

FOR OFFICIAL USE



National
Qualifications
2025

Mark

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X807/75/01

Biology
Section 1 — Answer Grid
and Section 2

TUESDAY, 27 MAY

1:30 PM – 4:00 PM



* X 8 0 7 7 5 0 1 *

Fill in these boxes and read what is printed below.

Full name of centre

Town

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Forename(s)

Surname

Number of seat

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Date of birth

Day

Month

Year

Scottish candidate number

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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.



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

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.

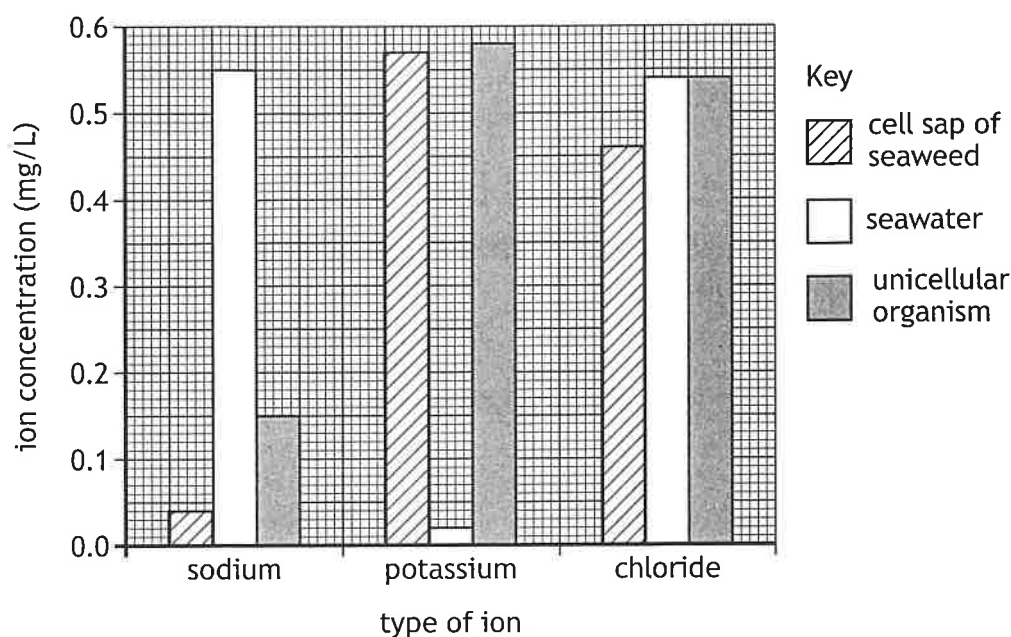
2



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

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



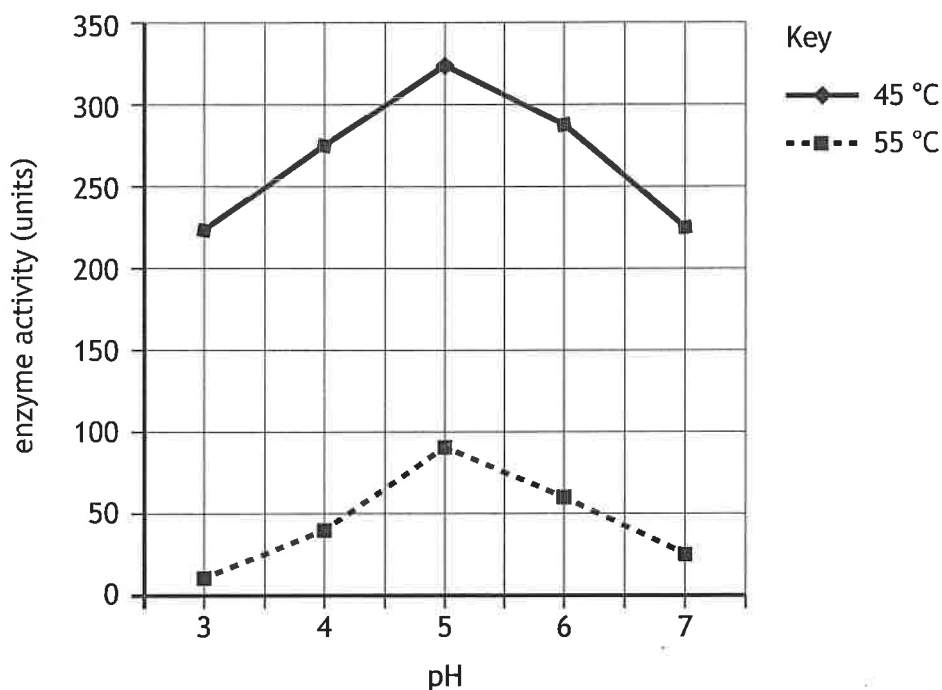
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3. The enzyme invertase is commonly used to make soft-centred chocolates. Invertase speeds up the following reaction:



- (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:



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

1

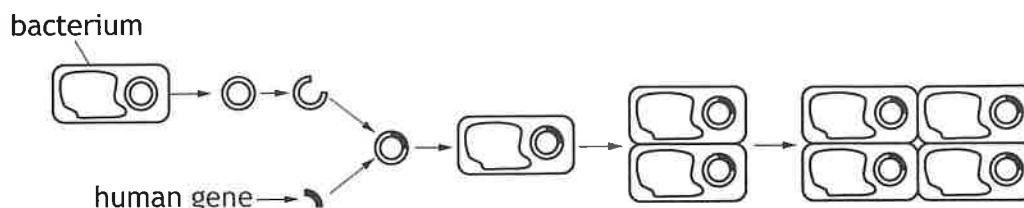
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* X 8 0 7 7 5 0 1 0 9 *

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



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

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



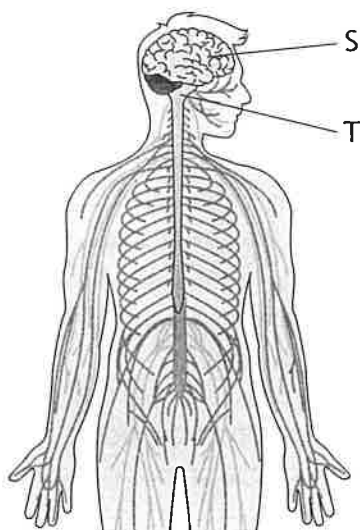
* X 8 0 7 7 5 0 1 1 1 *

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.

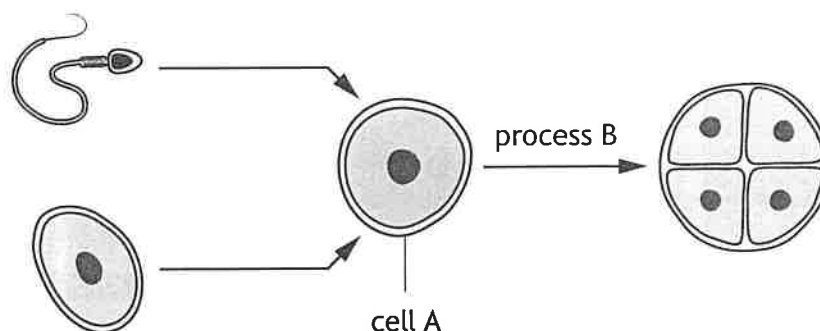
1

[Turn over



* X 8 0 7 7 5 0 1 1 3 *

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



* X 8 0 7 7 5 0 1 1 4 *

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

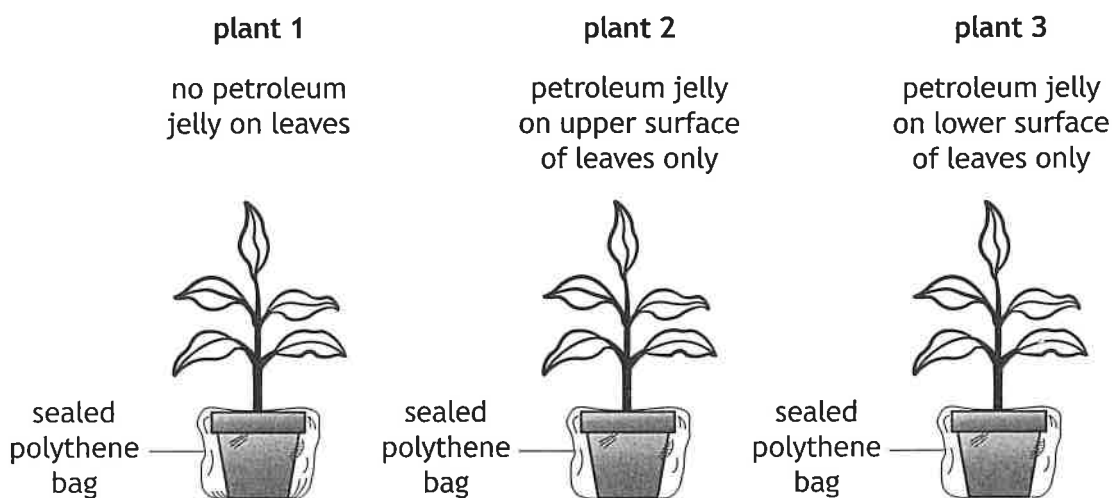
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9. An investigation was carried out to find out which leaf surface loses most water through transpiration.

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



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

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 _____



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

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



* X 8 0 7 7 5 0 1 2 0 *

11. (continued)

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

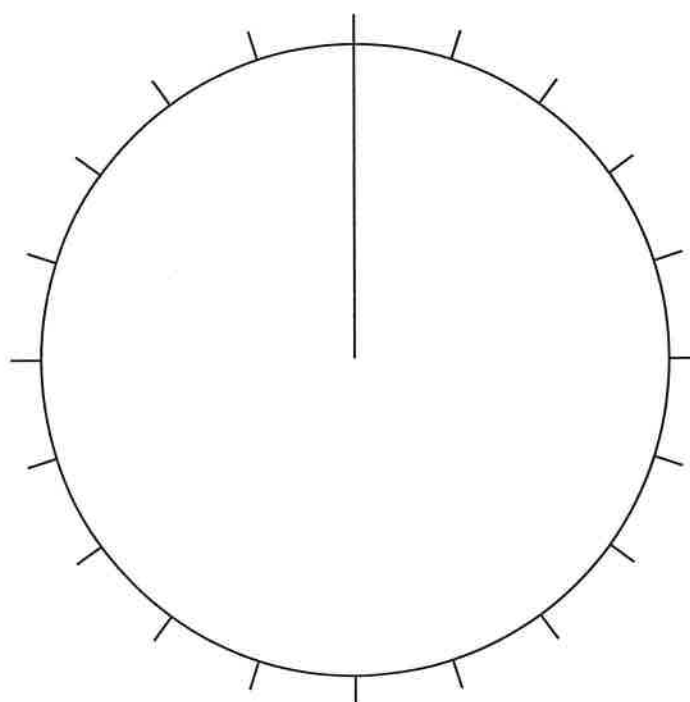


Content	Mass per 100 g (g)
Fat	20
Sugar	35
Protein	35
Other	10

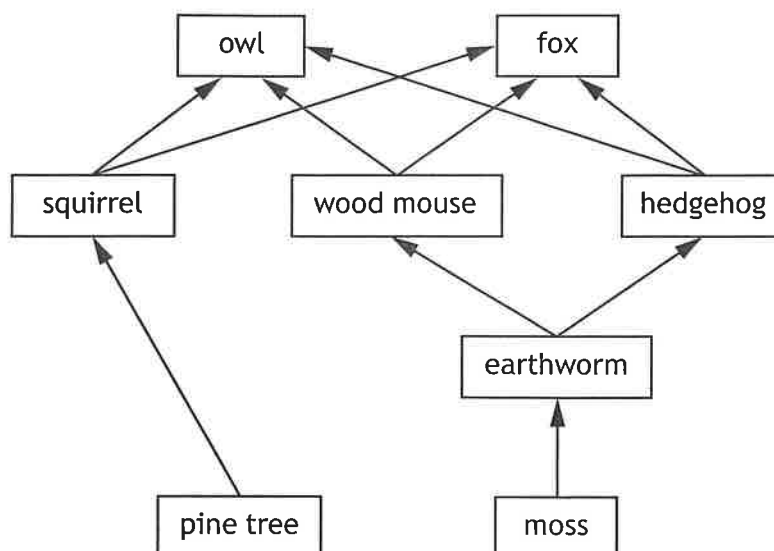
Use the information in the table to complete the pie chart.

(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



* X 8 0 7 7 5 0 1 2 2 *

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

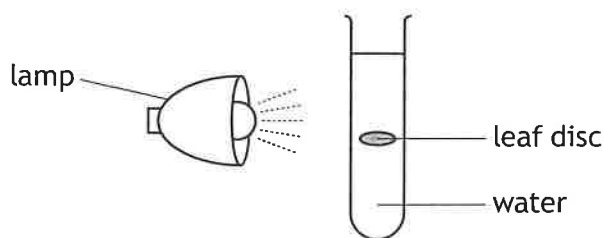
Maximum cap size is 2 cm

[Turn over



* X 8 0 7 7 5 0 1 2 3 *

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.

1

Name this gas.



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 _____

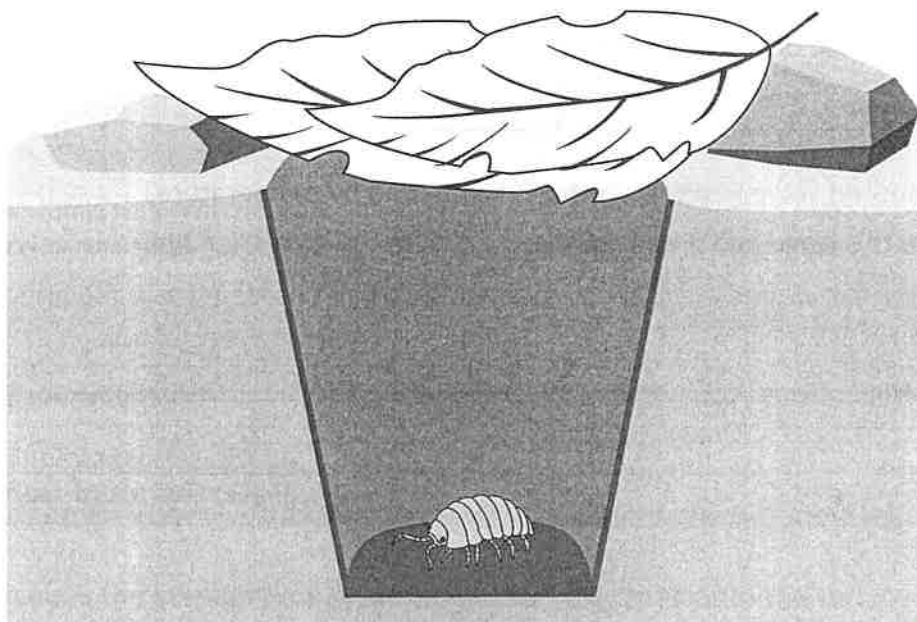
Reason _____

[Turn over



* X 8 0 7 7 5 0 1 2 5 *

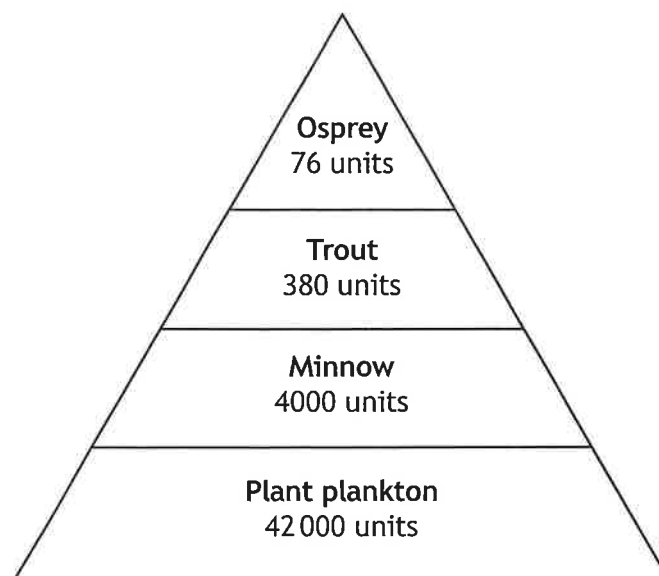
14. In an investigation into the distribution of woodlice in a woodland, students collected and counted them every day for five days using the sampling technique shown.



- (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



* X 8 0 7 7 5 0 1 2 7 *

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]

