

# 17.3 Evolution

## Question Paper

Course	CIE A Level Biology
Section	17. Selection & Evolution
Topic	17.3 Evolution
Difficulty	Medium

**Time allowed:** 40  
**Score:** /32  
**Percentage:** /100

**Question 1a**

Baleen whales have baleen plates in their mouths made of keratin, with which they filter plankton out of the water. The DNA of several species of baleen whale were analysed and used to compile a phylogenetic tree to show the evolutionary relationship between them.

Fig. 1 shows the phylogenetic tree compiled from the DNA analysis of baleen whales.

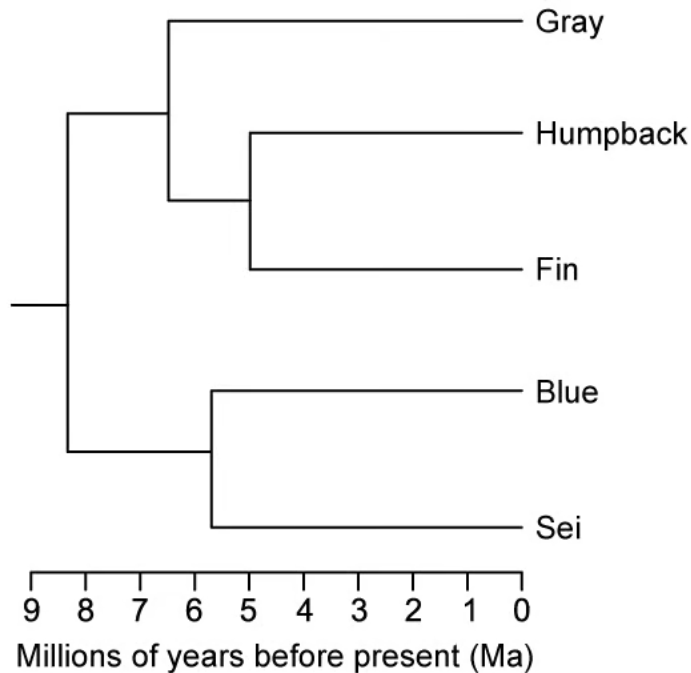


Fig. 1

(i)  
State the species of baleen whale that are genetically most similar.

[1]

(ii)  
Give a reason for your answer to part i)

[1]

[2 marks]

**Question 1b**

All species of baleen whale evolved from a common ancestor that had teeth.

Outline how the process of natural selection leads to evolution.

[5 marks]

**Question 1c**

When compiling phylogenetic trees, such as the one in Fig. 1, scientists will often analyse the mitochondrial DNA of organisms.

Explain the benefit of analysing mitochondrial DNA.

[2 marks]

**Question 1d**

State **one** process, **other than** natural selection, that can lead to evolution.

[1 mark]

## Question 2a

Renosterveld is a type of vegetation found within South Africa's Cape Floristic Region. Renosterveld is characterised by a variety of species of shrubs and grasses that grow in relatively fertile soil and which make the areas where they grow popular for cultivating crops such as wheat. Renosterveld is home to the endangered geometric tortoise, *Psammobates geometricus*, which survives in remaining pockets of natural vegetation.

Fig. 1 shows an example of a geometric tortoise.

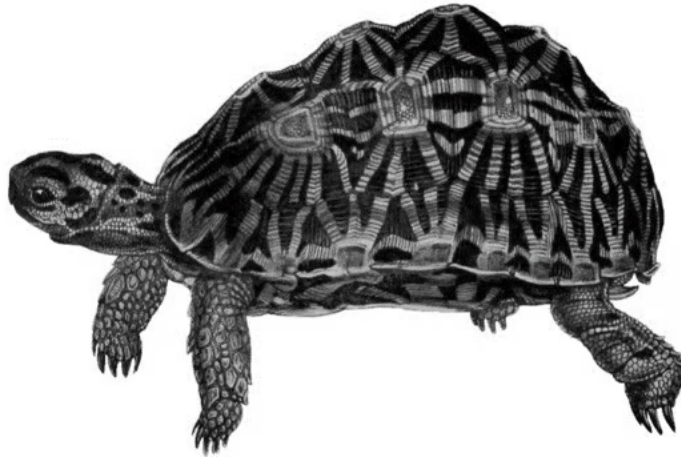


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**Fig. 1**

Explain how the cultivation of crops could result in speciation within a population of geometric tortoises over time.

**[5 marks]**

### Question 2b

Scientists investigated one of these tortoise populations and discovered that most individuals were either very large or very small. Very small individuals were able to hide under shrubs from aerial predators such as peregrine falcons, *Falco peregrinus*, while large individuals had large shells, making it difficult for aerial predators to get a secure grip on them.

(i)

Identify the type of selection that is taking place in this population.

[1]

(ii)

Give a reason for your answer.

[1]

[2 marks]

### Question 2c

A large fire swept through the habitat of the tortoise population, destroying all the vegetation. Only fifteen tortoises of the original population survived the fire. They were rescued by volunteers at a reptile sanctuary and released into a small nature reserve where no other geometric tortoises were present. All fifteen tortoises displayed a large phenotype.

Explain the effect that this event would have on the new nature reserve tortoise population.

[3 marks]

### Question 2d

The allele for large body size (L) is dominant over the allele for small body size (l) in the geometric tortoise.

Explain why there may still be tortoises with small body size appearing in future generations of the nature reserve population that was rescued from the fire.

[2 marks]

### Question 3a

Mining for gold produces waste material which contains sulfur-bearing minerals. When surface water and shallow groundwater come into contact with these minerals a chemical reaction occurs which produces sulfuric acid. This process is known as acid mine drainage and it can lower the soil pH to a level where very few plants can survive.

Environmentalists studied the area around an abandoned gold mine and discovered a few earleaf acacia, *Acacia auriculiformis*, individuals surviving in the acidic soil. *A. auriculiformis* typically occurs in more neutral or alkaline soils.

Explain how natural selection could produce a population of *A. auriculiformis* that would be tolerant to the acidic soil found around the mine shaft.

**[4 marks]**

**Question 3b**

*A. auriculiformis* typically flowers from April to July in its native habitat. Ecologists studied the flowering time of the population of *A. auriculiformis* that are tolerant to low soil pH and compared it to the flowering time of a population growing in the surrounding habitat which was not tolerant to low soil pH. They measured the density of flowers found on the trees over a period of 180 days from 20 April.

Fig. 1 shows the results of this study.

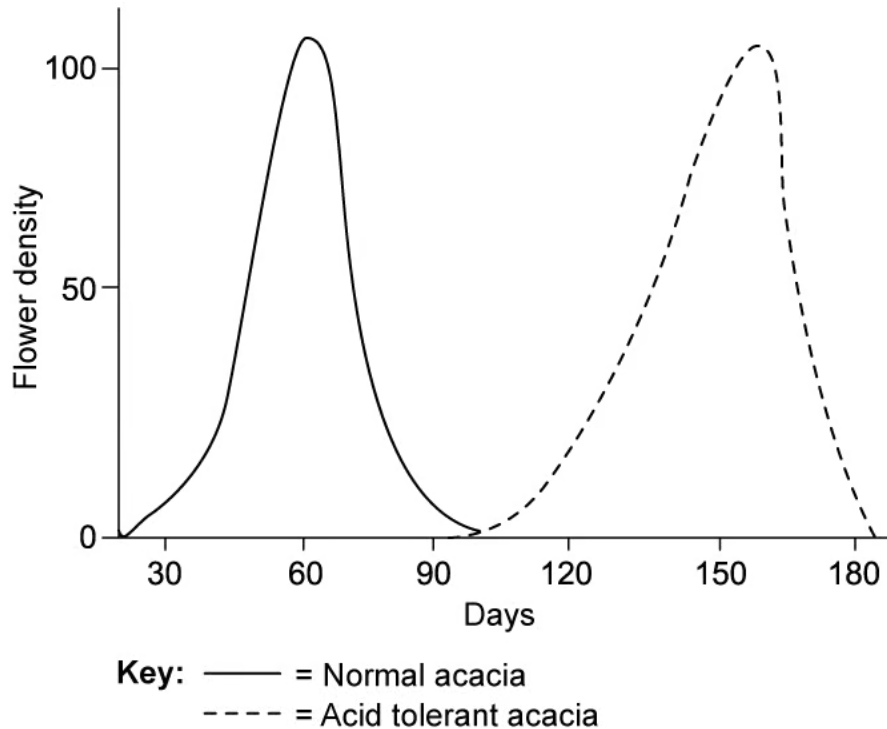


Fig. 1

Describe the flowering times of normal and acid-tolerant *A. auriculiformes*.

[1 mark]

**Question 3c**

Describe how the results shown in Fig. 1 could lead to the development of a new species of acacia.

[3 marks]

**Question 3d**

The change in soil pH can lead to the formation of a new species over time.

Define the term 'species'.

[2 marks]