AQA GCSE Biology | 8461

SPECIFICATION POINT 4.7.4.2

# Pyramids of biomass

## Past-paper questions

| | |
|---|---|
| Tier | **Foundation** |
| Question groups | **14** |
| Available paper years | **2008–2025** |

## 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.

### 4.7.4.2 Pyramids of biomass

**Question 01**

January 2008 | BLY2F | Original Q6 | Legacy

**6** (a) Tuna fish are carnivores. In the wild they feed on smaller fish called herring. Herring feed on plankton. Tuna can be attacked by parasitic worms which feed on their flesh.

(i) In the space below sketch the appearance of a pyramid of biomass for this food chain.

Do not forget to label each section of the pyramid.

*(2 marks)*

(ii) If a tuna eats 1 kg of herring, it gains about 65 g in mass.

Give **two** reasons why so little of the mass of the herring is converted into mass of the tuna.

1 .....

.....

2 .....

.....

*(2 marks)*

(b) Young tuna are caught by fish farmers and reared in large pens in the sea.

The fish are fed more food than they would normally catch themselves so they grow quickly. When they reach 400 kg they are sold.

The graph on the opposite page shows the effect of feeding tuna different amounts of protein in their food.

**4.7.4.2 Pyramids of biomass**

**Question 01 · continued**



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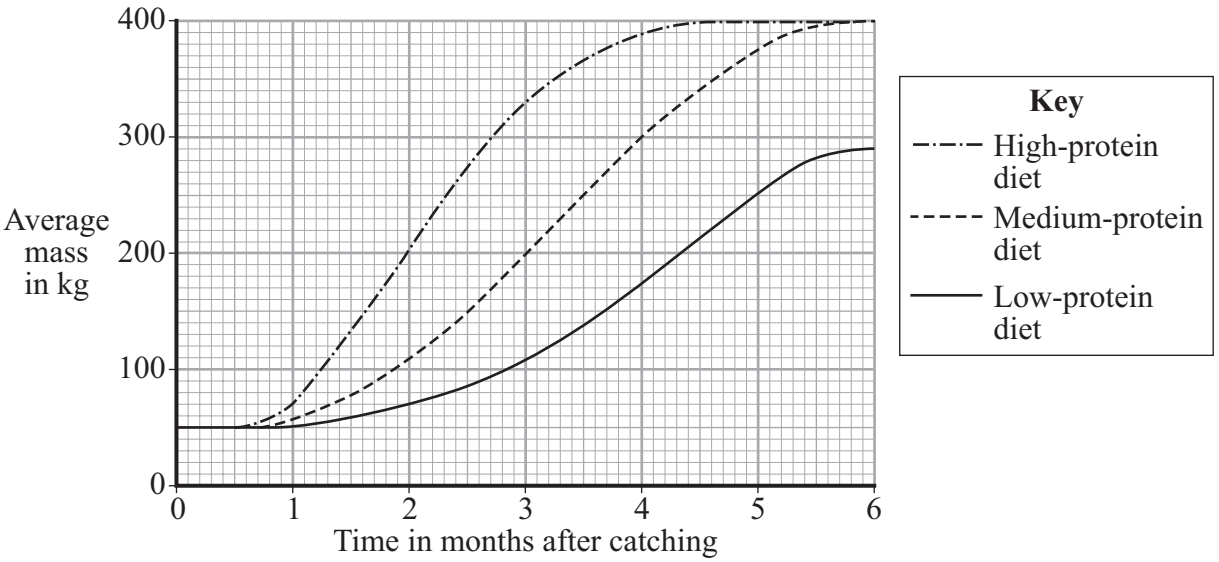


(i) Calculate the average increase in mass per month of the fish fed on the low-protein diet over the six months.

Show clearly how you work out your answer.

.....

.....

Average increase in mass per month ..... kg

*(2 marks)*

(ii) There is not enough information in the graph to allow the fish farmer to decide whether to use the high-protein diet or the medium-protein diet.

Suggest **one** other piece of information that he needs in order to make this decision.

.....

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*(1 mark)*

(c) Some consumers will not buy tuna grown in this way.

Suggest **one** reason for their decision.

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*(1 mark)*

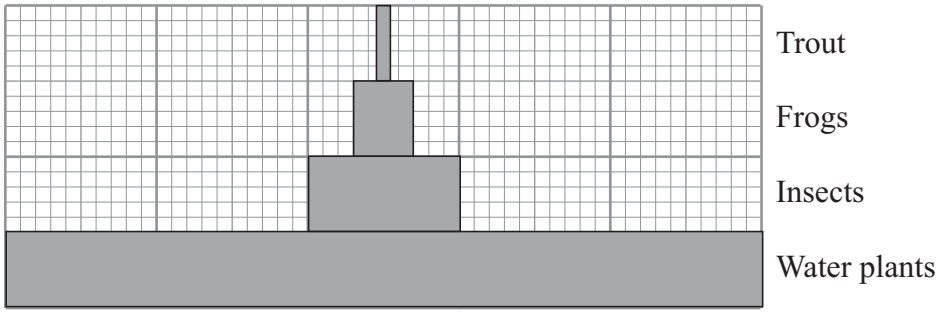
8

### 4.7.4.2 Pyramids of biomass

**Question 02**

January 2009 | BLY2F | Original Q6 | Legacy

**6** The diagram shows a pyramid of biomass drawn to scale.




**6** (a) What is the source of energy for the water plants?

.....

*(1 mark)*

**6** (b) The ratio of the biomass of water plants to the biomass of insects is 5 : 1.

Calculate the ratio of the biomass of insects to the biomass of frogs.

Show clearly how you work out your answer.

.....

.....

ratio = ..... : 1

*(2 marks)*

**6** (c) Give **two** reasons why the biomass of the frog population is smaller than the biomass of the insect population.

1 .....

.....

2 .....

.....

*(2 marks)*

**4.7.4.2 Pyramids of biomass**

**Question 02 · continued**



*for mark*

**6** (d) Some insects die.

Describe how the carbon in the dead insect bodies may be recycled.

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*(4 marks)*

**9**

### 4.7.4.2 Pyramids of biomass

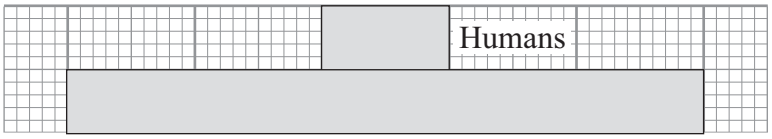
**Question 03**

June 2009 | BLY2F | Original Q4 | Legacy

**4** (a) The diagrams show three pyramids of biomass.

**4** (a) (i) Which pyramid would be the most efficient in providing food for humans?

Tick (✓) **one** box.

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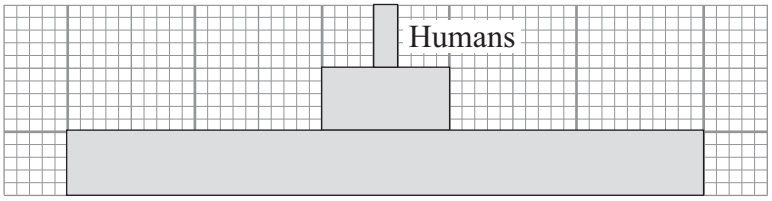


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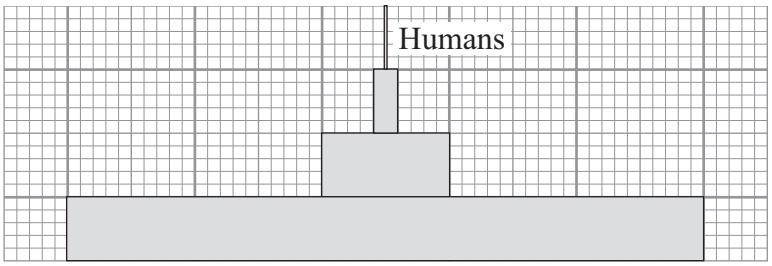



☐

*(1 mark)*

**4** (a) (ii) Give **one** reason for your choice.

.....

.....

*(1 mark)*

4.7.4.2 Pyramids of biomass

Question 03 · continued



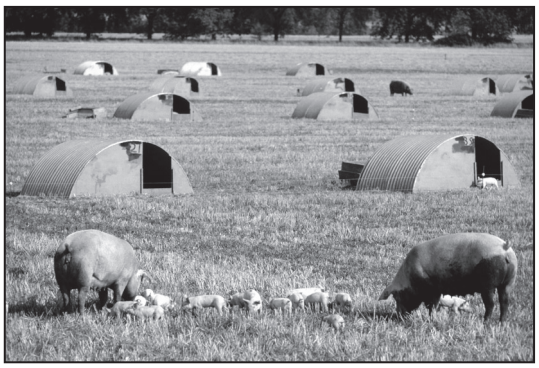
*for mark*

**4** (b) Pigs may be kept indoors or outdoors.

**Pigs kept indoors**

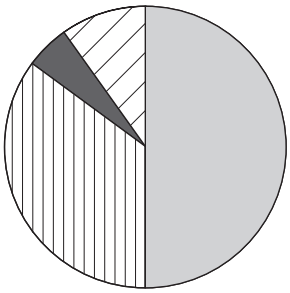


**Pigs kept outdoors**

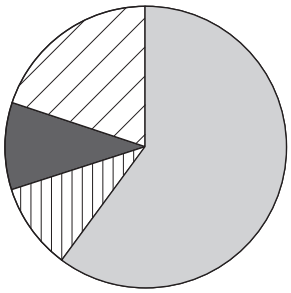


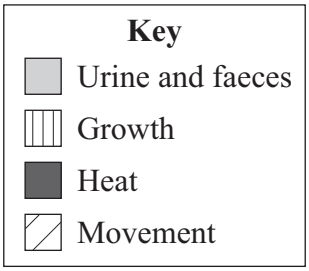
The pie charts show what happens to the energy in the food eaten by pigs kept indoors and pigs kept outdoors.

**Pigs kept indoors**



**Pigs kept outdoors**






**4** (b) (i) Farmers make more profit from keeping pigs indoors than from keeping pigs outdoors.

Use information from the pie charts to explain why.

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.....

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.....

*(2 marks)*

**4** (b) (ii) Meat from pigs kept outdoors may cost more than meat from pigs kept indoors.

Some people prefer to buy meat from animals that have been kept outdoors.

Suggest **one** reason why.

.....

.....

*(1 mark)*

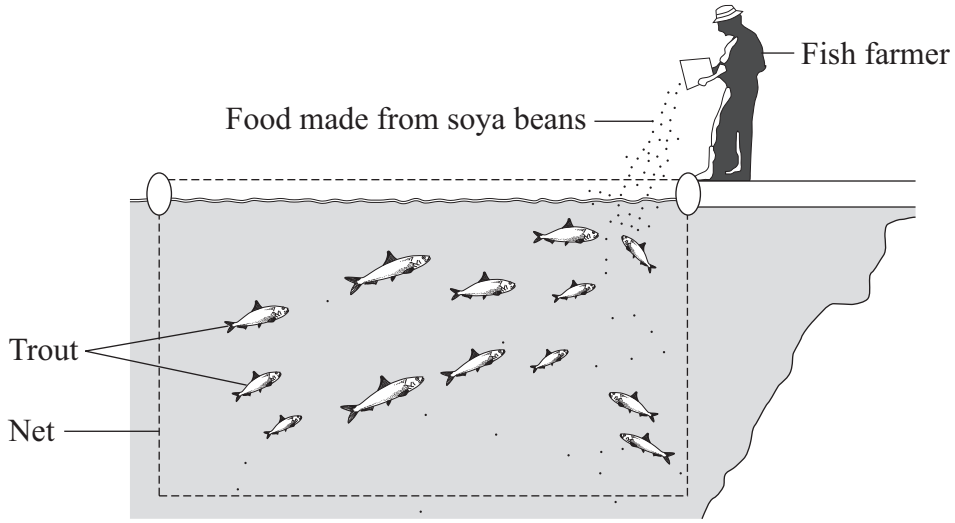
5

**4.7.4.2 Pyramids of biomass**

**Question 04**

January 2010 | BLY2F | Original Q6 | Legacy

**6** A fish farmer keeps trout in a large net in a lake.




The fish farmer feeds the trout on food made from soya beans.

When the trout are large enough the farmer sells them for food for people.

**6** (a) Draw a pyramid of biomass for the three organisms in this food chain.

Label the pyramid.

*(2 marks)*

4.7.4.2 Pyramids of biomass

Question 04 · continued



*for mark*

**6** (b) It would be more energy efficient if people ate the soya beans rather than eating the trout.

Which **two** of the following are reasons for this?

Tick (✓) **two** boxes.

Some people do not like eating animals such as trout. ☐

The trout release energy when they respire. ☐

Soya bean plants release energy when they respire. ☐

Some energy will be lost in waste from the trout. ☐

Soya bean plants absorb energy during photosynthesis. ☐

*(2 marks)*

**6** (c) Suggest **one** advantage to the fish farmer of keeping the trout in a large net instead of letting them swim freely in the lake.

.....

.....

*(1 mark)*

**6** (d) Some trout die before they are large enough to be sold.
The dead trout contain carbon.

Use your knowledge of the carbon cycle to describe how this carbon is returned to the atmosphere after the trout die.

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*(2 marks)*

7

### 4.7.4.2 Pyramids of biomass

**Question 05**

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.

.....

.....

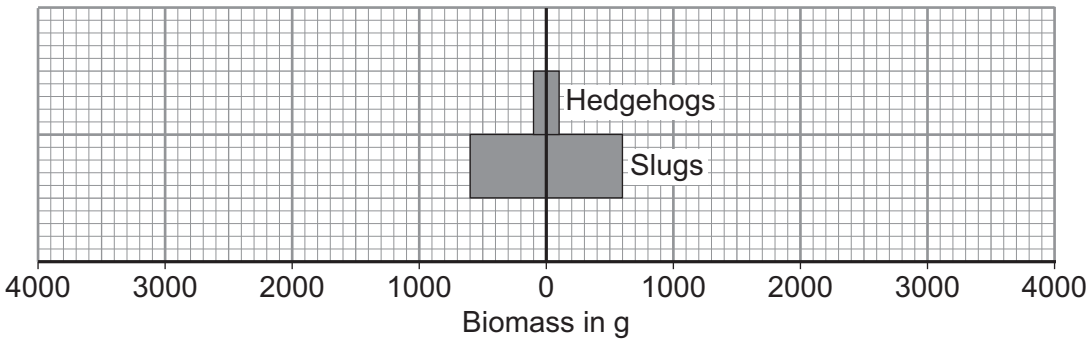
.....

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)*

### 4.7.4.2 Pyramids of biomass

**Question 05 · 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.

.....

.....

.....

.....

.....

.....

.....

*(3 marks)*

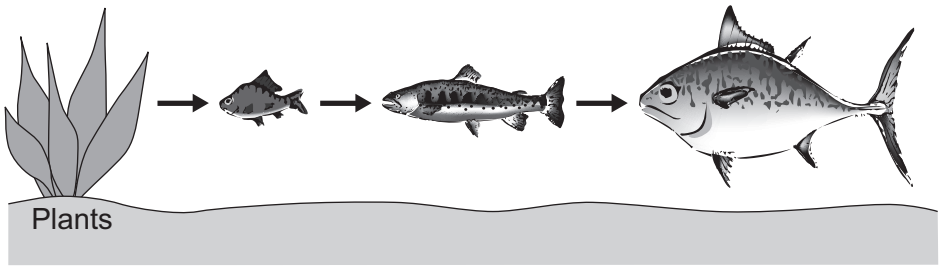
7

### 4.7.4.2 Pyramids of biomass

**Question 06**

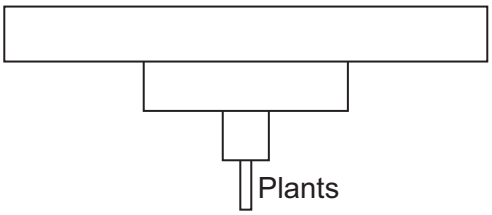
June 2011 | BLY2F | Original Q7 | Legacy

**7** The picture shows a food chain.




**7 (a)** Which diagram shows a pyramid of biomass for the food chain in the picture?

Tick (✓) **one** box.

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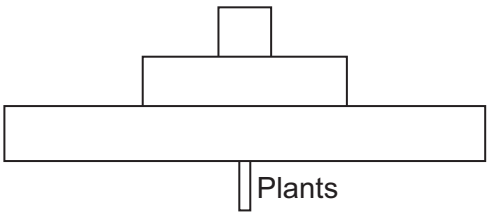


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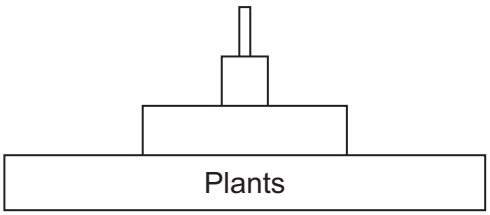



☐

*(1 mark)*

**7 (b)** The plants at the start of the food chain absorb energy.

Where does this energy come from?

Draw a ring around **one** answer.

**the water** **the sun** **minerals**

*(1 mark)*

4.7.4.2 Pyramids of biomass

Question 06 · continued



**7 (c)** Some energy is lost at each stage of the food chain.

Give **two** ways in which energy may be lost from the food chain.

1 .....

.....

2 .....

.....

*(2 marks)*

4

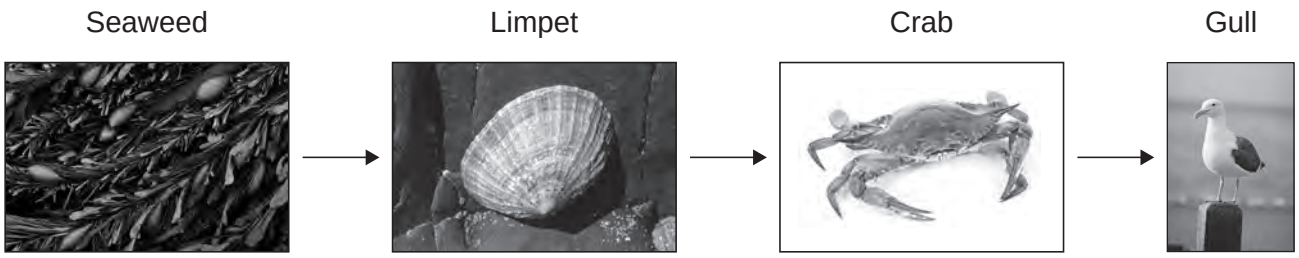
**Turn over for the next question**

### 4.7.4.2 Pyramids of biomass

**Question 07**

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)*

4.7.4.2 Pyramids of biomass

Question 07 · 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

### 4.7.4.2 Pyramids of biomass

**Question 08**

June 2013 | BL1FP | Original Q4 | Legacy

**4** There are two forms of peppered moth, dark and pale.
Birds eat the moths when the moths are resting on tree bark.

Pollution in the atmosphere may:
- kill lichens living on tree bark
- make the bark of trees go black.

**4 (a)** Draw a ring around the correct answer to complete the sentence.

Lichens are very sensitive to air pollution caused by

carbon dioxide.

nitrogen.

sulfur dioxide.

*(1 mark)*

**4 (b)** The photographs show the two forms of peppered moth, on tree bark.




Tree bark covered with lichens

Tree bark made black by pollution

4.7.4.2 Pyramids of biomass

Question 08 · continued



**4 (b) (i)** The dark form of the peppered moth was produced by a change in the genetic material of a pale moth.

Use **one** word from the box to complete the sentence.

| | | |
|---|---|---|
| **characteristic** | **clone** | **mutation** |

A change in genetic material is called a ..... .

*(1 mark)*

**4 (b) (ii)** In the 19th century, pollution made the bark of many trees go black.

Explain why:

- the population of the pale form of the moth in forests decreased
- the population of the dark form of the moth in forests increased.

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*(3 marks)*

**Question 4 continues on the next page**

4.7.4.2 Pyramids of biomass

Question 08 · continued

June 2013 | BL1FP | Original Q4 | Legacy

**4 (c) (i)** The larvae (young) of the peppered moths eat the leaves of birch trees.

The diagram shows the food chain:

birch trees → peppered moth larvae → birds

Draw a pyramid of biomass for this food chain.

Label the pyramid.

*(2 marks)*

**4 (c) (ii)** Which **two** reasons explain the shape of the pyramid you drew in part **(c)(i)**?

Tick (✓) **two** boxes.

Some material is lost in waste from the birds ☐

The trees are much larger than peppered moth larvae ☐

Peppered moth larvae do not eat all the leaves from the trees ☐

The trees do not use all of the Sun's energy ☐

*(2 marks)*

9

### 4.7.4.2 Pyramids of biomass

**Question 09**

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**

**grass** → **sheep** → **human**

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]**

4.7.4.2 Pyramids of biomass

Question 09 · 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]**

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6

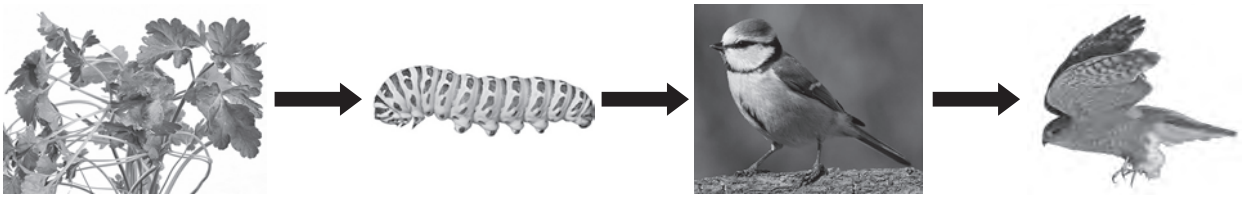
### 4.7.4.2 Pyramids of biomass

**Question 10**

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.

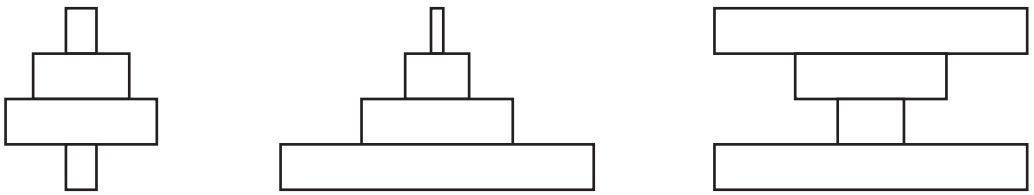
Why is photosynthesis important in the food chain?

**[2 marks]**

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

**[1 mark]**

Tick (✓) **one** box.



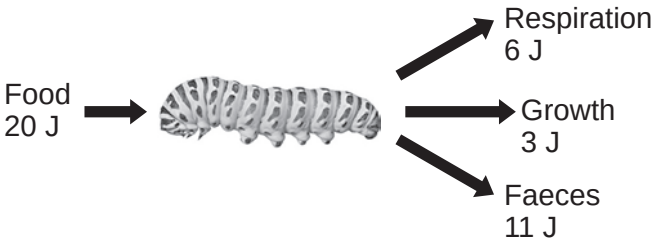
4.7.4.2 Pyramids of biomass

Question 10 · 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?

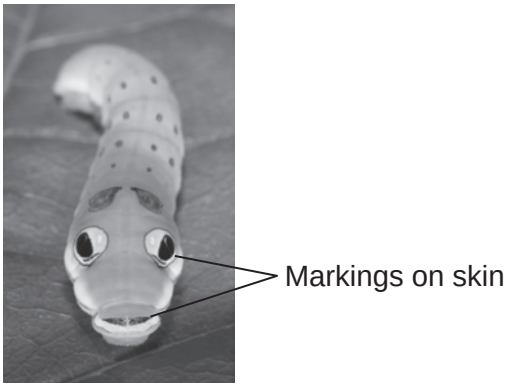
**[2 marks]**

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]**

4.7.4.2 Pyramids of biomass

Question 10 · 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

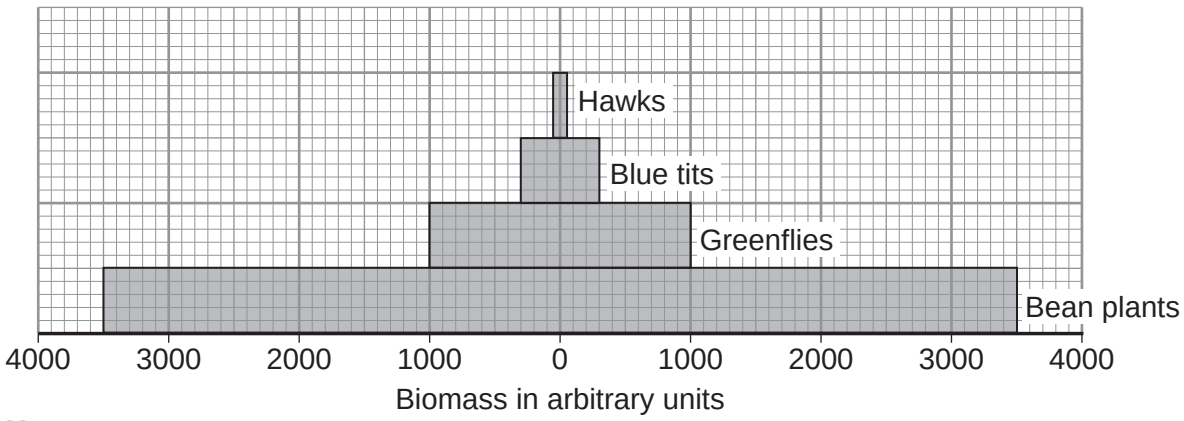
### 4.7.4.2 Pyramids of biomass

**Question 11**

June 2017 | BL1FP | Original Q7 | Legacy

**7** **Figure 8** shows a pyramid of biomass for a food chain.

**Figure 8**




**Key**

= 500 arbitrary units

**7 (a) (i)** Not all of the biomass of the bean plants is converted into the biomass of greenflies.

Calculate the biomass of bean plants that is **not** converted into the biomass of greenflies.

**[2 marks]**

Use information from **Figure 8**.

_____

_____

Biomass = _____ arbitrary units

4.7.4.2 Pyramids of biomass

Question 11 · continued



**7 (a) (ii)** For every 10 grams of biomass eaten by the hawks, more than 8 grams of biomass are lost.

Give **one** way in which the biomass eaten by hawks is lost from the food chain.

**[1 mark]**

Tick (✓) **one** box.

Hawks reproduce ☐

Hawks produce faeces ☐

Hawks grow ☐

Hawks feed on other birds ☐

**7 (b)** When the bean plants grow they gain biomass.

Complete the sentences.

**[2 marks]**

The bean plants gain biomass by the process of _____ .

In this process, the bean plants make a carbohydrate called _____ .

5

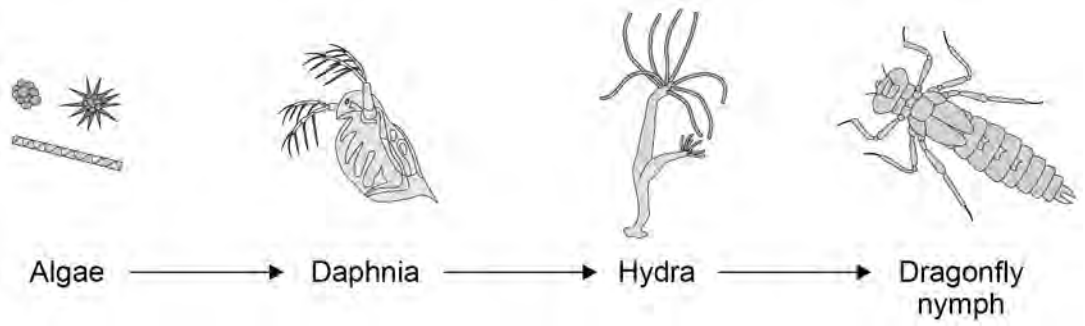
### 4.7.4.2 Pyramids of biomass

**Question 12**

June 2019 | 8461/2F | Original Q7

**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 ☐

4.7.4.2 Pyramids of biomass

Question 12 · 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 12 · 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 = _____

4.7.4.2 Pyramids of biomass

Question 12 · 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**

Question 12 · continued



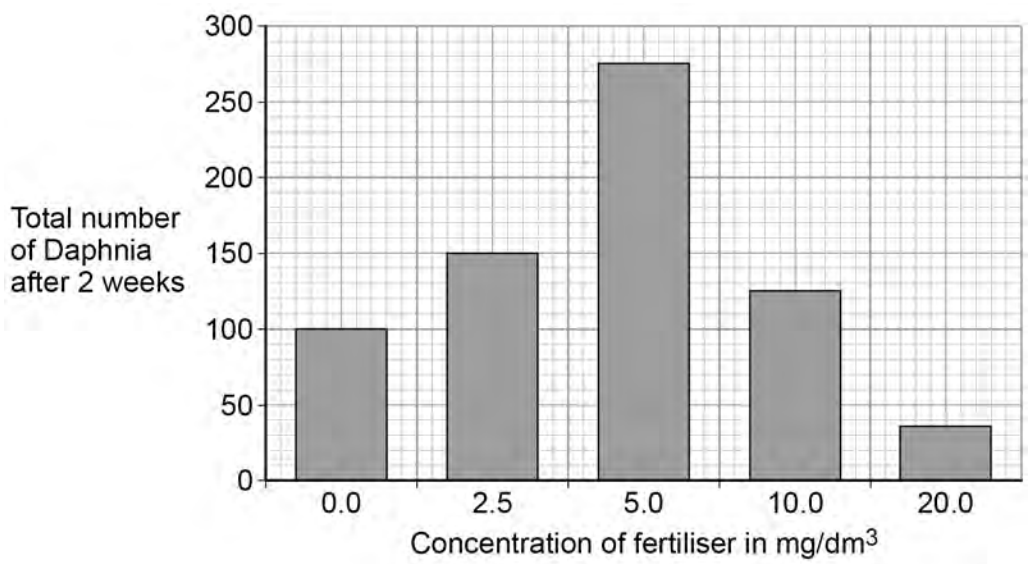
Rainfall can cause fertiliser to be washed from farmland into a pond.

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]**

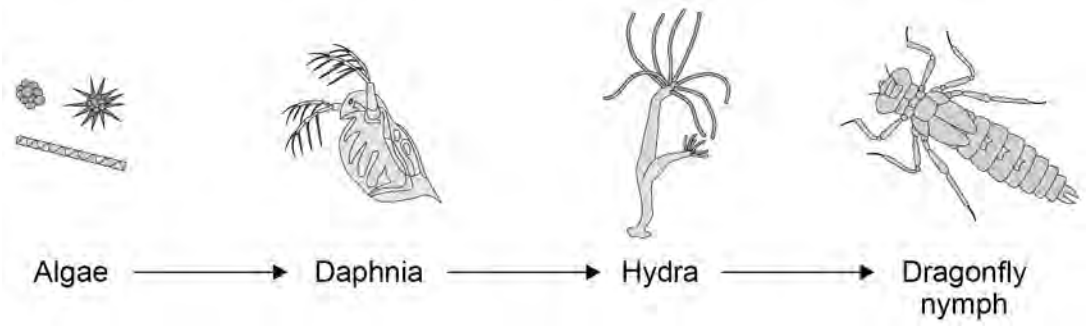
4.7.4.2 Pyramids of biomass

Question 12 · 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

4.7.4.2 Pyramids of biomass

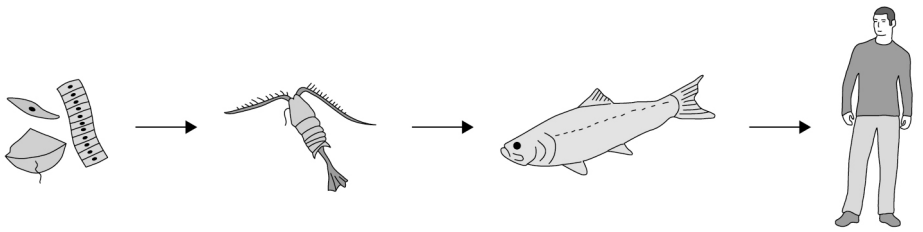
Question 13

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 ☐

4.7.4.2 Pyramids of biomass

Question 13 · continued



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

**[1 mark]**

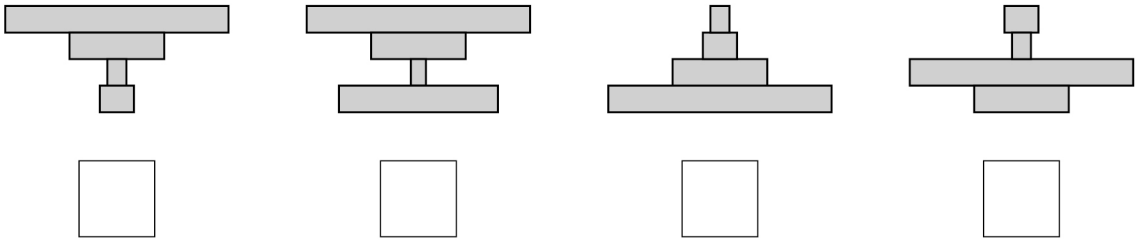
Tick (✓) **one** box.

- 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**

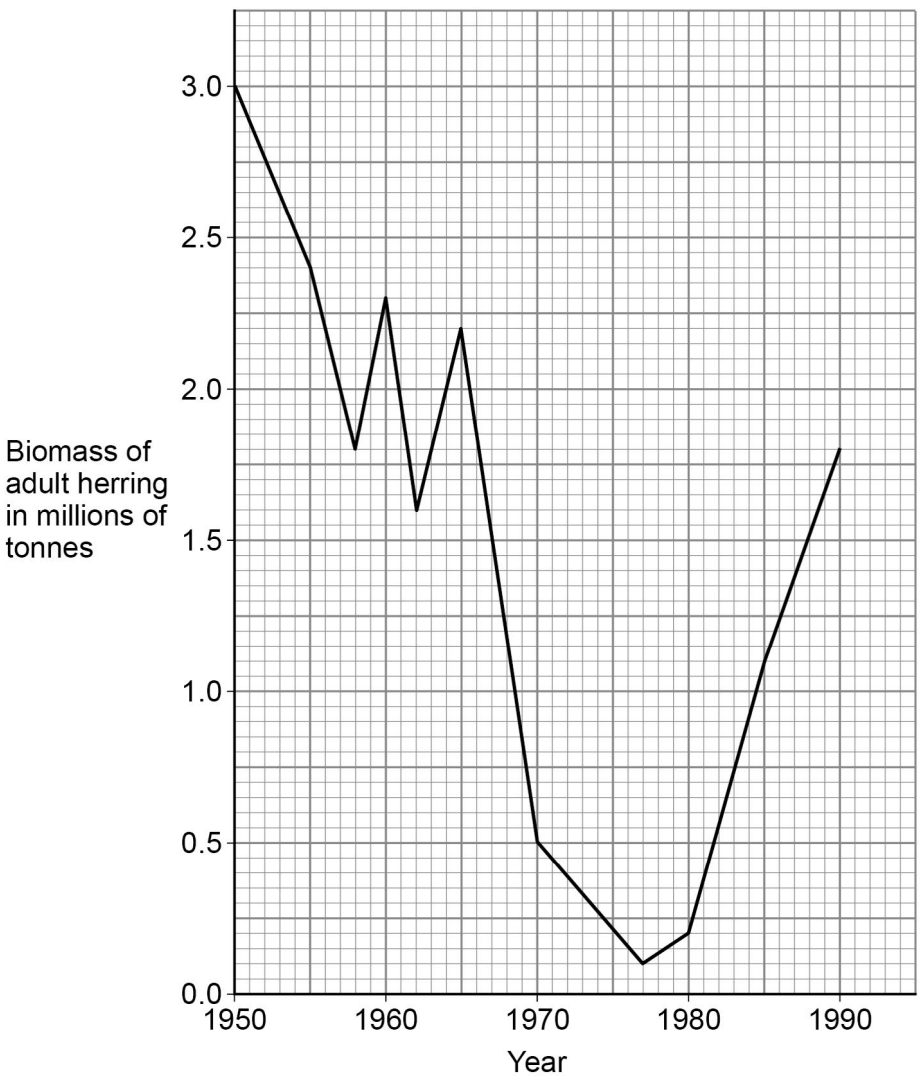
4.7.4.2 Pyramids of biomass

Question 13 · continued



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

**Figure 5**



4.7.4.2 Pyramids of biomass

Question 13 · 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**

4.7.4.2 Pyramids of biomass

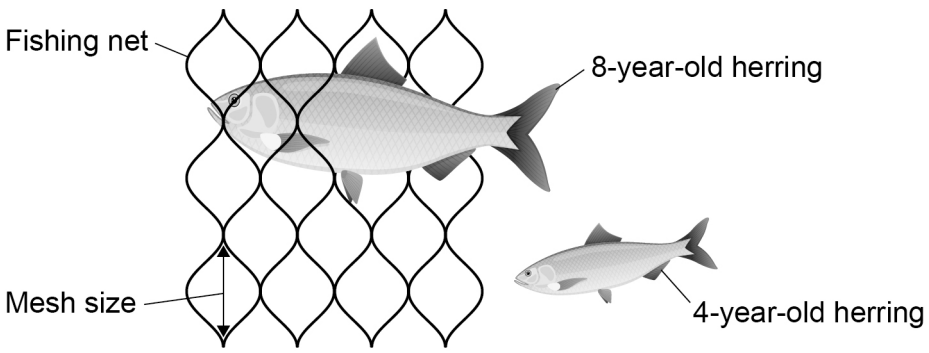
Question 13 · continued



**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

4.7.4.2 Pyramids of biomass

Question 14

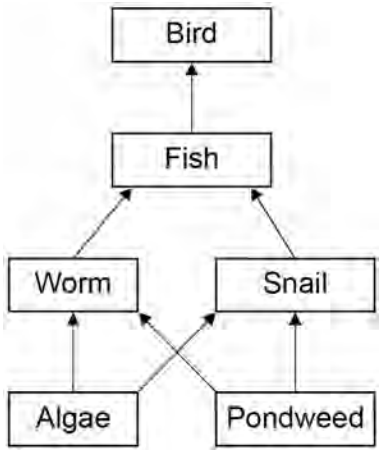


**0 6** Different species in a habitat may depend on each other for food.

Several food chains may be linked together to form a food web.

**Figure 10** shows a food web in a lake.

**Figure 10**




**0 6 . 1** Most organisms in the food web get their energy by eating other organisms.

Where does the pondweed get energy from?

**[1 mark]**

Tick (✓) **one** box.

- Carbon dioxide ☐
- Mineral ions ☐
- Sunlight ☐
- Water ☐

4.7.4.2 Pyramids of biomass

Question 14 · continued



**0 6 . 2** Name **one** organism from **Figure 10** that is a primary consumer.

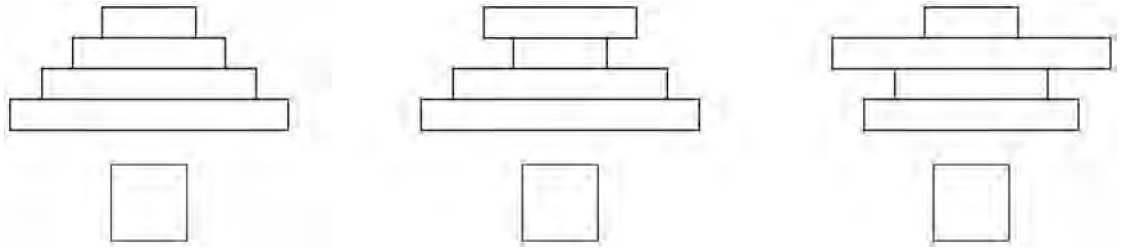
**[1 mark]**

**0 6 . 3** There are four trophic levels in **Figure 10**.

Which is the correct pyramid of biomass for the food web in **Figure 10**?

**[1 mark]**

Tick (✓) **one** box.



**0 6 . 4** One of the food chains in **Figure 10** is:

algae → worm → fish → bird

10% of the biomass in each trophic level is transferred to the next trophic level.

What percentage of the biomass in the algae is transferred to the fish?

**[1 mark]**

Tick (✓) **one** box.

10% ☐ 1% ☐ 0.1% ☐

**Question 6 continues on the next page**

4.7.4.2 Pyramids of biomass

Question 14 · continued



**0 6 . 5** What are **two** ways that **energy** is lost from organisms in the food chain?

**[2 marks]**

Tick (✓) **two** boxes.

- Diffusion ☐
- Faeces ☐
- Movement ☐
- Osmosis ☐
- Photosynthesis ☐

**0 6 . 6** Scientists counted the number of fish, snails and worms in a sample taken from the lake.

**Table 3** shows the results.

**Table 3**

| | Tally | Number of organisms in the sample |
|---|---|---|
| Fish | \|\|\| | |
| Snails | 𝍸 𝍸 \|\| | |
| Worms | 𝍸 𝍸 𝍸 𝍸 \|\|\| | |

Complete **Table 3**.

**[2 marks]**

8