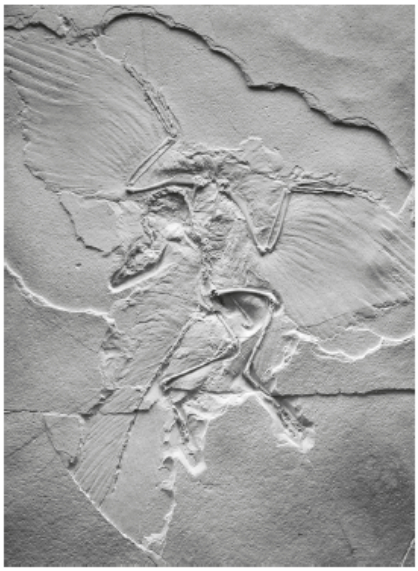
Life on Earth – past, present and future – 2021/20 GCSE 21st Biology Combined Science B

1. Nov 2021/Paper_J260/01/No.6

The drawing shows an *Archaeopteryx* fossil.



Archaeopteryx lived at the same time as therapod dinosaurs.

Archaeopteryx fossils have features in common with therapod dinosaurs and modern birds. Some common features are shown in the table.

Feature	Therapod dinosaurs	*Archaeopteryx* fossils	Modern birds
Beak		✓	✓
Feathers		✓	✓
Long bony tail	✓	✓	
Teeth	✓	✓	
Wing		✓	✓

(a) How many features do therapod dinosaurs and *Archaeopteryx* fossils have in common?

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

(b) (i) Suggest why some scientists think *Archaeopteryx* was the first modern bird.

Use information from the table to support your answer.

.....

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

(ii) Suggest why other scientists looking at the same evidence disagree.

.....

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

(c) Fossils are used as evidence of evolution. Scientists collect fossils to show how a species has changed over time.

What are the limitations of using fossils as evidence of evolution of a species?

Tick (✓) **one** box.

Fossils are very old. ☐

It is easy to break fossils. ☐

There are periods of time for which we have no fossils. ☐

[1]

(d) Name **one** modern source of evidence used to help classify organisms.

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

2. Nov 2021/Paper_J260/01/No.7

In 2016 a scientist collected a sample of mosquitoes which were found in underground tunnels in London. She found that underground mosquitoes were different to mosquitoes found above ground.

Underground mosquitoes feed on mammals and do not hibernate, but those that live above ground feed on birds and hibernate in the winter. The two groups of mosquitoes can no longer breed with each other.

(a) Which piece of evidence shows that the two groups of mosquitoes are different species?

Tick (✓) **one** box.

Underground mosquitoes bite mammals. ☐

Underground mosquitoes can no longer breed with above-ground mosquitoes. ☐

Underground mosquitoes do not hibernate. ☐

Underground mosquitoes have been sealed under-ground for over 100 years. ☐

[1]

(b) The statements describe the steps in natural selection that caused underground mosquitoes to evolve. The statements are **not** in the correct order.

Write a number from **1–5** in each box to give the correct order for the steps in natural selection.

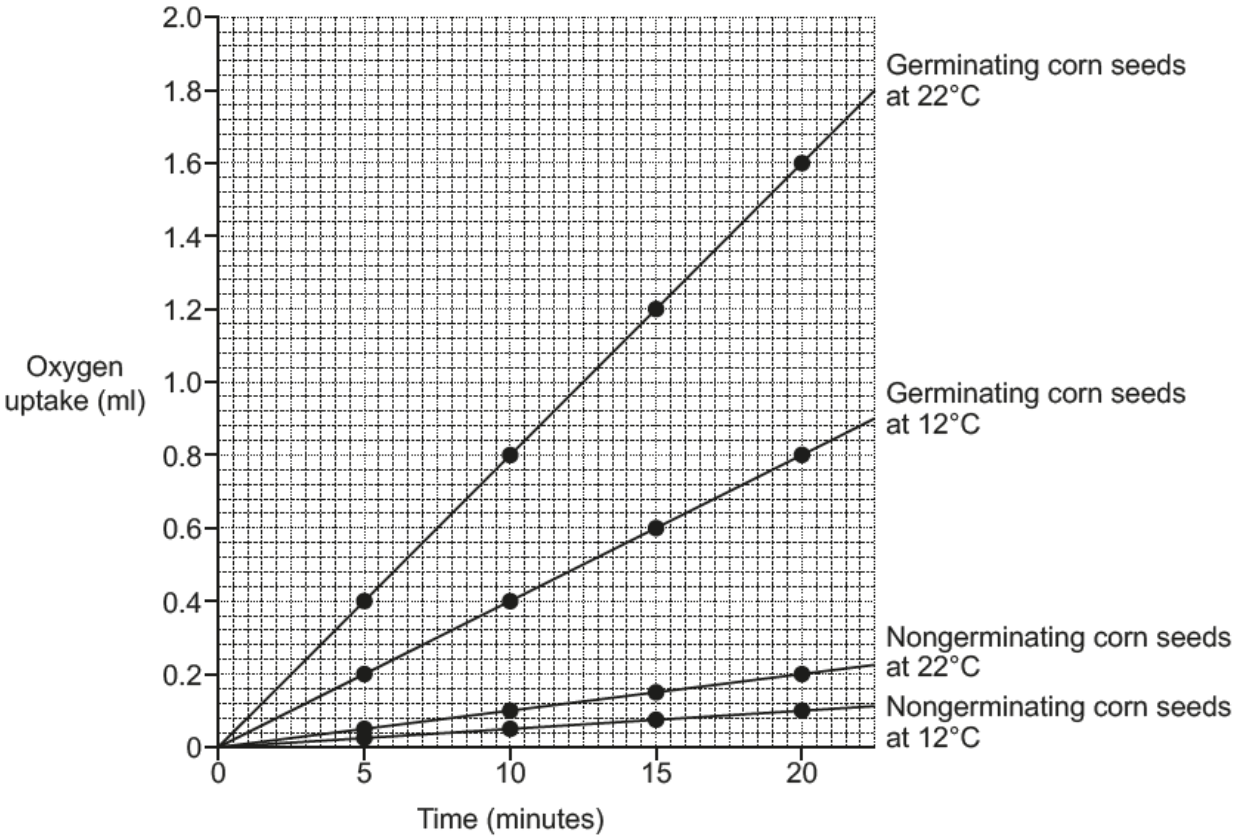
One has been done for you.

	The individual mosquitoes trapped underground had different characteristics.
	Mosquitoes that could feed on mammals were more likely to survive.
2	There was a limited supply of food types underground, so the trapped mosquitoes had to compete.
	Over a long period of time the characteristics of the underground mosquito population changed.
	The mosquitoes that survived could breed and pass on their alleles.

[3]

3. Nov 2021/Paper_J260/01/No.9

The graph shows results from an investigation into the effect of temperature on the volume of oxygen taken up by germinating and nongerminating corn seeds.



(a) How much oxygen has been taken up by germinating corn seeds after 15 minutes at 22 °C?

Oxygen uptake = ... ml **[1]**

(b) Some of the oxygen that the germinating corn seeds take up is **not** used for germination.

Explain how we know this from the graph.

.....

.....

.....

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

(c) After 5 minutes, germinating corn seeds at 12 °C have taken up 0.2 ml of oxygen.

Calculate the rate of oxygen uptake by germinating corn seeds at 12 °C.

Use the equation: rate of oxygen uptake = $\frac{\text{oxygen uptake}}{\text{number of minutes}}$

Rate of oxygen uptake = ... ml/min **[1]**

(d) Which equation represents the linear relationships shown in the graph?

Tick (✓) **one** box

$y = mx + c$ ☐

$y = mc + x$ ☐

$y = m + cx$ ☐

[1]

4. Nov 2021/Paper_J260/04/No.6

The Amazon rainforest is an area of very high biodiversity.

The table shows data on **four** species groups found in the Amazon rainforest.

	Number of different species in different areas	
Species groups	**Rainforest with no human activity**	**Rainforest that has been deforested**
Mammals	667	12
Birds	1604	30
Reptiles	749	8
Plants	30 000	20

(a)* Explain the effect of human activity on species found in the Amazon rainforest.

Use data in the table to support your answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

(b) Which **two** statements are benefits of maintaining biodiversity in the Amazon rainforest?

Tick (✓) **two** boxes.

It prevents rainforest species from becoming extinct.	☐
More wood can be cut down and sold to other countries.	☐
The rainforest ecosystem is less resistant to change.	☐
More of the rainforest is available for farming.	☐
Rainforest plants could be a source of new medicines.	☐

[2]

5. Nov 2021/Paper_J260/04/No.8

Beth plans an investigation to help her estimate the population of buttercup plants in her garden.

(a) This is part of Beth's method:

1. Divide the garden into four equal sections.
2. Count the number of buttercup plants in the section that has the most buttercup plants.
3. Multiply the number of buttercup plants counted by four.

Describe how Beth could improve her method.

.....

.....

.....

.....

.....

.....

.....

.....

[4]

(b) Beth thinks three factors are having an effect on the growth of buttercup plants in her garden.

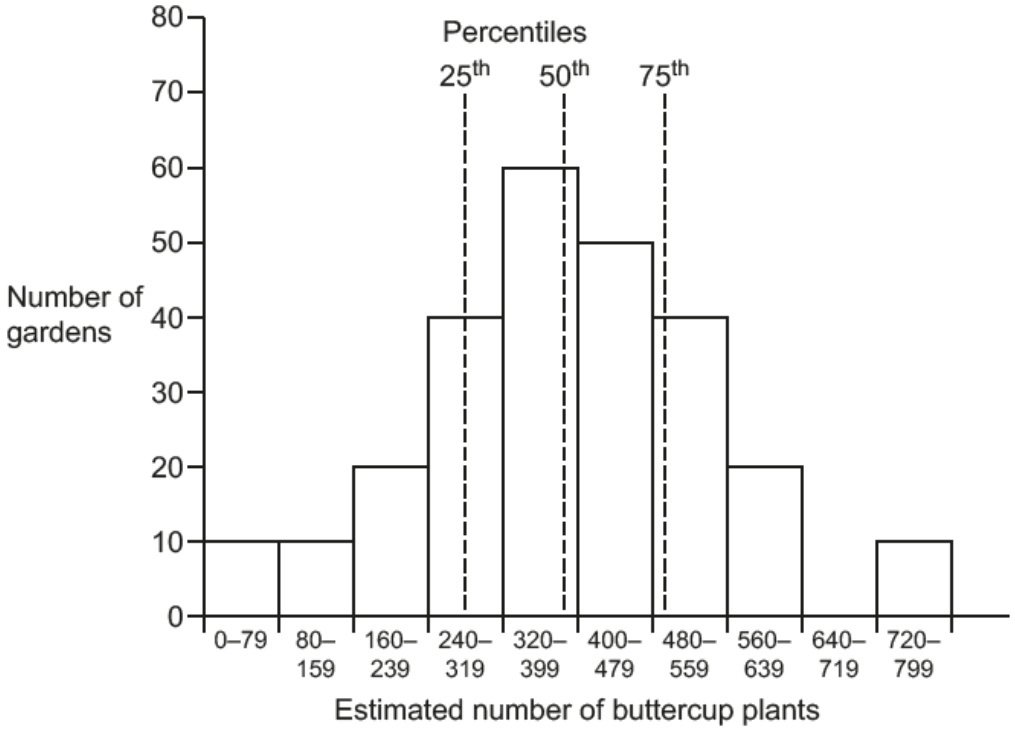
Draw lines to connect each factor with the correct explanation of its effect on buttercup plants.

Factor	**Explanation of its effect on buttercup plants**
Shade from trees	Less sunlight is available for photosynthesis
Waterlogged soil	Fewer leaves to absorb light
More slugs to eat plants	Less oxygen is available for respiration in root cells

[2]

(c) A group of students plot the estimated number of buttercup plants in their gardens.

The graph shows the students' results.



(i) How many gardens are sampled to produce the graph?

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

(ii) Kai estimates that he has 450 buttercup plants in his garden.

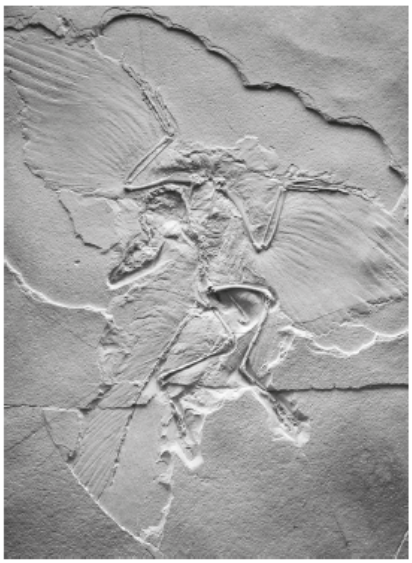
Which percentile of the students' data does Kai's estimation lie below?

Put a (ring) around the correct answer.

25th **50th** **75th** **[1]**

6. Nov 2021/Paper_J260/05/No.4

The drawing shows an *Archaeopteryx* fossil.



Archaeopteryx lived at the same time as therapod dinosaurs.

Archaeopteryx fossils have features in common with therapod dinosaurs and modern birds. Some common features are shown in the table.

Feature	Therapod dinosaurs	*Archaeopteryx fossils*	Modern birds
Beak		✓	✓
Feathers		✓	✓
Long bony tail	✓	✓	
Teeth	✓	✓	
Wing		✓	✓
Wishbone		✓	✓

(a) Scientists think *Archaeopteryx* fossils provide evidence of evolution.

Describe the evidence from the table which supports the theory that *Archaeopteryx* was the **first modern bird**.

.....

.....

.....

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

(b) No *Archaeopteryx* fossil DNA has been found.

Describe how DNA would help scientists to decide if the *Archaeopteryx* fossil was a bird or is a missing link between therapod dinosaurs and modern birds.

.....

.....

.....

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

7. Nov 2021/Paper_J260/05/No.6

A student is reading an article on evolution.

Evolution underground

In 1860 many underground tunnels were dug beneath London. Some *Culex pipiens* mosquitoes were trapped in these underground tunnels and for over 120 years the mosquitoes had no contact with any other mosquitoes.

In 2016 a scientist collected samples of mosquitoes which were found in the tunnels. She found that they had changed.

Underground mosquitoes feed on mammals; they also do not hibernate. Mosquitoes that live above ground feed on birds and hibernate in the winter. The two groups of mosquitoes can no longer breed with each other.

Explain how the new species of underground mosquito evolved.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

8. Nov 2021/Paper_J260/08/No.1

Beth plans an investigation to help her estimate the population of buttercup plants in her garden.

(a) This is part of Beth's method:

1. Divide the garden into four equal sections.
2. Count the number of buttercup plants in the section that has the most buttercup plants.
3. Multiply the number of buttercup plants counted by four.

Describe how Beth could improve her method.

.....

.....

.....

.....

.....

.....

.....

.....

[4]

(b) Beth thinks three factors are having an effect on the growth of buttercup plants in her garden.

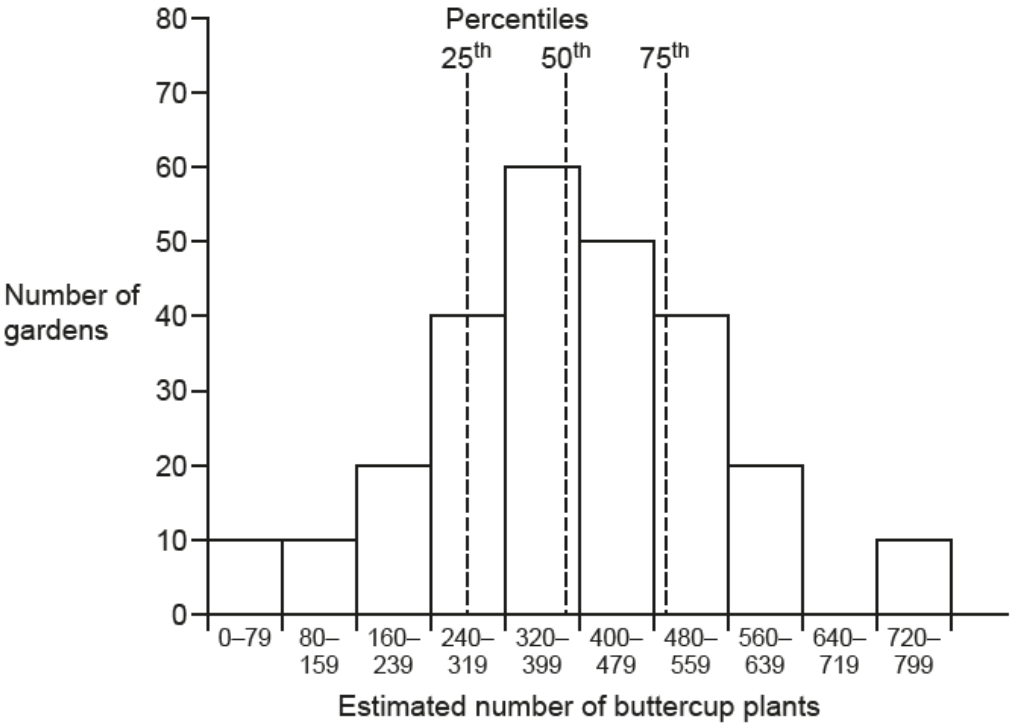
Draw lines to connect each factor with the correct explanation of its effect on buttercup plants.

Factor	**Explanation of its effect on buttercup plants**
Shade from trees	Less sunlight is available for photosynthesis
Waterlogged soil	Fewer leaves to absorb light
More slugs to eat plants	Less oxygen is available for respiration in root cells

[2]

(c) A group of students plot the estimated number of buttercup plants in their gardens.

The graph shows the students' results.



(i) How many gardens are sampled to produce the graph?

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

(ii) Kai estimates that he has 450 buttercup plants in his garden.

Which percentile of the students' data does Kai's estimation lie below?

Put a (ring) around the correct answer.

25th **50th** **75th** **[1]**

9. Nov 2020/Paper_J260/05/No.5

Coal tits are the smallest of several different species of tit that are found on mainland Sweden. They feed on insects and seeds.

The coal tits found on an isolated island are bigger than the coal tits found on mainland Sweden, as shown in **Fig. 5.1**. Coal tits are the only species of tits living on the isolated island.

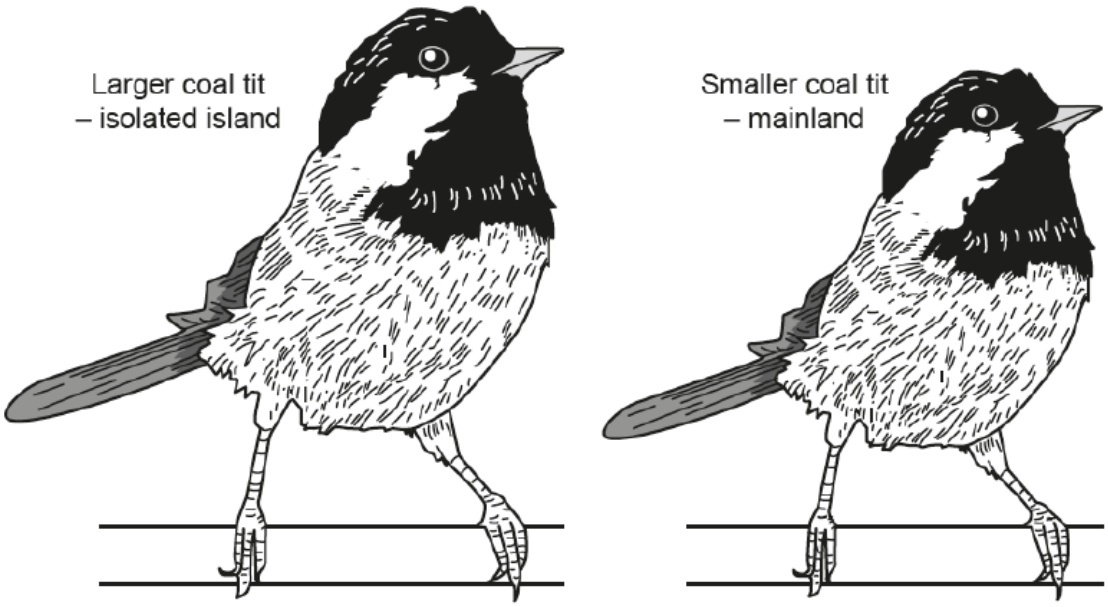


Fig. 5.1

(a) The mean length of coal tits found on the mainland is 95 mm. On the isolated island, the mean length of coal tits found is 115 mm.

Calculate the percentage increase in the mean length of coal tits that are found on the isolated island, compared to the mainland.

Give your answer to **2** significant figures.

$$\text{Percentage increase} = \frac{\text{change}}{\text{original}} \times 100$$

Percentage increase = ... %

[3]

(b) Scientists think that the increase in size is an example of natural selection.

Explain why coal tits found on the isolated island are bigger than coal tits found on the mainland.

Use ideas about natural selection in your answer.

.....

.....

.....

.....

.....

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

(c) The scientists make a hypothesis that the increase in size on the isolated island is due to a genetic change.

To test their hypothesis, they swap eggs from coal tit nests found on the island and the mainland.

(i) Predict the outcome of the scientist's experiment, based on their hypothesis.

.....

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

(ii) Explain your answer to **(c)(i)**.

.....

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

10. Nov 2020/Paper_J260/05/No.20

Homo sapiens, modern humans, evolved from *homo erectus*, upright humans.

Fig. 10.1 shows two models, **Model A** and **Model B** from a 2008 scientific paper, to try and explain the evolution of modern humans from upright man.

The curved arrows in **Fig. 10.1** represent human migration from Africa, to Europe, and Asia.

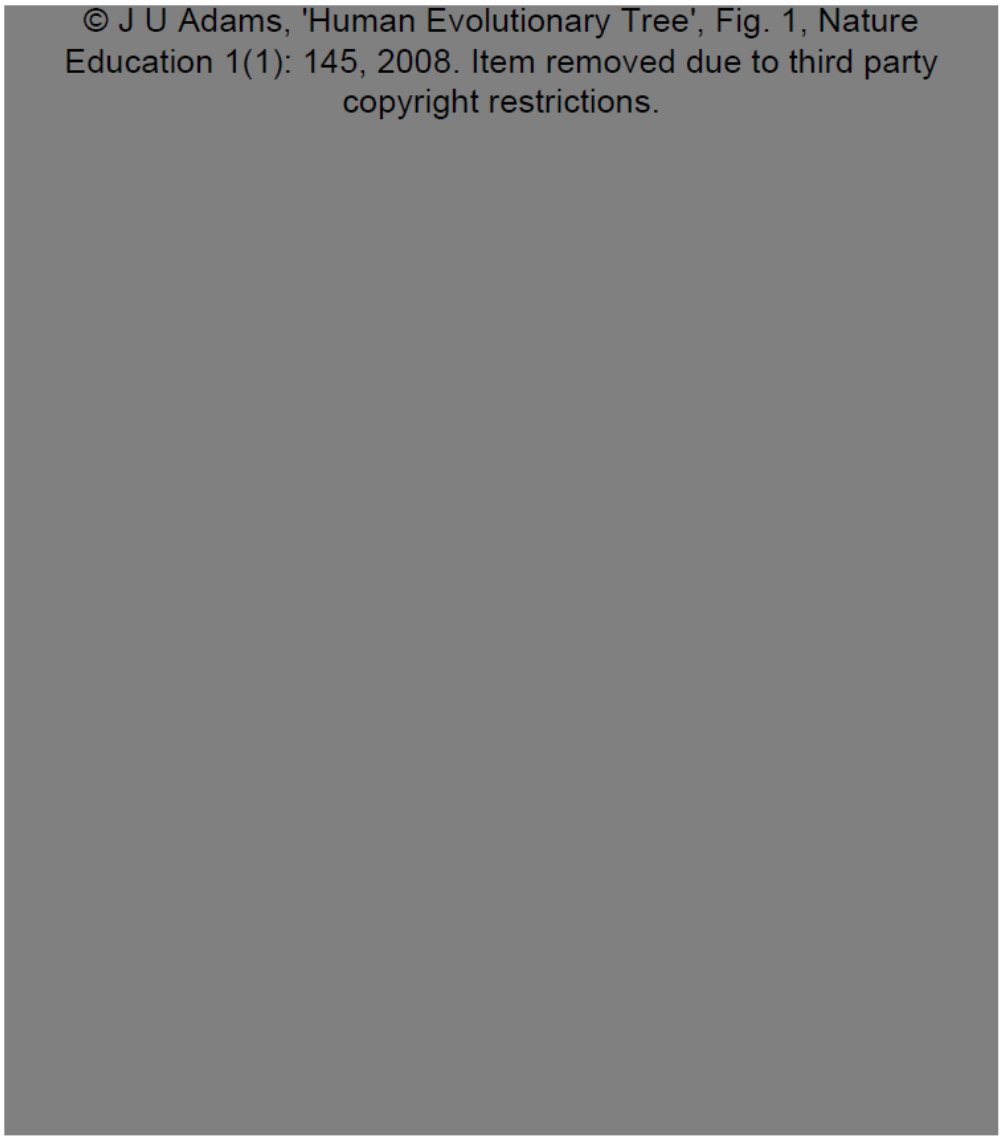


Fig. 10.1

(a) Complete **Table 10.1** to identify what is shown by each model.

Tick (✓) **at least one** box in each row.

Statement	Model A	Model B
Upright humans and modern humans both evolved in Africa.		
Modern humans evolved separately and continuously in three continents.		
Modern humans migrated out of Africa 100 000 years ago.		

Table 10.1

[3]

(b) Since 2008, more human fossils have been found and advances in technology have provided DNA evidence.

Complete **Table 10.2** by deciding if each new piece of evidence is supported by each model.

Use **Fig. 10.1** to help you.

Tick (✓) **at least one** box in each row.

New evidence	Model A	Model B
A modern human fossil dated as 200 000 years old has been found outside of Africa.		
About 2% of the DNA found in modern humans living in Europe is from modern humans who lived in Europe more than 100 000 years ago.		
Mitochondrial DNA suggests that all modern humans share a single African female common ancestor who lived 200 000 years ago.		

Table 10.2

[3]

(c) In 2008 most scientists accepted **Model A**.

Suggest why many scientists today still accept **Model A**.

.....

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