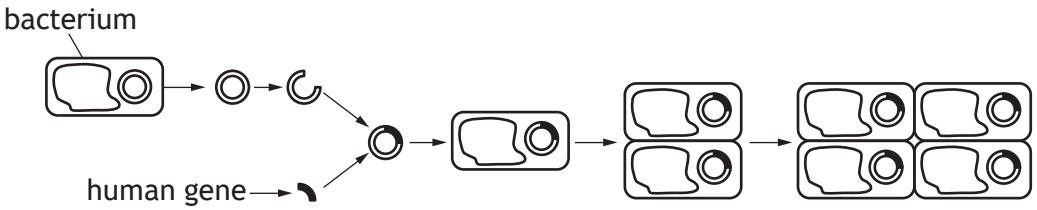
starch ⟶ maltose

Explain why invertase would **not** speed up this reaction. **1**

[Turn over

4. Interferon is a type of protein made naturally by cells of the immune system. It can be manufactured by genetic engineering and is used to treat viral infections.

(a) Interferon was one of the first human proteins to be manufactured by transferring genes between organisms.



(i) What is a gene? **1**

(ii) Describe **one** use of enzymes in the process of genetic engineering. **1**

(b) (i) Before its manufacture by genetic engineering, interferon was extracted from white blood cells.

45 000 litres of blood were needed to produce 400 g of interferon.

Calculate how many litres of blood were required to produce 1 g of interferon. **1**

Space for calculation

_____ litres

4. (b) (continued)

(ii) During its manufacture by genetic engineering, 85 mg of interferon can be produced per litre of bacterial culture.

Calculate the mass in grams of interferon produced in 45 000 litres. **1**

(1 g = 1000 mg)

Space for calculation

_____ g

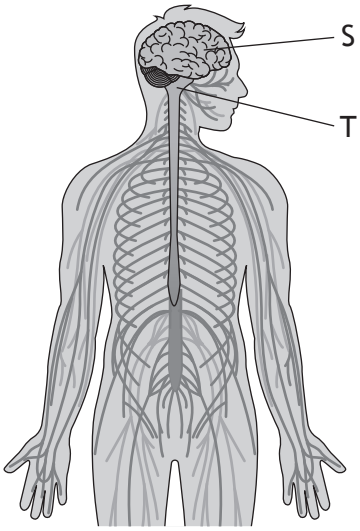
(c) Name another type of protein produced by the immune system in response to pathogens. **1**

_____

[Turn over

5. Describe the breakdown of glucose in animal cells when oxygen is present. **4**

6. The diagram represents parts of the human nervous system.



(a) The central nervous system (CNS) consists of the brain and one other structure.
Name the other structure. **1**

_____

(b) The structures labelled S and T in the diagram are parts of the brain.

(i) Name structure S. **1**

_____

(ii) Give the function of structure T. **1**

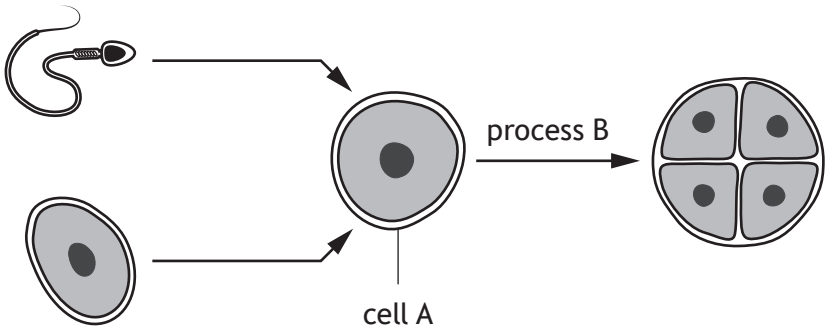
_____

(c) State the role of receptors in the nervous system. **1**

_____

[Turn over

7. The diagram represents some of the events that occur during reproduction and early growth in humans.



(a) Name the site of sperm production in the body. **1**

_____

(b) Describe how the chromosome complement of a sperm cell differs from cell A. **1**

_____

_____

_____

(c) Name process B. **1**

_____

(d) Early embryos contain stem cells.

What feature of stem cells makes them important in early embryo development? **1**

_____

8. (a) The ability of a person to roll their tongue is a dominant characteristic represented by the symbol R.

(i) A male with the genotype Rr and a female with genotype rr had a child who was unable to roll their tongue.

State the genotype of their child. **1**

_____

(ii) Tick (✓) one box to identify whether the child's genotype is homozygous or heterozygous and give a reason for your choice. **1**

Homozygous ☐ Heterozygous ☐

Reason _____

_____

(iii) The male and female are having another child.

Predict the percentage chance that this child will be able to roll their tongue. **1**

Space for calculation

_____ %

(b) State which type of variation is shown by tongue-rolling ability. **1**

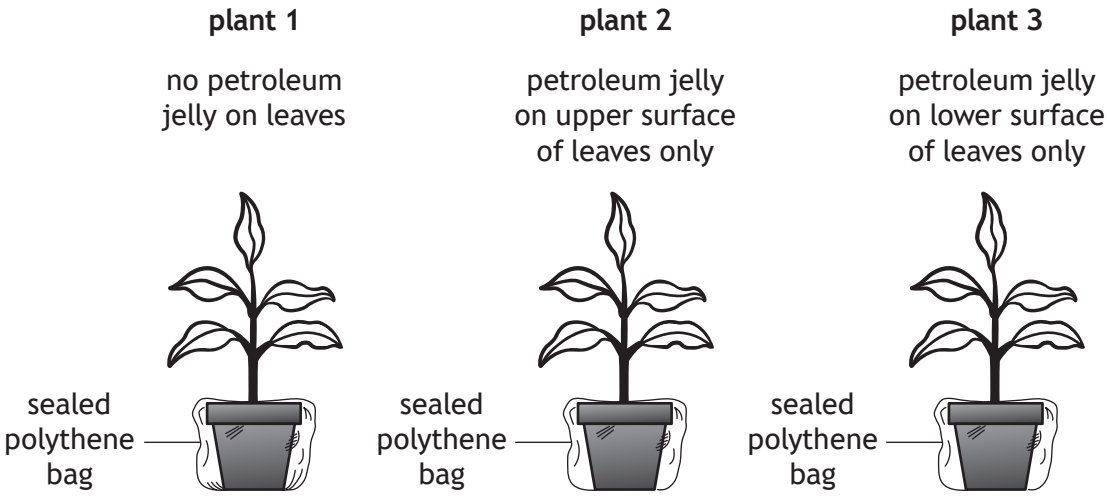
_____

[Turn over

9. An investigation was carried out to find out which leaf surface loses most water through transpiration.

Three plants were set up as shown.

Petroleum jelly was used to prevent water loss.



The plants were weighed then left for 24 hours at 20 °C before being reweighed.

(a) Name the openings found on leaves that water evaporates through. **1**

_____

(b) Which plant was used as a control in this investigation? **1**

Plant _____

(c) Suggest why it was necessary to cover the plant pots with a polythene bag. **1**

_____

_____

9. (continued)

(d) The results for the investigation are shown in the table.

Plant	Mass of plant at start (g)	Mass of plant after 24 hours (g)	Percentage decrease in mass of plant (%)
1	250.0	150.0	40
2	275.0	176.0	36
3	220.0	211.2	4

(i) Explain why the results were calculated as a percentage change. **1**

(ii) **With reference to the aim**, give a conclusion for this investigation. **1**

[Turn over

10. The results of a blood count for two patients are shown.

Component of blood count	Normal range (units)	Patient R (units)	Patient S (units)
White blood cell	4.0–11.0	6.5	5.0
Red blood cell	4.5–5.5	4.97	4.01
Haemoglobin	130–170	150	115
Platelets	150–450	330	390

(a) (i) Which patient has all four components within the normal range? **1**

Patient _____

(ii) Four weeks later, both patients had their blood re-tested.

The haemoglobin content of the blood of Patient S had increased by 20%.

Calculate the number of units of haemoglobin in this second blood count. **1**

Space for calculation

_____ units

(b) Other than containing haemoglobin, describe one way in which a red blood cell is specialised to carry out its function and explain the advantage of this specialisation. **2**

Description _____

_____

Explanation _____

_____

_____

10. (continued)

(c) Two types of blood vessel are arteries and veins.
Compare the structure of these two types of blood vessel. **3**

[Turn over

11. In a study, scientists interviewed 350 British athletes competing in different sports including: cycling, swimming, rowing, athletics, football, hockey, and rugby. Approximately half of these athletes have tooth decay compared to a third of adults the same age.

The study showed that these athletes put more effort into looking after their teeth with 95% of them brushing their teeth twice a day compared to 75% of the general public. Only 21% of the general public floss their teeth regularly compared to 44% of the athletes.

The study also found that smoking rates in the athletes were found to be lower and overall diets were better compared to the general public.

However, '88% of elite athletes used sports drinks, 56% used energy bars, and 72% used energy gels frequently during training and competitions,' said one of the researchers, adding that 'the sugar in these products increases the risk of tooth decay, and their acidity increases the risk of tooth erosion'.

(a) The scientists were surprised to find that elite athletes have more tooth decay than the general public.

Use information from the passage to explain why this finding was unexpected. **1**

(b) Calculate how many of the athletes flossed regularly. **1**

Space for calculation

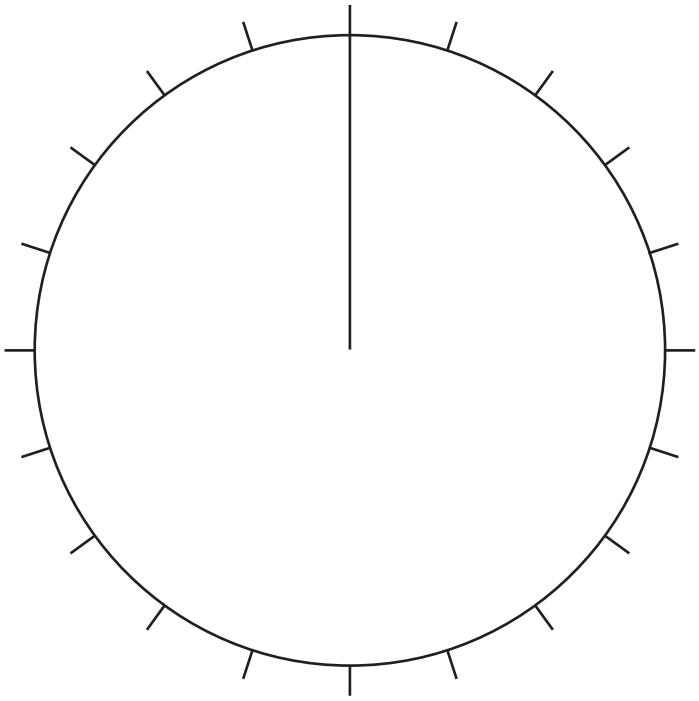
(c) Suggest a reason why **this** study may **not** be valid. **1**

11. (continued)

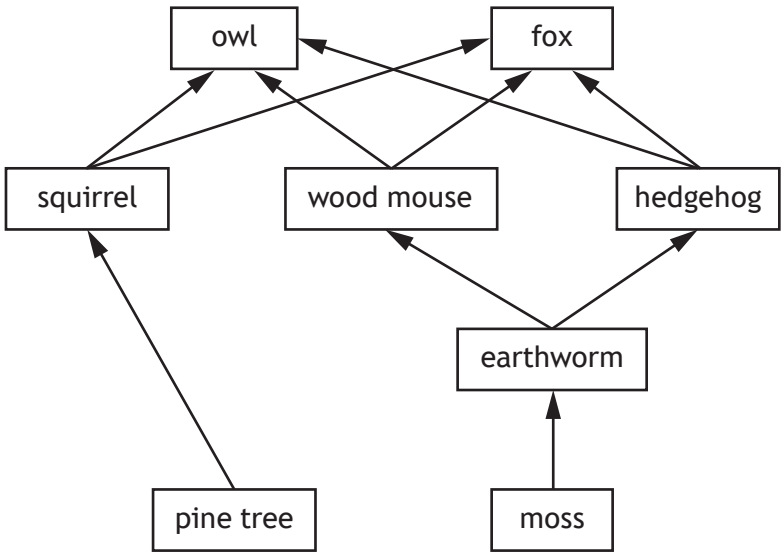
(d) The table shows the nutritional content of a sports energy bar.

Content	Mass per 100 g (g)
Fat	20
Sugar	35
Protein	35
Other	10

Use the information in the table to complete the pie chart.
(An additional pie chart, if required, can be found on *page 29*.) **2**



12. The diagram shows part of a food web in a pine forest.



(a) Complete the table by giving one example of each type of organism from the food web. **2**

Type of organism	Example
Producer	
Predator	

(b) Use the words **'increases'**, **'decreases'**, or **'stays the same'** to suggest what might happen to the size of the squirrel population if all the foxes were removed.

Explain your answer. **1**

Squirrel population _____

Explanation _____

_____

_____

(c) State the term used to describe the role of an organism within its community. **1**

_____

12. (continued)

(d) The table shows some features of fungi commonly found in Scotland's pine forests.

Fungus	Maximum cap size (cm)	Cap colour	Stem colour
Velvet rollrim	20	mid brown	dark brown
Sickener	10	bright scarlet	white
Earpick fungus	2	dark brown	dark brown
Pelargonium bonnet	1	dark brown	dark brown
Pinewood gingertail	2	bright brown	brown

Use the information in the table to complete the key. **3**

1. Stem colour is not dark brown — Go to 2

   Stem colour is dark brown — Go to 3

2. Cap colour is bright scarlet — Sickener

   Cap colour is bright brown — ☐

3. Cap colour is dark brown — ☐

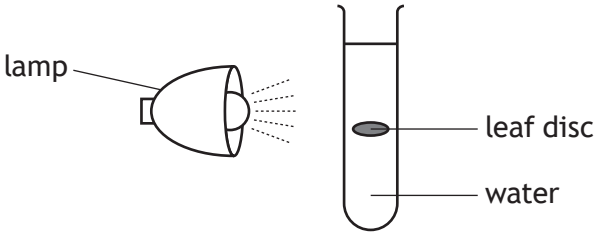
   Cap colour is mid brown — Velvet rollrim

4. Maximum cap size is 1 cm — Pelargonium bonnet

   Maximum cap size is 2 cm — ☐

[Turn over

13. An experiment into photosynthesis was carried out.



After the lamp was switched on, the time taken for the leaf disc to float to the surface was recorded.

The experiment was repeated five times and the results are shown in the table.

Experiment	**1**	**2**	**3**	**4**	**5**
Time taken for disc to float to surface (seconds)	18.4	17.8	16.6	11.7	13.8

(a) Calculate the average time taken for the leaf disc to float to the surface. **1**

Space for calculation

_____ seconds

(b) A gas produced during the first stage of photosynthesis diffuses out of the cells, causing the leaf discs to float to the surface.

Name this gas. **1**

_____

13. (continued)

(c) During photosynthesis the light energy from the lamp is converted into chemical energy.

Name the molecule generated by this chemical energy that is then used in the second stage of photosynthesis. **1**

_____

(d) The second stage of photosynthesis is affected by temperature.

Name this stage and give a reason. **2**

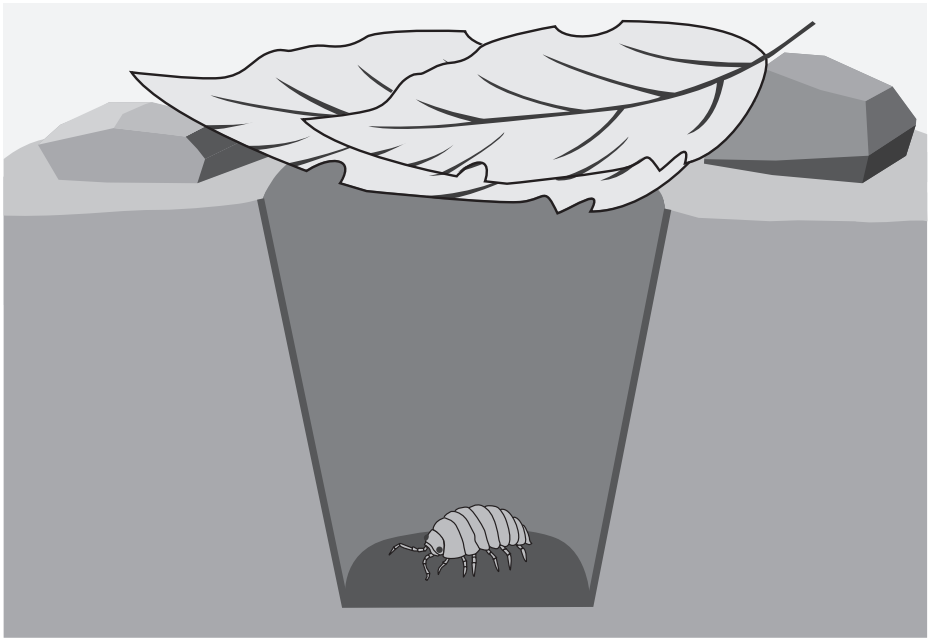
Stage _____

Reason _____

_____

[Turn over

14. In an investigation into the distribution of woodlice in a woodland, students collected and counted them every day for five days using the sampling technique shown.



(a) (i) Name this sampling technique. **1**

_____

(ii) Identify two variables that should be kept constant when setting up this sampling technique. **2**

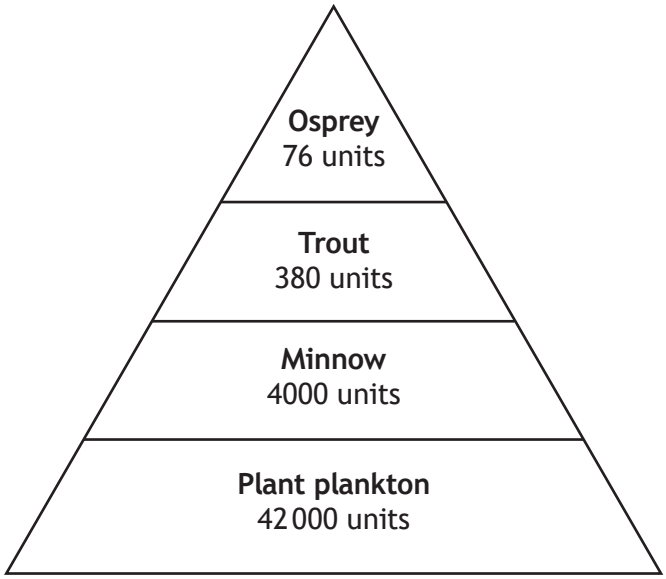
1. _____

2. _____

(b) State one way in which the results could be made more reliable. **1**

_____

15. The diagram shows the transfer of energy through a food chain in an ecosystem. The numbers represent the energy in the different populations.



(a) Name the type of diagram shown. **1**

_____

(b) 5% of light reaching the plant plankton is converted into new plant material.
Calculate how much energy the plant plankton received. **1**
Space for calculation

_____ units

(c) State one way in which energy can be lost from a food chain. **1**

_____

[Turn over

16. A wren is a small bird found in most parts of Britain.

MARKS DO NOT WRITE IN THIS MARGIN

Wrens found on the St. Kilda islands, off the west coast of Scotland, differ from those found on the Scottish mainland in several characteristics including colour, size and wing length.

It is thought that the St. Kilda wren is evolving into a new species.

(a) Suggest how scientists could prove that the St. Kilda's wren is not yet a different species from the Scottish mainland wren. **1**

(b) The following statements refer to the sequence of events in the possible evolution of a new species.

The statements are **not** in the correct order.

A A new species is formed.

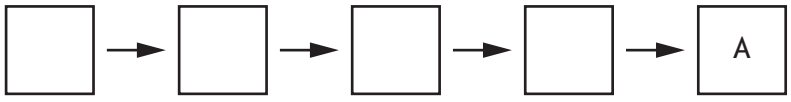
B Natural selection occurs.

C Part of the mainland population become isolated on an island.

D Mutation occurs within each sub-population producing variation.

E Over time each sub-population becomes genetically different.

Rearrange the statements into the correct order by writing the letters into the boxes. The last box has been completed. **1**

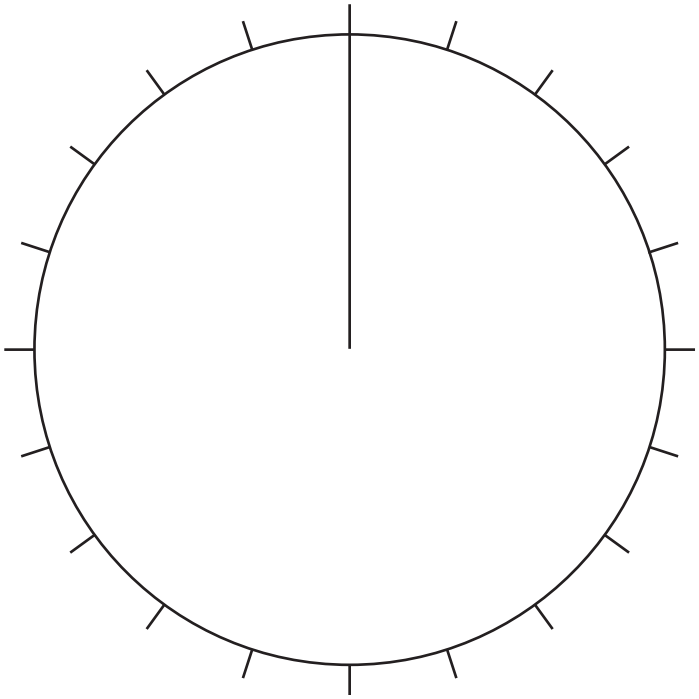


(c) Explain how natural selection results in the evolution of a species. **2**

[END OF QUESTION PAPER]

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

Additional diagram for question 11 (d)



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ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

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Question 16 Greens and Blues/shutterstock.com