

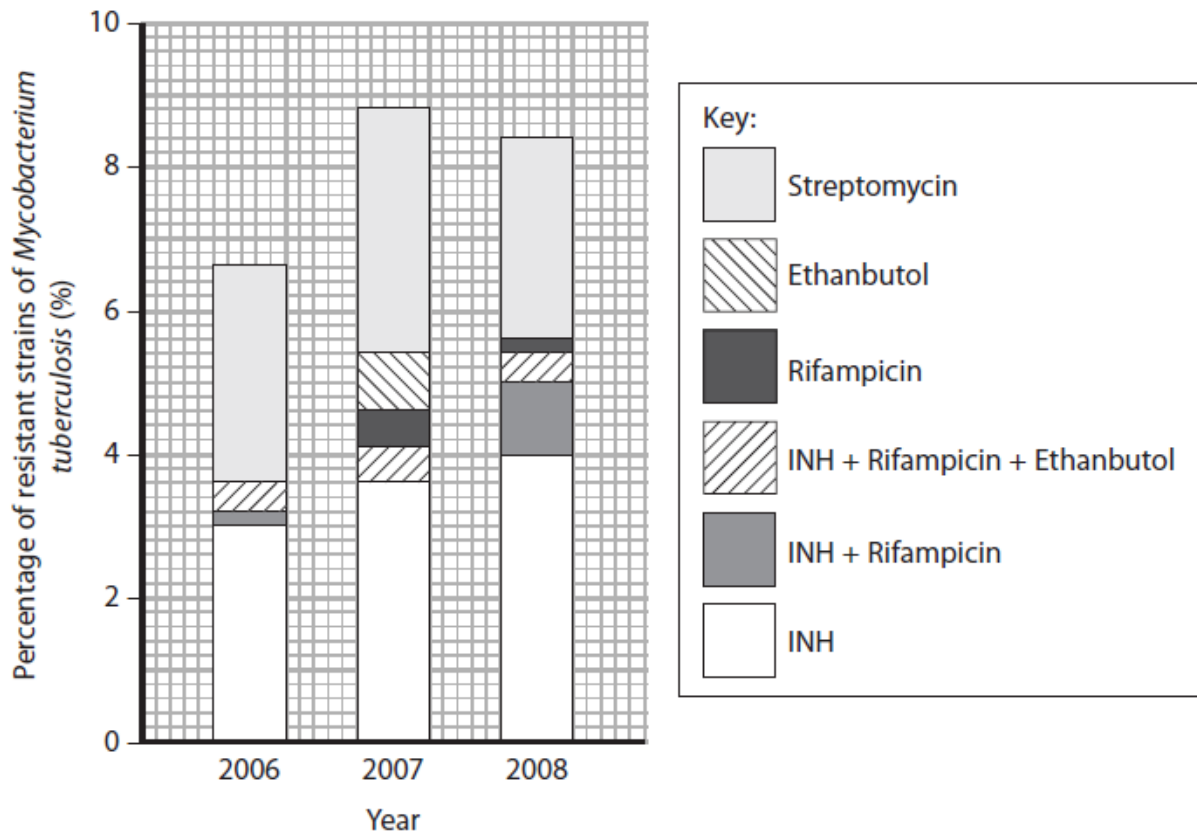
Natural Selection, Evolution and Speciation - Questions by Topic

Q1.

Treating *Mycobacterium tuberculosis* infections can be a problem, as the bacteria are resistant to many antibiotics.

There are many strains of *Mycobacterium tuberculosis*. Different strains are resistant to different antibiotics or combinations of antibiotics.

The chart below shows the percentage of resistant strains of *Mycobacterium tuberculosis* to six different antibiotics, or combinations of antibiotics, in 2006, 2007 and 2008.



(i) Using the information in the graph, compare the types of antibiotics and combinations of antibiotics that the *Mycobacterium tuberculosis* are resistant to in 2006 with 2007.

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(ii) The percentage of strains of *Mycobacterium tuberculosis* resistant to the antibiotic INH has increased during these three years.

Suggest how natural selection could have resulted in this increase.

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(iii) Suggest how hospitals could prevent an increase in the percentage of strains of *Mycobacterium tuberculosis* resistant to antibiotics.

(2)

Q2.

Scientists have studied behavioural, anatomical and genetic variation in elephants.

The table shows some information about two populations of African elephants.

Population	Location	Feeding behaviour	Anatomical differences
Forest elephant	tropical forest of central and West Africa	feeds on leaves and fruits of high-growing plants such as shrubs and trees	<ul style="list-style-type: none">• lower jaw longer and narrower• tusks straighter and downward facing• overall a much smaller size
Savannah elephant	African savannah	feeds on grass and leaves of low-growing shrubs	<ul style="list-style-type: none">• lower jaw shorter and wider• tusks more curved and upward facing• overall a larger size

The photographs show elephants from the two populations.



Forest elephant



Savannah elephant

DNA samples were collected from these two populations of elephants.

Scientists have concluded that the forest elephant and the savannah elephant are two different species.

* (i) Analyse the data and the information provided to comment on the validity of this conclusion.

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(ii) Explain how two species of African elephant could evolve from a common ancestor.

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(Total for question = 9 marks)

Q3.

The scientific article you have studied is adapted from several sources.

Use the information from the scientific article and your own knowledge to answer the following questions.

Name one process that would have validated Pettersson's paper before it was published in the journal known as the Proceedings of the National Academy of Science (paragraph 58).

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(Total for question = 1 mark)

Q4.

A new species of mosquito has evolved in the tunnels of the London Underground. These mosquitoes are believed to be the descendants of bird-biting mosquitoes which colonised the tunnels 100 hundred years ago. The mosquitoes now feed on rats, mice and human beings instead of birds.

(a) Place a cross in the box next to the best definition of a species.

(1)

- A** individuals can interbreed to produce fertile offspring
- B** individuals can interbreed to produce hybrid offspring
- C** individuals can interbreed to produce sterile offspring
- D** individuals can interbreed to produce offspring

(b) Explain how this species of mosquito may have evolved.

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(Total for question = 6 marks)

Q5. The group of birds, known as warblers, contains many species which are very similar in external appearance.

Two of these species, the chiffchaff, *Phylloscopus collybita*, and the willow warbler, *Phylloscopus trochilus*, are so similar that many experts can identify them only by listening to their individually-characteristic songs.

These songs are used during breeding to mark territory and attract mates.

The photographs below show these two warblers.



Chiffchaff



Willow warbler

Magnification $\times 0.75$

(a) Although chiffchaffs and willow warblers are often found at the same time in the same woodlands, they do not interbreed.

(i) Suggest why successful interbreeding between chiffchaffs and willow warblers would make some scientists doubt their classification as separate species.

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(ii) Suggest reasons why the two species do not interbreed.

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(b) Records show that very little change in the appearance of chiffchaffs and willow warblers has occurred during the last two hundred years.

Suggest why the rate of change in the appearance of these two species is relatively slow.

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(Total for Question = 9 marks)