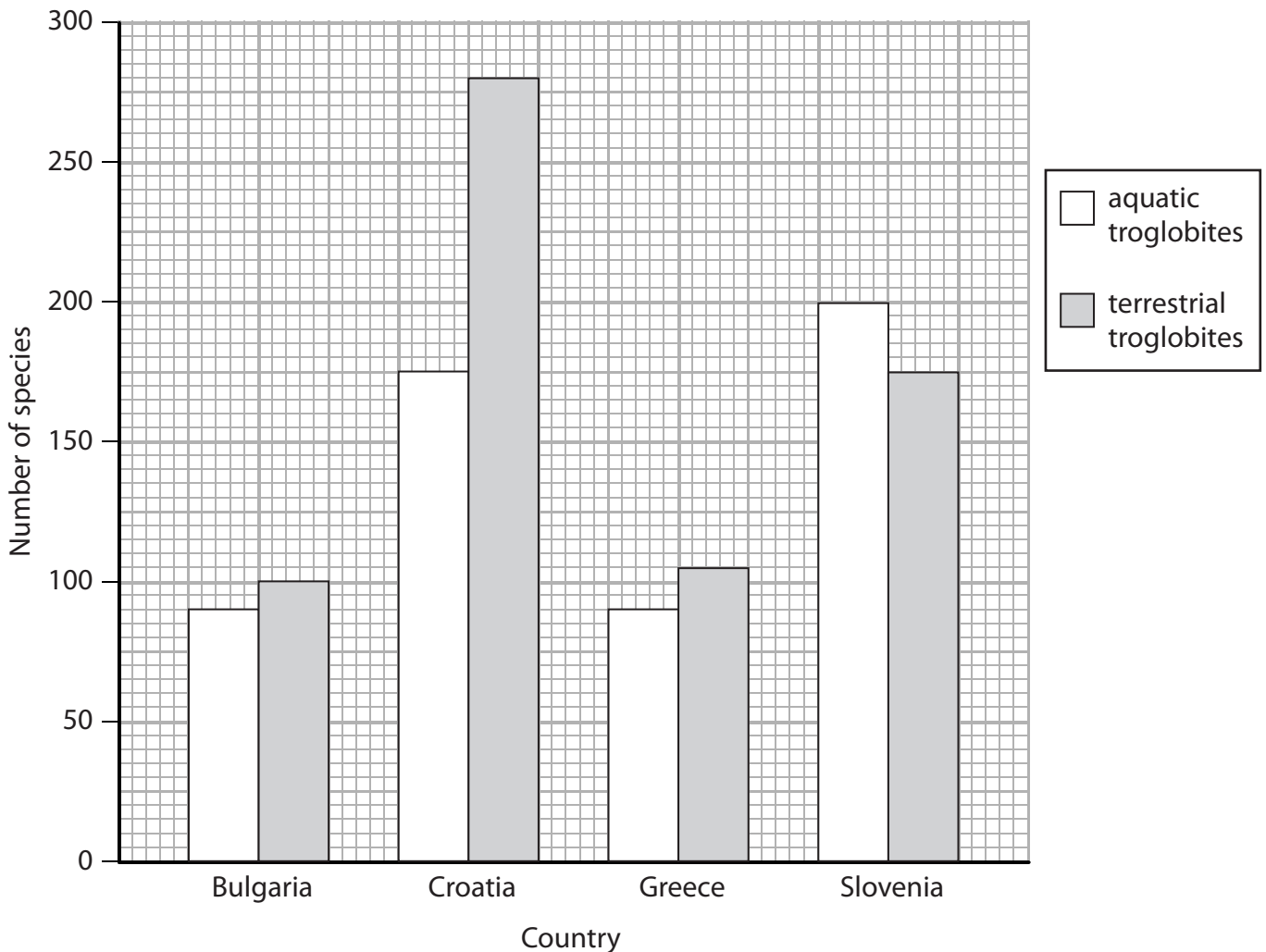


1 Animals that live only in underground caves are called troglobites.

Aquatic troglobites live in water in caves. Terrestrial troglobites live on the floors and walls of caves.

(a) The graph below shows the numbers of species of aquatic troglobites and terrestrial troglobites in four European countries.



(i) Using information in the graph, identify which country has the lowest biodiversity of troglobites.

(1)

(ii) Place a cross  in the box that corresponds to the correct ratio of aquatic troglobites to terrestrial troglobites in Croatia.

(1)

**A** 5:8

**B** 6:7

**C** 8:7

**D** 9:10

(iii) Using the information from the graph, compare the biodiversity of troglobites in Greece and Slovenia.

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(b) Troglobites occupy different niches.

Explain what is meant by the term **niche**.

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- (c) An example of a troglobite is the olm, *Proteus anguinus*, as shown in the photograph below. This species is an amphibian endemic to the caves of Slovenia and Croatia.

Olms have a number of special adaptations: external gills as adults, undeveloped eyes, lack of skin pigmentation and a slow metabolic rate.



Magnification  $\times 0.1$

- (i) Explain what is meant by the phrase 'endemic to the caves of Slovenia and Croatia'.  
(1)

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- (ii) Suggest which of the following is a physiological adaptation of olms to their habitat.

Place a cross  in the box corresponding to the correct answer.

(1)

- A** external gills as adults
- B** slow metabolic rate
- C** streamlined shape
- D** undeveloped eyes

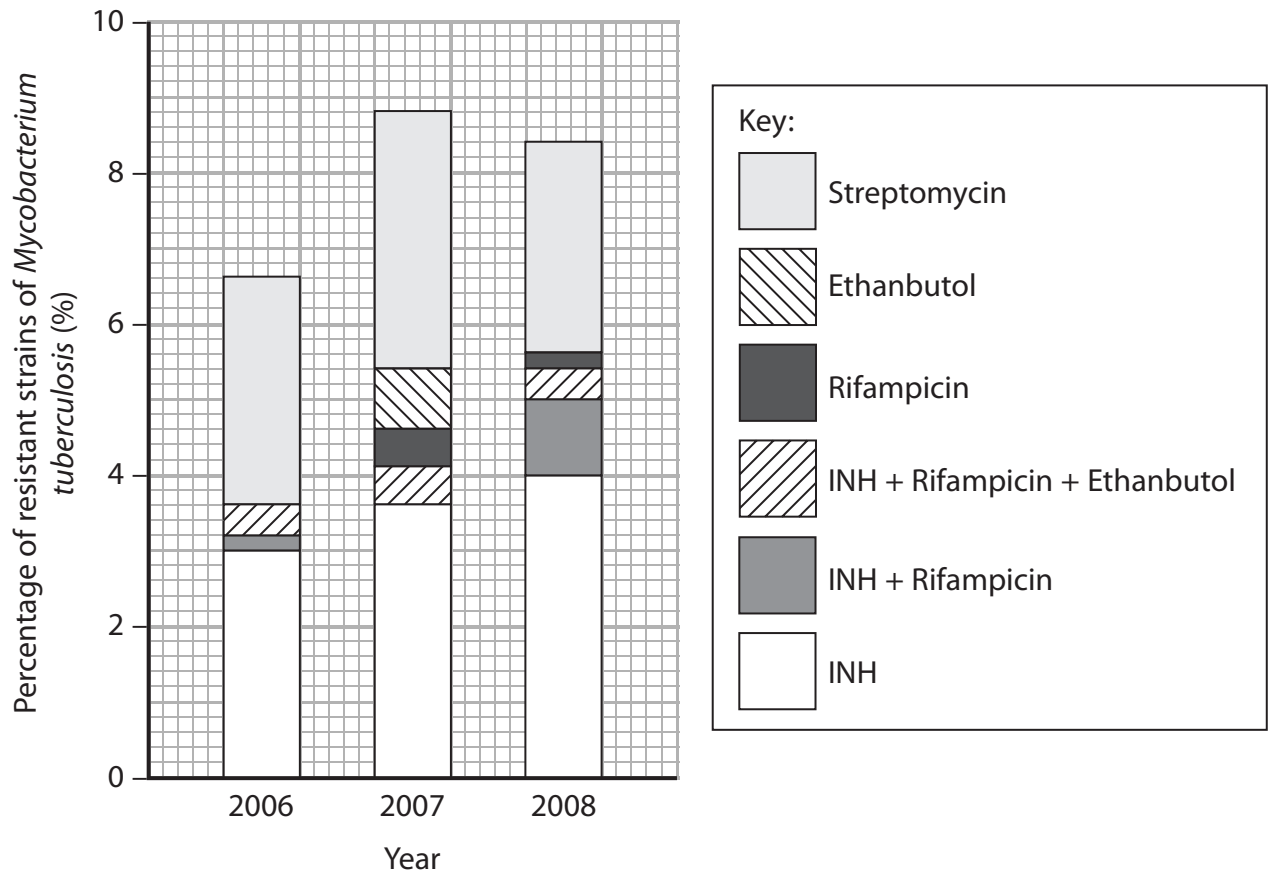




(b) Treating *Mycobacterium tuberculosis* infections can be a problem, as the bacteria are resistant to many antibiotics.

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.

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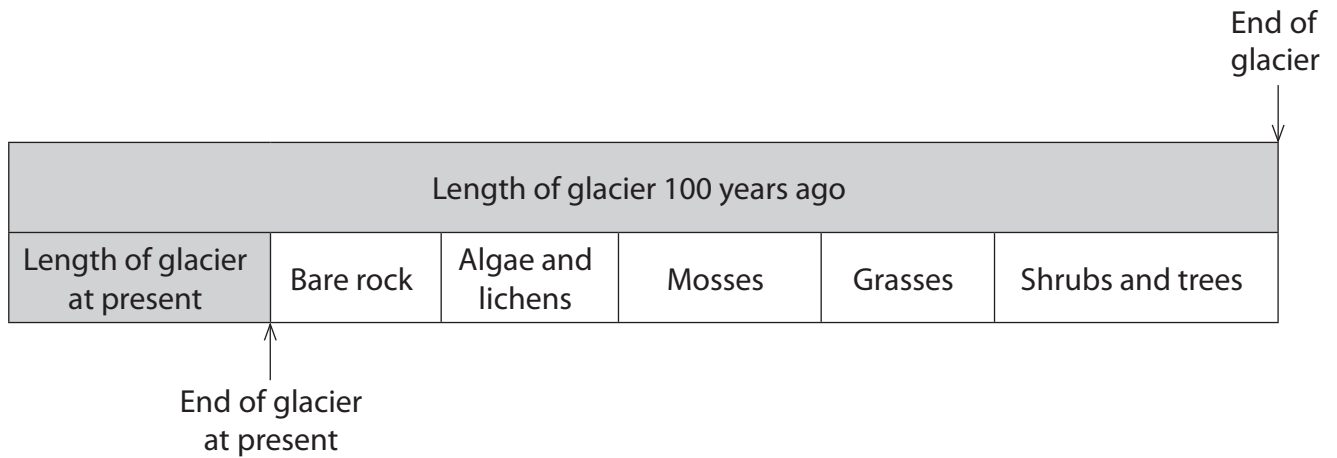
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**(Total for Question 2 = 12 marks)**

- 3 Glaciers are long, large masses of ice that formed thousands of years ago. As a result of warmer climates, more ice is melting. This is reducing the length of the glaciers. As a result, bare rock that was once covered by the glacier becomes exposed.

The diagram below shows the length of a glacier 100 years ago and the glacier at present. It also shows what is now found in a transect taken from where the front edge of the glacier is at present.



- (a) Using the information in the diagram, describe and explain the changes in the distribution of organisms with distance from the front edge of this glacier.

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(b) *Epilobium latifolium* is a plant that occupies a niche in an area once covered by this glacier. It is a short flowering plant that grows in clumps.

The photograph below shows three clumps of *Epilobium latifolium*.



} Clump of *Epilobium latifolium*

Magnification  $\times 0.2$

(i) Explain what is meant by the term **niche**, using the plant *Epilobium latifolium* as an example.

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(ii) Describe how to carry out a study of the distribution of *Epilobium latifolium* from the front edge of this glacier.

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(iii) Suggest **one** abiotic factor that might affect the abundance of *Epilobium latifolium* and describe how this factor could be measured.

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**(Total for Question 3 = 13 marks)**

- 4 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 4 = 9 marks)**