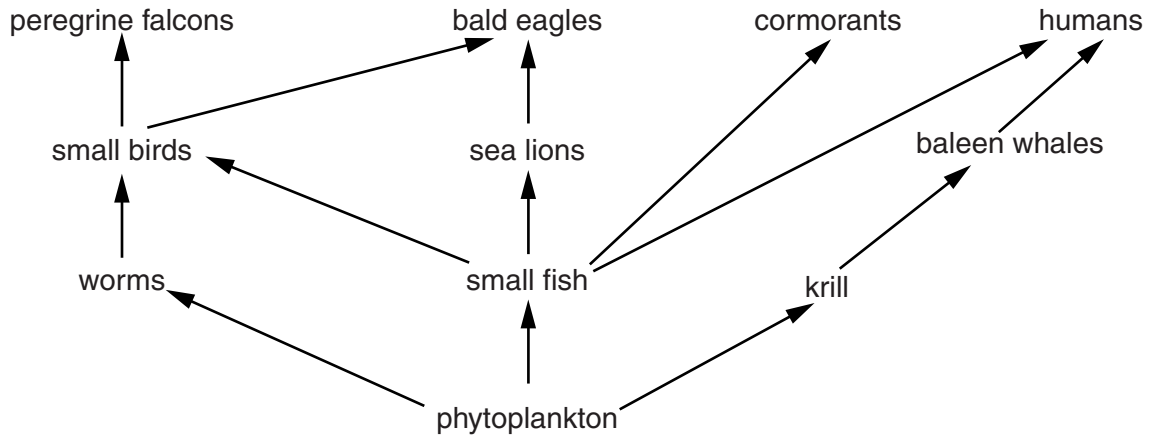
1 Look at the food web.



(a) (i) This is one of the food chains from the food web.

It shows the relative biomass at each stage.

phytoplankton ⟶ small fish ⟶ cormorants

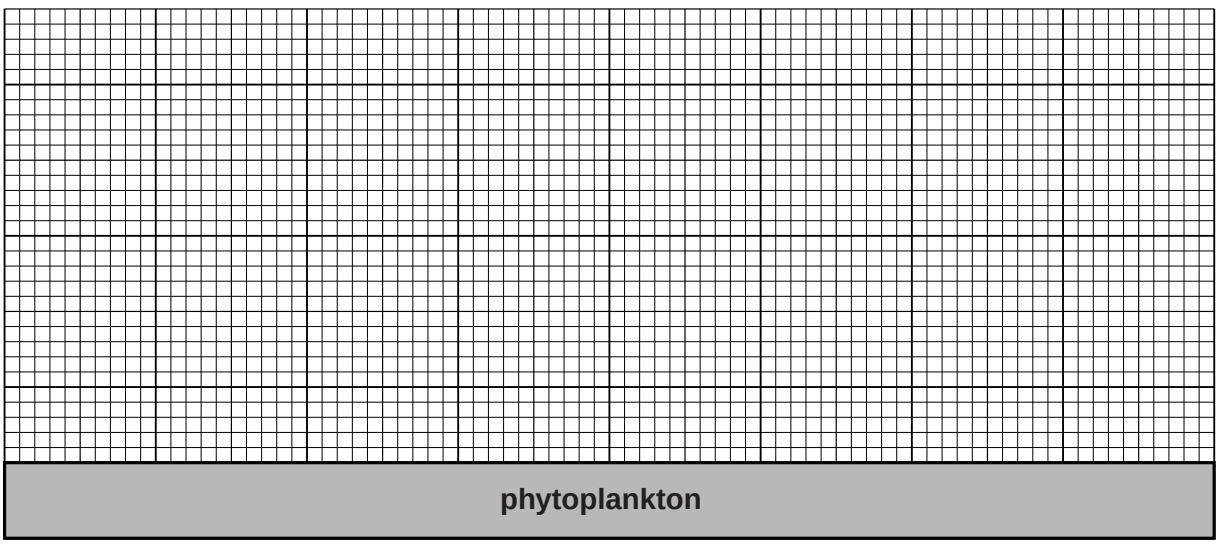
dry biomass **8000** **800**

A pyramid of biomass can be drawn to describe this food chain.

Finish the pyramid of biomass to include the small fish and the cormorants.

Make sure the bars are drawn **to scale** and **labelled**.

The bar for phytoplankton has been drawn for you.



[2]

(ii) Here is another food chain in this food web.

phytoplankton ⟶ krill ⟶ baleen whales ⟶ humans

Biologists would have great difficulty in collecting the data for the pyramid of biomass for **this** food chain.

Explain why.

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..... **[2]**

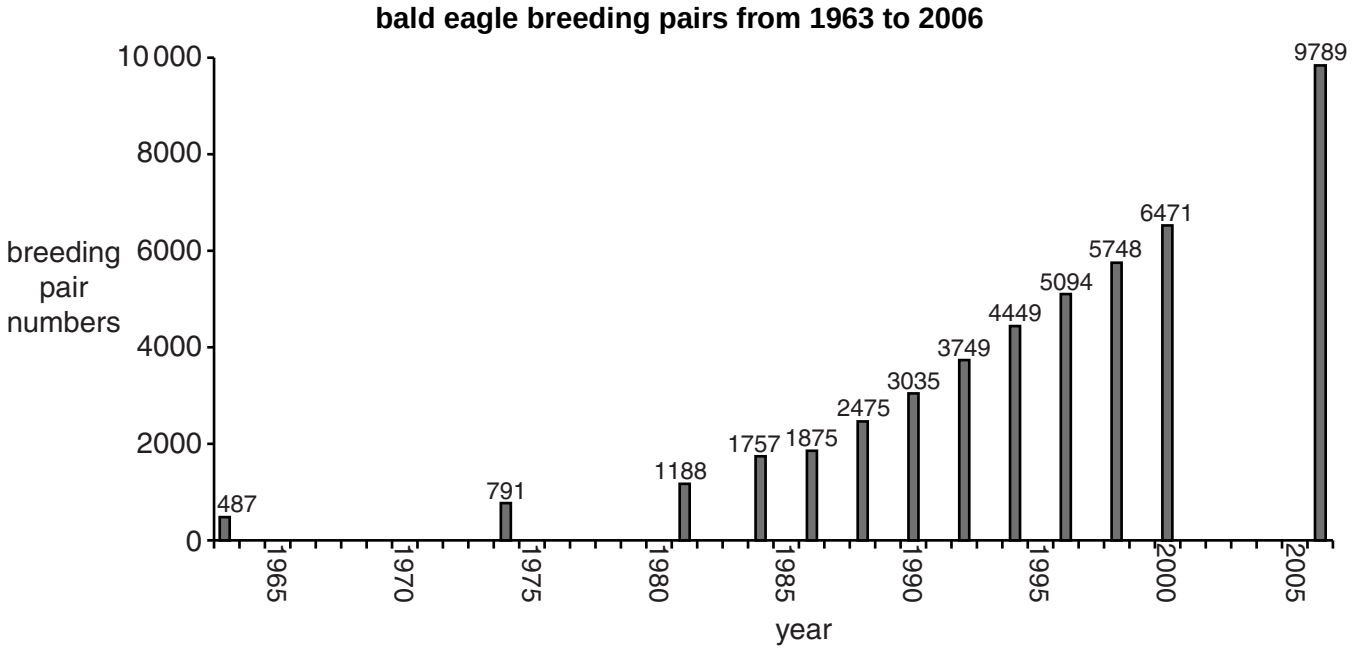
(b) The bald eagle was an endangered bird in the USA.

It has had legal protection since 1940.

From 1963 until 2006, surveys of bald eagle breeding pairs were done.

In 2007 the bald eagle was removed from the USA list of endangered species.

Look at the graph.



Use the evidence in the graph to suggest why the bald eagle was at risk of extinction and why it has now been removed from the endangered list.

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..... **[3]**

2 There are many types of microorganisms.

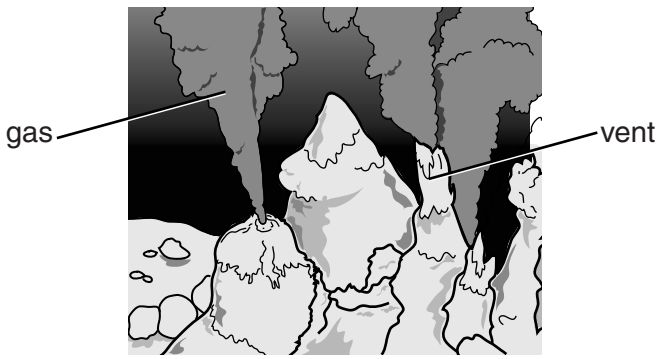
(a) Some are useful to humans and some are harmful to humans.

Draw straight lines to join each **type of microorganism** to its **impact on humans**.

type of microorganism	impact on humans
Lactobacillus bacteria	used in biogas production
bacteria that rot organic material releasing methane	used in yoghurt making
bacteria that produce toxins	used in production of antibiotics
fungus producing penicillin	cause diseases such as cholera or food poisoning

[2]

(b) Some bacteria live deep in the ocean near hot volcanic vents.



There are similarities and differences in the way that these bacteria get their food compared to the way that green plants get their food.

Write about **one** similarity and **one** difference.

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..... **[2]**

[Total: 4]

3 Soil contains different components.

These include mineral particles and dead material.

(a) Write down the name for partially decomposed dead material in soil.

..... **[1]**

(b) Percy reads about different soils.

He finds out that mineral particles in soil can be sand, silt or clay.

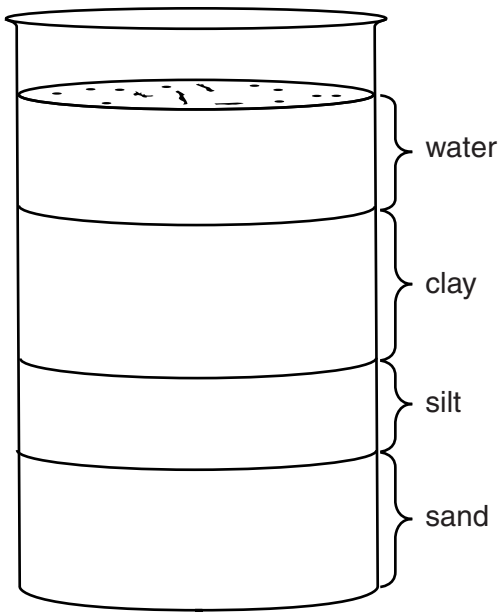
Each particle is a different size.

Sand particles are largest and clay particles are smallest.

Percy gets some soil from his garden and shakes it up in a beaker of water.

He then lets it settle.

Look at the diagram of his results.



(i) Suggest why the sand, silt and clay form separate layers as shown in the diagram.

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..... **[2]**

(ii) Percy uses his ruler to measure the height of the clay layer.

The height of the clay layer is 20 mm.

The total height of the three mineral layers is 50 mm.

He calculates that 40% of the mineral content is clay.

Use a ruler to measure the height of the sand layer.

Use this to calculate what percentage of the mineral content is sand.

sand = ... % **[2]**

(iii) Percy uses information in this table to work out the type of soil in his garden.

Type of soil	Range of clay content %	Range of sand content %
clay	>50	<50
loam	10–45	30–70
sandy	<45	>55

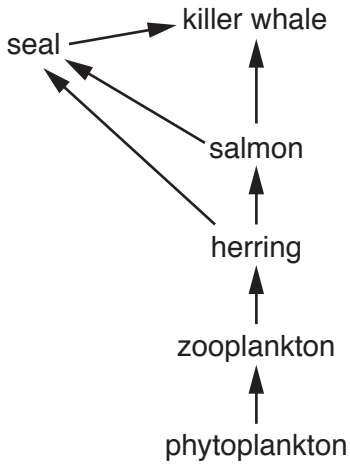
Work out what type of soil Percy has in his garden.

Use the percentages in **(b)(ii)** and the table.

Percy's soil type is ..... **[1]**

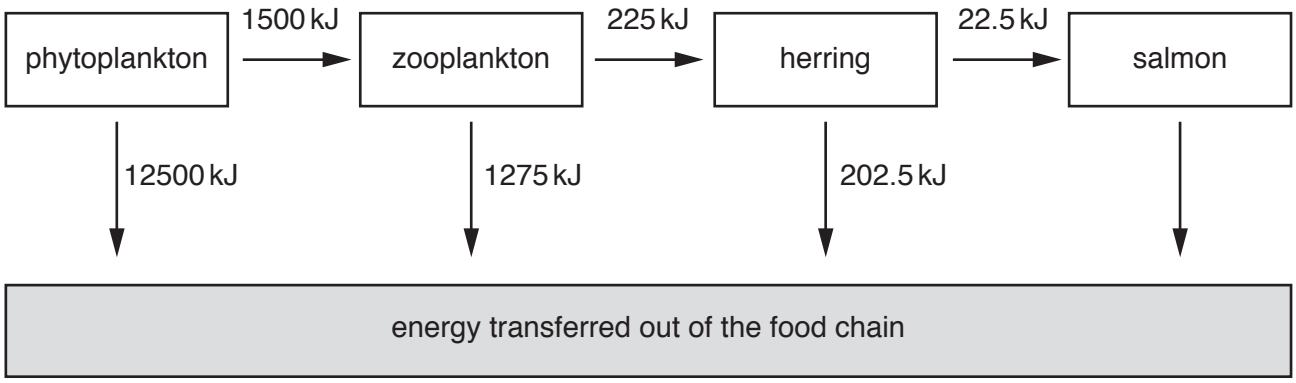
[Total: 6]

4 Look at the food web.



Look at the diagram.

It shows the energy flow in **part** of one food chain from the food web.



(a) The energy efficiency between zooplankton and herring in this chain is 15%.

Calculate the energy efficiency between the **herring** and **salmon** in the food chain and use this value to explain why there are no more trophic levels after killer whales.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

(b) Captivity can be used as a way to conserve endangered species.

Some killer whales are kept in captivity.

Some people are concerned about keeping killer whales in captivity. Describe reasons why.

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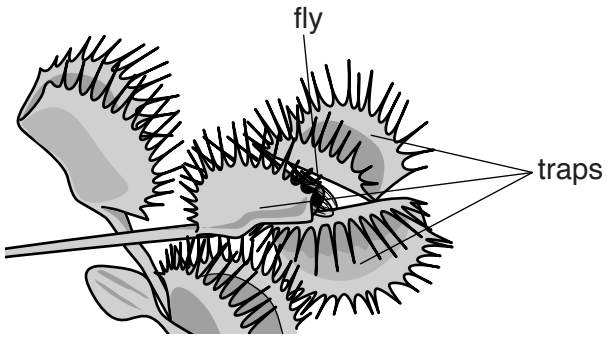
..... **[2]**

5 The venus flytrap is a plant that lives in very wet ground, such as bogs.

Bogs contain very low levels of minerals, such as nitrates, that plants need for growth.

The venus flytrap catches insects which it digests to get minerals.



(a) Venus flytraps digest insects by extracellular digestion.

What does **extracellular** mean?

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..... **[1]**

(b) Bogs contain very low levels of minerals because the rate of decay is very slow.

This is because very low levels of oxygen mean there are very low numbers of the microorganisms that cause decay.

Explain why very low levels of oxygen mean there are very low numbers of these microorganisms.

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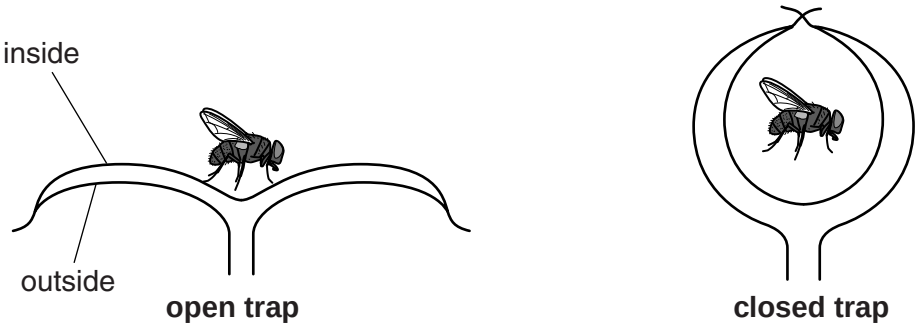
..... **[2]**

(c) The way the traps close to catch insects involves osmosis.

The cells on the outside of the trap become turgid and swell more than the cells on the inside.

This causes the trap to close.



Suggest how the cells on the outside become more turgid than those on the inside.

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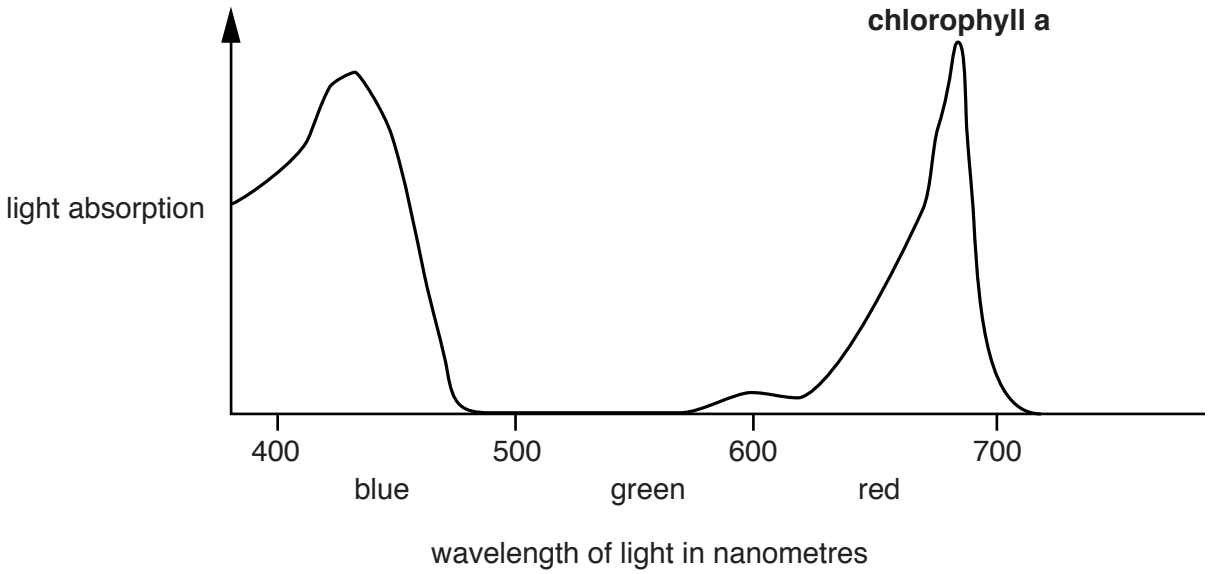
..... **[3]**

(d) The outside of each trap is green because these cells contain **chlorophyll a**.

The inside of each trap is red because these cells contain a red pigment called anthocyanin.

The red colour attracts insects.

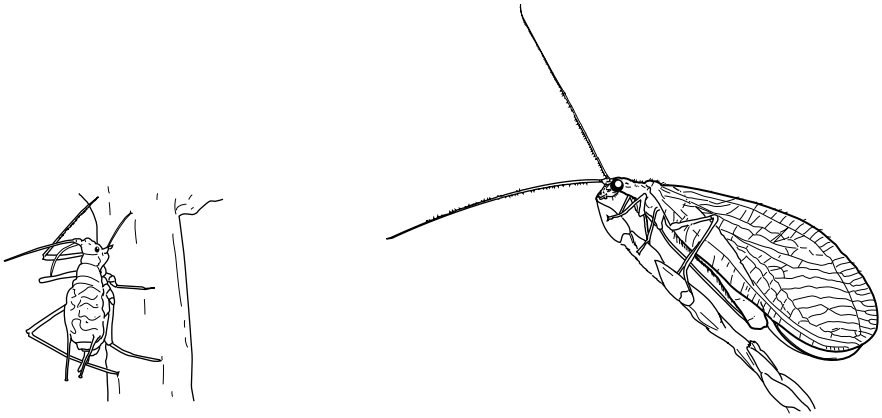
The diagram shows how **chlorophyll a** absorbs light of different wavelengths.



Draw a line **on the graph** to show the absorption of light by anthocyanin. **[1]**

6 Aphids are small insects that feed on plants and damage crops.

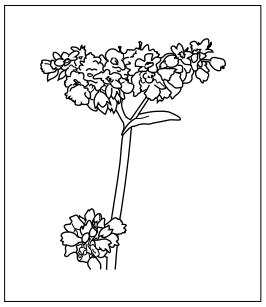
Lacewings are insects that can be used for biological control.



aphid **lacewing**

(a) A seed company wants to sell buckwheat seeds to cotton farmers. Look at their advert.

Planting buckwheat seeds increases your cotton crop yield



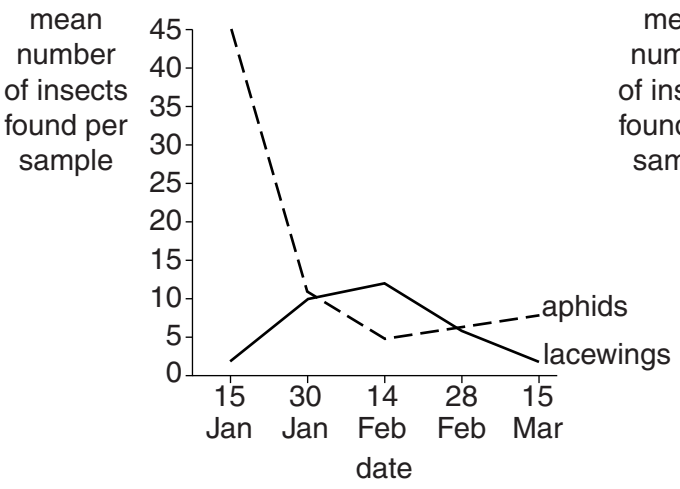
Planting buckwheat alongside your cotton plants will increase your cotton yield.

Buckwheat attracts lacewings because they feed on buckwheat nectar.

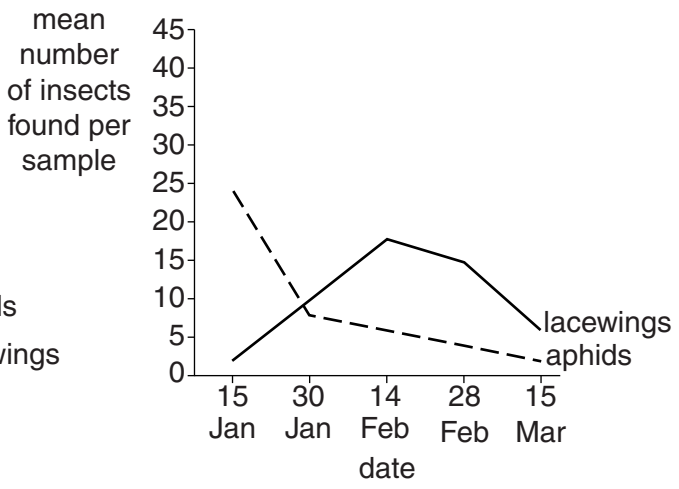
Lacewings are also predators and will control the aphids that damage your cotton plants.

The graphs show the effect of planting buckwheat:

Graph A
No buckwheat



Graph B
With buckwheat



(i) Look at graph **A**.

Describe and explain the relationship between the numbers of aphids and lacewings when there is **no** buckwheat.

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..... **[2]**

(ii) The advert claims that growing buckwheat attracts lacewings and increases crop yield.

Discuss whether the graphs support this claim.

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..... **[3]**

(b) To produce the graphs in the advert, scientists needed to collect aphids and lacewings.

They did this several times and calculated the mean (average) number per sample.

Increasing the number of samples increases the accuracy of the mean.

Explain why.

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..... **[1]**

[Total: 6]

7 This question is about microorganisms that cause disease.

Flu (influenza) is caused by a virus.

Salmonella food poisoning is caused by bacteria.

(a) Describe the structure of a virus.

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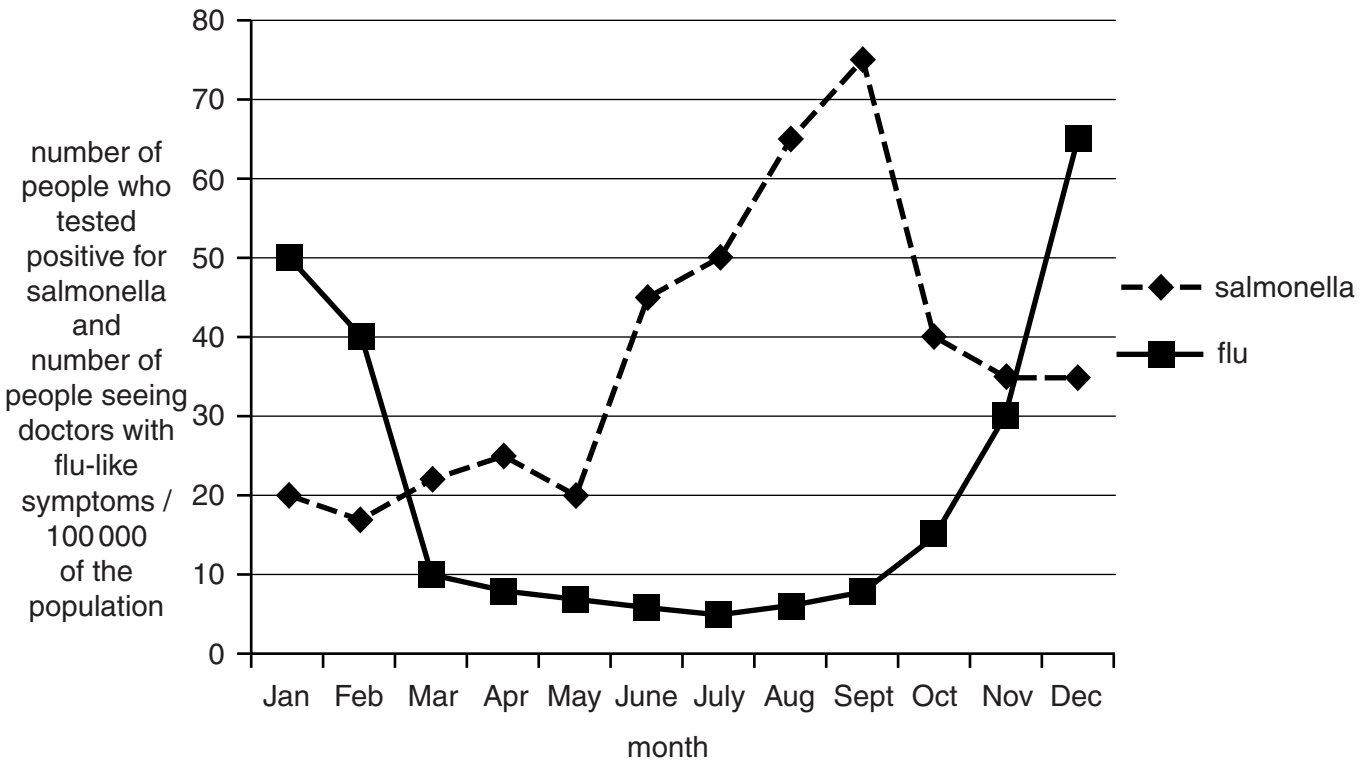
..... **[2]**

(b) Look at the graph.

It shows the number of people who tested positive each month for salmonella bacteria.

It also shows the number of people with flu-like symptoms visiting their doctor each month.



(i) Discuss whether the graph gives the true numbers of people actually having salmonella or flu.

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..... **[2]**

(ii) It is thought that the way the diseases are spread will affect **when** people are more likely to get the disease.

Flu is spread by airborne droplets, usually indoors or on crowded buses or trains.

Salmonella is spread through food that is not cooked thoroughly or stored at incorrect temperatures.

Write about how the way the microorganisms are spread can explain the patterns in the graph.

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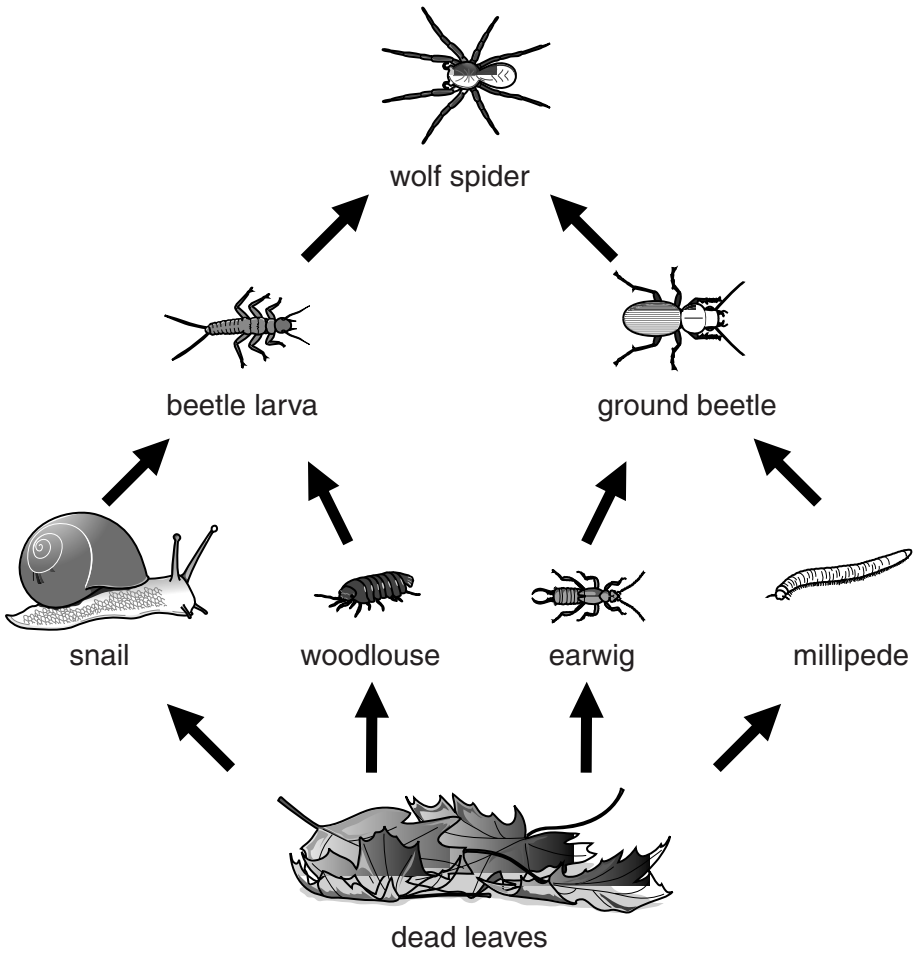
..... **[3]**

[Total: 7]

8 Look at the woodland food web.



(a) (i) Look at one food chain in this web showing the numbers at each level.

100 dead leaves → 4 snails → 10 beetle larvae → 1 wolf spider

Would you expect the pyramid of numbers and pyramid of biomass to be the same shape for this food chain?

Explain your answer.

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..... **[1]**

(ii) The woodlouse and earwig are in the same trophic level.

Some energy from this trophic level does not pass into the next trophic level.

Write down reasons why.

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..... **[2]**

(b) The efficiency of energy transfer between trophic levels can be calculated.

Look at the data on energy flow through four trophic levels.

producers	→	primary consumers	→	secondary consumers	→	tertiary consumers
97 000 kJ		**7000 kJ**		**600 kJ**		**50 kJ**

The efficiency of energy transfer between producers and primary consumers is 7.2%.

The efficiency of energy transfer between primary and secondary consumers is 8.6%.

(i) Calculate the efficiency of energy transfer between the secondary and tertiary consumers.

Secondary to tertiary consumers efficiency of energy transfer = ... % **[1]**

(ii) Use your answer to part **(i)** to explain why it is unlikely that there would be a fifth trophic level.

.....

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..... **[2]**

[Total: 6]