



A-Level Biology

Evolution and Speciation

Question Paper

Time available: 53 minutes

Marks available: 42 marks

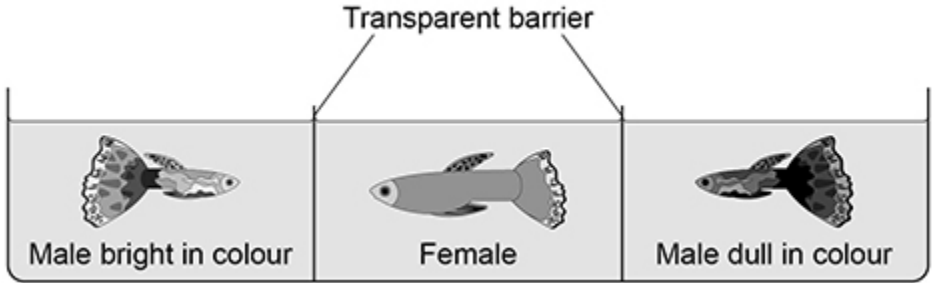
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1.

Guppies are small fish. Female guppies are dull in colour. Male guppies can be bright or dull in colour.

Scientists investigated the effect of female brain size on choosing a mate. They used laboratory-bred female guppies with large brains and with small brains.

They set up a fish tank as shown in the diagram below.



They observed each female for 10 minutes and recorded which male they were attracted towards. They repeated this with 45 large-brained females and 45 small-brained females.

(a) Suggest **three** possible limitations of this investigation.

- 1 _____

- 2 _____

- 3 _____

(3)

Guppies with large brains are better at identifying predators.

The scientists found that **only** female guppies with large brains were attracted to male guppies bright in colour.

(b) Suggest and explain the advantage of this behaviour to the population of guppies.

(3)

(c) Describe how the behaviour of female guppies could result in sympatric speciation.

(3)

(Total 9 marks)

2.

(a) What is a gene pool?

(1)

- (b) Lord Howe Island in the Tasman Sea possesses two species of palm tree which have arisen via sympatric speciation. The two species diverged from each other after the island was formed 6.5 million years ago. The flowering times of the two species are different.

Using this information, suggest how these two species of palm tree arose by sympatric speciation.

(5)

(Total 6 marks)

3.

There are nine subspecies of giraffe. These subspecies evolved when populations of giraffe were separated for long time periods. Each subspecies has distinct coloured skin markings. Some biologists have suggested that up to six of these subspecies should be classified as different species.

- (a) Explain how different subspecies of giraffe may have evolved from a common ancestor. Use information from the passage in your answer.

(5)

- (b) Biologists compared the mitochondrial DNA of the different subspecies of giraffe. They used the results from comparing this DNA to conclude that six of the nine subspecies are separate species.

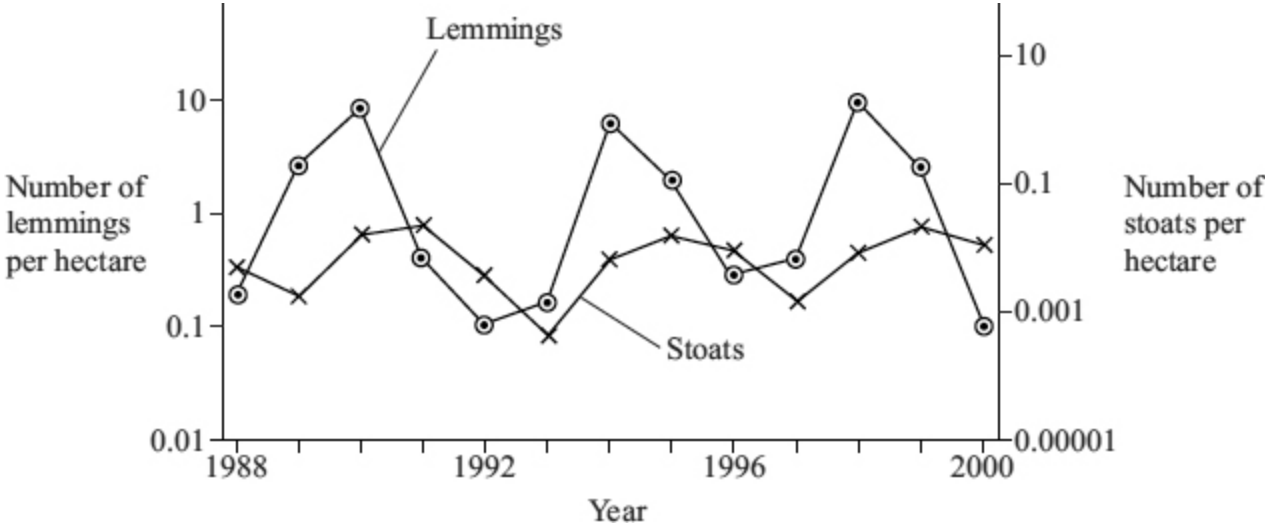
Suggest how they came to this conclusion.

(2)

(Total 7 marks)

4.

Lemmings are small mammals which live in the Arctic. Their main predator is the stoat, a small carnivorous mammal, which feeds almost entirely on lemmings. The graph shows the changes in the numbers of lemmings and stoats from 1988 to 2000.



(a) Describe and explain the changes which occur in the lemming and stoat populations.

(6)

- (b) Lemmings often live in isolated populations. From time to time some lemmings move and join other populations. Explain how this movement is important in maintaining genetic variability in lemming populations which have large fluctuations in size.

(2)

- (c) James Bay is a large ocean bay in northern Canada. It was formed by the melting of glaciers. One species of lemming inhabits the eastern side of James Bay and another species of lemming inhabits the western side. Before the glaciers melted there was only one species of lemming present. Explain how two species of lemming evolved from the original species.

(4)

(Total 12 marks)

5. Lake Malawi in East Africa contains around 400 different species of cichlids which are small, brightly coloured fish. All these species have evolved from a common ancestor.

- (a) Describe **one** way in which scientists could find out whether cichlids from two different populations belong to the same species.

(2)

- (b) During the last 700 000 years there have been long periods when the water level was much lower and Lake Malawi split up into many smaller lakes. Explain how speciation of the cichlids may have occurred following the formation of separate, smaller lakes.

(4)

- (c) Many species of cichlids are similar in size and, apart from their colour, in appearance. Suggest how the variety of colour patterns displayed by these cichlids may help to maintain the fish as separate species.

(2)

(Total 8 marks)