1 **(a)** Some farmers regularly give their cows low doses of antibiotics.

This can increase the amount of milk that the cows make.

Use of antibiotics can lead to the development of resistant strains of bacteria.

Suggest why the regular use of low doses of antibiotics may make this problem worse.

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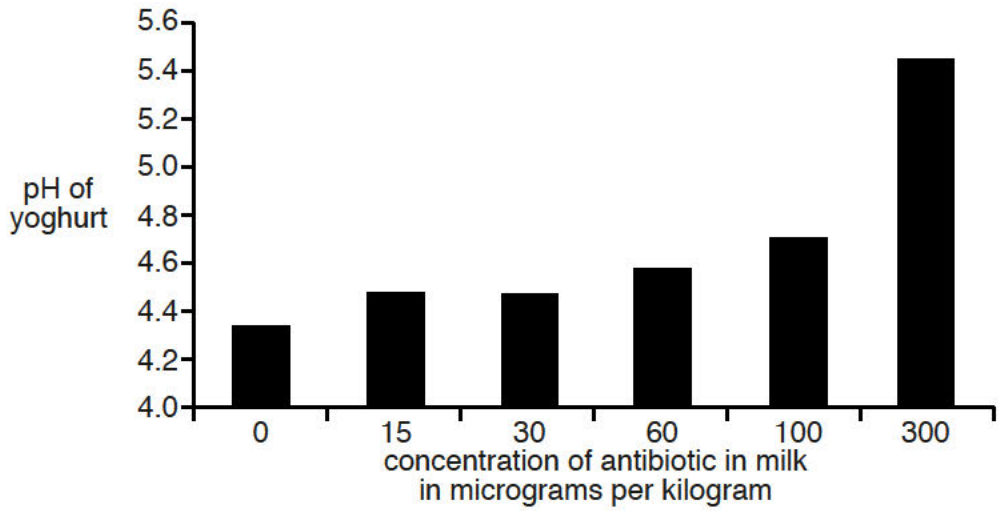
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..... **[2]**

(b) When cows are given antibiotics, some of these antibiotics pass into the milk.

Cows' milk is used to make yoghurt.

The graph shows the effect of antibiotics in milk on yoghurt making.



Explain the effects of antibiotics on the yoghurt making process and suggest why giving antibiotics to cows can cause problems for yoghurt makers.

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

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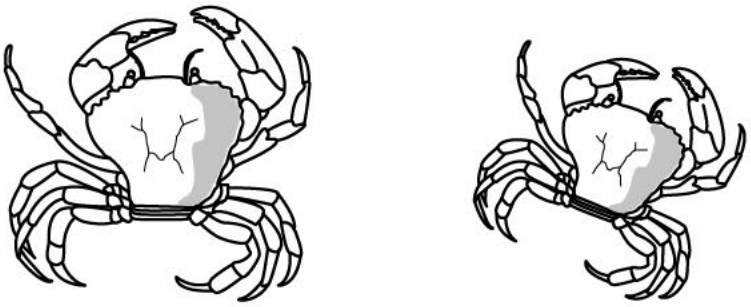
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..... **[6]**

2 This question is about classification.

(a) Biologists use visible features to classify animals.

Look at the picture of two crabs.



(i) The crabs in the picture are able to breed with each other and produce fertile offspring.

What is the **smallest** group the two crabs could be classified into?

Put a tick (✓) in the box next to the correct answer.

family	☐
genus	☐
kingdom	☐
order	☐
phylum	☐
species	☐

[1]

(ii) Crabs belong to a class of arthropods.

Biologists often find it difficult to place organisms into definite groups just on visible features.

Explain why.

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

(b) Biologists have used two types of classification system.

One is called **natural** and the other is called **artificial**.

Explain the difference between these two systems.

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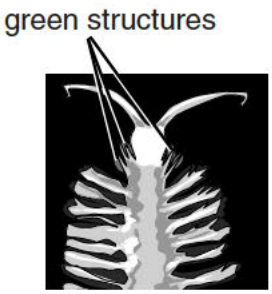
[Total: 4]

3 This question is about classifying.

Read the article about a species that was first discovered in 2009.



2009 The Year of the Green Bomber



The 'green bomber' is an annelid worm that lives at depths below 1800 metres in the seas off California. At these depths it is very dark.

Otherwise known as **Swima bombiviridis**, the green bomber worm gets its name from the green oval structures near its head. When the worm sheds them, they briefly glow in the dark with a brilliant, green light.

The green oval structures are thought to be helpful in escaping from predators.

(a) **Swima bombiviridis** is a newly discovered species.

What is meant by the term species?

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.....

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

(b) Swima bombiviridis has been named using the binomial system.

What do the two parts of the name identify?

Put ticks (✓) in the boxes next to the two correct answers.

class	☐
family	☐
genus	☐
order	☐
species	☐

[2]

(c) Swima bombiviridis is more likely to survive at depths below 1800 metres than other worms. This is because of its green oval structures.

Suggest how the green oval structures make it more likely to survive.

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..... [2]

(d) A similar species of worm lives in shallow waters. It does not have green oval structures.

Scientists think that Swima bombiviridis evolved from the ancestors of the species that lives in shallow waters.

Explain how a population of worms with green oval structures may have become a separate species.

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..... [3]

[Total: 9]

4 Scientists discover a new animal living in an area of remote forest.

Two of the scientists are discussing the animal.

Mark
The animal has similar characteristics to other animals in the forest. This means it must be related.





Anna
Just because it looks similar, it does not mean that it is closely related.
I would like to find out if it is a different species.

Explain why Anna is more likely to be correct and how she could investigate her ideas.

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

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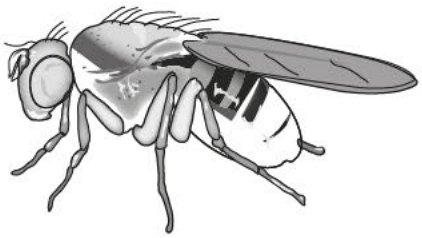
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[Total: 6]

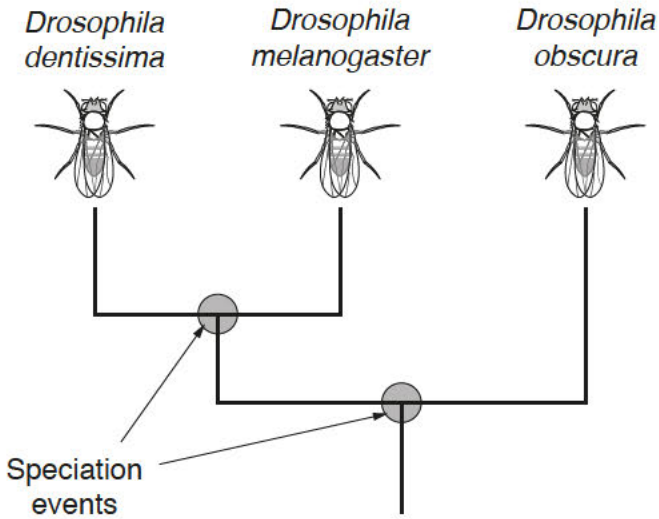
5 This question is about classification.

(a) The picture shows a species of fruit fly, *Drosophila melanogaster*.



Look at the diagram.

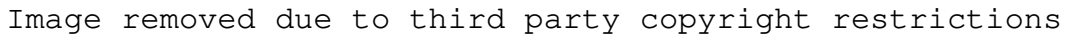
It shows part of an evolutionary tree for three different drosophila fruit flies.



What is the genus of all three fruit flies?

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

(b) Look at the picture of a Catalina macaw.



Catalina macaws are produced when a 'Scarlet' macaw species breeds with a 'Blue and Gold' macaw species.

Most Catalina macaws are infertile.

However, there are now some Catalina macaws that can breed together and produce new Catalina macaws.

Explain why this has caused problems in classifying the Catalina macaw.

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

(c) **(i)** Natural selection can help explain how species evolve.

When Charles Darwin suggested his ideas about evolution by natural selection, some people were against his theory.

Explain why.

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

(ii) Natural selection is now widely accepted as a theory about evolution.

Explain why.

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

6 (a) Scientists have been trying to estimate the number of different species there are on the Earth.

First they counted the number of species that have already been discovered and named.

Then they used several ways to estimate the number of species that might actually exist.

The table shows their results.

Kingdom	Number of species already discovered and named in thousands	Number of species estimated to exist in thousands
animals	953	7770
plants	216	298
fungi	43	611
protoctists (mostly single-celled)	21	64
prokaryotes (no nucleus in cells)	11	10
Total	**1244**	**8753**

(i) Which kingdom has the smallest percentage of species that have already been discovered?

Calculate this percentage.

kingdom .....

percentage of species that have already been discovered ..... %

[2]

(ii) Look at the results for prokaryotes.

Prokaryotes include microscopic organisms such as bacteria.

More species of prokaryotes have been discovered and named than scientists have estimated to exist.

One reason is that the estimate might be incorrect.

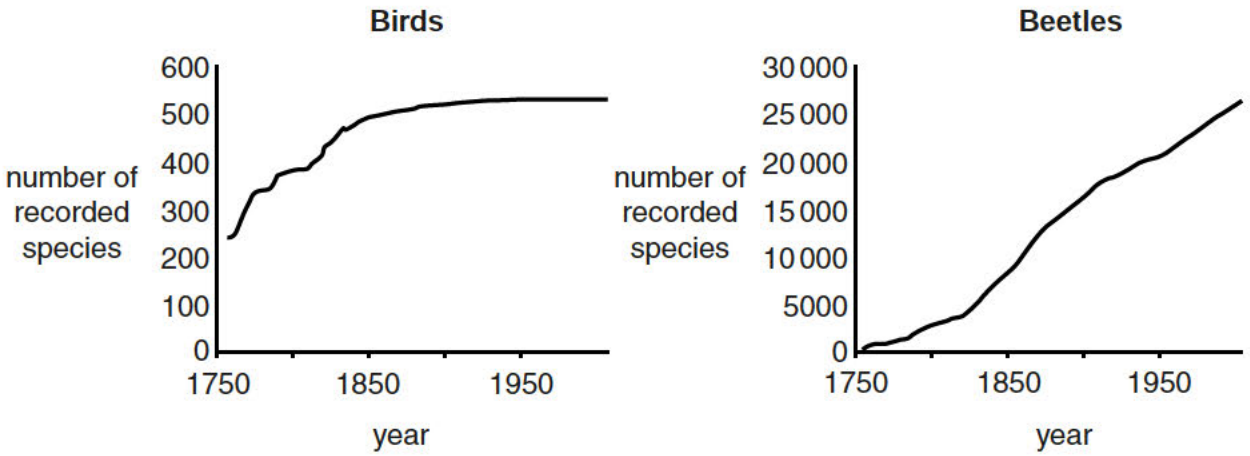
Suggest **one other** reason why.

.....

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

(b) The number of species already discovered increases as time goes on.

The graphs show the number of species of birds and beetles recorded in Europe since 1750.



Look at the two graphs.

Suggest **why** the graph for birds is **different** from the graph for beetles.

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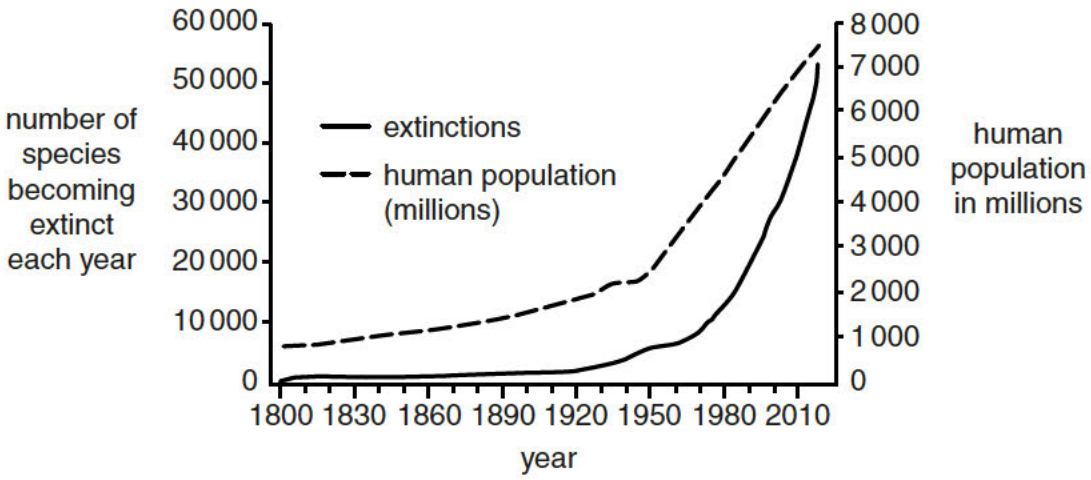
..... **[2]**

(c) Look at the graph.

It came from a website that is trying to stop species becoming extinct.

The graph shows the human population over the last 200 years.

It also shows the number of species that has become extinct each year.



(i) Does the graph **prove** that humans are causing species to become extinct?

Explain your answer.

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

(ii) Suggest why the person who drew the graph chose the two vertical scales as they are.

Explain your answer.

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

(iii) Other evidence could support the idea that humans are causing species to become extinct.

Suggest one piece of extra evidence that could support this idea.

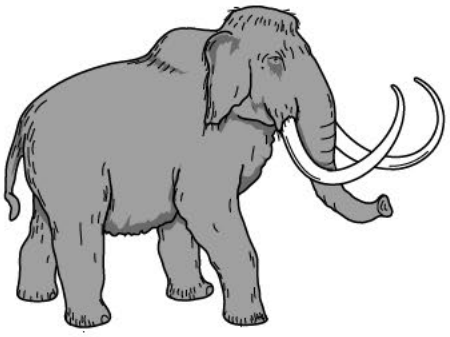
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[Total: 10]

7 Read this article about mammoths.



Mammoths were large elephant-like animals that are now extinct.
The bodies of more and more mammoths are being found preserved in ice.
This is because the global temperature is increasing. This is melting the ice caps.

Some people suggest using mammoth tusks instead of elephant tusks as a source of ivory. They hope that this will stop elephants from becoming extinct.
However, they know that this is not a long term solution because this source of ivory is not sustainable.

(a) Mammoths are now extinct.

Some people are worried that elephants in Africa might become extinct.

(i) Suggest **one** way that preventing the extinction of elephants could **benefit** people that live in Africa.

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

(ii) Some scientists say that the idea of using mammoth ivory instead of elephant ivory may help elephant conservation.

Suggest why this idea may help.

.....

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

(b) The increase in global temperature is melting ice and exposing the dead mammoths.

Many people think that the increase in global temperature is due to increased carbon dioxide levels in the atmosphere.

Explain how increased carbon dioxide levels could lead to global warming.

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

(c) Mammoths and elephants are thought to have descended from common ancestors.

Elephants have much less hair on their bodies than mammoths did.

A scientist called Lamarck had a theory that could explain why mammoths had long hair.

Lamarck's explanation: Mammoths lived in cold climates.

This made their hair grow longer to keep them warm.

This characteristic was passed on to their offspring.

Over many generations the mammoths developed long hair.

(i) Lamarck's explanation is now thought to be incorrect.

Explain why it is thought to be incorrect.

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..... [2]

(ii) About fifty years after Lamarck put forward his theory, Charles Darwin suggested an alternative theory called natural selection.

How would Charles Darwin's theory explain the long hair of mammoths?

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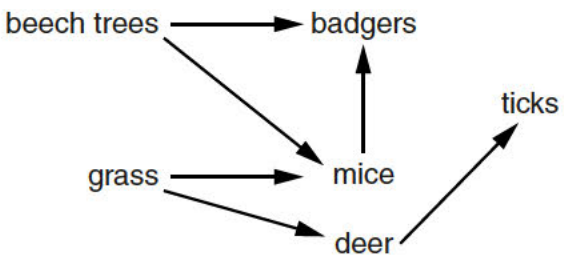
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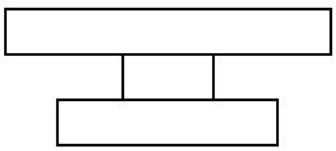
[Total: 9]

8 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.

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

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

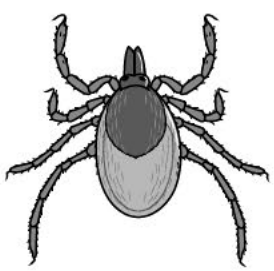
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..... **[2]**

(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.

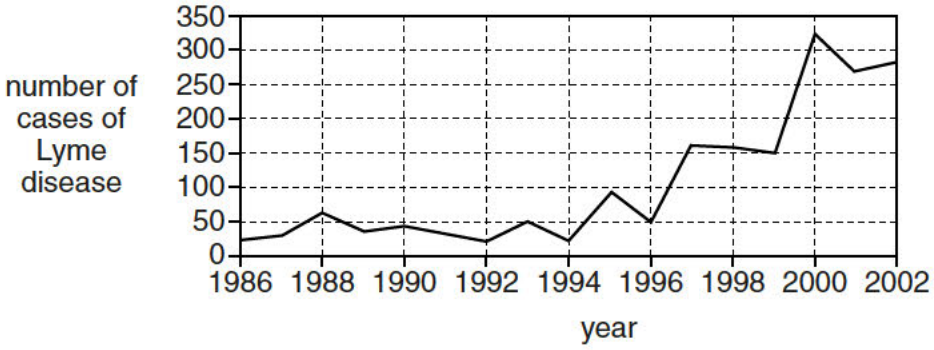
If people are bitten by ticks they can get a disease called Lyme disease.

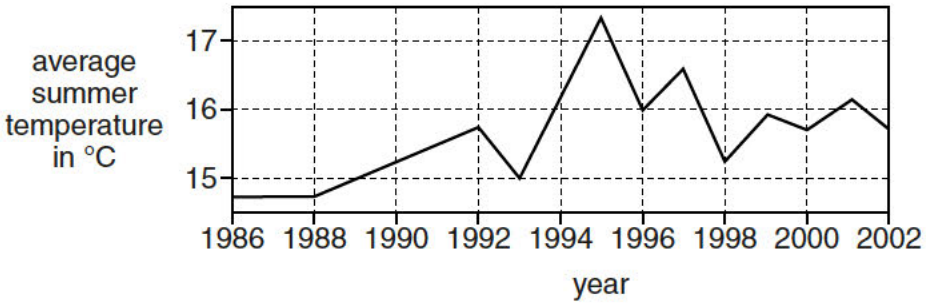
The number of people getting Lyme disease seems to be increasing.

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.

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

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

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

[Total: 7]