

GCSE Biology

Worksheet: Speciation

TIME 35 min	TOTAL 32 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Speciation

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

The statements describe how a new species can form. They are in the wrong order.

A The two populations become so different that they can no longer interbreed to produce fertile offspring.

B A population of one species is split into two by a barrier, such as a mountain range.

C In each population, individuals with the characteristics best suited to the conditions survive and breed.

D Conditions on the two sides of the barrier are different.

E Different alleles become more common in each population.

0 1 . 1

Put the statements in the correct order. Statement **B** has been done for you.

B → → → →

.....

.....

.....

.....

[2 marks]

0 1 . 2

Give **two** examples of barriers, other than a mountain range, that could split a population of land animals into two.

[2 marks]

0 1 . 3

Which scientist is best known for his pioneering work on speciation and on warning colouration in animals?

Tick (✓) **one** box.

Charles Darwin

☐

Jean-Baptiste Lamarck

☐

Gregor Mendel

☐

Alfred Russel Wallace

☐

[1 mark]

0 2

Alfred Russel Wallace was a scientist who worked at the same time as Charles Darwin.

0 2 . 1

Wallace independently proposed a scientific theory.

Which theory?

Tick (✓) **one** box.

The gene theory

☐

The theory of evolution by natural selection

☐

The theory that characteristics gained during life are inherited

☐

The three-domain system of classification

☐

[1 mark]

0 2 . 2

Wallace is best known for his theory of speciation and for his work on one other topic.

What was the other topic?

Tick (✓) **one** box.

Antibiotic resistance in bacteria

☐

The structure of DNA

☐

Naming organisms using two names

☐

Warning colouration in animals

☐

[1 mark]

0 2 . 3

In 1858 Wallace and Darwin published joint writings.

What did this prompt Darwin to do the following year?

.....

.....

[1 mark]

0 2 . 4

Speciation is the formation of new species.

What is a species?

.....

.....

[1 mark]

.....

0 3

Two populations of shrews live in two mountain valleys. They became separated when glaciers filled the pass between the valleys.

Scientists compared the base sequence of one gene in the two populations. Mutations build up in this gene at a steady rate. For every million years that two populations are separated, their base sequences become about 1.5% more different.

The base sequences of the two populations differ by 6%.

0 3 . 1

Estimate how many million years ago the two populations became separated.

.....

.....

.....

.....

Time = million years

[2 marks]

0 3 . 2

Scientists found that shrews from the two populations can no longer interbreed to produce fertile offspring.

What does this show about the two populations?

.....

.....

.....

.....
[1 mark]

0 4

A species of small mouse lived across a large area of grassland. A wide river changed its course and split the population into two. The mice cannot cross the river.

Over thousands of years the conditions on the two sides of the river became different. On one side the grass became taller and denser. On the other side the land became drier, with sandy soil.

0 4 . 1

The two populations of mice may eventually become two different species. Describe how.

[4 marks]

0 4 . 2

Scientists want to find out whether the two populations have become different species.

Describe how they could do this.

[2 marks]

0 4 . 3

Suggest **one** characteristic that might be selected for in the population on the dry, sandy side of the river.

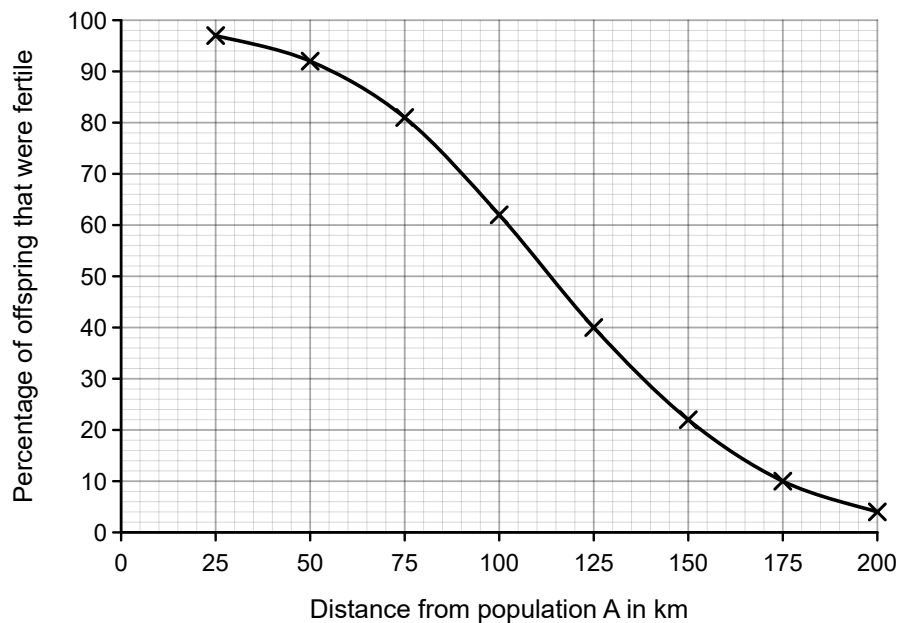
[1 mark]

0 5

A species of land snail lives in a chain of populations along a valley that is 200 km long. Scientists crossed snails from population A, at one end of the valley, with snails from populations at different distances from A. They recorded the percentage of the offspring that were fertile.

Figure 1 shows the results.

Figure 1



0 5 . 1

Describe the relationship shown in Figure 1.

.....

.....

.....

.....

[2 marks]

0 5 . 2

The scientists decided to treat two populations as separate species if 10% or fewer of their offspring are fertile.
Use Figure 1 to find the smallest distance from A at which a population would be treated as a separate species.

.....

.....

.....

Distance = km

[1 mark]

0 5 . 3

Suggest why snails from populations that are further apart produce fewer fertile offspring.

.....

.....

.....

.....

[2 marks]

0 5 . 4

A student said: ‘The population 200 km from A is definitely a different species from population A.’
Evaluate this statement.

.....

.....

.....

.....

[2 marks]

0 6

Two populations of snails live in two lakes. They became separated when the water level fell and a large lake split into two.

Scientists compared the base sequence of one gene in the two populations. Mutations build up in this gene at a steady rate. For every million years that two populations are separated, their base sequences become about 1.5% more different.

The base sequences of the two populations differ by 12%.

0 6 . 1

Estimate how many million years ago the two populations became separated.

.....

.....

.....

.....

Time = million years

[2 marks]

0 6 . 2

Scientists found that snails from the two populations can no longer interbreed to produce fertile offspring.

What does this show about the two populations?

.....

.....

.....

.....
[1 mark]

0 7

Two populations of beetles live in two cave systems. They became separated when a river cut a deep valley between the caves.

Scientists compared the base sequence of one gene in the two populations. Mutations build up in this gene at a steady rate. For every million years that two populations are separated, their base sequences become about 1% more different.

The base sequences of the two populations differ by 8%.

0 7 . 1 Estimate how many million years ago the two populations became separated.

.....

.....

.....

.....

Time = million years

[2 marks]

0 7 . 2 Scientists found that beetles from the two populations can no longer interbreed to produce fertile offspring.
What does this show about the two populations?

.....

.....

.....

.....

[1 mark]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Biology · Worksheet: Speciation · 32 marks

Question 1 (5 marks)

01.1 [2 marks]

Answer: B, D, C, E, A

- two of D, C, E and A in the correct positions (1)
- all correct: B, D, C, E, A (1)

Notes: B, D, C, E, A scores 2 marks.

01.2 [2 marks]

- a river (1)
- a sea / an ocean / a stretch of water (1)
- a desert (1)
- a canyon / a gorge (1)
- a human-made barrier, e.g. a motorway, a city or farmland (1)

Any 2 of the points above.

01.3 [1 mark]

Correct: Alfred Russel Wallace

Question 2 (4 marks)

02.1 [1 mark]

Correct: The theory of evolution by natural selection

02.2 [1 mark]

Correct: Warning colouration in animals

02.3 [1 mark]

Answer: Publish *On the Origin of Species* (1859)

- publish (the book) *On the Origin of Species* / publish his theory (1)
-

02.4 [1 mark]

Answer: A group of organisms that can breed together to produce fertile offspring

- a group of organisms that can (inter)breed to produce fertile offspring (1)

Notes: 'Fertile' is required.

Question 3 (3 marks)

03.1 [2 marks]

Answer: 4 million years

- $6 \div 1.5$ (1)
 - 4 (million years) (1)
-

03.2 [1 mark]

Answer: They are different species

- they are now two different species (1)
-

Question 4 (7 marks)

04.1 [4 marks]

- the populations are isolated (by the river) / cannot interbreed (1)
- there is (genetic) variation in each population / mutations occur in each population (1)
- the conditions / environments on the two sides are different (1)
- natural selection: in each population the individuals with the most suitable characteristics survive and breed (1)
- different alleles are passed on / become more common in each population (1)
- (eventually) the populations become so different that they can no longer interbreed to produce fertile offspring (1)

Any 4 of the points above.

04.2 [2 marks]

- breed a mouse from one population with a mouse from the other population (1)
- find out whether the offspring are fertile / can breed (if they are not, the populations are different species) (1)

04.3 [1 mark]

- sandy / pale fur (for camouflage) (1)
- ability to survive with less water / produce concentrated urine (1)
- strong claws / legs for digging burrows in sandy soil (1)

Any 1 of the points above.

Notes: Allow any sensible characteristic linked to dry or sandy conditions.

Question 5 (7 marks)

05.1 [2 marks]

- as the distance increases, the percentage of fertile offspring decreases (1)
- use of data, e.g. 97% at 25 km and 4% at 200 km / the decrease is steepest between about 75 km and 150 km (1)

05.2 [1 mark]

Answer: 175 km

- 175 (km) (1)

Notes: Allow 170–180.

05.3 [2 marks]

- snails that live far apart do not interbreed / are isolated from each other (snails cannot travel that far) (1)
- (so) more genetic differences have built up between them, by mutation and by natural selection in different conditions (1)

05.4 [2 marks]

- 4% of the offspring were fertile, so the two populations can still produce some fertile offspring (1)
- so by the definition of a species they are not completely separate species / speciation is not complete (1)
- but 4% is below the scientists' 10% limit, so by their rule it would be treated as a separate species (1)
- the 10% limit was chosen by the scientists, so the decision depends on the rule used (1)

Any 2 of the points above.

Question 6 (3 marks)

06.1 [2 marks]

Answer: 8 million years

- $12 \div 1.5$ (1)
- 8 (million years) (1)

06.2 [1 mark]

Answer: They are different species

- they are now two different species (1)
-

Question 7 (3 marks)

07.1 [2 marks]

Answer: 8 million years

- $8 \div 1$ (1)
 - 8 (million years) (1)
-

07.2 [1 mark]

Answer: They are different species

- they are now two different species (1)
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