AQA GCSE Biology | 8461

SPECIFICATION POINT 4.7.4.2

Pyramids of biomass

Past-paper questions

Tier	**Higher**
Question groups	**11**
Available paper years	**2009–2024**

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:** _____

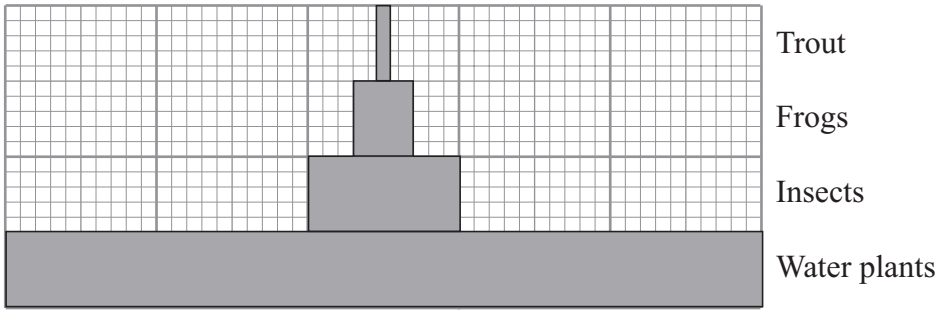
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.7.4.2 Pyramids of biomass

Question 01

January 2009 | BLY2H | Original Q1 | Legacy

1 The diagram shows a pyramid of biomass drawn to scale.



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

.....

(1 mark)

1 (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.

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.....

ratio = ... : 1

(2 marks)

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

1 .....

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2 .....

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(2 marks)

4.7.4.2 Pyramids of biomass

Question 01 · continued

for mark

1 (d) Some insects die.

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

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(4 marks)

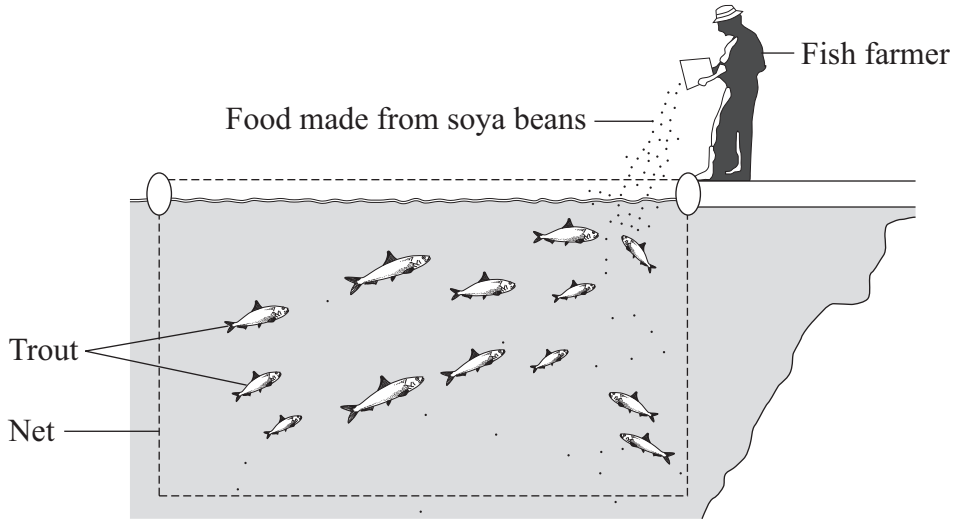
9

4.7.4.2 Pyramids of biomass

Question 02

January 2010 | BLY2H | Original Q1 | Legacy

1 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.

1 (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 02 · continued

for mark

1 (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)

1 (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.

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(1 mark)

1 (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 03

January 2011 | BLY2H | Original Q2 | Legacy

2 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	

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

Show clearly how you work out your answer.

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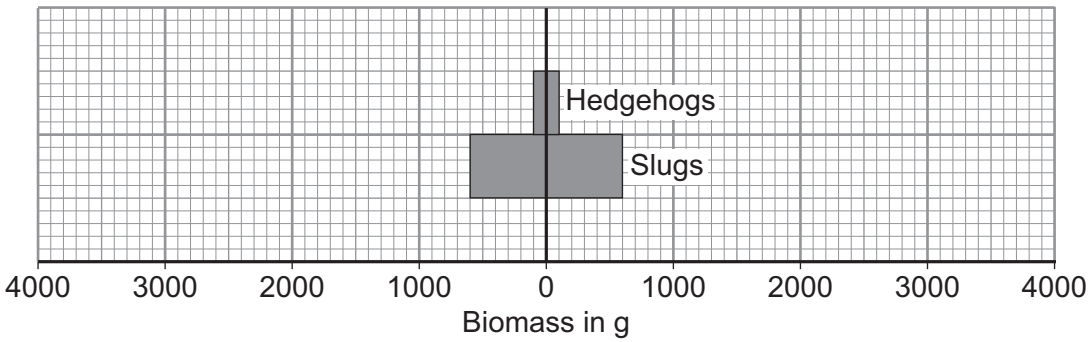
.....

Biomass = ... g

(2 marks)

2 (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 03 · continued

2 (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)

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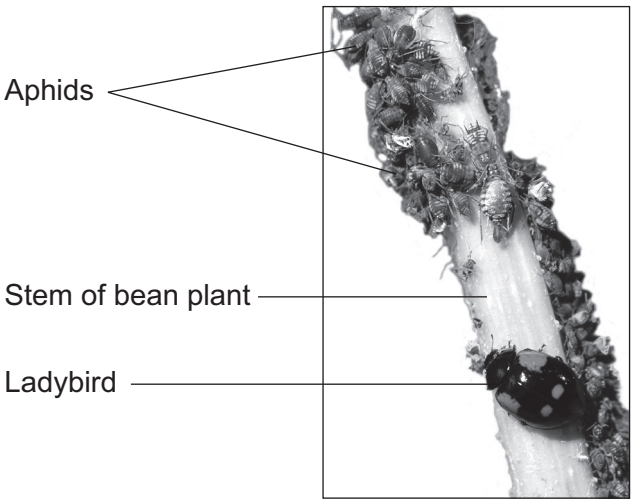
4.7.4.2 Pyramids of biomass

Question 04

January 2012 | BL1HP | Original Q3 | Legacy

3 Students investigated a food chain in a garden.

The students found 650 aphids feeding on one bean plant.
Five ladybirds were feeding on the aphids.



3 (a) (i) Draw a pyramid of biomass for this food chain.
Label the pyramid.

(2 marks)

4.7.4.2 Pyramids of biomass

Question 04 · continued

3 (a) (ii) The biomass in the five ladybirds is less than the biomass in the bean plant.

Give **two** reasons why.

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(2 marks)

3 (b) The carbon in dead bean plants is returned to the atmosphere via the carbon cycle.

Describe this part of the carbon cycle.

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(4 marks)

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4.7.4.2 Pyramids of biomass

Question 05

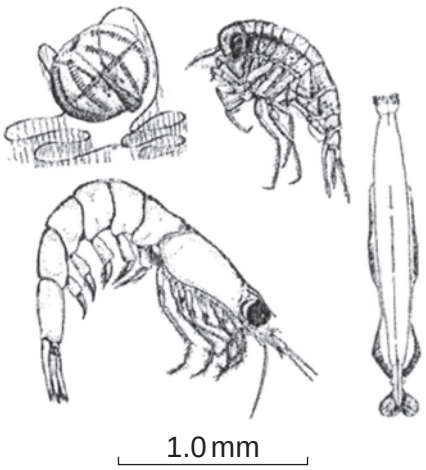
June 2013 | BL1HP | Original Q9 | Legacy

9 Plankton live in the sea.
The diagram shows plant plankton and animal plankton drawn to the scales shown.

Plant plankton



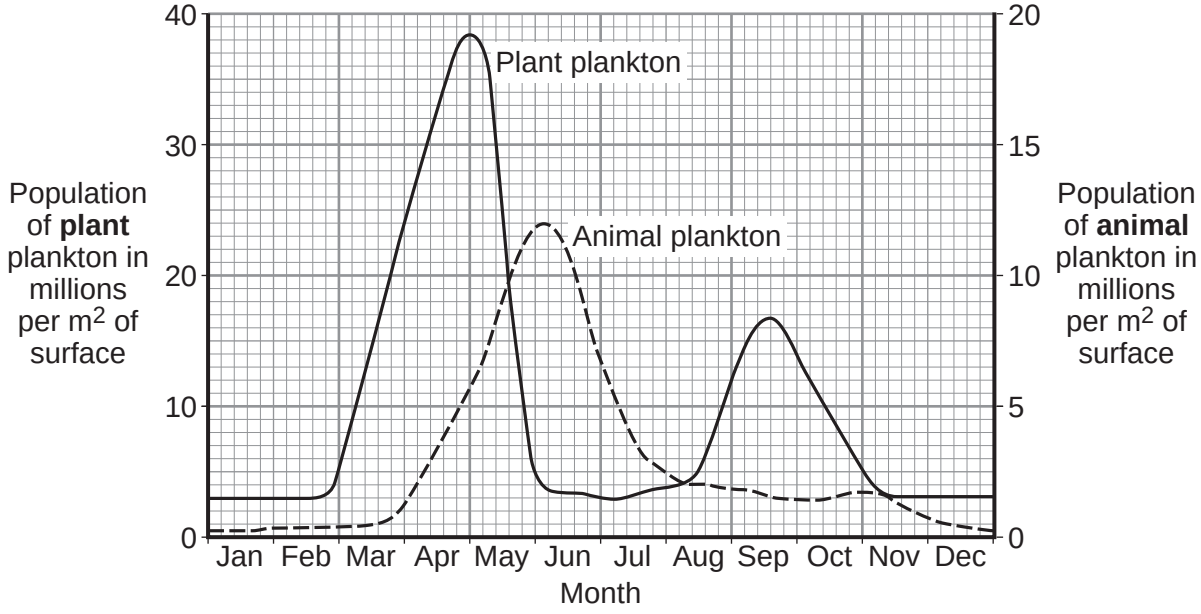
Animal plankton



Animal plankton eat plant plankton.

Graph 1 shows how the populations of the plankton change through the year in the seas around the UK.

Graph 1



4.7.4.2 Pyramids of biomass

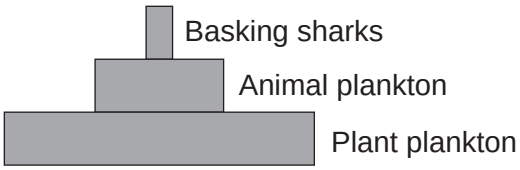
Question 05 · continued

9 (a) Basking sharks eat animal plankton. Basking sharks grow up to 8 metres long.

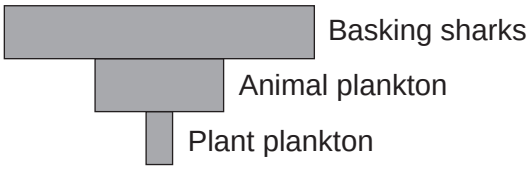
Look at the diagram and **Graph 1**.

Which is the correct shape for the pyramid of biomass to show the relationship between plant plankton, animal plankton and basking sharks, in June?

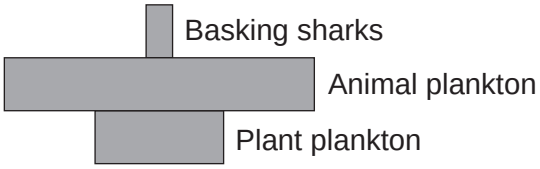
Tick (✓) **one** box.



☐



☐



☐

(1 mark)

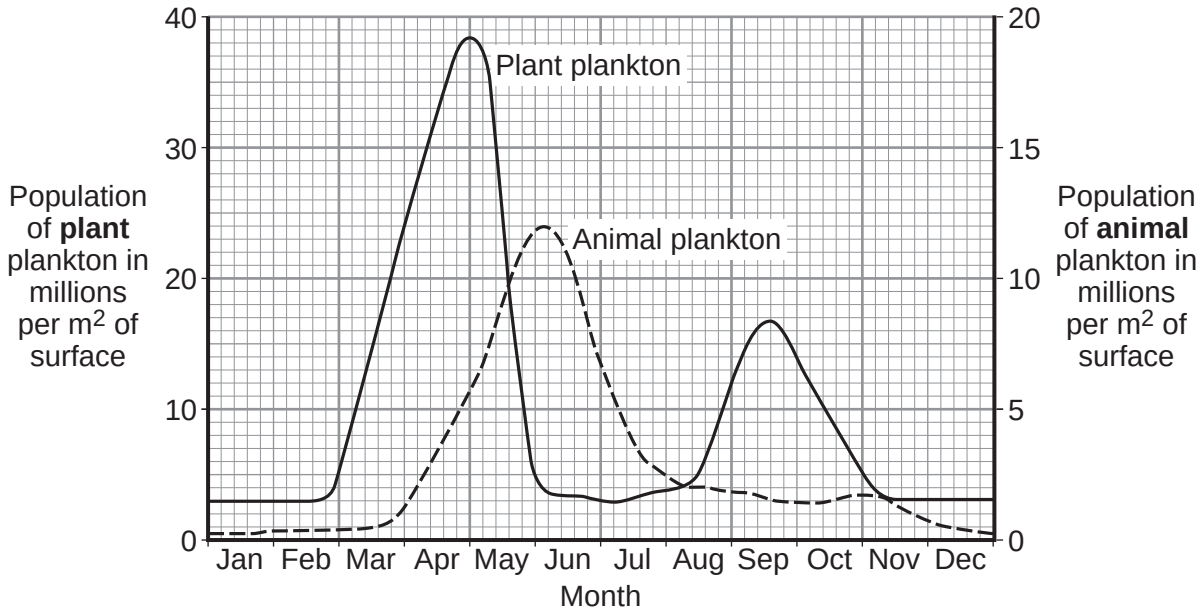
Question 9 continues on the next page

4.7.4.2 Pyramids of biomass

Question 05 · continued

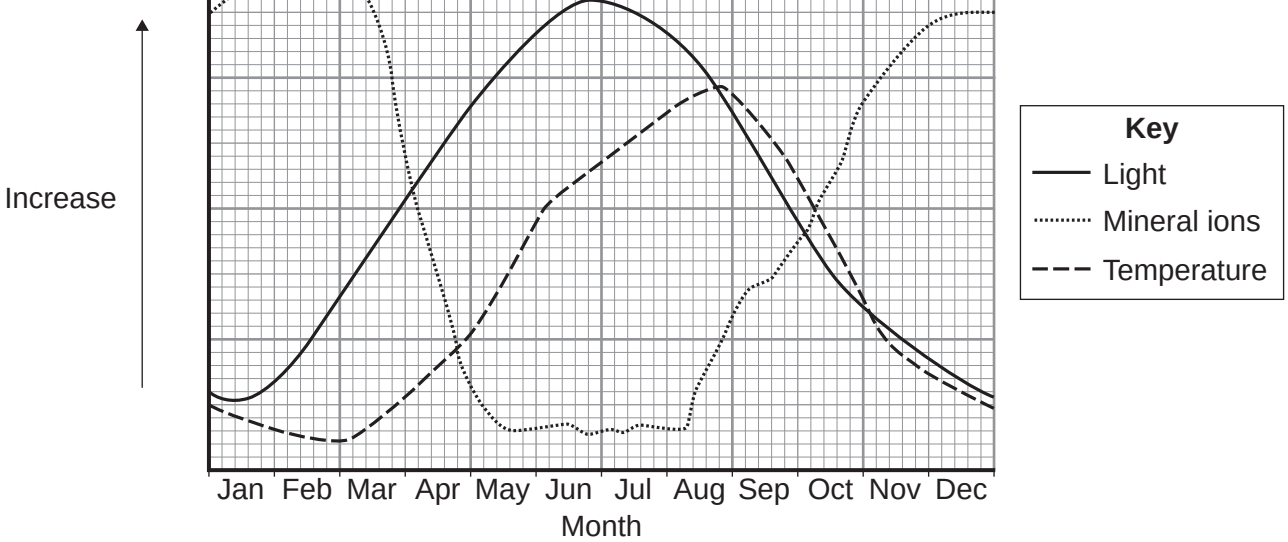
Graph 1 is repeated here to help you answer the following questions.

Graph 1



Graph 2 shows changes in some of the conditions in the upper layers of the sea around the UK.

Graph 2



4.7.4.2 Pyramids of biomass

Question 05 · continued

9 (b) The population of plant plankton increases between February and April.

Suggest **one** reason for the increase.

Explain your answer.

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(2 marks)

9 (c) The population of animal plankton changes between April and July.

Suggest explanations for the changes.

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(2 marks)

9 (d) The concentration of mineral ions changes between February and December.

Suggest explanations for the changes.

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(3 marks)

8

4.7.4.2 Pyramids of biomass

Question 06

June 2014 | BL1HP | Original Q1 | Legacy

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

1 (a) **Figure 1** shows a food chain.

Figure 1



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 06 · continued

1 (b) **Table 1** shows three food chains, **A**, **B** and **C**.

Table 1

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

1 (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]

1 (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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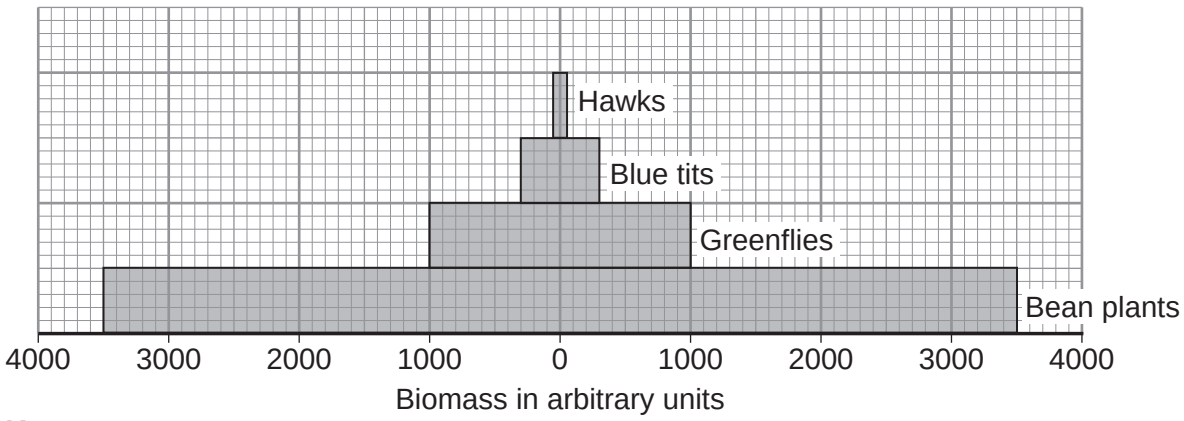
4.7.4.2 Pyramids of biomass

Question 07

June 2017 | BL1HP | Original Q1 | Legacy

1 **Figure 1** shows a pyramid of biomass for a food chain.

Figure 1



Key

= 500 arbitrary units

1 (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 1**.

_____

_____

Biomass = _____ arbitrary units

4.7.4.2 Pyramids of biomass

Question 07 · continued

1 (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 ☐

1 (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 08

June 2018 | 8461/2H | Original Q7

0 7 **Figure 8** shows:

- a food chain for organisms in a river
- the biomass of the organisms at each trophic level.

Figure 8



Biomass in g/m^2:	840	200	40	10

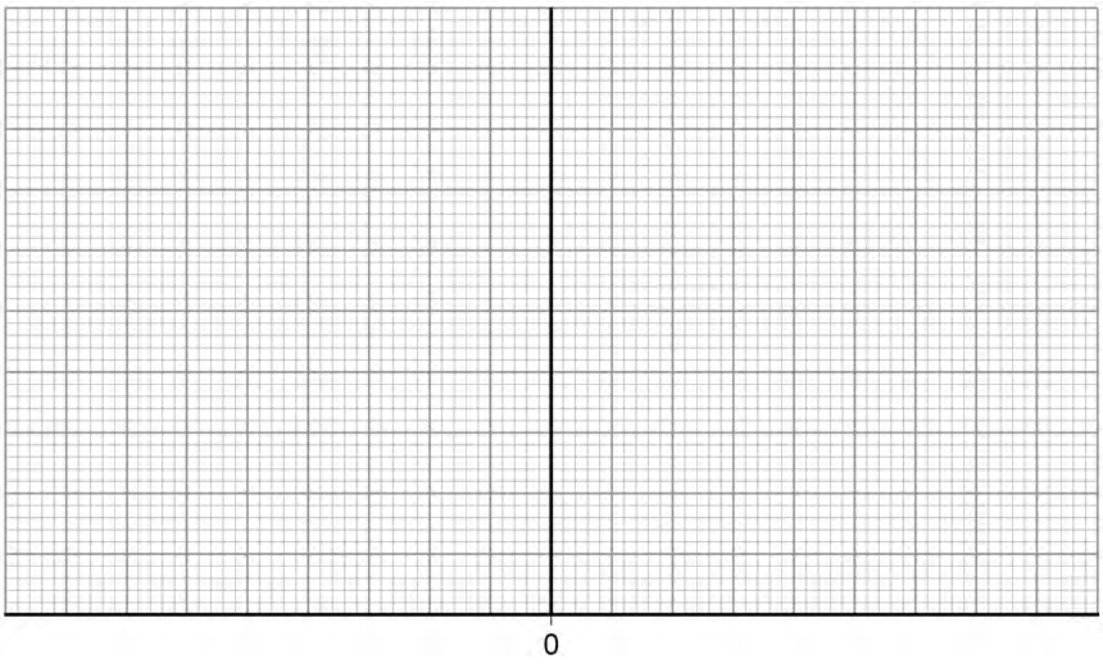
0 7 . 1 Draw a pyramid of biomass for the food chain in **Figure 8** on **Figure 9**.

You should:

- use a suitable scale
- label the x-axis
- label each trophic level.

[4 marks]

Figure 9



4.7.4.2 Pyramids of biomass

Question 08 · continued

0 7 . 2 Calculate the percentage of the biomass lost between the algae and the large fish.

Give your answer to 2 significant figures.

[3 marks]

Percentage loss = _____

0 7 . 3 Give **one** way that biomass is lost between trophic levels.

[1 mark]

Question 7 continues on the next page

4.7.4.2 Pyramids of biomass

Question 08 · continued

0 7 . 4 A large amount of untreated sewage entered the river. Many fish died.

Untreated sewage contains organic matter and bacteria.

Explain why many fish died.

[5 marks]

13

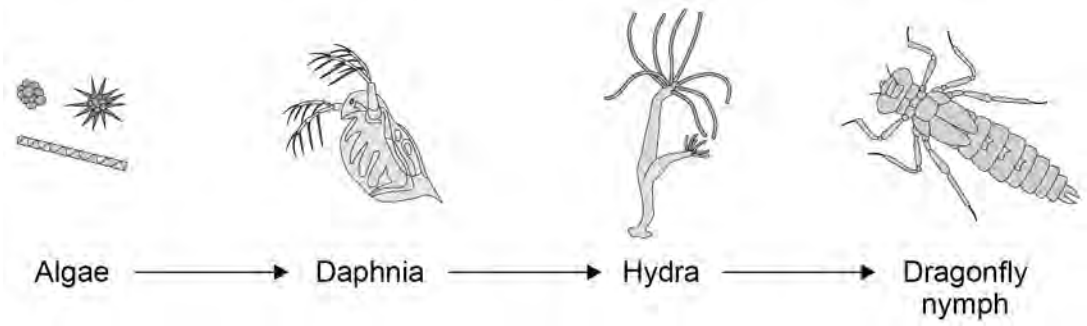
4.7.4.2 Pyramids of biomass

Question 09

June 2019 | 8461/2H | Original Q1

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

Figure 1



0 1 . 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 09 · continued

0 1 . 2 Draw a pyramid of biomass for the food chain.

Label each trophic level.

[2 marks]

0 1 . 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 1 continues on the next page

Question 09 · 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 1 shows the results.

Table 1

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

0 1 . 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 09 · continued

0 1 . 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 **01.4**.

Give your answer in standard form.

[4 marks]

Number of Daphnia in the pond = _____

Question 1 continues on the next page

Question 09 · continued

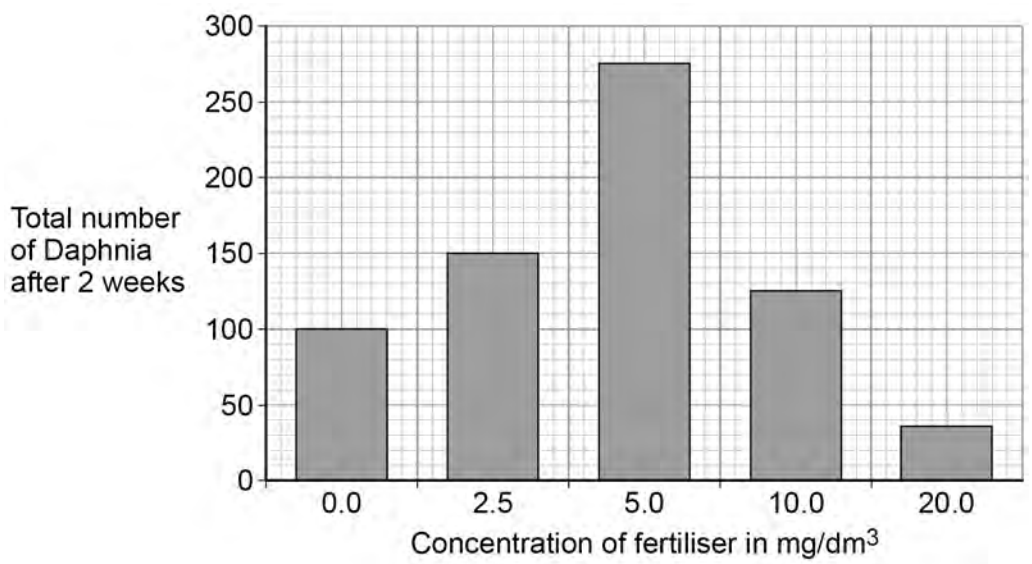
Rainfall can cause fertiliser to be washed from farmland into a pond.

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 2 shows the results.

Figure 2



0 1 . 6 A concentration of 5.0 mg/dm^3 of fertiliser caused a large increase in the population of Daphnia.

Explain why.

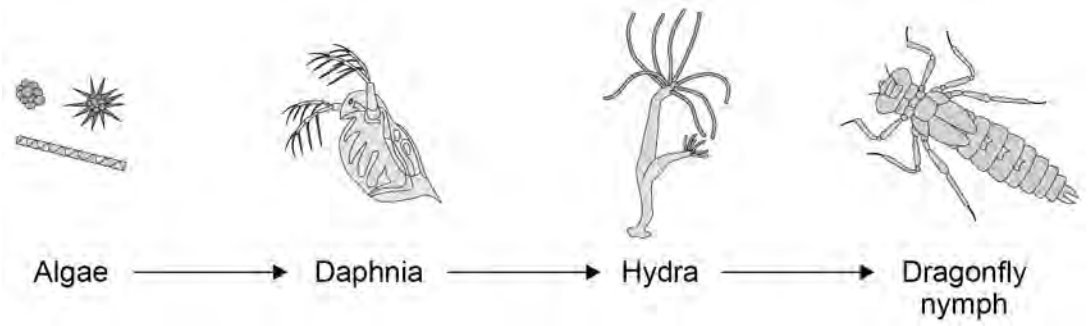
[2 marks]

4.7.4.2 Pyramids of biomass

Question 09 · continued

0 1 . 7 **Figure 1** is repeated below.

Figure 1



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 10

November 2020 | 8461/2H | Original Q7

0 7 A new dog food has been developed that does **not** contain meat from cows, sheep or chickens.

The new dog food contains insects.

The insects in the dog food factory are fed on waste vegetables.

0 7 . 1 Sketch the pyramid of biomass for the food chain that produces food for dogs from insects.

Label the pyramid.

[2 marks]

0 7 . 2 Describe **two** reasons why the biomass of the insects eaten by dogs does **not** all become biomass of the dogs.

[2 marks]

1 _____

_____

2 _____

_____

4.7.4.2 Pyramids of biomass

Question 10 · continued

0 7 . 3 Explain how making dog food from insects could improve **human** food security in the future.

[4 marks]

8

4.7.4.2 Pyramids of biomass

Question 11

June 2024 | 8461/2H | Original Q7

0 7 Farmers can increase the growth rate of farm animals by controlling the animals' diets.

A farmer has 1000 chickens.

- The farmer feeds the chickens on seeds from maize plants.
- 1 hectare of land produces 16.4 tonnes of maize seeds.
- The maize seeds have an energy content of 16 MJ per kg.
- Chickens can use 80% of the energy in maize seeds.
- Each chicken needs 46 MJ of energy to grow to full size.

0 7 . 1 Calculate the area of land needed to provide enough energy from maize seeds for 1000 chickens to grow to full size.

Give your answer in m^2.

Give your answer to 3 significant figures.

1 hectare = 10 000 m^2

1 tonne = 1000 kg

[5 marks]

Area of land (3 significant figures) = _____ m^2

Question 7 continues on the next page

4.7.4.2 Pyramids of biomass

Question 11 · continued

0 7 . 2 Another farmer produced 4200 kg of maize seeds in a field.

The farmer fed the maize to 1000 chickens.

At full size, the mean mass of one chicken was 2.2 kg.

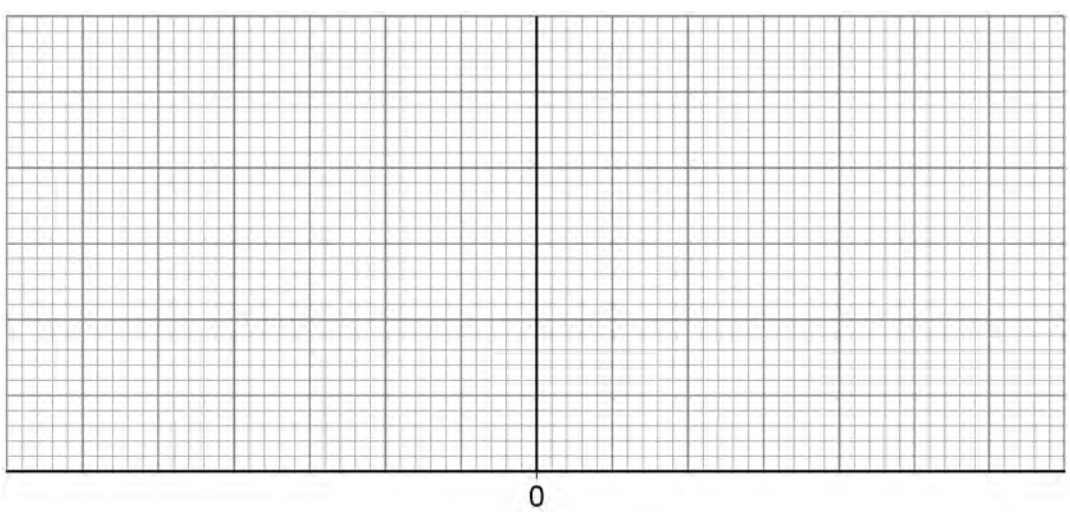
Complete **Figure 11** to show a pyramid of biomass for the food chain from the maize seeds to 1000 chickens.

[3 marks]

You should:

- label the x-axis
- use a suitable scale.

Figure 11



4.7.4.2 Pyramids of biomass

Question 11 · continued

0 7 . 3 Calculate the ratio of chicken biomass to maize seed biomass.

Use data from Question **07.2**.

Give your answer in its simplest form.

[2 marks]

Ratio = _____ : _____

0 7 . 4 Chickens can use 80% of the biomass from the maize seeds they eat for respiration and growth.

What happens to the remaining 20% of the biomass in the maize seeds?

[1 mark]

Question 7 continues on the next page

4.7.4.2 Pyramids of biomass

Question 11 · continued

Protein is an important part of a chicken's diet.

- Proteins contain 20 different types of amino acid.
- A chicken can make many of the 20 amino acids from other substances in the diet.
- Essential amino acids are amino acids the chicken **cannot** make.
- Essential amino acids must be included in the diet.

Maize seeds contain protein but the proportion of some essential amino acids is low.

Scientists have produced a type of maize called Quality Protein Maize (QPM).

Table 2 compares the proportions of seven essential amino acids in normal maize seeds and in QPM seeds.

Table 2

Amino acid	Mass of amino acid in protein in g/kg	
	Normal maize	Quality protein maize (QPM)
Leucine	122.2	88.1
Lysine	28.9	41.9
Methionine	19.9	18.1
Phenylalanine	49.4	40.9
Threonine	34.5	36.5
Tryptophan	7.3	16.3
Valine	45.9	51.2

4.7.4.2 Pyramids of biomass

Question 11 · continued

0 7 . 5 Which amino acids are found in significantly higher proportions in the QPM seeds?

[1 mark]

Tick (✓) **one** box.

- Lysine and tryptophan ☐
- Lysine and valine ☐
- Threonine and tryptophan ☐
- Threonine and valine ☐

0 7 . 6 **Table 2** shows that 1 kg of QPM contains less leucine than 1 kg of normal maize.

Suggest why a diet containing less leucine does **not** slow down the growth of chickens.

[1 mark]

_____

_____

13