

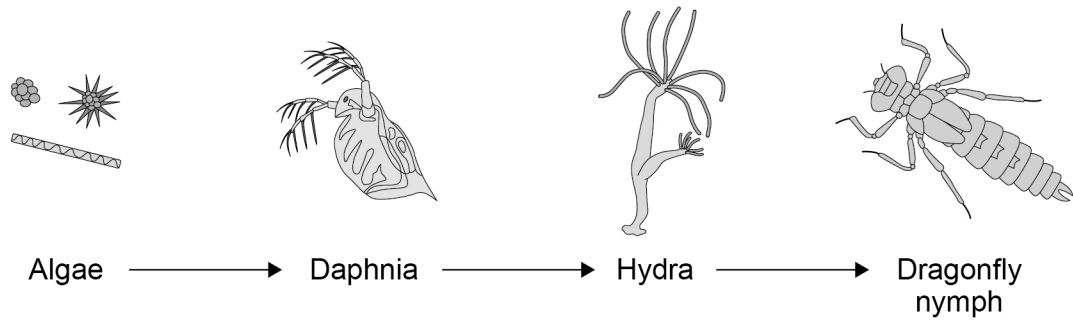
Answer **all** questions in the spaces provided.

Do not write  
outside the  
box

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



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]

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Question 1 continues on the next page

Turn over ►



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

This is the method used.

1. Collect 1 dm<sup>3</sup> 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 <sup>3</sup> water
1	5
2	21
3	0
4	16
5	28

**0 1 . 4** Calculate the mean number of Daphnia in 1 m<sup>3</sup> of pond water.

$$1 \text{ m}^3 = 1000 \text{ dm}^3$$

**[2 marks]**

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Mean number of Daphnia in 1 m<sup>3</sup> of pond water = \_\_\_\_\_



**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]**

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Number of Daphnia in the pond = \_\_\_\_\_

**Question 1 continues on the next page**

**Turn over ►**

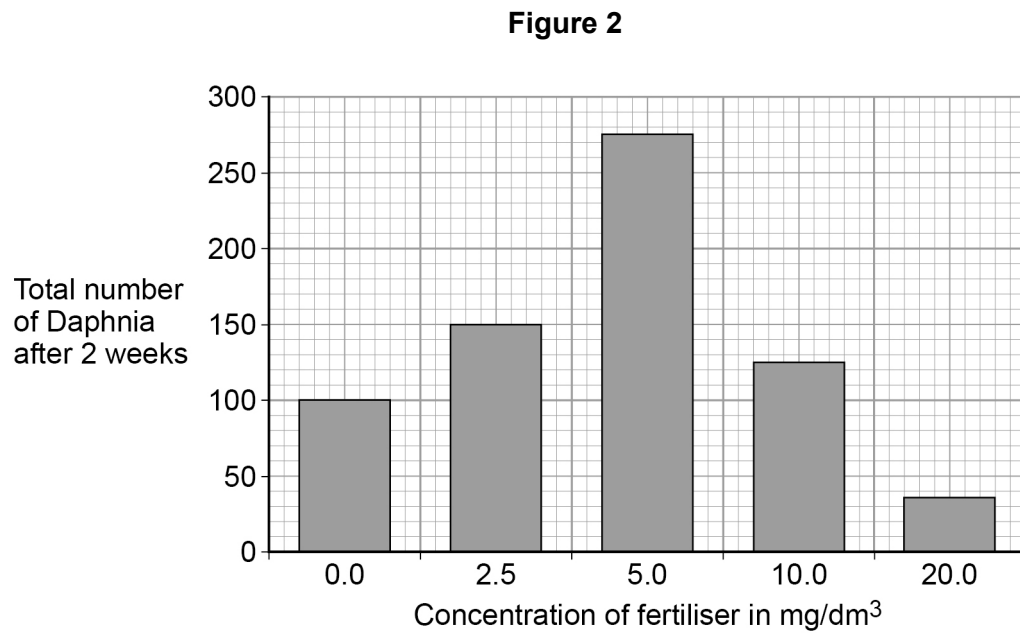


Rainfall can cause fertiliser to be washed from farmland into a pond.

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.



0 1 . 6

A concentration of 5.0 mg/dm<sup>3</sup> of fertiliser caused a large increase in the population of Daphnia.

Explain why.

**[2 marks]**

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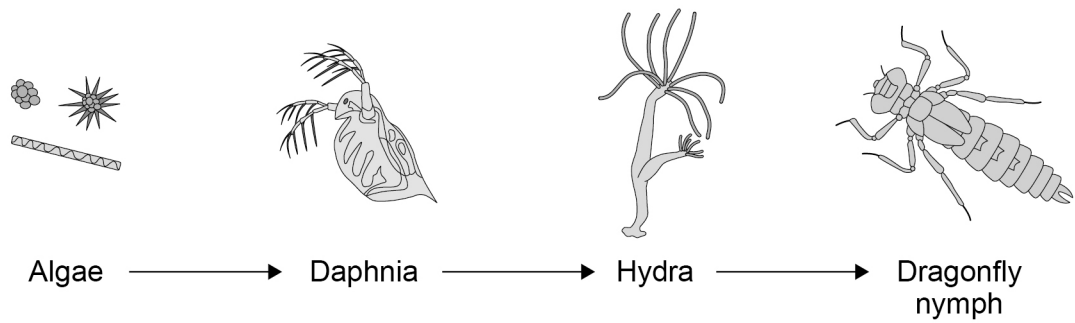


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0 1 . 7 Figure 1 is repeated below.

Figure 1



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

Explain why.

[2 marks]

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Turn over for the next question

Turn over ►



Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	primary consumer		1	AO2 4.7.2.1 4.7.4.1
01.2	<p>correct shape: 4 tiers with largest at bottom and smallest at top</p> <p>correctly labelled:</p> <p>dragonfly / nymph</p> <p>+ hydra</p> <p>+ daphnia</p> <p>+ algae</p>	<p>in this order  <b>or</b> allow:                      3<sup>rd</sup>-order <b>or</b> tertiary consumer <b>or</b> apex / top predator <b>or</b> (trophic level) 4                      2<sup>nd</sup>-order <b>or</b> secondary consumer <b>or</b> (trophic level) 3                      1<sup>st</sup>-order <b>or</b> primary consumer <b>or</b> herbivore <b>or</b> (trophic level) 2                      producer <b>or</b> (trophic level) 1</p> <p>allow for <b>2</b> marks inverted pyramid if correctly labelled</p>	<p>1</p> <p>1</p>	AO2 4.7.4.2
01.3	<p>any <b>one</b> from:                      (Daphnia biomass smaller because)</p> <ul style="list-style-type: none"> <li>• non-digestible parts (of algae) or lost in faeces</li> <li>• not all absorbed</li> <li>• lost in urine / urea</li> <li>• used in respiration <b>or</b> lost as carbon dioxide / CO<sub>2</sub></li> <li>• algae not all eaten <b>or</b> eaten by other organisms</li> <li>• some algae decompose</li> </ul>	<p>ignore waste</p> <p>allow excretion                      allow (to supply energy) for movement / warmth                      allow used to supply energy</p>	1	AO1 4.7.4.3
01.4	<p>14</p> <p>14 000</p>	<p>an answer of 14 000 scores <b>2</b> marks</p> <p>allow evidence of an incorrectly calculated mean × 1000                      allow <math>1.4 \times 10^4</math></p>	<p>1</p> <p>1</p>	AO2 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
<b>01.5</b>	(volume of pond = ) 1.875 <b>or</b> $2.5 \times 1.5 \times 0.5$  14 000 $\times$ 1.875  26250  $2.625 \times 10^4$	an answer of $2.625 \times 10^4$ <b>or</b> $2.63 \times 10^4$ <b>or</b> $2.6 \times 10^4$ scores <b>4</b> marks  an answer of 26250 scores <b>3</b> marks  allow ecf from Question <b>01.4</b>  an incorrect answer for one step does <b>not</b> prevent allocation of marks for subsequent steps  allow ecf from Question <b>01.4</b>  allow $2.63 \times 10^4$ <b>or</b> $2.6 \times 10^4$	1   1  1  1	AO2 4.7.2.1
<b>01.6</b>	increased (growth / reproduction of) algae  (more algae so) more food for Daphnia	allow fertiliser toxic to Hydra (1) (so) fewer Daphnia eaten (1)	1  1	AO2 4.7.2.1 4.7.3.2 4.7.4.1
<b>01.7</b>	(Hydra have) less food  because (graph shows) fewer Daphnia (with more fertiliser)	allow other valid suggestions, eg fertiliser toxic to Hydra (1) <b>or</b> fertiliser causes growth of algae (on surface) which block light and so die and decay <b>or</b> eutrophication (1) (decay / eutrophication) uses up oxygen (so lack of oxygen for Hydra) (1)	1  1	AO3 4.7.2.1 4.7.3.2
<b>Total</b>			<b>14</b>	