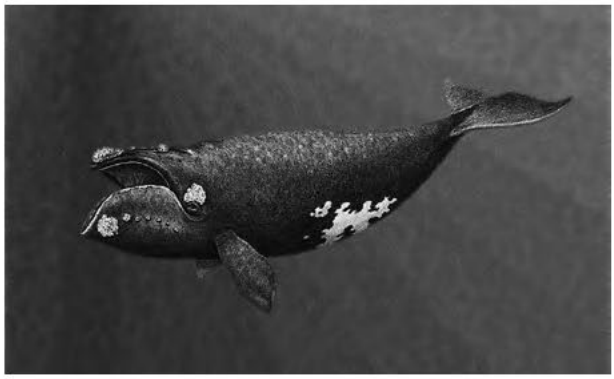
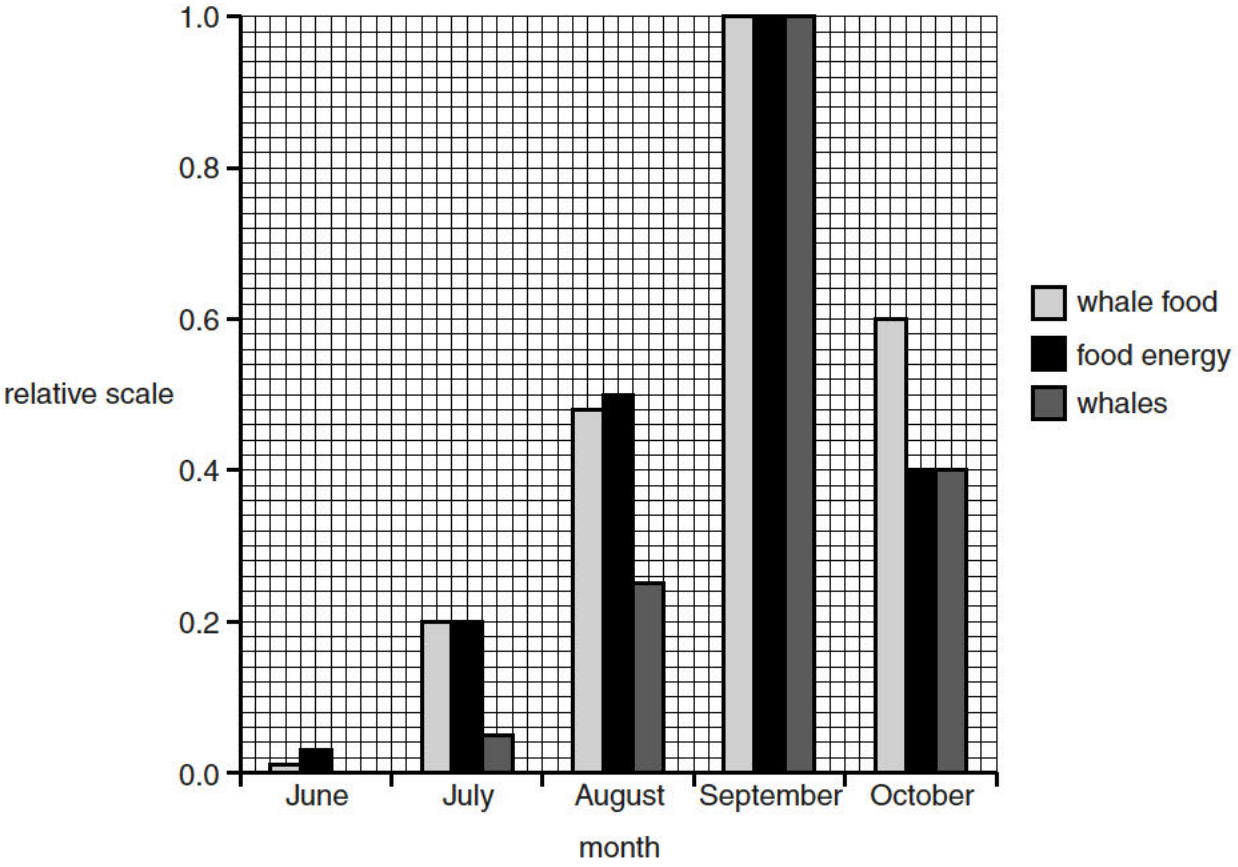
1 The picture shows a right whale.



Biologists have measured the population of right whales in an area of the North Atlantic during five separate months.

They also measured the amount of food available in that area and the energy in that food.

Results were plotted on a graph.



(a) (i) The ratio of whales to food energy in September and October is 1:1.

What is the ratio of whales to food energy in July?

whales: food energy ratio = ... **[2]**

(ii) Right whales are critically endangered.

Biologists think their results show that whale food energy is linked to whale population size in a particular area.

They think it will allow them to predict where migrating whales can be found.

Use your answer from part **(i)** and information in the graph to evaluate their claims.

.....

.....

.....

.....

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

(b) Whales are thought to have evolved from animals similar to the hippopotamus by natural selection.

Put the following statements in the correct order, 1 to 4, to best explain the theory of evolution by natural selection.

The first one has been done for you. Write numbers 2 to 4 in the correct boxes.

	competition for limited resources
	inheritance of 'successful' adaptations
1	presence of natural variation
	survival of the fittest

[2]

(c) The right whale is adapted to living in very cold environments.

What anatomical and behavioural adaptations does the right whale have to help it to survive in very cold environments?

.....

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

[Total: 9]

2 Read the information about 'spontaneous generation'.

Until the late 19th century, people thought life could be created from non-living matter.

The process was called 'spontaneous generation'.

For example, people thought that stale bread would turn into mould and meat would turn into maggots.

In 1668, Francesco Redi believed that maggots developed from eggs laid by flies.

To test his idea, he put meat into three flasks, one open to the air, one sealed completely, and the other covered with cloth. As he expected, maggots only appeared in the open flask.



(a) Explain how Redi's results suggest that the theory of 'spontaneous generation' is wrong.

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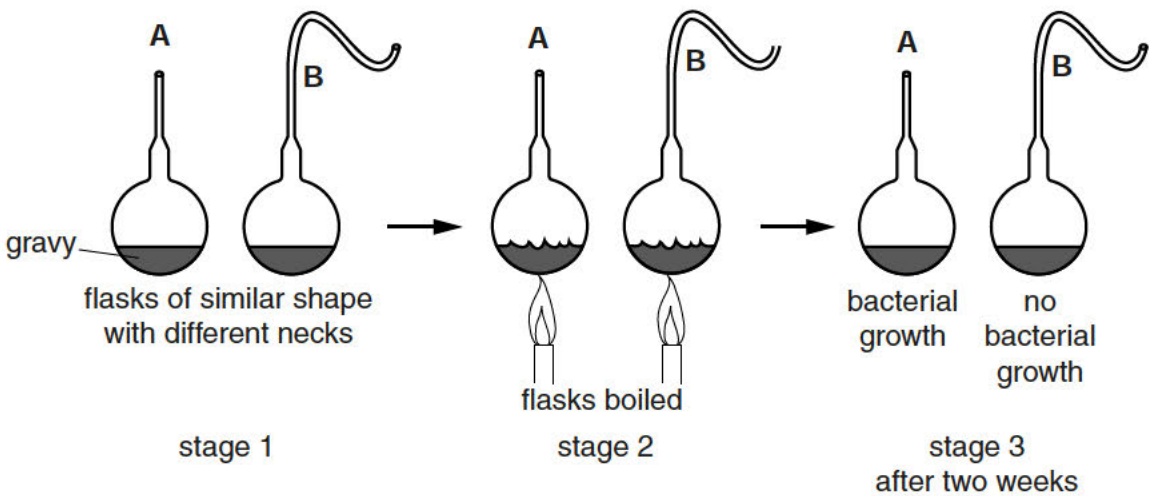
.....

.....

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

(b) The theory of 'spontaneous generation' was finally disproved in 1859, by Louis Pasteur.

Look at the diagram. It shows part of his experiment.



Use your scientific knowledge to explain the results in flasks **A** and **B** after two weeks.

.....

.....

.....

.....

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

(c) Louis Pasteur also developed the process of pasteurisation.

Most milk in the UK is pasteurised before it is sold.

Some people want to buy unpasteurised milk. This milk is called 'raw' milk.

Other people want to ban the sale of raw milk because they think it is harmful.

Should the sale of raw milk be banned? .....

Explain your answer.

.....

.....

.....

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

(d) Some bacteria can be found living near vents on the ocean floor where there is no light.

The water near the vents can be 400 °C and full of the poisonous gas hydrogen sulfide.

Suggest how the bacteria are able to survive these extreme conditions.

.....

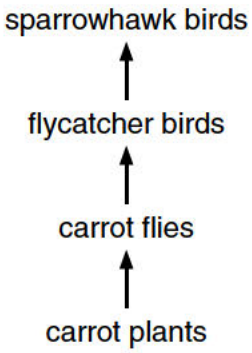
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..... **[2]**

[Total: 9]

3 Look at the food chain.



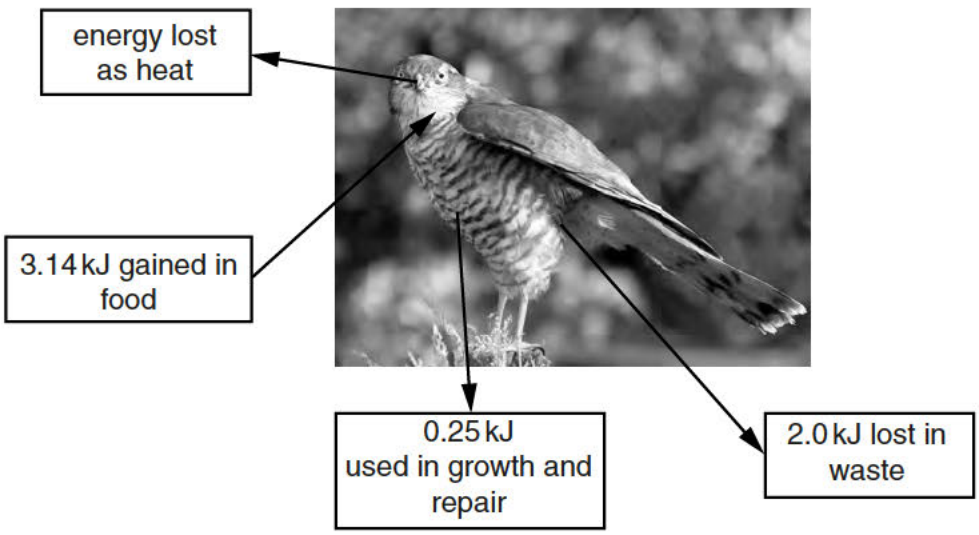
(a) Studying food chains often involves constructing pyramids of biomass.

What information is needed to construct a pyramid of biomass?

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

(b) Look at the diagram.

It shows all the energy transferred to and from a sparrowhawk.



(i) What process in the sparrowhawk's body releases heat?

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

(ii) Calculate the energy lost as heat.

answer..... kJ [1]

(iii) Some of the energy gained in food is transferred to growth and repair in the sparrowhawk.

Work out the percentage of the energy gained in food which is transferred to growth and repair.

answer ..... % [2]

(iv) This food chain has four trophic levels.

Use your answers to part (ii) and part (iii) to explain why it does not have any more.

.....

.....

..... [2]

[Total: 7]

4 In wet areas such as marshes, dead plants decompose very slowly.

(a) Explain why dead plants decompose very slowly in marshes.

.....

.....

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

(b) Over tens of thousands of years the partly decomposed plants form a substance called peat.

Peat builds up in the marsh and makes a habitat called a peat bog.

These bogs contain rare plants.

(i) Peat is often removed from bogs.

It is sold to dig into soil to improve plant growth.

The dead material in the peat is converted to nitrates in the soil.

This involves two different processes.

Describe the processes by which dead material is converted into nitrates.

.....

.....

.....

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

(ii) Many people think that removing peat from peat bogs should be stopped.

An alternative to peat for gardeners has been developed involving using the outer coating from coconuts.

This is a waste product from coconut-processing factories.

Explain the advantages of this example of sustainable development.

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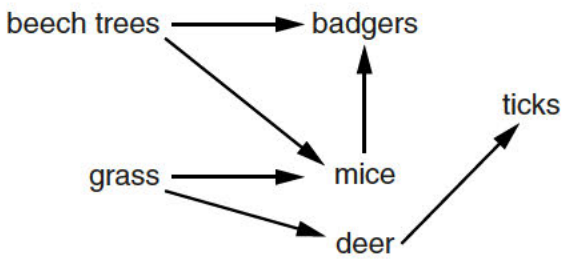
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..... **[2]**

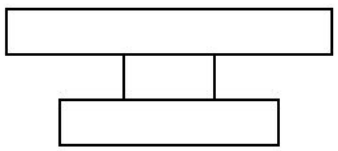
[Total: 7]

5 The diagram shows part of a food web.



(a) (i) The diagram shows the shape of a pyramid of numbers for this food web.

pyramid of numbers



pyramid of biomass

Describe how a pyramid of biomass would look different to this pyramid of numbers.

You may draw a diagram in the space above if you wish.

.....

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

(ii) It is harder to obtain the data to draw a pyramid of biomass than a pyramid of numbers. Explain why.

.....

.....

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

(b) The food web contains ticks.

This is a drawing of the tick called *Ixodes ricinus*.



Which genus does the tick belong to?

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

(c) Ticks can also feed on the blood of humans if they land on human skin.

People often like to walk in forest areas where deer live.

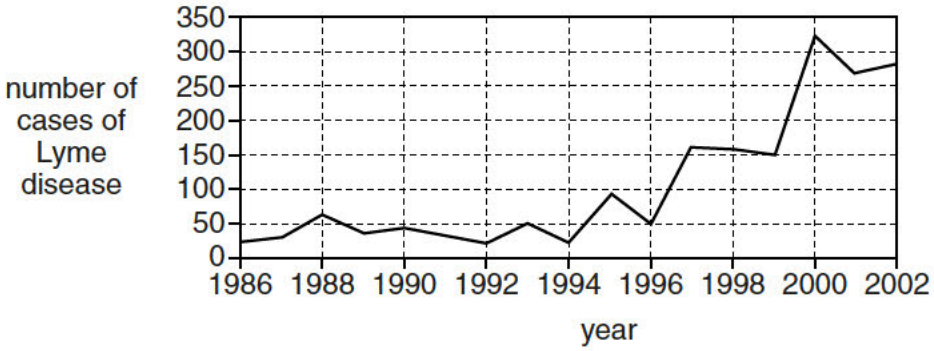
If people are bitten by ticks they can get a disease called Lyme disease.

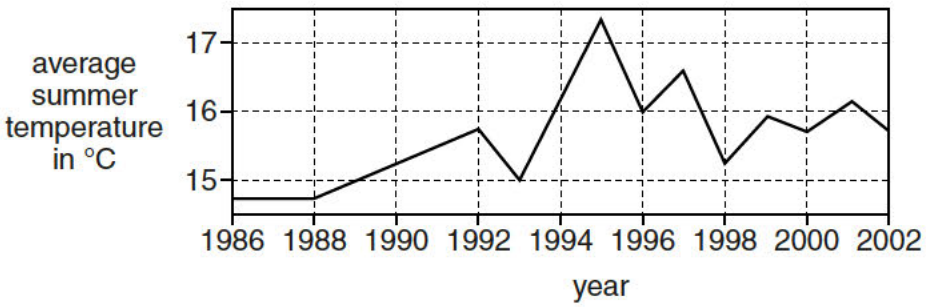
The number of people getting Lyme disease seems to be increasing.

Some people think that this is because global warming is making the ticks more active.

One graph shows the number of cases of Lyme disease from 1986 to 2002.

The other graph shows the average summer temperature during those years.





(i) How strong is the evidence in the graphs for a link between global warming and the number of people getting Lyme disease? Explain your answer.

.....

.....

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

(ii) Suggest **another** explanation for a link between the weather data and the number of people getting Lyme disease.

.....

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

[Total: 7]

6 (a Buffalo are herbivores that live in Africa.



Buffalo feed on grass.

Yellow-billed oxpeckers are small birds that live on buffalo.

Yellow-billed oxpeckers hunt for live ticks that feed on buffalo.

The ticks feed on buffalo blood.

(i) Write down **one** reason why a pyramid of biomass for this food chain may look different from a pyramid of numbers.

.....

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

(ii) The ticks are **parasites** of the buffalo.

What does the word parasite mean?

.....

.....

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

(b) A different species of oxpecker lives in another part of Africa.

This is the red-billed oxpecker. It also lives on buffalo.

A scientist wants to investigate whether buffalo also benefit from the red-billed oxpecker.

He counts the number of ticks on six buffalo.

He stops red-billed oxpeckers from sitting on three of the buffalo.

Red-billed oxpeckers are allowed to sit on the other three buffalo.

After several days he works out the change in the number of ticks on each buffalo.

His results are in the table.

	change in the number of ticks on each buffalo after the experiment		
buffalo with red-billed oxpeckers	+3	+7	–4
buffalo without red-billed oxpeckers	+4	–4	+6

Discuss what the data show about any possible benefit gained by the buffalo.

.....

.....

..... [2]

(c) Buffalo often have small wounds and sores on their bodies.

The scientist also looks at the effect that red-billed oxpeckers have on these wounds.

	number of wounds that DO NOT heal	number of wounds that heal	number of wounds that heal in %
buffalo with red-billed oxpeckers	49	55	
buffalo without red-billed oxpeckers	3	24	88.9

(i) Work out the missing percentage in the table.

answer……..%

[1]

(ii) Describe the results of this experiment and suggest possible explanations.

.....

.....

.....

..... [3]

(d) Explain why the two species of oxpecker do not occupy the same ecological niche.

.....

..... [1]

[Total: 10]