AQA GCSE Biology | 8461

SPECIFICATION POINT 4.7.2.1

Levels of organisation

Past-paper questions

Tier	**Foundation**
Question groups	**29**
Available paper years	**2007–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.7.2.1 Levels of organisation

Question 01

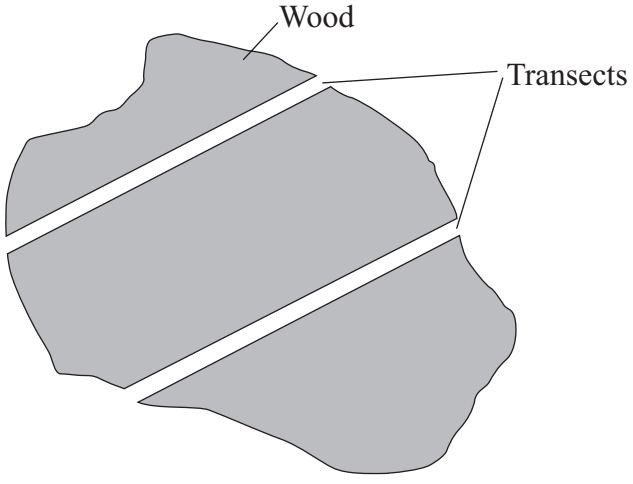
January 2007 | BLY1F | Original Q8 | Legacy

8 Red squirrels live in trees. They eat seeds from the cones of conifer trees. Squirrels store cones in 'larders' on the ground. These larders provide food through the winter. Each red squirrel makes and defends one larder.

Scientists monitor squirrel numbers to find the best habitats for the squirrel's survival. In one investigation, scientists estimated the numbers of squirrels in different types of woodland. Each woodland contains a different species of conifer tree.

Here is their method.

- Ten woods of each type of woodland were surveyed.
- In each wood scientists measured out two transects (strips), each 600 m long and 10 m wide.
- A scientist walked slowly down the centre of each transect, recording the number of squirrel larders he could see.



(a) (i) How many transects all together did the scientists survey in each **type** of woodland?

Number of transects .....

(1 mark)

(ii) What was the total area surveyed in **one** wood?

.....

Area ..... m^2

(1 mark)

4.7.2.1 Levels of organisation

Question 01 · continued

BLANK

(b) Name **one** variable that was controlled in this investigation.

.....

(1 mark)

(c) (i) The scientists recorded the number of larders instead of the number of squirrels they saw.

Explain how this could have increased the accuracy of the investigation.

.....

.....

(1 mark)

(ii) This method of counting the number of larders could have led to an inaccurate estimate of the number of squirrels.

Explain how.

.....

.....

.....

.....

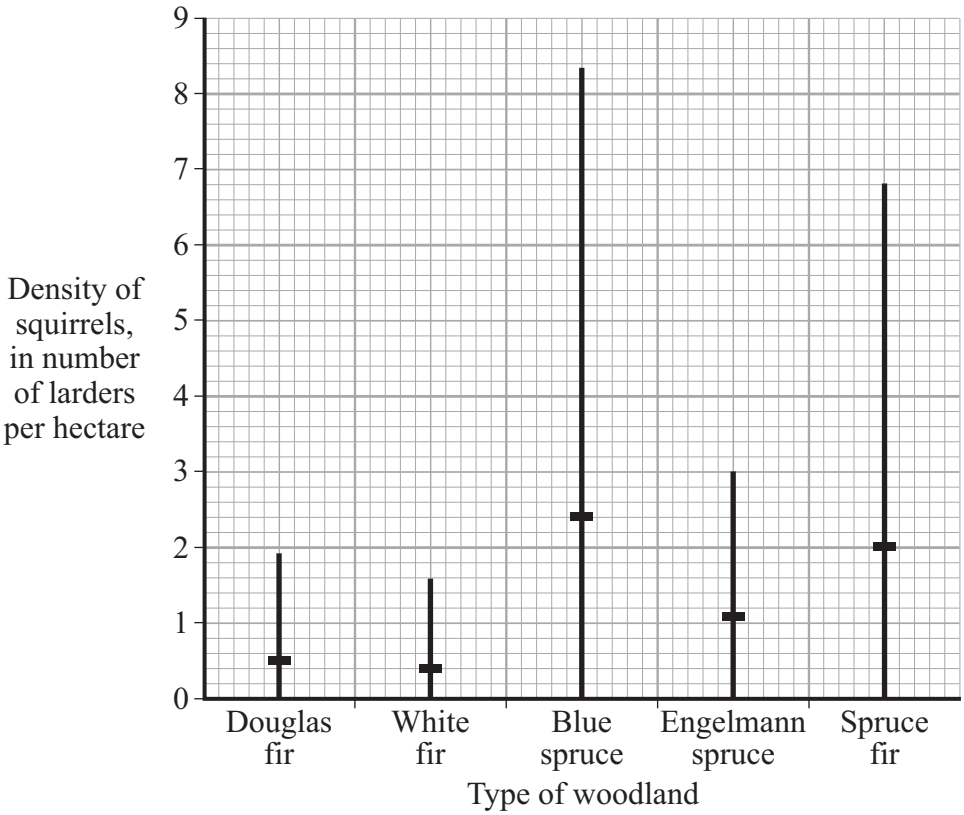
(2 marks)

Question 8 continues on the next page

Question 01 · continued

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(d) The results of the investigation are shown in the graph.



The horizontal mark on each bar represents the mean number of larders per hectare of woodland.

The range of the number of larders observed for Douglas fir woodland was 0 to 1.9 per hectare.

(i) What was the range of the number of larders per hectare in the Spruce fir woodland?

.....

(1 mark)

(ii) The highest mean number of larders per hectare was found in Blue spruce woodland.

Suggest **one** explanation for this.

.....

.....

(1 mark)

8

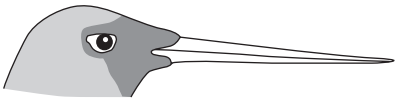
4.7.2.1 Levels of organisation

Question 02

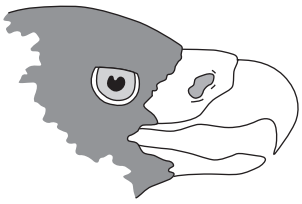
March 2008 | BLY1BP | Original Q3 | Legacy

QUESTION THREE

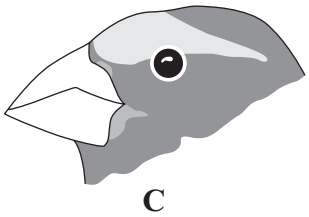
The birds in the diagrams have beaks which are well-suited to the food they eat and the ways in which they obtain it.



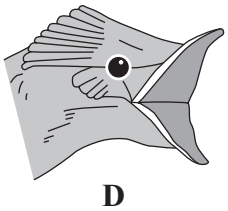
A



B



C



D

Match diagrams, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

	Feeding habits
1	catches small insects as it flies
2	kills small animals with its hooked beak
3	feeds on nectar from deep inside flowers
4	eats seeds which it cracks open

4.7.2.1 Levels of organisation

Question 03

June 2008 | BLY2F | Original Q2 | Legacy

2 Green plants are able to make their own food.

Complete each sentence by drawing a ring around the correct answer in the box.

2 (a) Green plants make their own food during the process of

diffusion
photosynthesis
respiration

.

(1 mark)

2 (b) This process can be summarised by the equation:

carbon dioxide + water → glucose +

mineral salts
light
oxygen

.

(1 mark)

2 (c) The energy needed for this process is trapped for the plant by

chlorophyll
glucose
light

.

(1 mark)

2 (d) Some of the food made by plants is stored as insoluble

chlorophyll
glucose
starch

.

(1 mark)

4

4.7.2.1 Levels of organisation

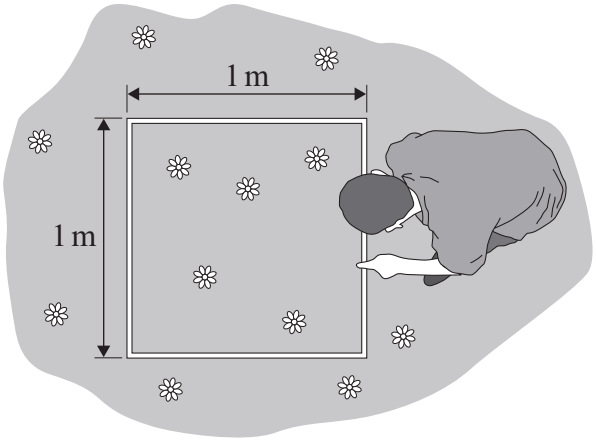
Question 04

November 2008 | BLY1BP | Original Q7 | Legacy

QUESTION SEVEN

Some students wanted to see what effect people walking on a field had on the number of different plants growing there.

In order to sample the plants, they used a quadrat, as shown in the diagram.



The students investigated the numbers of daisies, dandelions, buttercups and plantains growing in areas that were walked on and areas that were not.

7A Which of the following techniques would make the investigation as fair as possible?

1 placing all the quadrats on areas that had been walked on

2 placing all the quadrats where there were lots of plants

3 placing all the quadrats randomly in the two different sample areas

4 placing all the quadrats where all four types of plant were growing

7B The students found that the mean number of dandelions in a $1\,m^2$ quadrat was 4.
The area of the field was $1000\,m^2$.

How many dandelions were there likely to be in the whole field?

1 about 4

2 about 400

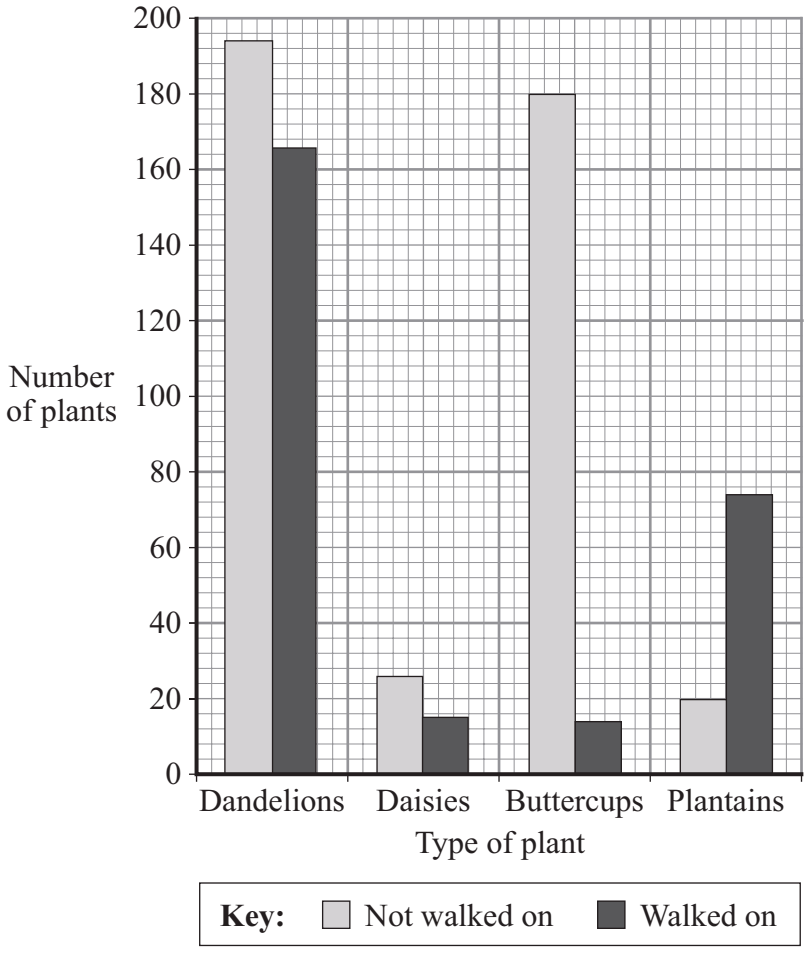
3 about 1000

4 about 4000

4.7.2.1 Levels of organisation

Question 04 · continued

The bar chart shows the results.



7C How many daisies grew in the area which was walked on?

1 15

2 25

3 30

4 40

7D Which type of plant grew best in areas that were walked on?

1 dandelion

2 daisy

3 buttercup

4 plantain

4.7.2.1 Levels of organisation

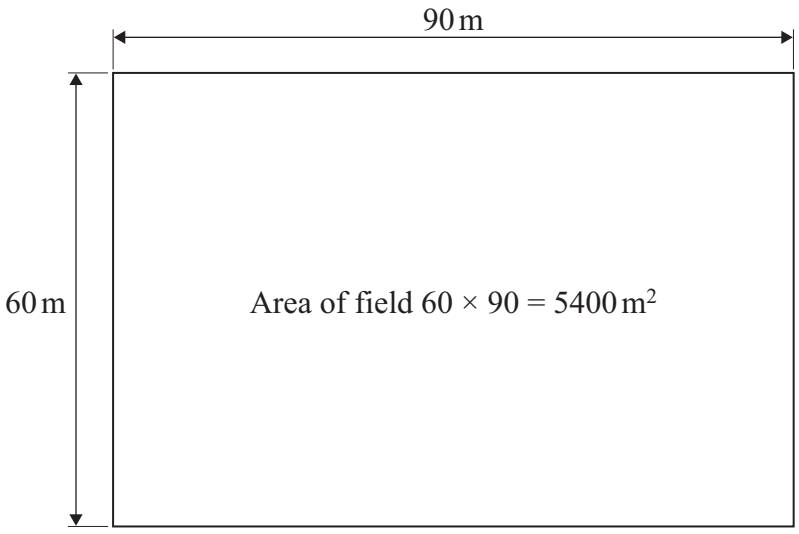
Question 05

March 2009 | BLY1BP | Original Q7 | Legacy

QUESTION SEVEN

A class of students was set the task of estimating the number of dandelions on the school field.
To do this, they decided to use sampling squares called quadrats.
Each quadrat had an area of 1 m^2.

The diagram shows the dimensions of the school field.



7A They wanted to make their investigation as fair as possible.

Which would be the best way to sample the field?

1 throw all the quadrats near the middle of the field

2 throw the quadrats where there were lots of dandelions to count

3 throw the quadrats randomly around the field

4 make sure all the quadrats had a similar number of dandelions in them

7B Each student collected data by throwing 10 quadrats.

Which would be the best way to improve the reliability of their estimate?

1 count all the dandelions on the field

2 use the results of the student with the highest estimate

3 work out an estimate using all the data collected by all the students

4 use smaller quadrats

4.7.2.1 Levels of organisation

Question 05 · continued March 2009 | BLY1BP | Original Q7 | Legacy

These are the results for one student, Mary.

Quadrat number	Number of dandelions
1	3
2	3
3	6
4	2
5	1
6	2
7	0
8	3
9	2
10	0

7C What was the mean number of dandelions per quadrat counted by Mary?

1 1.7

2 1.8

3 2.0

4 2.2

7D Another student, Sharon, calculated a mean of 2.8 dandelions per quadrat from her results.

Estimate the number of dandelions in the whole field by using:
- the mean of 2.8
- information from the diagram on the opposite page
- the equation below.

Estimated number of dandelions on field	=	mean number of dandelions per quadrat	×	number of quadrats that would fit into the field

1 28

2 420

3 15 120

4 54 000

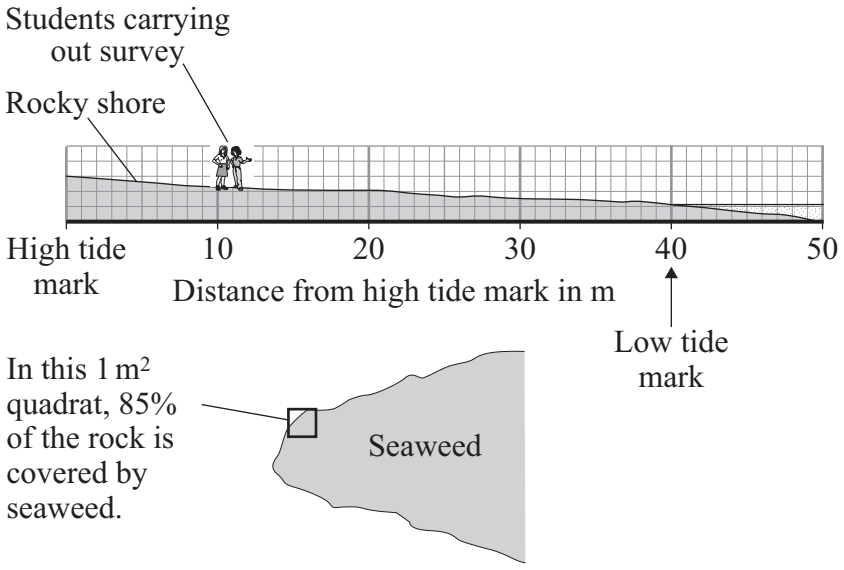
4.7.2.1 Levels of organisation

Question 06

November 2009 | BLY1BP | Original Q9 | Legacy

QUESTION NINE

A group of students carried out a survey on a rocky sea shore. The students were measuring the distribution of four different seaweeds down the whole shore. They used 1 metre square quadrats. In each quadrat, they measured the percentage abundance of each seaweed.



9A Which of the following sampling methods would provide the most reliable results?

1 sampling every 5 metres from the low tide mark to the high tide mark

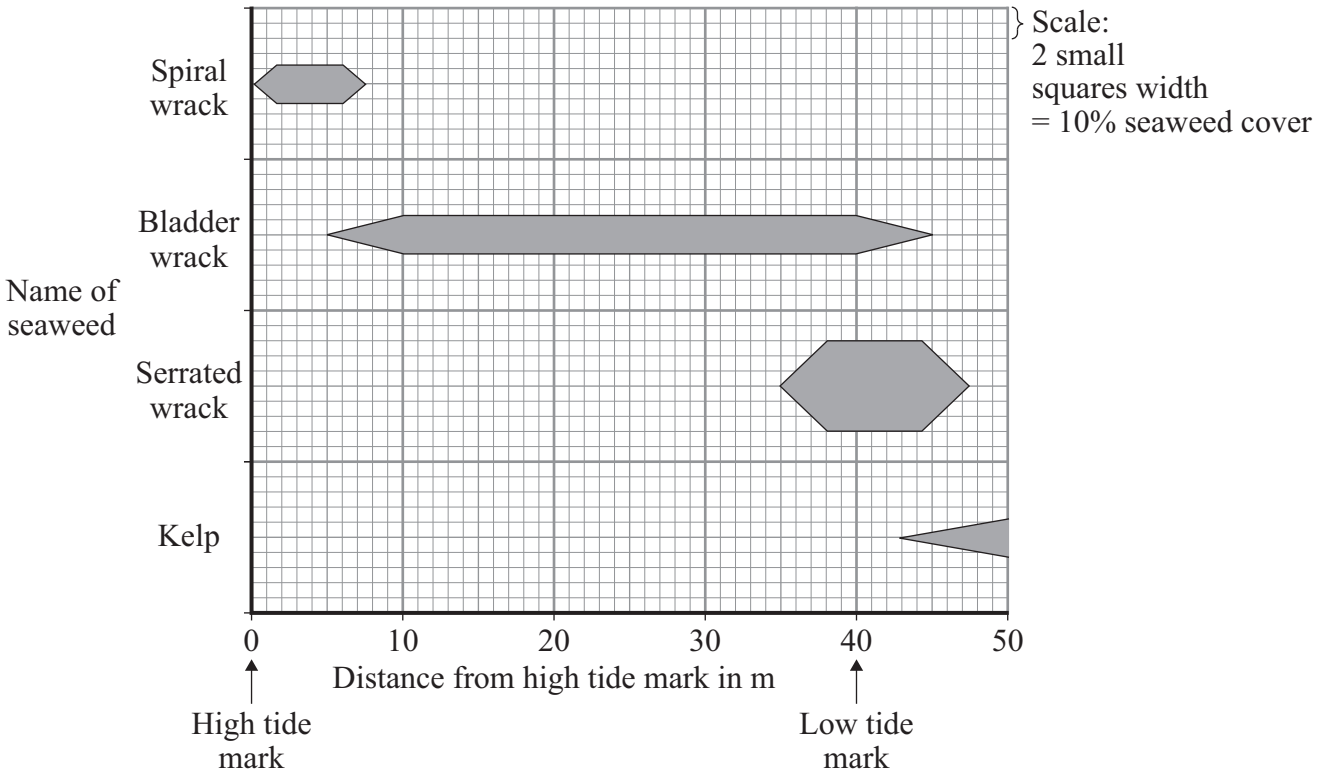
2 sampling every 1 metre from the low tide mark to the high tide mark

3 sampling every 1 metre from the high tide mark for 20 metres down the rocky shore

4 sampling every 5 metres from the low tide mark for 20 metres up the rocky shore

Question 06 · continued

The diagram shows the students' results.



9B What is the distribution range of bladder wrack on the rocky shore?

1 0 to 8 metres

2 5 to 45 metres

3 35 to 48 metres

4 43 to 50 metres

9C What is the percentage cover of serrated wrack at the low tide mark?

1 20

2 30

3 50

4 60

9D Which seaweed is likely to be able to survive the driest conditions?

1 Spiral wrack

2 Bladder wrack

3 Serrated wrack

4 Kelp

END OF TEST

4.7.2.1 Levels of organisation

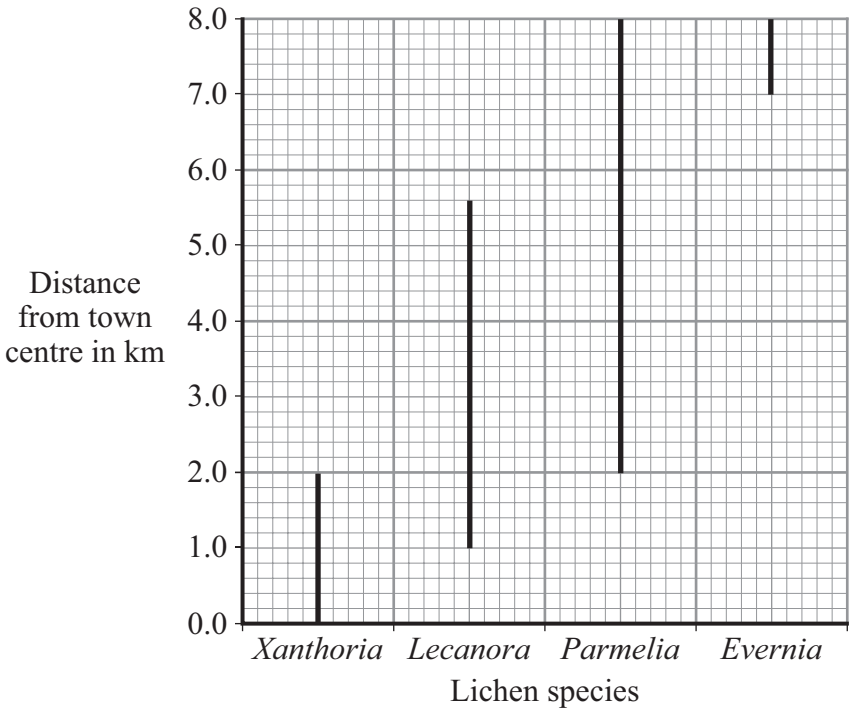
Question 07

7 Lichens are sensitive to the amount of sulfur dioxide in the atmosphere. They are used as indicator species for the amount of air pollution. Air pollution is generally higher in town centres than in the countryside.

Students investigated the relationship between lichen species and distance from a town centre.

- On a map, they drew a transect (line) from the centre of the town to the countryside.
- They examined sites every 200 metres along the transect (line).
- At each site, they recorded the lichen species growing on trees and walls up to a height of 2 metres.

The graph shows their results.
The lines on the graph indicate the range of each lichen species.



7 (a) Give **one** way in which the students could have obtained more accurate results.

.....

.....

(1 mark)

4.7.2.1 Levels of organisation

Question 07 · continued

for mark

7 (b) (i) Which lichen species was found over the greatest range?

.....

(1 mark)

7 (b) (ii) Which lichen species grows only in the least polluted air?

.....

(1 mark)

7 (c) One student concluded 'You can tell how much sulfur dioxide there is in the air by the amount of *Lecanora* growing'.

Give **two** reasons why this is **not** a valid conclusion.

1 .....

.....

2 .....

.....

(2 marks)

5

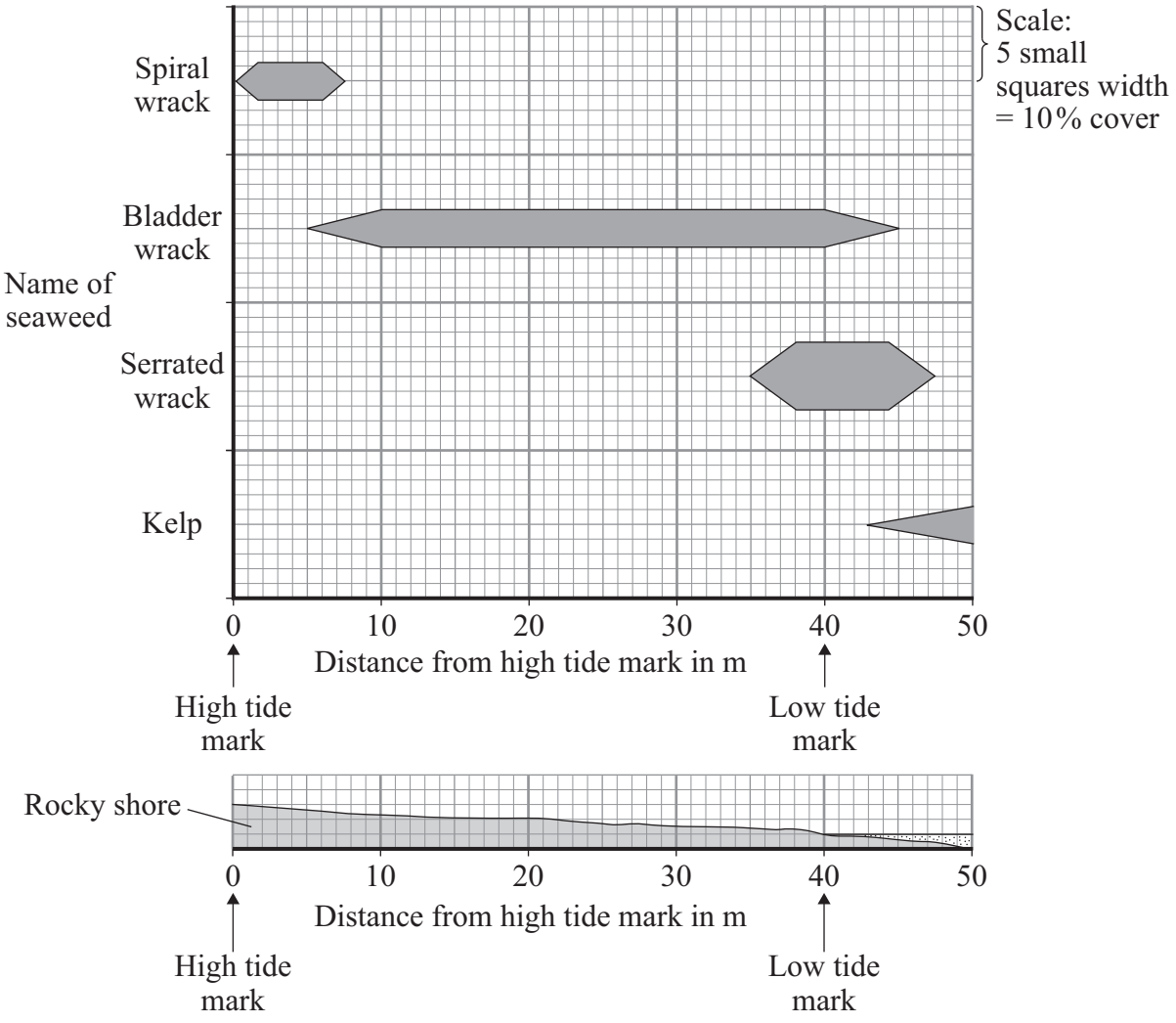
4.7.2.1 Levels of organisation

Question 08

March 2010 | BLY1BP | Original Q4 | Legacy

QUESTION FOUR

The diagram shows how much of four different seaweeds are found growing on different parts of a rocky shore.



Use the diagram to match the names of seaweeds, **A**, **B**, **C** and **D**, with the statements **1–4** in the table.

A spiral wrack

B bladder wrack

C serrated wrack

D kelp

1	All of this seaweed is always covered by the sea.
2	This seaweed is found across the widest range of distance on the rocky shore.
3	This seaweed can survive the driest conditions.
4	At 45 metres from the high tide mark there is more of this seaweed than any other.

4.7.2.1 Levels of organisation

Question 09

January 2011 | BLY2F | Original Q8 | Legacy

8 A group of students investigated a food chain in a garden.

The table shows the estimates of the population and biomass of some of the organisms the students found.

Organism	Number in the garden	Mean mass of each one in g	Biomass of population in g
Hedgehog	1	200	200
Slug	600	2	1200
Lettuce	20	300	

8 (a) (i) Calculate the biomass of the lettuce population.

Show clearly how you work out your answer.

.....

.....

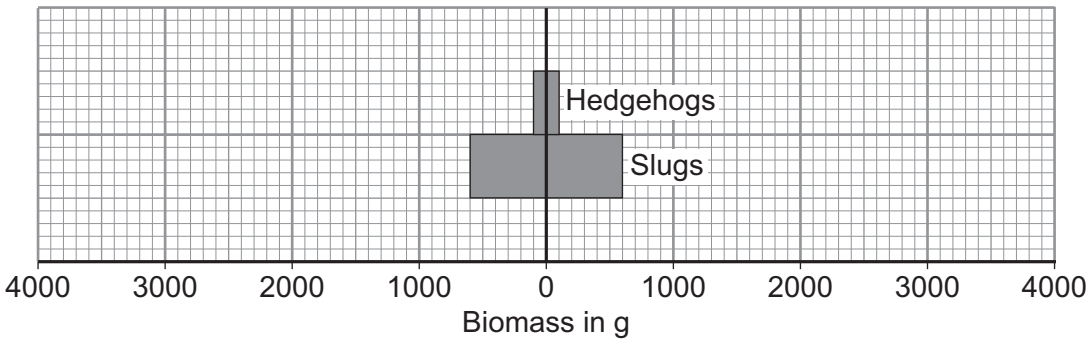
.....

Biomass = ... g

(2 marks)

8 (a) (ii) Use your answer to part (a)(i) to complete the pyramid of biomass.

Show the biomass of the lettuces in the garden.



(2 marks)

4.7.2.1 Levels of organisation

Question 09 · continued

8 (b) Hedgehogs eat slugs.

The biomass of the hedgehog population is much less than the biomass of the slug population.

Explain why as fully as you can.

.....

.....

.....

.....

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.....

.....

(3 marks)

7

4.7.2.1 Levels of organisation

Question 10

June 2012 | BL1FP | Original Q3 | Legacy

3 Green plants are found at the start of all food chains.

3 (a) Complete the sentences.

3 (a) (i) The source of energy for green plants is radiation from the ..... .

(1 mark)

3 (a) (ii) Green plants absorb some of the light energy that reaches them for a process called ..... .

(1 mark)

3 (b) Draw a ring around the correct answer to complete each sentence.

3 (b) (i) This process transfers light energy into chemical / sound / electrical energy.

(1 mark)

3 (b) (ii) The process uses the gas carbon dioxide. / oxygen. / water.

(1 mark)

3 (b) (iii) The process produces carbon-containing compounds called carbohydrates. / minerals. / salts.

(1 mark)

4.7.2.1 Levels of organisation

Question 10 · continued

3 (c) The amount of living material (biomass) at each stage in a food chain is less than at the previous stage.

The diagram shows a food chain.

oak tree → **caterpillar** → **blue-tit** → **hawk**

Give **two** ways in which biomass is lost in this food chain.

Tick (✓) **two** boxes.

As carbon dioxide from the caterpillar ☐

As food eaten by the hawk ☐

As oxygen from the oak tree ☐

As faeces (droppings) from the blue-tit ☐

(2 marks)

7

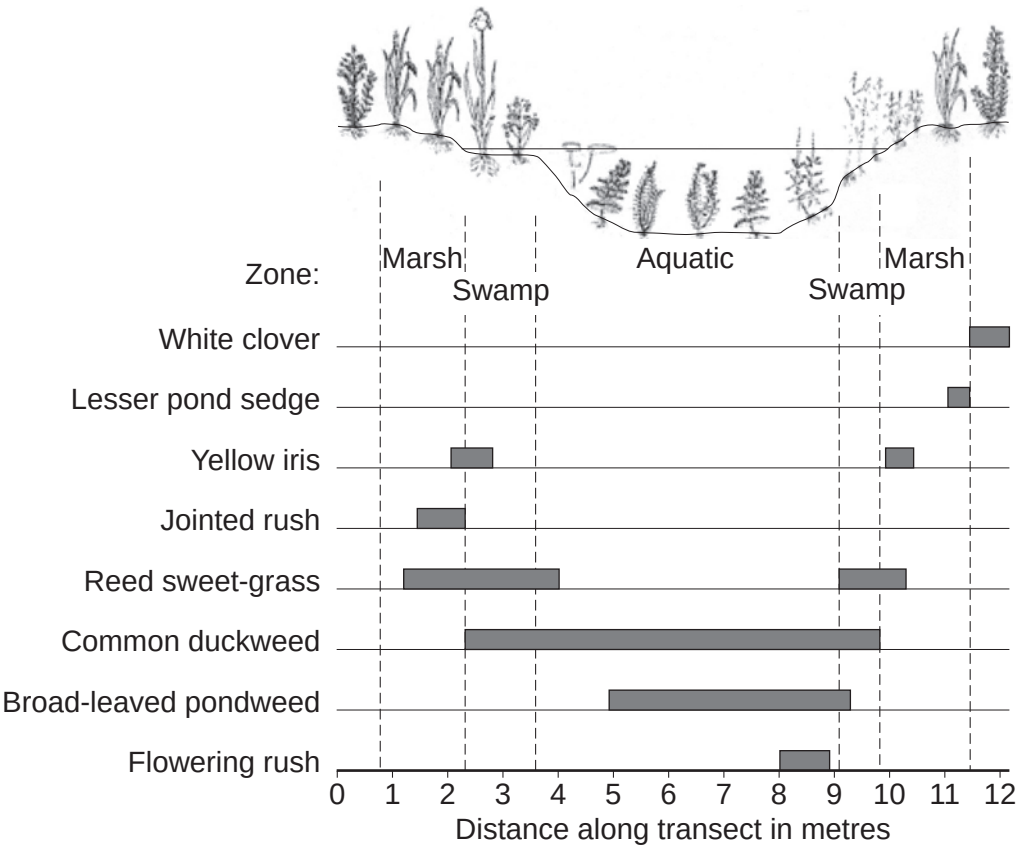
4.7.2.1 Levels of organisation

Question 11

June 2012 | BL2FP | Original Q8 | Legacy

8 Some students investigated the distribution of some of the plants growing in and around a shallow stream. They sampled along a transect line.

The diagram shows their results.



8 (a) (i) Name the **one** species that grew only in the driest conditions.

.....

(1 mark)

8 (a) (ii) Only **one** species grew in the marsh, the swamp and in the aquatic zones.

Which species?

.....

(1 mark)

8 (a) (iii) Duckweed grows floating in water. What evidence is there for this in the students' results?

.....

.....

(1 mark)

4.7.2.1 Levels of organisation

Question 11 · continued

8 (b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Describe how you would use a $\frac{1}{2}$-metre $\times$ $\frac{1}{2}$-metre quadrat frame and a 30-metre tape measure to obtain data similar to the data shown in the diagram.

You should include details of how you would make sure that you would obtain valid results.

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(6 marks)

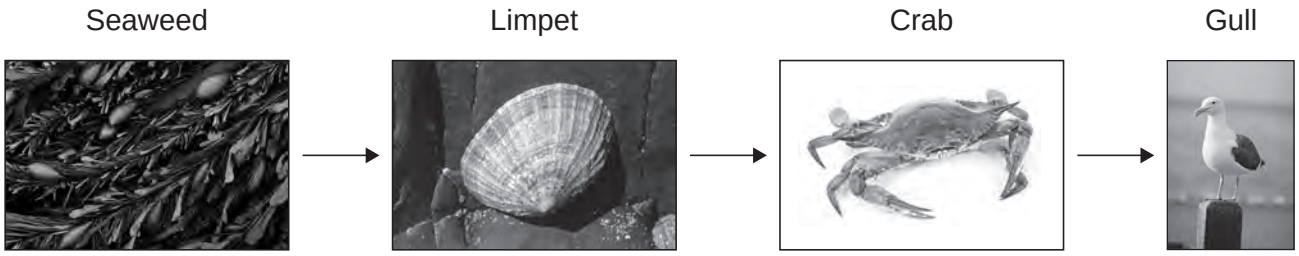
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4.7.2.1 Levels of organisation

Question 12

January 2013 | BL1FP | Original Q6 | Legacy

6 The photographs show a food chain from a seashore. The photographs are **not** to the same scale.



Students estimated the population and biomass of each of the organisms on part of a seashore.

The table shows the students' results.

Organism	Population	Mean mass of one organism in grams	Biomass of population in grams
Seaweed	50	4000	200 000
Limpet	1200	30	36 000
Crab	100	90	9 000
Gull	2	900	

6 (a) (i) Use the data in the table to calculate the biomass of the gull population.

.....

.....

Biomass = ... g

(1 mark)

4.7.2.1 Levels of organisation

Question 12 · continued

6 (a) (ii) Draw a pyramid of biomass for this food chain.

Label the pyramid.

(2 marks)

6 (b) The biomass of the crab population is much less than the biomass of the limpet population.

Suggest **two** reasons why.

1 .....

.....

2 .....

.....

(2 marks)

5

4.7.2.1 Levels of organisation

Question 13

January 2013 | BL2FP | Original Q4 | Legacy

4 Some students wanted to find the number of thistle plants growing on a lawn.
The students placed 10 quadrats at different positions on the lawn.
Each quadrat measured 1 metre × 1 metre.
The students counted the number of thistle plants in each quadrat.

4 (a) Which method should the students use to decide where to place the 10 quadrats?

Tick (✓) **one** box.

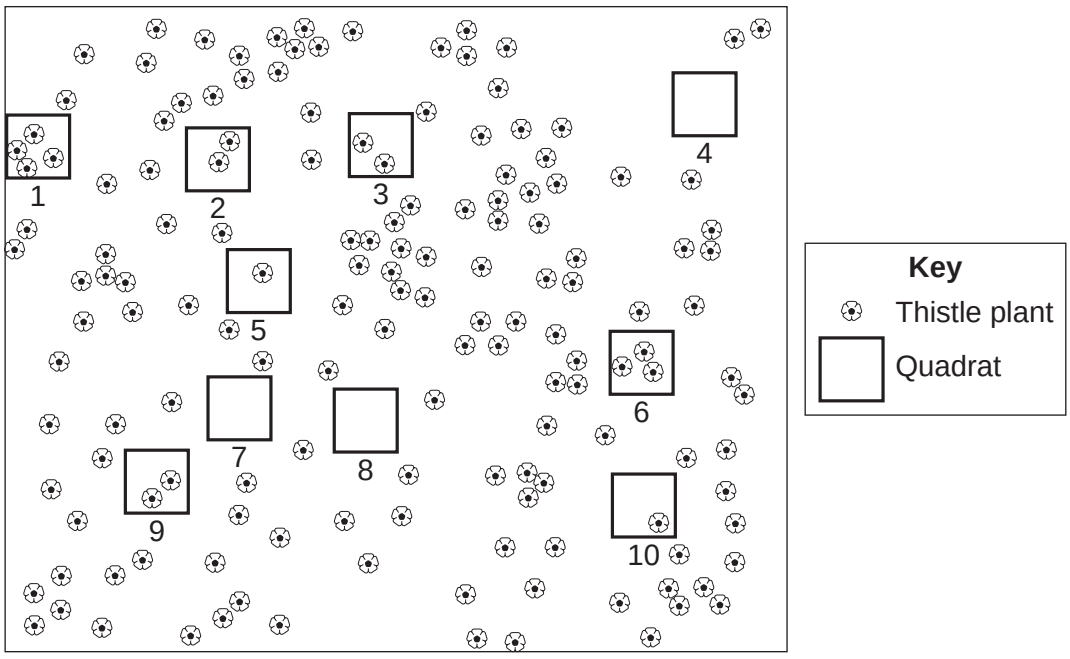
Place the quadrats as evenly as possible around the lawn. ☐

Place 5 quadrats in areas with many thistle plants and 5 quadrats in areas with only a few thistle plants. ☐

Place all the quadrats randomly on the lawn. ☐

(1 mark)

4 (b) The diagram shows the lawn with the positions of the thistle plants and the students' 10 quadrats.



4.7.2.1 Levels of organisation

Question 13 · continued

4 (b) (i) Complete the table to show:

- how many thistle plants the students found in each of the first four quadrats
- the total number of thistle plants found in all 10 quadrats.

Quadrat number	Number of thistle plants in each quadrat
1	
2	
3	
4	
5	1
6	3
7	0
8	0
9	2
10	1
Total	

(2 marks)

4 (b) (ii) Calculate the mean number of thistle plants in one quadrat.

.....

Mean = ...

(1 mark)

4 (b) (iii) The lawn measured 12 metres long and 10 metres wide.

Use your answer from part **(b)(ii)** to estimate the number of thistle plants on the lawn.

.....

.....

Estimated number of thistle plants = ...

(2 marks)

4 (c) How could the students make their estimate more accurate?

.....

.....

(1 mark)

7

4.7.2.1 Levels of organisation

Question 14

June 2013 | BL2FP | Original Q8 | Legacy

8 Some students were asked to investigate the distribution of clover in a field of grass. They noticed that the clover grew in patches amongst the grass.

8 (a) The students decided to use quadrats.

Describe how the students should decide where to place the quadrats to investigate the distribution of the clover.

.....

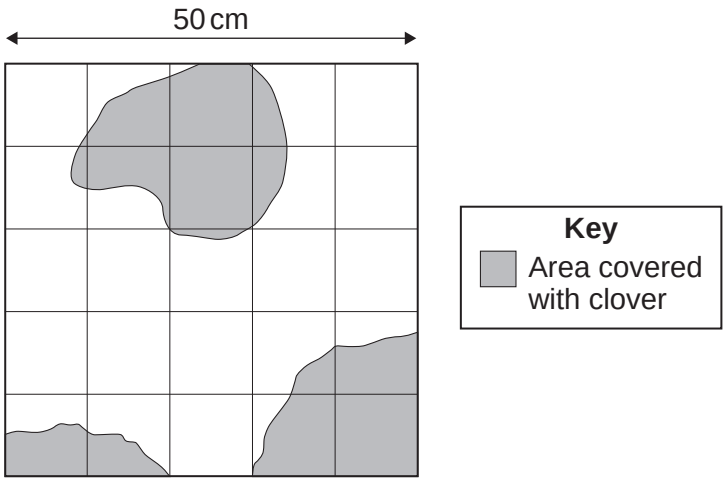
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.....

.....

(2 marks)

8 (b) The diagram shows one of the quadrats the students used.



8 (b) (i) Estimate the number of squares of the quadrat covered with clover.

.....

.....

Number of squares = ...

(1 mark)

4.7.2.1 Levels of organisation

Question 14 · continued

8 (b) (ii) Describe how you worked out your answer to part **(b)(i)**.

.....

.....

.....

(1 mark)

8 (b) (iii) Use your answer from part **(b)(i)** to calculate the percentage of the quadrat covered by the clover.

.....

.....

.....

Answer = ... %

(2 marks)

8 (c) Suggest **one** factor that could account for the distribution of the clover plants.

.....

(1 mark)

7

4.7.2.1 Levels of organisation

Question 15

June 2014 | BL1FP | Original Q8 | Legacy

8 Food chains show the flow of energy through the organisms in a habitat.

8 (a) **Figure 9** shows a food chain.

Figure 9



The biomass in each stage of the food chain changes as food passes along the food chain.

Draw a pyramid of biomass for this food chain.

Label the pyramid.

[2 marks]

4.7.2.1 Levels of organisation

Question 15 · continued

8 (b) **Table 2** shows three food chains, **A**, **B** and **C**.

Table 2

	Food chain
A	plants → sheep → human
B	plants → grasshoppers → frogs → trout → human
C	plants → human

8 (b) (i) In which food chain, **A**, **B** or **C**, will the greatest proportion of biomass and energy of the plants be passed to humans? ☐

[1 mark]

8 (b) (ii) Give reasons why the food chain that you chose in part **(b)(i)** passes on the greatest proportion of biomass and energy to humans.

[3 marks]

.....

.....

.....

.....

.....

.....

6

4.7.2.1 Levels of organisation

Question 16

June 2014 | BL2FP | Original Q2 | Legacy

2 Some students investigated the distribution of dandelion plants in a grassy field. The grassy field was between two areas of woodland.

Figure 2 shows two students recording how many dandelion plants there are in a 1 metre x 1 metre quadrat.

Figure 2

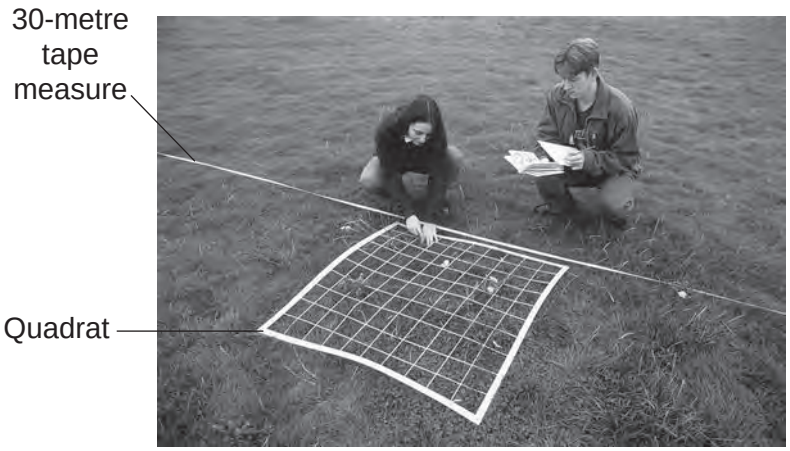


Figure 3 shows a section across the area studied and **Figure 4** shows a bar chart of the students' results.

Figure 3

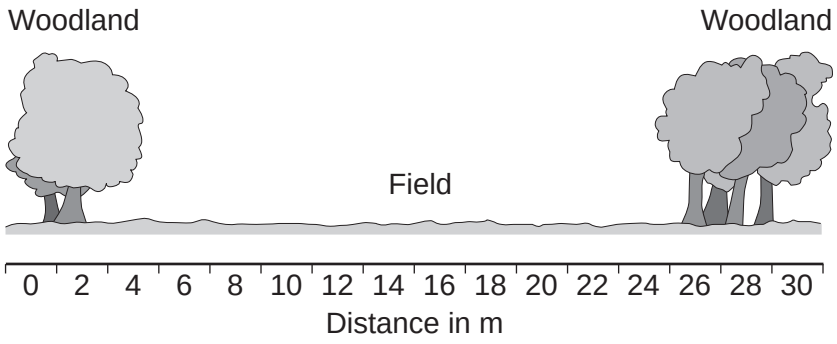
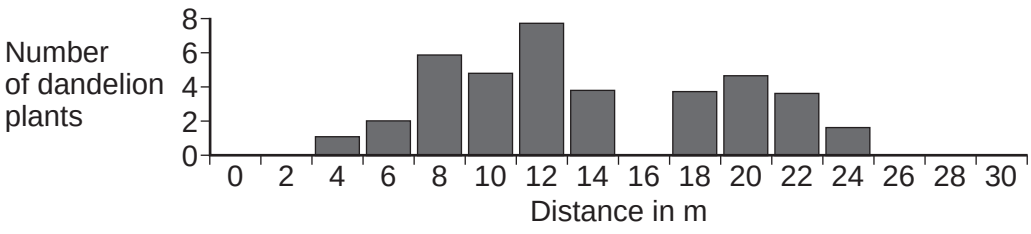


Figure 4



4.7.2.1 Levels of organisation

Question 16 · continued

2 (a) How did the students use the quadrat and the 30-metre tape measure to get the results in **Figure 4**?

Use information from **Figure 2**.

[3 marks]

.....

.....

.....

.....

.....

.....

2 (b) (i) Suggest **one** reason why the students found no dandelion plants under the trees.

[1 mark]

.....

.....

2 (b) (ii) Suggest **one** reason why the students found no dandelion plants at 16 metres.

[1 mark]

.....

.....

2 (c) The teacher suggested that it was **not** possible to make a valid conclusion from these results.

Describe how the students could improve the investigation so that they could make a valid conclusion.

[2 marks]

.....

.....

.....

.....

7

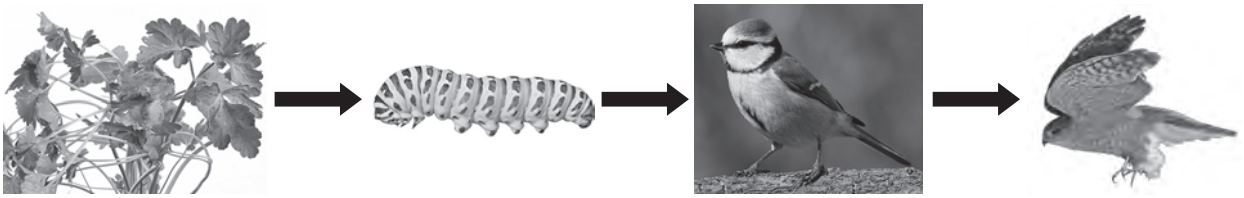
4.7.2.1 Levels of organisation

Question 17

June 2016 | BL1FP | Original Q3 | Legacy

3 **Figure 3** shows how energy and biomass pass along a food chain.

Figure 3



Parsley Swallowtail caterpillar Blue tit Hawk

3 (a) The parsley shown in **Figure 3** carries out photosynthesis.

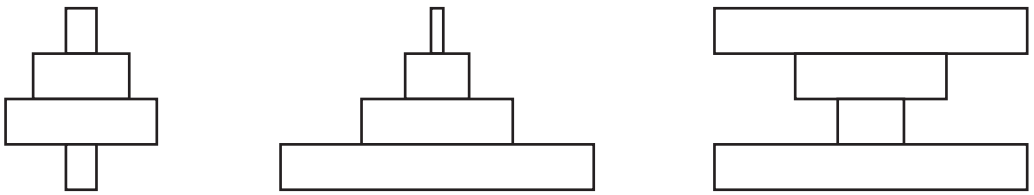
Why is photosynthesis important in the food chain?

[2 marks]

3 (b) Which diagram shows the pyramid of biomass for the food chain in **Figure 3**?

[1 mark]

Tick (✓) **one** box.







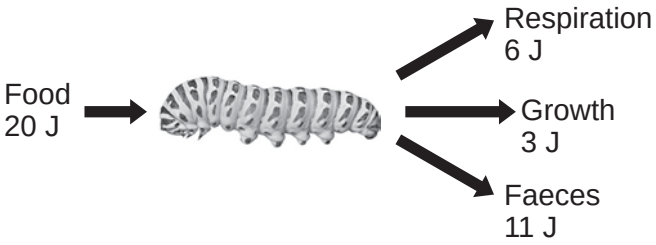


4.7.2.1 Levels of organisation

Question 17 · continued

3 (c) **Figure 4** shows the ways a swallowtail caterpillar transfers 20 J of energy from food.

Figure 4



What percentage of the energy in the caterpillar's food is used for growth?

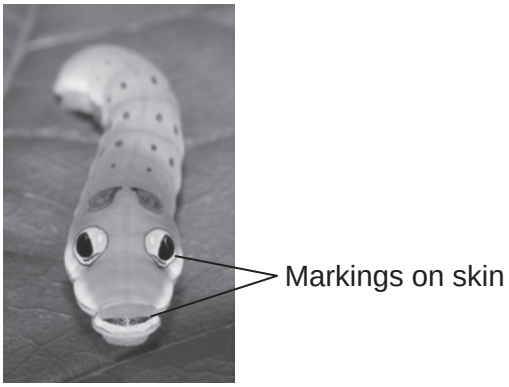
[2 marks]

Percentage = _____

3 (d) The organisms in the food chain are adapted for survival.

3 (d) (i) **Figure 5** shows a swallowtail caterpillar seen from the back.

Figure 5



Suggest how the swallowtail caterpillar shown in **Figure 5** is adapted to reduce the chance of being eaten by blue tits.

[2 marks]

4.7.2.1 Levels of organisation

Question 17 · continued

3 (d) (ii) **Figure 6** shows a hawk.

Figure 6



Suggest **two** ways that the hawk is adapted to catch and kill blue tits.

[2 marks]

1 _____

_____

2 _____

_____

9

4.7.2.1 Levels of organisation

Question 18

June 2016 | BL2FP | Original Q3 | Legacy

3 Ragwort is a plant that often grows as a weed in grassland.

Figure 3 shows a ragwort plant.

Figure 3



Some students estimated the number of ragwort plants growing in a field on a farm.

The students:

- placed a quadrat at 10 random positions in the field
- counted the number of ragwort plants in each quadrat.

The quadrat measured 1 metre × 1 metre. The area of the field was 80 000 m^2.

Table 1 shows the students' results.

Table 1

Quadrat number	Number of ragwort plants
1	1
2	0
3	3
4	0
5	0
6	0
7	5
8	0
9	0
10	2

4.7.2.1 Levels of organisation

Question 18 · continued

3 (a) Complete the following calculation to estimate the number of ragwort plants in the field.

Use information from **Table 1**.

[2 marks]

Total number of ragwort plants in 10 quadrats = _____

Mean number of ragwort plants in 1 m^2 = _____

Therefore estimated number of ragwort plants in field = _____

3 (b) What could the students do to get a more accurate estimate?

[1 mark]

Tick (✓) **one** box.

Place the quadrat in 100 random positions. ☐

Place the quadrat only in areas where they could see ragwort plants. ☐

Place the quadrat in positions at the edge of the field. ☐

Question 3 continues on the next page

4.7.2.1 Levels of organisation

Question 18 · continued

3 (c) The farmer who owned the field kept horses.

If horses eat ragwort, the ragwort can poison them.

The farmer considered two methods of controlling ragwort in his field.

Method 1: Spraying with a selective weed killer

Method 2: Pulling out the ragwort plants by hand

In **Method 1**:

- the cost of the weed killer was £420
- the weed killer would not harm the grass but would kill all other plants
- the farmer could apply the weed killer from a sprayer towed by a tractor.

Method 2 could be done by local volunteers.

What are the advantages and disadvantages of using **Method 2** instead of **Method 1** for controlling ragwort?

[3 marks]

Advantages of **Method 2** _____

_____

_____

_____

Disadvantages of **Method 2** _____

_____

_____

_____

6

4.7.2.1 Levels of organisation

Question 19

June 2017 | BL2FP | Original Q1 | Legacy

1 Green plants make their own food.

1 (a) (i) What is the name of the process that plants use to make food?

[1 mark]

Draw a ring around the correct answer.

digestion **growth** **photosynthesis** **respiration**

1 (a) (ii) Plants need energy to make food.

Where does this energy come from?

[1 mark]

Draw a ring around the correct answer.

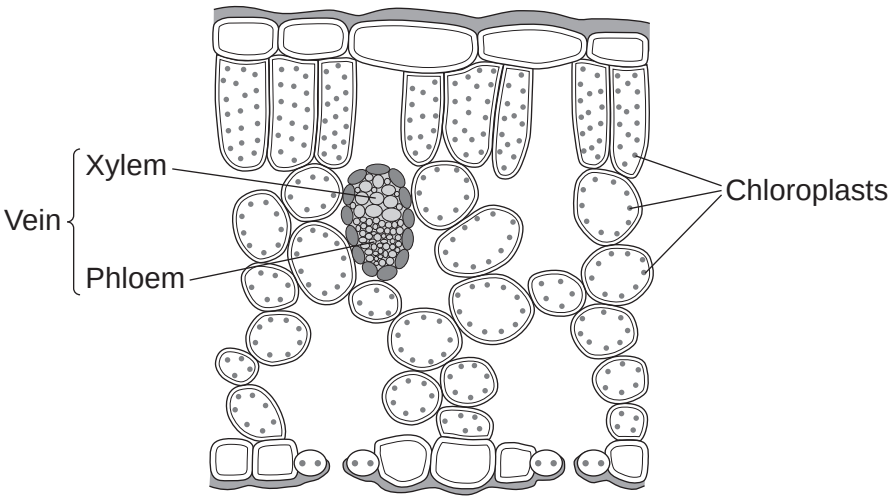
light **oxygen** **soil** **water**

1 (b) In plants, most of the food is made by the leaves.

Figure 1 shows a section through a plant leaf.

In the leaf, many of the cells contain chloroplasts.

Figure 1



1 (b) (i) Chloroplasts contain a green substance.

Name this green substance.

[1 mark]

_____

4.7.2.1 Levels of organisation

Question 19 · continued

1 (b) (ii) How does this green substance help chloroplasts to make food?

[1 mark]

_____

_____

1 (b) (iii) What is the function of the vein shown in **Figure 1**?

[1 mark]

_____

_____

1 (b) (iv) Plants make glucose.

Name **two** substances a plant must take in to make glucose.

[2 marks]

1 _____

2 _____

7

4.7.2.1 Levels of organisation

Question 20

June 2017 | BL2FP | Original Q7 | Legacy

7 **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Figure 7 shows part of a plant called cross-leaved heath.

Figure 7



A student noticed that some areas of marshland contained cross-leaved heath plants and some areas did not.

The student made the following hypothesis:

'Soil pH affects the amount of cross-leaved heath plants that grow in an area.'

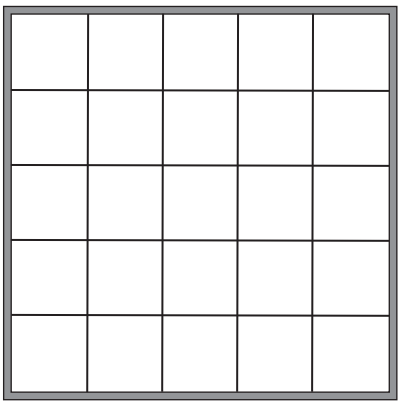
How could the student use apparatus, including the quadrat and pH meter shown in **Figure 8**, to find the range of pHs where the cross-leaved heath plants grew best?

You should include details of how the student could make sure the results are valid.

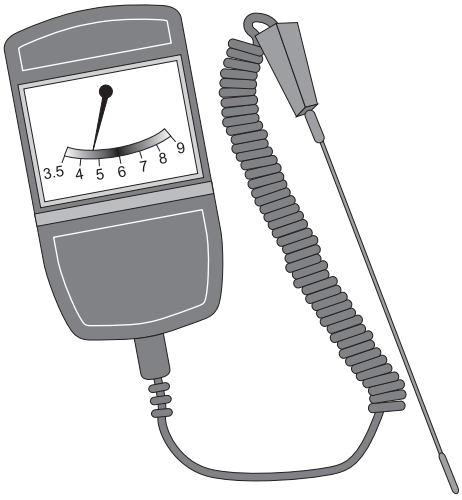
[6 marks]

Figure 8

1 m x 1 m quadrat



Soil pH meter



Not to scale

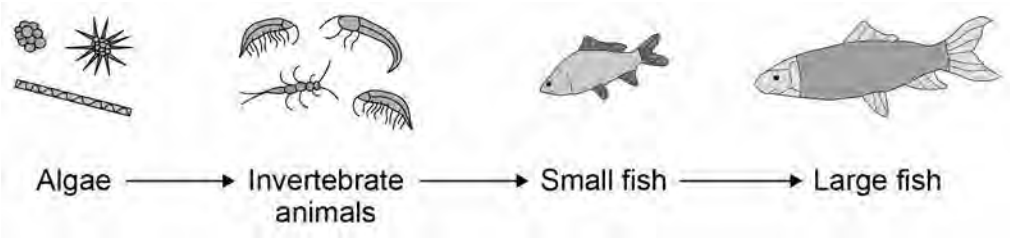
4.7.2.1 Levels of organisation

Question 21

June 2018 | 8461/2F | Original Q1

0 1 **Figure 1** shows a food chain in a river.

Figure 1



0 1 . 1 Draw **one** line from each scientific term to the correct organism in the food chain.

[3 marks]

Scientific term	Organism in the food chain
	Algae
Apex predator	Invertebrate animals
Primary consumer	Large fish
Producer	Small fish

4.7.2.1 Levels of organisation

Question 21 · continued

0 1 . 2 **Table 1** shows the biomass of the organisms at each stage in the food chain.

Table 1

Organism	Biomass in arbitrary units
Algae	840
Invertebrate animals	200
Small fish	40
Large fish	10

Calculate the percentage of the biomass of the invertebrate animals that is transferred to the large fish.

[2 marks]

Use the equation:

$$\text{percentage} = \frac{\text{biomass of large fish}}{\text{biomass of invertebrate animals}} \times 100$$

Percentage = _____

Question 1 continues on the next page

4.7.2.1 Levels of organisation

Question 21 · continued

0 1 . 3 A large amount of biomass is lost from the food chain.

Complete the sentences.

[3 marks]

Choose answers from the box.

coordination	**digestion**	**excretion**
filtration	**ingestion**	**respiration**

When the small fish eat the invertebrate animals, not all of this material is broken down during _____ .

Materials absorbed from the gut may enter the body cells of the small fish. These materials are broken down into carbon dioxide and water by _____ .

The carbon dioxide and other waste materials from the body cells are removed from the small fish by _____ .

0 1 . 4 A disease kills many of the small fish.

Why does the number of invertebrate animals increase?

[1 mark]

_____

_____

9

4.7.2.1 Levels of organisation

Question 22

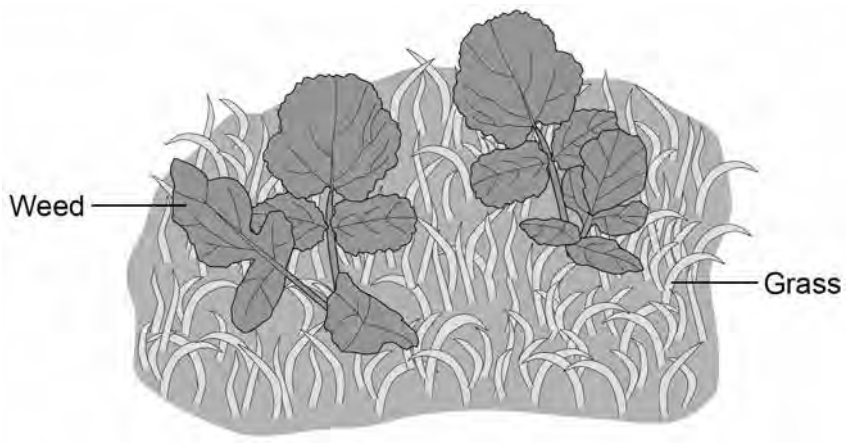
June 2018 | 8461/2F | Original Q6

0 6 Some weed killers are selective.

Selective weed killers kill broad-leaved weed plants, but do **not** kill narrow-leaved grass plants.

Figure 8 shows some weeds growing on a grassy lawn.

Figure 8



Some students investigated the effect of a selective weed killer on the weeds growing in a lawn. They used 0.5 m × 0.5 m quadrats.

The lawn was 20 metres long and 10 metres wide.

This is the method used.

1. Divide the lawn into two halves, side **A** and side **B**.
2. Place 5 quadrats in different positions on side **A**.
3. Place 5 more quadrats in different positions on side **B**.
4. Count the number of weed plants in each quadrat.
5. Spray side **A** with weed killer solution.
6. Spray side **B** with the same volume of water.
7. Repeat steps 2-4 after 2 weeks.

0 6 . 1 Suggest a method the students should have used to place each quadrat.

[1 mark]

Question 22 · continued

0 6 . 2 Give the reason for the method you suggested in Question **06.1**.

[1 mark]

0 6 . 3 Explain why the students used water on one side of the lawn instead of weed killer.

[2 marks]

Table 3 shows the students' results.

Table 3

	Number of weeds per quadrat			
	At start		After 2 weeks	
	Side A (Weed killer)	Side B (Water)	Side A (Weed killer)	Side B (Water)
	8	14	3	8
	2	9	4	15
	12	3	0	7
	15	16	2	12
	13	3	1	13
Mean	10	9	2	**X**

0 6 . 4 Calculate the mean value, **X**, in **Table 3**.

[1 mark]

Mean value, **X** = _____

4.7.2.1 Levels of organisation

Question 22 · continued

0 6 . 5 Calculate the percentage decrease in the number of weeds on side **A** after 2 weeks.

[2 marks]

Use the following equation:

$$\text{percentage decrease} = \frac{(\text{mean at start} - \text{mean after 2 weeks})}{\text{mean at start}} \times 100$$

Percentage decrease = _____

0 6 . 6 One student thought the results were **not** valid.

Suggest **one** improvement the students could have made to the method to make the results more valid.

Give the reason for your answer.

[2 marks]

Improvement _____

Reason _____

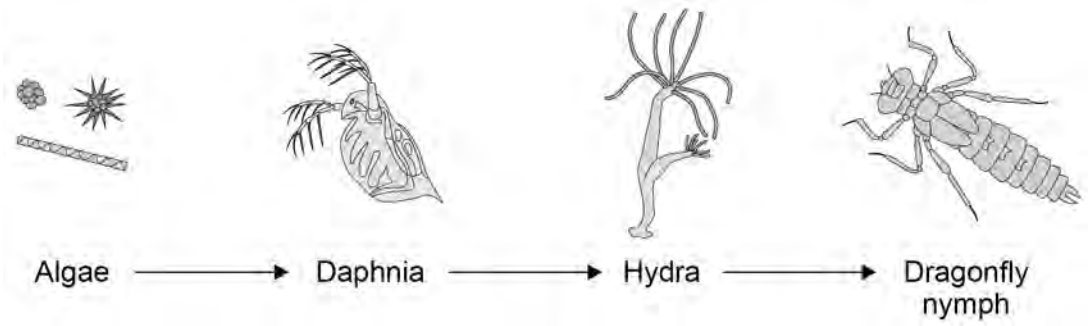
9

4.7.2.1 Levels of organisation

Question 23

0 7 **Figure 14** shows a food chain in a pond.

Figure 14



0 7 . 1 Which term describes the Daphnia in this food chain?

[1 mark]

Tick (✓) **one** box.

- Apex predator ☐
- Primary consumer ☐
- Producer ☐
- Secondary consumer ☐

4.7.2.1 Levels of organisation

Question 23 · continued

0 7 . 2 Draw a pyramid of biomass for the food chain.

Label each trophic level.

[2 marks]

0 7 . 3 Give **one** reason why the total biomass of the Daphnia in the pond is different from the total biomass of the algae.

[1 mark]

_____

_____

Question 7 continues on the next page

Question 23 · continued

Students investigated the size of the population of Daphnia in the pond.

This is the method used.

1. Collect 1 dm^3 of pond water from near the edge of the pond.
2. Pour the water through a fine net.
3. Count the number of Daphnia caught in the net.
4. Repeat steps 1–3 four more times.

Table 3 shows the results.

Table 3

Sample number	Number of Daphnia in 1 dm^3 water
1	5
2	21
3	0
4	16
5	28

0 7 . 4 Calculate the mean number of Daphnia in 1 m^3 of pond water.

1 m^3 = 1000 dm^3

[2 marks]

Mean number of Daphnia in 1 m^3 of pond water = _____

4.7.2.1 Levels of organisation

Question 23 · continued

0 7 . 5 The pond was a rectangular shape, measuring:

- length = 2.5 metres
- width = 1.5 metres
- depth = 0.5 metres.

Calculate the estimated number of Daphnia in the pond.

Use your answer from Question **07.4**.

Give your answer in standard form.

[4 marks]

Number of Daphnia in the pond = _____

Question 7 continues on the next page

4.7.2.1 Levels of organisation

Question 23 · continued

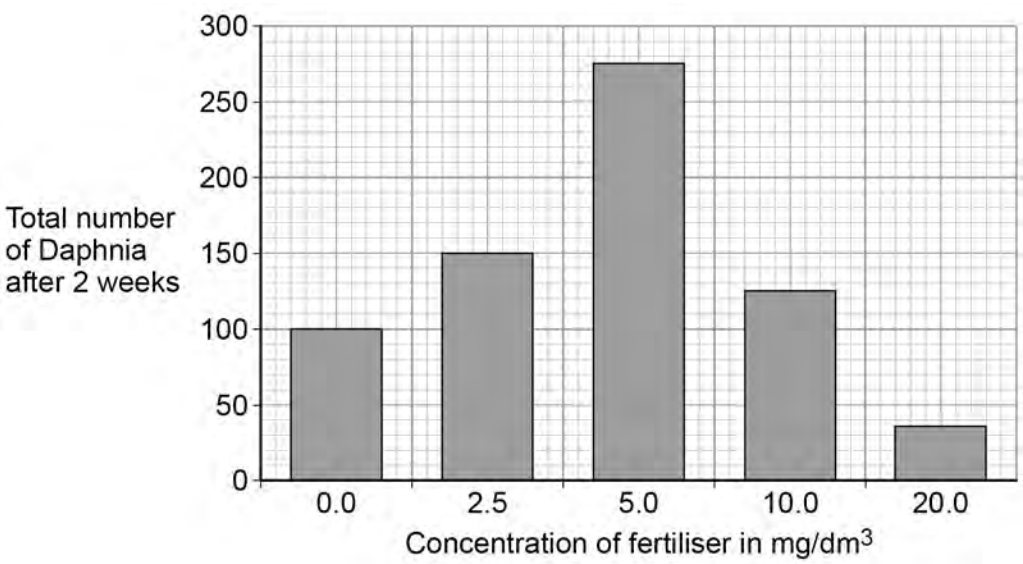
Rainfall can cause fertiliser to be washed from farmland into a pond.

The students investigated the effect of fertiliser on the population of Daphnia in water from the pond.

- The students put 20 Daphnia in each of five different concentrations of fertiliser.
- The students counted the total number of Daphnia in each concentration of fertiliser after 2 weeks.

Figure 15 shows the results.

Figure 15



0 7 . 6 A concentration of 5.0 mg/dm^3 of fertiliser caused a large increase in the population of Daphnia.

Explain why.

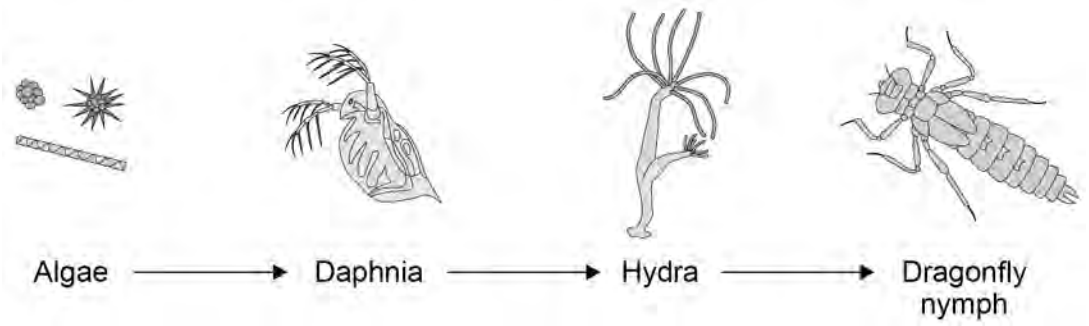
[2 marks]

4.7.2.1 Levels of organisation

Question 23 · continued

0 7 . 7 **Figure 14** is repeated below.

Figure 14



The population of **Hydra** will decrease when 20 mg/dm^3 of fertiliser is added to the pond.

Explain why.

[2 marks]

14

4.7.2.1 Levels of organisation

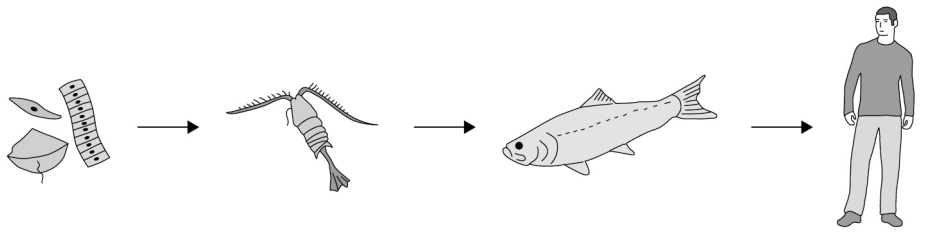
Question 24

November 2021 | 8461/2F | Original Q3

0 3 People eat fish caught in the North Sea.

Figure 4 shows a food chain.

Figure 4



Not to scale

0 3 . 1 The algae make glucose by photosynthesis.

Which **two** substances do the algae need for photosynthesis?

[2 marks]

Tick (✓) **two** boxes.

- Carbon dioxide ☐
- Nitrogen ☐
- Oxygen ☐
- Starch ☐
- Water ☐

4.7.2.1 Levels of organisation

Question 24 · continued

0 3 . 2 What is the source of energy for photosynthesis?

[1 mark]

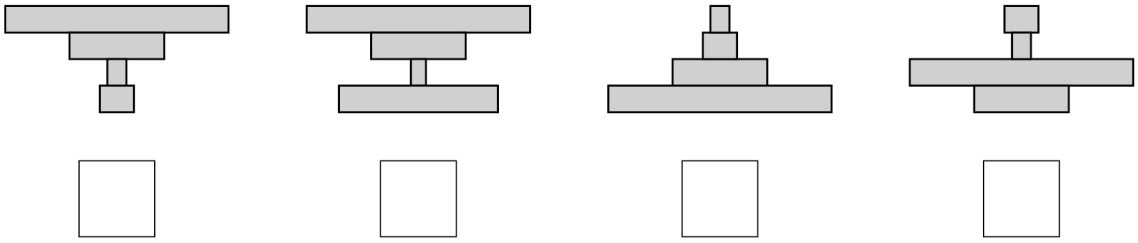
Tick (✓) **one** box.

- Light ☐
- Mineral ions ☐
- Protein ☐
- Water ☐

0 3 . 3 Which pyramid of biomass is correct for the food chain shown in **Figure 4**?

[1 mark]

Tick (✓) **one** box.



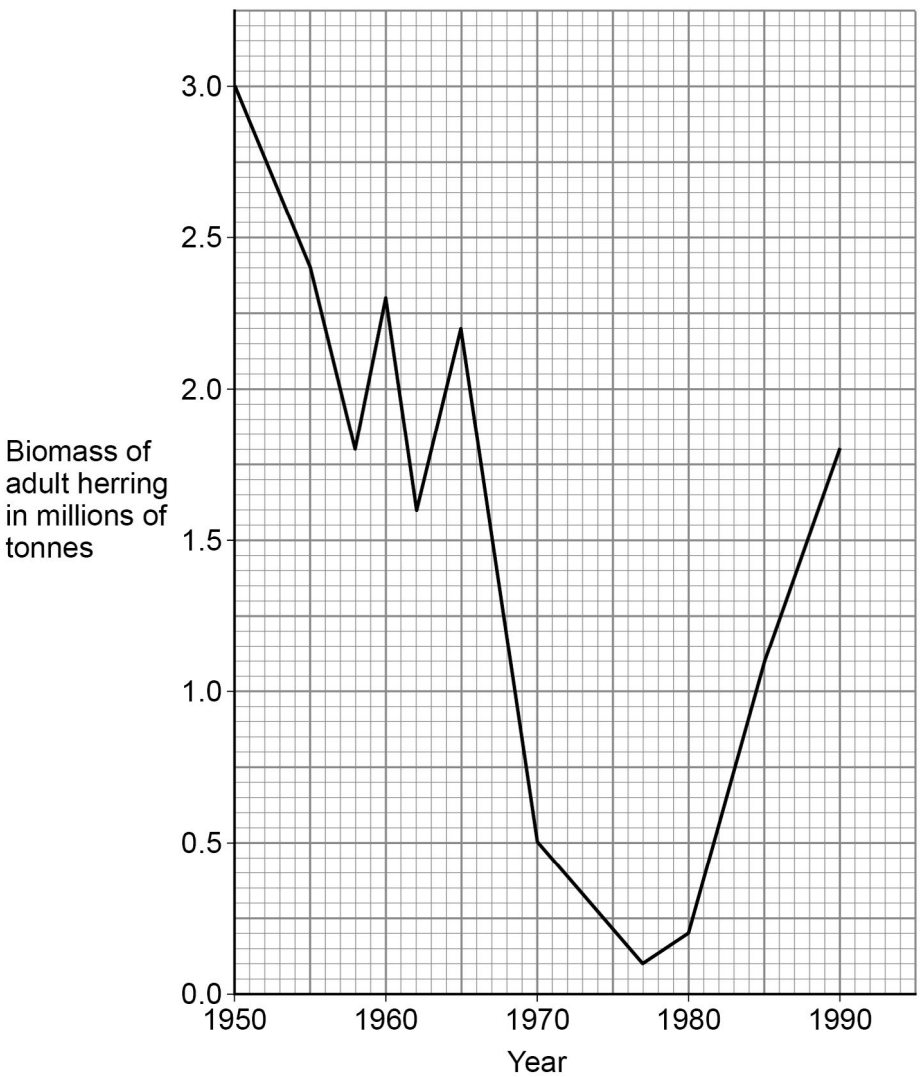
Question 3 continues on the next page

4.7.2.1 Levels of organisation

Question 24 · continued

Figure 5 shows the biomass of adult herring in the North Sea between 1950 and 1990.

Figure 5



4.7.2.1 Levels of organisation

Question 24 · continued

0 3 . 4 Too many herring were caught in the 1960s.

Calculate the percentage decrease in the biomass of adult herring between 1960 and 1970.

Use the equation:

$$\text{percentage decrease} = \frac{(\text{biomass in 1960} - \text{biomass in 1970})}{\text{biomass in 1960}} \times 100$$

Give your answer to the nearest whole number.

[4 marks]

Percentage decrease = _____ %

From 1977, laws were introduced to help conserve herring.

0 3 . 5 Describe the change in biomass of adult herring from 1977 to 1990.

Use data from **Figure 5** in your answer.

[2 marks]

Question 3 continues on the next page

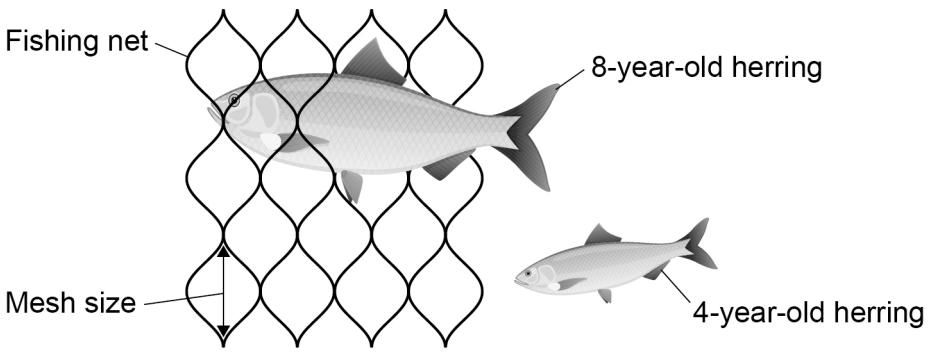
4.7.2.1 Levels of organisation

Question 24 · continued

0 3 . 6 One of the laws was to control mesh size of fishing nets.

Figure 6 shows a fishing net with a legal mesh size.

Figure 6



Herring can live for up to 12 years.

Herring start to reproduce when they are 3 to 4 years old.

Explain how the control of mesh size of fishing nets has helped to conserve stocks of herring.

[2 marks]

12

4.7.2.1 Levels of organisation

Question 25

November 2021 | 8461/2F | Original Q6

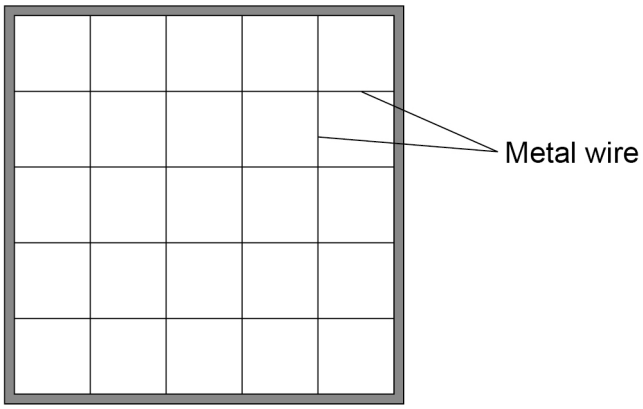
0 6 A student estimated the percentage cover of buttercup plants in a field.

The student used a quadrat.

The quadrat was divided into 25 equal squares.

Figure 10 shows the quadrat.

Figure 10



This is the method used.

1. Place the quadrat on the ground.
2. Record how many squares in the quadrat contain buttercup plants.
3. Place the quadrat in a new position in the field.
4. Record how many squares in the quadrat contain buttercup plants.
5. Repeat steps 3 and 4 another three times.

4.7.2.1 Levels of organisation

Question 25 · continued

0 6 . 1 What method should the student have used for placing the quadrat?

[1 mark]

Tick (✓) **one** box.

Place the quadrat where there are many buttercup plants. ☐

Place the quadrat only where there are no trees. ☐

Place the quadrat using random coordinates. ☐

Use the same person to place all the quadrats. ☐

The student calculated the percentage cover of buttercup plants for each quadrat.

Table 1 shows the student's results.

Table 1

Quadrat number	Number of squares containing buttercup plants	Percentage cover of buttercup plants
1	10	40
2	13	52
3	22	88
4	20	80
5	10	40
	Mean	**X**

0 6 . 2 Calculate mean value **X** in **Table 1**.

[2 marks]

X = _____ %

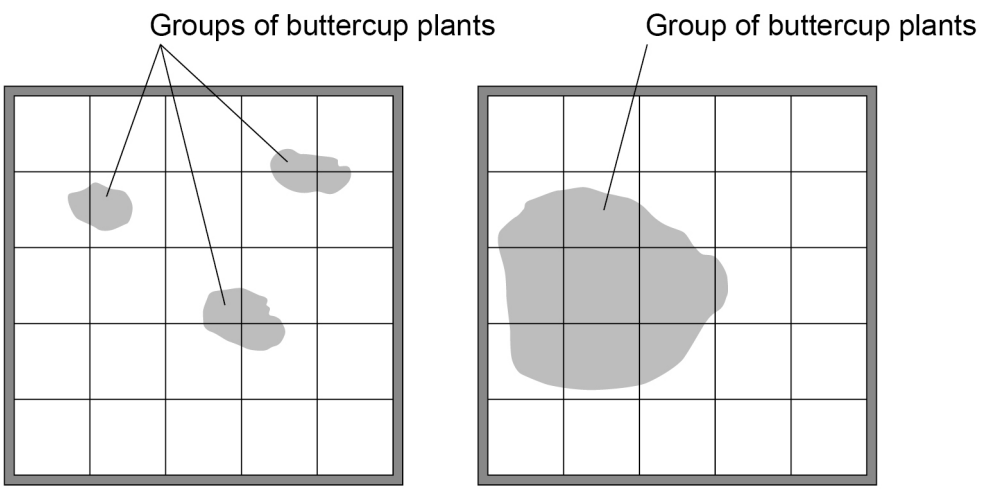
Question 6 continues on the next page

Question 25 · continued

Table 1 shows that quadrat **1** and quadrat **5** each had 40% cover of buttercup plants.

Figure 11 shows the results for quadrat **1** and quadrat **5**.

Figure 11



0 6 . 3 The student's method of estimating the percentage cover of buttercup plants is **not** accurate.

How does **Figure 11** show this?

[1 mark]

Tick (✓) **one** box.

Quadrat 1 has more groups of buttercup plants. ☐

The area of buttercup plants in quadrat 5 is much larger. ☐

The buttercup plants are in ten squares in both quadrats. ☐

4.7.2.1 Levels of organisation

Question 25 · continued

0 6 . 4 The student wanted to get a more valid estimate of the percentage cover of buttercup plants in the field.

Suggest **two** improvements to the method to make the results more valid.

[2 marks]

1 _____

_____

2 _____

_____

0 6 . 5 Give **three** environmental factors that would affect the growth of buttercup plants in a field.

[3 marks]

1 _____

2 _____

3 _____

9

4.7.2.1 Levels of organisation

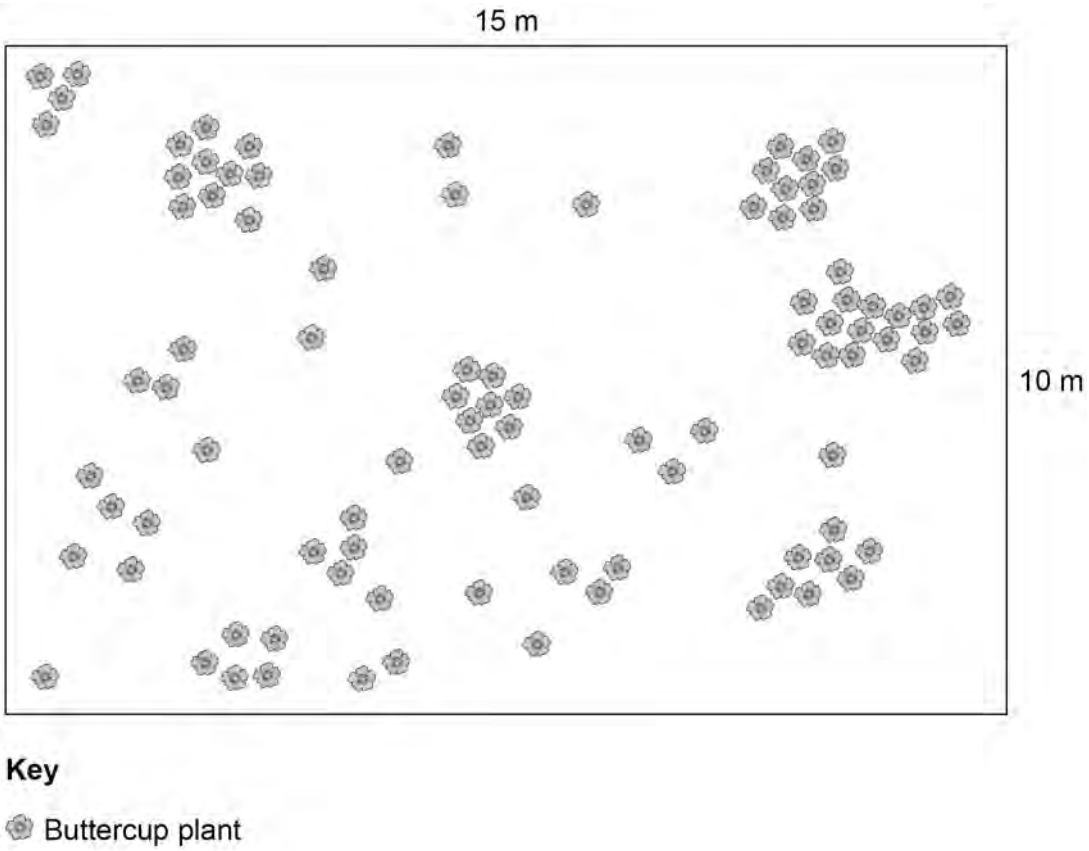
Question 26

0 2 Students estimated the population of buttercup plants growing on a lawn.

The lawn is a rectangle measuring 15 m × 10 m.

Figure 2 shows the lawn.

Figure 2



This is the method used.

1. Measure the length and width of the lawn.
2. Choose five locations to sample.
3. Place a 1 m × 1 m square frame at each location.
4. Record the number of buttercup plants in each square frame.

4.7.2.1 Levels of organisation

Question 26 · continued

0 2 . 1 Complete the sentences.

Choose answers from the box.

[2 marks]

15 cm ruler		**30 m tape measure**
balance	**quadrat**	**transect**

The length and width of the lawn should be measured

using a _____ .

The 1 m × 1 m square frame is called a _____ .

0 2 . 2 How should the students choose the five locations to sample?

[1 mark]

Tick (✓) **one** box.

Choose locations at random. ☐

Choose locations at the corners of the lawn. ☐

Choose locations with lots of buttercup plants. ☐

Choose locations with no buttercup plants. ☐

Question 2 continues on the next page

Question 26 · continued

Table 1 shows the results.

Table 1

Sample number	Number of buttercup plants
1	2
2	7
3	0
4	0
5	1

The students used their results to calculate the population of buttercup plants.

0 2 . 3 Complete the sentences.

Choose answers from the box.

[2 marks]

area	mean	median	perimeter	volume

Multiply the length of the lawn by the width of the lawn to give the lawn's _____ .

Add up the total number of buttercup plants and divide by 5 to give the _____ .

4.7.2.1 Levels of organisation

Question 26 · continued

0 2 . 4 The students calculated that the population of buttercup plants on the lawn was 300.

How did the students use the results in **Table 1** to calculate the population?

[1 mark]

0 2 . 5 How could the students improve the accuracy of the estimate?

[1 mark]

Tick (✓) **one** box.

Count and record more samples. ☐

Select locations in the middle of the lawn. ☐

Use a square frame measuring 0.5 m × 0.5 m. ☐

0 2 . 6 One **abiotic** factor that affects the number of buttercup plants on the lawn is soil pH.

Give **one** other **abiotic** factor that could affect the number of buttercup plants on the lawn.

Do **not** refer to soil pH in your answer.

[1 mark]

8

4.7.2.1 Levels of organisation

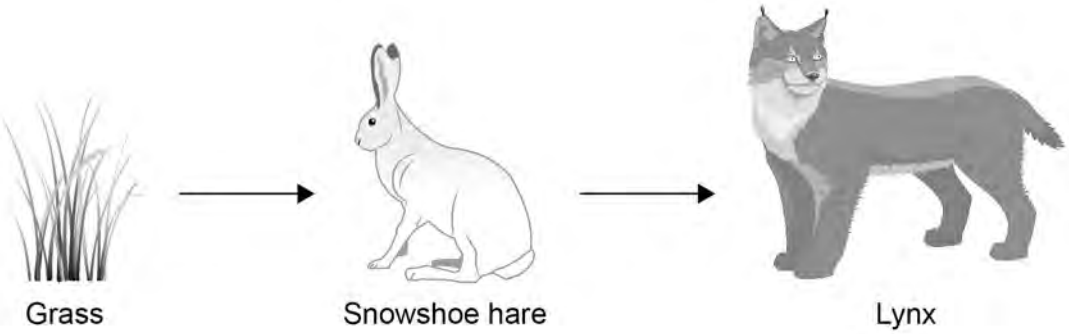
Question 27

June 2023 | 8461/2F | Original Q3

0 3 Different species in a habitat may depend on each other for food.

Figure 3 shows a food chain.

Figure 3



0 3 . 1 The grass needs energy to grow.

What is the source of energy for the grass?

[1 mark]

4.7.2.1 Levels of organisation

Question 27 · continued

0 3 . 2 **Table 2** lists different types of feeding relationship.

Table 2

Feeding relationship	Organism
Secondary consumer	Lynx
Primary consumer	
Producer	
Herbivore	
Carnivore	
Prey	
Predator	

Write the name of **one** organism from **Figure 3** in each box in **Table 2**.

[3 marks]

Each organism may be written in one box or in more than one box.

The first box has been completed for you.

Question 3 continues on the next page

0 3 . 3 **Figure 4** shows the appearance of the snowshoe hare in the summer and in the winter.

Figure 4

Snowshoe hare in summer



Snowshoe hare in winter



The snowshoe hare has a different fur colour in the summer than in the winter.

Explain how the different fur colour increases the chance of survival of the snowshoe hare.

[3 marks]

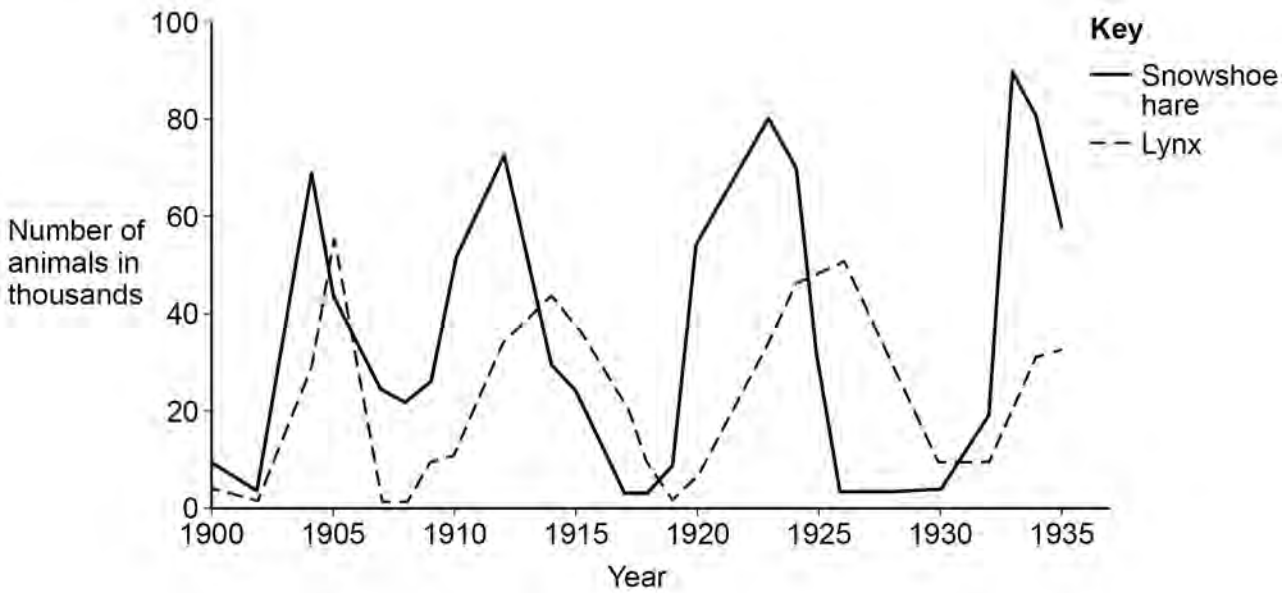
Question 3 continues on the next page

4.7.2.1 Levels of organisation

Question 27 · continued

Figure 5 shows how the number of snowshoe hares and the number of lynx varied in one area between 1900 and 1935.

Figure 5



0 3 . 4 **Figure 5** shows that the number of snowshoe hares and the number of lynx increase and decrease several times.

Suggest **two** reasons why the number of **snowshoe hares** increases.

[2 marks]

1 _____

_____

2 _____

_____

4.7.2.1 Levels of organisation

Question 27 · continued

0 3 . 5 The number of snowshoe hares increased and decreased four times between 1900 and 1935.

What effect does an **increase** in the number of snowshoe hares have on the number of lynx?

[1 mark]

0 3 . 6 Suggest **one** reason why the number of lynx decreased from 1915 to 1919.

Use information from **Figure 5**.

[1 mark]

0 3 . 7 When the snowshoe hare eats grass, about 90% of the biomass of the grass is lost.

Give **two** ways the biomass is lost.

[2 marks]

1

2

13

4.7.2.1 Levels of organisation

Question 28

June 2024 | 8461/2F | Original Q11

1 1 Frogs are animals that lay their eggs in water. The eggs hatch as tadpoles.

Students investigated the number of tadpoles in a pond for 8 weeks.

This is the method used.

1. Collect 10 dm^3 of pond water in a bucket.
2. Count the number of tadpoles collected.
3. Put the tadpoles back into the pond.
4. Repeat steps 1 to 3 another three times in different parts of the pond.
5. Repeat steps 1 to 4 at intervals for 8 weeks.

1 1 . 1 Suggest **one** improvement to the method.

[1 mark]

Question 11 continues on the next page

4.7.2.1 Levels of organisation

Question 28 · continued

Table 1 shows the results.

Table 1

Sample number	Number of tadpoles in each sample					
	0 weeks	1 week	2 weeks	3 weeks	5 weeks	8 weeks
1	11	17	8	9	5	0
2	15	11	12	7	0	5
3	23	16	14	10	7	3
4	11	14	16	**X**	4	4
Totals	60	58	50	32	16	12

1 1 . 2 Value **X** is the number of tadpoles in sample 4, at 3 weeks.

Calculate value **X**.

[1 mark]

Value **X** = _____

4.7.2.1 Levels of organisation

Question 28 · continued

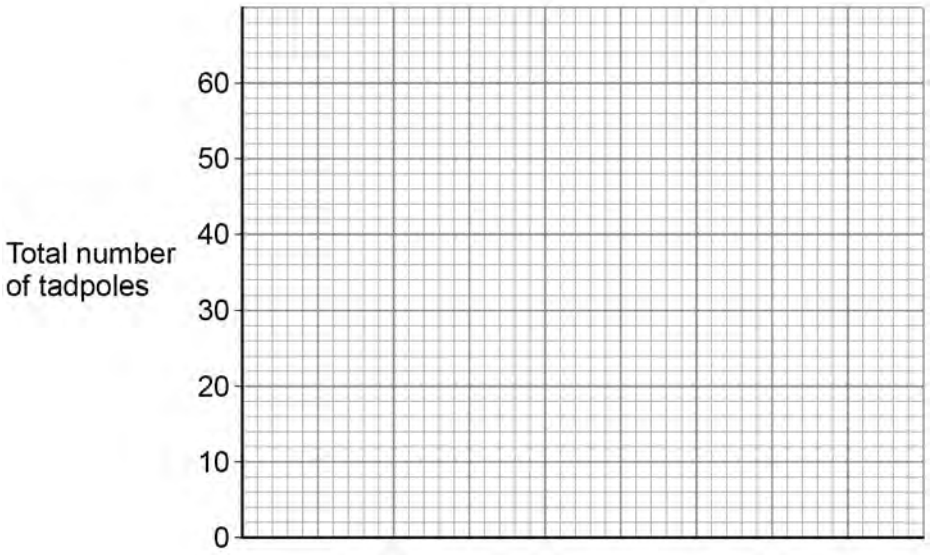
1 1 . 3 Complete **Figure 15** to show how the **total** number of tadpoles changed over the 8 weeks.

[4 marks]

You should:

- label the x-axis
- use a suitable scale for the x-axis
- plot the data for the **total** numbers of tadpoles from **Table 1**
- draw a line of best fit.

Figure 15



1 1 . 4 After 0 weeks, no more tadpoles hatched in the pond.

Calculate the percentage of the tadpoles that would still be found in the pond at 4 weeks compared with 0 weeks.

Use information from **Figure 15**.

[3 marks]

Percentage of tadpoles found at 4 weeks = _____ %

4.7.2.1 Levels of organisation

Question 28 · continued

1 1 . 5 After 4 weeks many of the tadpoles had died.

Suggest **two** reasons why the tadpoles died.

[2 marks]

1 _____

_____

2 _____

_____

11

4.7.2.1 Levels of organisation

Question 29

June 2025 | 8461/2F | Original Q9

0 9

Students investigated how many daisy plants were growing in a field at different distances from a tree.

This is the method used.

1. Place a 20-metre tape measure on the ground, with the tree at 0 metres.

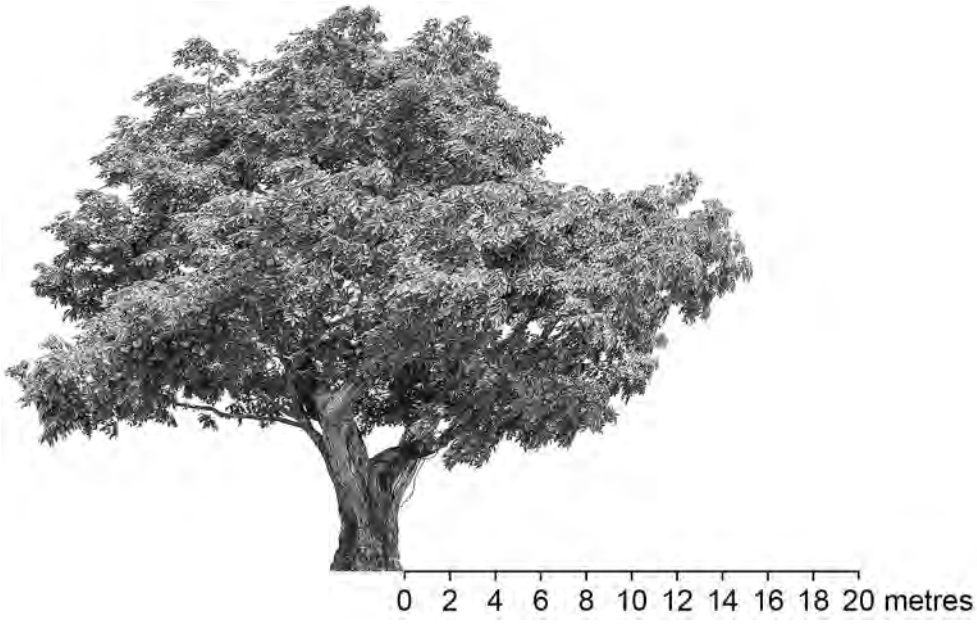
2. Place a 1 m^2 quadrat on the ground every 4 metres along the tape measure.

3. Count the number of daisy plants in each quadrat.

4. Take a soil sample from each quadrat to find the percentage of water in the soil.

Figure 14 shows the tree and the tape measure.

Figure 14



This is the method used for finding the percentage of water in each soil sample (step 4):

5. Weigh an empty container.

6. Place the soil sample in the container and weigh again.

7. Heat the container of soil in an oven at 100 °C for several hours.

8. Allow the container of soil to cool and weigh again.

9. Repeat steps 7 and 8 until there is no further change in mass.

4.7.2.1 Levels of organisation

Question 29 · continued

0 9 . 1 Suggest why the students repeated steps **7** and **8** until there was no further change in mass.

[1 mark]

Question 9 continues on the next page

Question 29 · continued

Table 6 shows the results.

Table 6

	Distance from the tree in metres				
	4	**8**	**12**	**16**	**20**
Mass of fresh soil in grams	250	266	260	248	252
Mass of dried soil in grams	225	234	209	184	181
Mass of water lost from soil in grams	25	32	51	64	71
Percentage of water in soil	10	12	20	26	**X**
Number of daisies per m^2	0	7	15	28	32

0 9 . 2 Calculate percentage **X** in **Table 6**.

Give your answer to the nearest whole number.

[3 marks]

Percentage **X** (nearest whole number) = _____ %

0 9 . 3 Describe the effect of distance from the tree on the percentage of water in the soil between 4 metres and 16 metres.

Use **Table 6**.

[1 mark]

4.7.2.1 Levels of organisation

Question 29 · continued

0 9 . 4 A student concluded:

‘As the water content of the soil increases, so does the number of daisy plants.’

Describe **two** changes to the investigation that would increase the validity of the student’s conclusion.

[2 marks]

1 _____

_____

2 _____

_____

0 9 . 5 The percentage of water in the soil is an abiotic factor.

Suggest **three** other **abiotic** factors that might have caused more daisy plants to grow further away from the tree.

Do **not** refer to water in your answer.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

10