

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education  
Foundation Tier and Higher Tier  
June 2011

**Science A**  
Unit Biology B1b (Evolution and Environment)  
**Biology**  
Unit Biology B1b (Evolution and Environment)

**BLY1BP**  
**F&H**

**Tuesday 28 June 2011 Morning Session**

**For this paper you must have:**

- a black ball-point pen
  - an objective test answer sheet.
- You may use a calculator.

**Time allowed**

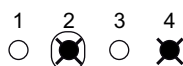
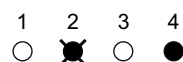
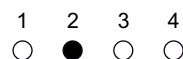
- 30 minutes

**Instructions**

- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title 'Biology Unit 1b' printed on it.
- Attempt **one Tier only**, either the Foundation Tier **or** the Higher Tier.
- Make sure that you use the correct side of the separate answer sheet; the Foundation Tier is printed on one side and the Higher Tier on the other.
- Answer **all** the questions for the Tier you are attempting.
- Record your answers on the separate answer sheet only.
- Do all rough work in this book, **not** on your answer sheet.

**Instructions for recording answers**

- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown.
- Do **not** extend beyond the circles.
- If you want to change your answer, **you must** cross out your original answer, as shown.
- If you change your mind about an answer you have crossed out and now want to choose it, draw a ring around the cross as shown.



**Information**

- The maximum mark for this paper is 36.

**Advice**

- Do **not** choose more responses than you are asked to. You will lose marks if you do.
- Make sure that you hand in both your answer sheet and this question paper at the end of the test.
- If you start to answer on the wrong side of the answer sheet by mistake, make sure that you cross out **completely** the work that is not to be marked.

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.  
The Higher Tier starts on page 14 of this booklet.

## FOUNDATION TIER

### Section One

Questions **ONE** to **FIVE**.

In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

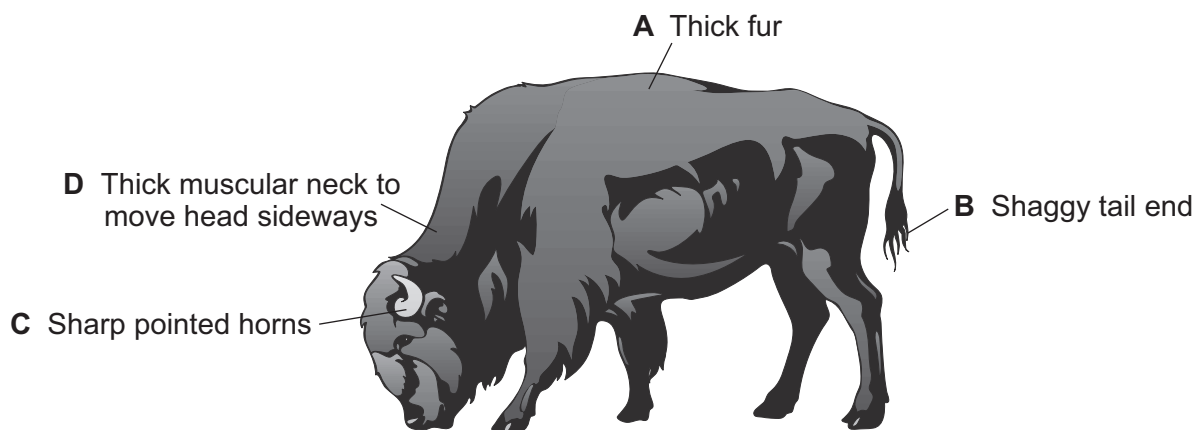
Use **each** answer only **once**.

Mark your choices on the answer sheet.

### QUESTION ONE

American bison live in places where the summers are hot and the winters are very cold and snowy.

The drawing shows a male bison.



Match adaptations, **A**, **B**, **C** and **D**, with the statements **1–4** in the table.

<b>1</b>	to brush away flies in the summer
<b>2</b>	to fight off other males which are competing to mate with the females
<b>3</b>	to keep warm in the snowy conditions
<b>4</b>	to help to clear thick snow from the grass on which it feeds

**QUESTION TWO**

Human activities affect the environment.

Match activities, **A**, **B**, **C** and **D**, with the statements **1–4** in the table.

- A** burning fuels that release carbon dioxide
- B** building new houses
- C** spraying crops with pesticides
- D** using weedkillers on crops

	<b>Effect on the environment</b>
<b>1</b>	may damage hedges that surround fields
<b>2</b>	may kill useful insects such as bees
<b>3</b>	may cause global warming
<b>4</b>	may reduce the land available for wild plants

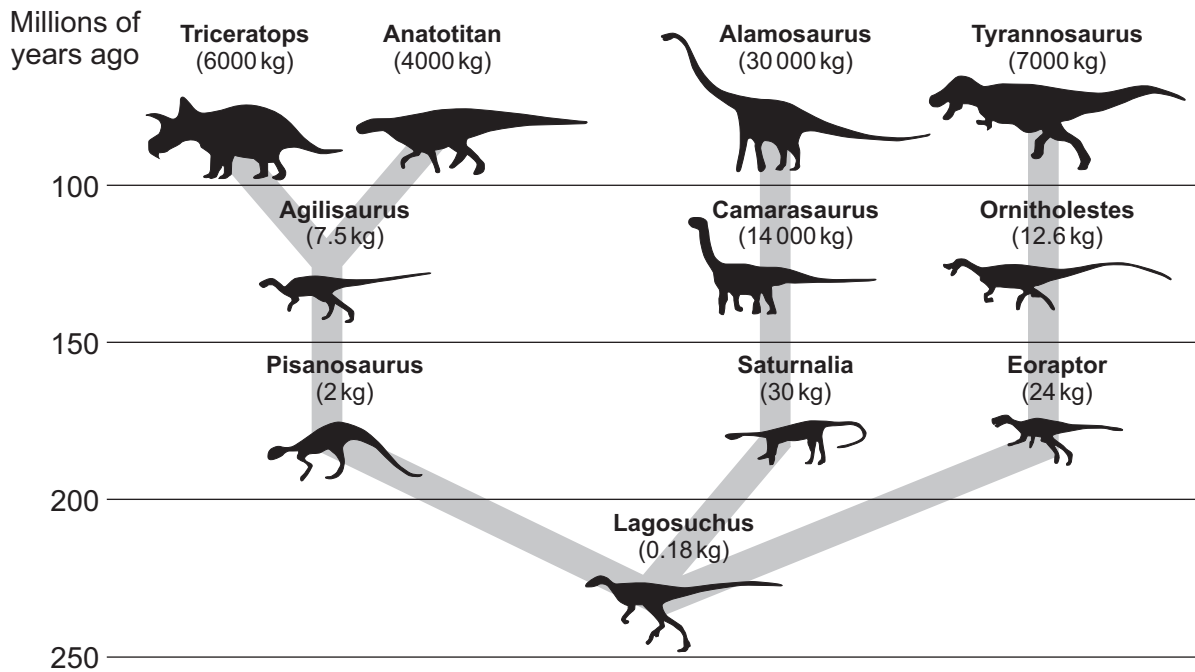
**Turn over for the next question**

**Turn over ►**

### QUESTION THREE

The diagram shows a timeline for the evolution of some dinosaurs.

The average mass of each dinosaur is shown in brackets under its name.



Match dinosaurs, **A**, **B**, **C** and **D**, with the statements 1–4 in the table.

- A** Alamosaurus
- B** Lagosuchus
- C** Saturnalia
- D** Triceratops

<b>1</b>	the dinosaur that lived the longest time ago
<b>2</b>	the dinosaur that evolved from Agilisaurus
<b>3</b>	the dinosaur from which Camarasaurus evolved
<b>4</b>	the dinosaur with the largest average mass

**QUESTION FOUR**

Living organisms affect the environment.

Match the organisms, **A**, **B**, **C** and **D**, with the statements **1–4** in the table.

- A** invertebrates
- B** lichens
- C** rice crops
- D** trees

<b>1</b>	are used as an indicator of air pollution
<b>2</b>	are used as an indicator of water pollution
<b>3</b>	'lock up' carbon dioxide for many years
<b>4</b>	release methane into the atmosphere

**QUESTION FIVE**

The modern theory of evolution is based mainly on Charles Darwin's work.

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

- A** extinction
- B** mutation
- C** reproduction
- D** variation

The range of characteristics we can see in a species is known as . . . **1** . . . .

This range of characteristics has been brought about by . . . **2** . . . .

Characteristics that give advantages are passed on during . . . **3** . . . .

Characteristics that are disadvantages may result in . . . **4** . . . .

Turn over ►

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**Section Two**Questions **SIX** to **NINE**.

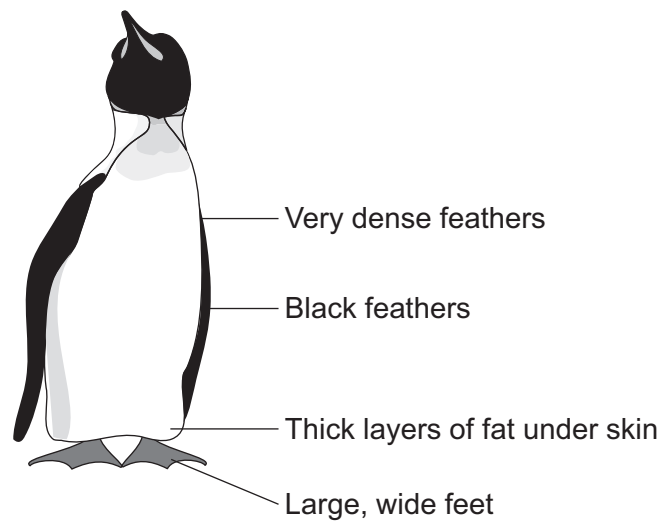
Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

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**QUESTION SIX**The Antarctic is a very cold environment, with temperatures often colder than  $-40^{\circ}\text{C}$ .

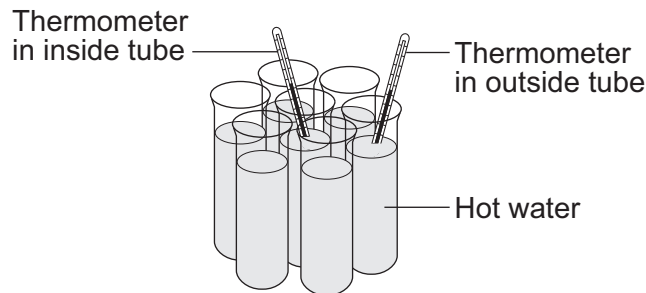
The picture shows an Emperor penguin.



**6A** Which feature does **not** help the Emperor penguin to keep its body temperature constant in cold conditions?

- 1 large, wide feet
- 2 thick layers of fat
- 3 black feathers
- 4 very dense feathers

Penguins are often seen huddling together. A group of students did an investigation to find out if huddling helps to keep animals warm. The students put hot water into each of seven large test tubes. The students recorded the temperature of the water in two of the tubes every minute for 10 minutes.



**6B** Which would be the best experimental control for this investigation?

- 1 repeating the investigation to check the results
- 2 recording the temperature of water in a tube left on its own
- 3 measuring the temperature of real penguins in a huddle
- 4 moving the tubes around every two minutes

The table shows the data collected by the students.

Time in minutes	Temperature of water in inside tube in °C	Temperature of water in outside tube in °C
0	75	74
10	68	49

**6C** To collect data for a line graph, the students should . . .

- 1 collect results for more than 10 minutes.
- 2 make sure that the water in the tubes was at the same temperature at the start.
- 3 collect results more often during the 10 minutes.
- 4 use a thermometer that measures to greater precision.

**6D** The students looked at their results and wrote a conclusion.

Which is the best conclusion based on the results?

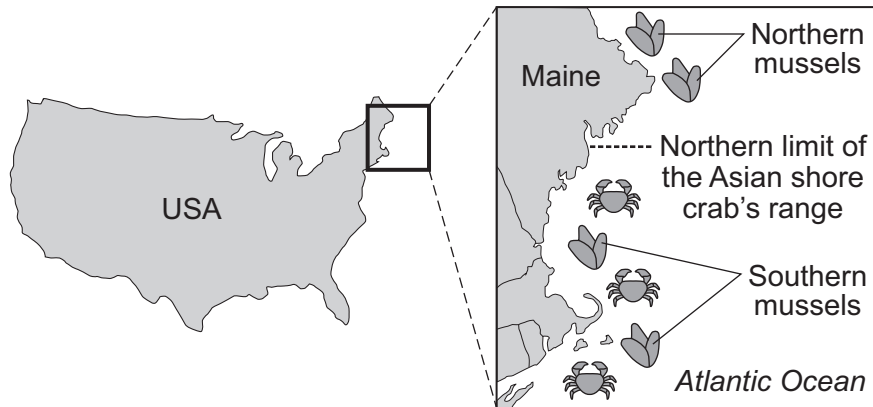
- 1 Penguins on the outside of a huddle will be warmer than penguins on the inside.
- 2 Penguins on the inside of the huddle will be warmer than penguins on the outside.
- 3 Penguins on their own would stay warmer than penguins in a huddle.
- 4 Penguins always cool down at the same rate.

Turn over ►

**QUESTION SEVEN**

Fifteen years ago, the Asian shore crab was brought to part of the USA. The Asian shore crabs eat mussels.

The map shows the range of the Asian shore crab now.



Native Green crabs live along the whole of the coastline.

The Southern mussels have developed thicker shells. The Asian shore crabs find the Southern mussel shells difficult to crack open.

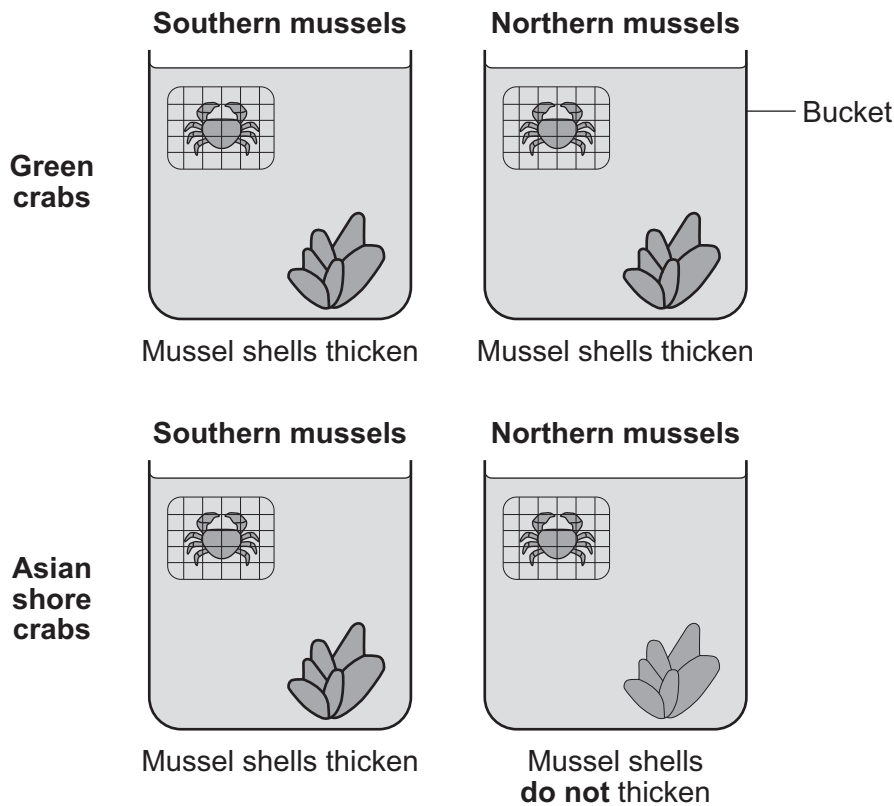
**7A** Scientists had the idea that the Southern mussels had evolved because of the effect of Asian shore crabs, but the Northern mussels had not.

This idea is an example of . . .

- 1 a conclusion.
- 2 hearsay.
- 3 a hypothesis.
- 4 a theory.



The scientists carried out the investigation shown in the diagram below. The scientists put mussels from different parts of the area in buckets. The scientists put different crabs in small cages inside the buckets. The crabs could not kill the mussels but the mussels could detect any chemical released by the crabs into the water. The diagram shows the results of this investigation.



**7B** In this investigation, the native Green crabs were used as a . . .

- 1 control group.
- 2 dependent variable.
- 3 placebo.
- 4 survey.

**7C** The results of the investigation show that . . .

- 1 both types of mussel respond to the chemicals released by the Asian shore crabs.
- 2 neither type of mussel responds to the chemicals released by the Asian shore crabs.
- 3 only the Northern mussels respond to the chemicals released by the Asian shore crabs.
- 4 only the Southern mussels respond to the chemicals released by the Asian shore crabs.

**7D** In the past 15 years, the Southern mussels have evolved the ability to . . .

- 1 thicken their shells.
- 2 detect Green crabs.
- 3 detect Asian shore crabs.
- 4 increase their range.

Turn over ►

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**QUESTION EIGHT**

There are only a few unmapped and unexplored places on Earth. Scientists looking at satellite images on the internet have discovered a new giant forest area in Mozambique.

The scientists have made the first expedition to this giant forest area in Mozambique.

The scientists discovered several new species.

**8A** Only in the past 20 years have scientists been able to investigate the distribution of animals and plants by . . .

- 1 looking for fossil evidence.
- 2 going on an expedition.
- 3 searching the internet.
- 4 doing laboratory experiments.

**8B** The scientists say that the newly discovered giant forest has 'a very large biodiversity'.

Biodiversity is . . .

- 1 the total number of plant and animal species in an area.
- 2 the number of undiscovered plants and animals in the giant forest.
- 3 the number of plants and animals already known to scientists.
- 4 the number of plants and animals known to local villagers.

**8C** Why is it important to maintain a high level of biodiversity?

- 1 so that the forest is not cut down
- 2 so that many plant and animal specimens can be collected and stored
- 3 so that scientists may discover new plants to use as drugs and to use in different ways in the future
- 4 so that the locations of plants and animals can be recorded

**8D** Some people think that it was not ethical for scientists to go on the expedition to the giant forest because . . .

- 1 scientists may discover new species.
- 2 scientists may help to map the area.
- 3 scientists may put information about the area's food chains on the internet.
- 4 scientists may carry new diseases to the people in the area.

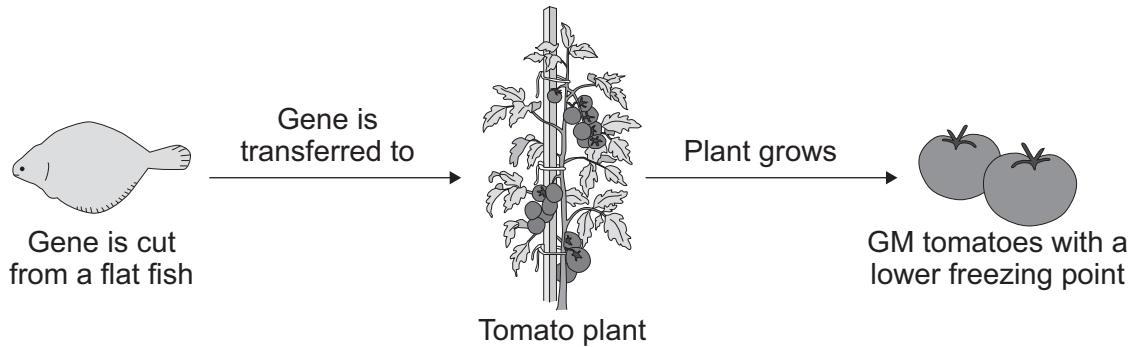
**Turn over for the next question**

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**QUESTION NINE**

Scientists have produced genetically modified (GM) tomatoes. The GM tomatoes freeze at a lower temperature than non-GM tomatoes. GM tomatoes are less likely to be damaged in storage.

The diagram shows how the scientists produced the GM tomatoes by genetic engineering.



**9A** The scientists removed the gene from the flat fish by using . . .

- 1 hormones.
- 2 enzymes.
- 3 very small scissors.
- 4 a very fine pipette.

**9B** The scientists wanted to produce large numbers of plants identical to the new tomato plants quickly.

Which would be the best way of doing this?

- 1 reproducing the new embryo plant sexually
- 2 splitting embryos from the new tomato plant
- 3 growing seeds from the new tomato plant
- 4 culturing groups of cells from the new tomato plant

- 9C** One ethical reason for allowing the GM crops to be grown is that . . .
- 1 scientists know that there are no health risks from eating GM crops.
  - 2 GM companies will make large profits from the sale of GM plants.
  - 3 the high yield from some GM crops could feed starving people.
  - 4 GM crops are not a risk to the environment.
- 9D** Some people object to GM crops because GM crops . . .
- 1 could be made resistant to insect attack.
  - 2 could have a longer shelf-life.
  - 3 could be made resistant to weedkillers.
  - 4 could transfer genes to wild plants.

**END OF TEST**

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You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.  
The Foundation Tier is earlier in this booklet.

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## HIGHER TIER

### Section One

Questions **ONE** and **TWO**.

In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

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### QUESTION ONE

The modern theory of evolution is based mainly on Charles Darwin's work.

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

- A** extinction
- B** mutation
- C** reproduction
- D** variation

The range of characteristics we can see in a species is known as . . . **1** . . . .

This range of characteristics has been brought about by . . . **2** . . . .

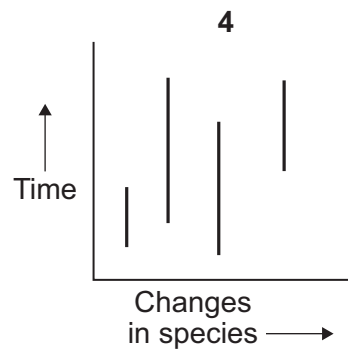
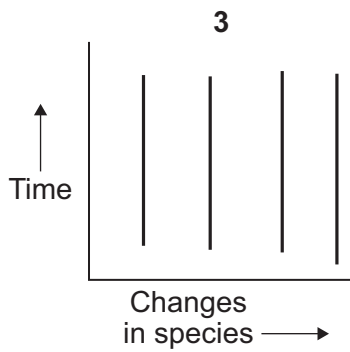
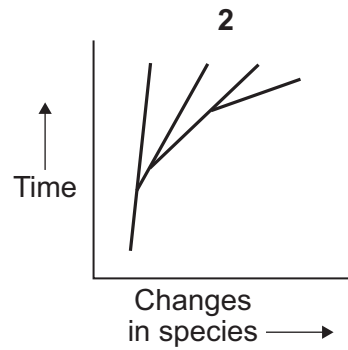
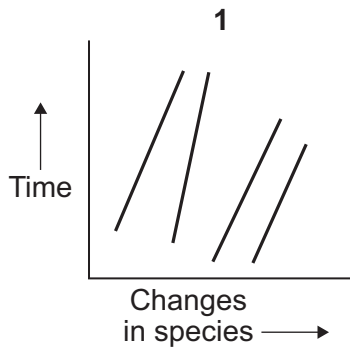
Characteristics that give advantages are passed on during . . . **3** . . . .

Characteristics that are disadvantages may result in . . . **4** . . . .

**QUESTION TWO**

Evolution takes place when species change over time.

In each of the diagrams below, the four lines show the changes in four different species.



Match statements, **A**, **B**, **C** and **D**, with diagrams **1–4**.

- A** each of the four species changes slowly over time
- B** none of the four species changes over time and some species die out
- C** none of the four species changes over time
- D** new species evolve over time

Turn over ►

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**Section Two**Questions **THREE** to **NINE**.

Each of these questions has four parts.

In each part choose only **one** answer.Mark your choices on the answer sheet.

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**QUESTION THREE**

There are only a few unmapped and unexplored places on Earth. Scientists looking at satellite images on the internet have discovered a new giant forest area in Mozambique.

The scientists have made the first expedition to this giant forest area in Mozambique.

The scientists discovered several new species.

**3A** Only in the past 20 years have scientists been able to investigate the distribution of animals and plants by . . .

- 1 looking for fossil evidence.
- 2 going on an expedition.
- 3 searching the internet.
- 4 doing laboratory experiments.

**3B** The scientists say that the newly discovered giant forest has 'a very large biodiversity'.

Biodiversity is . . .

- 1 the total number of plant and animal species in an area.
- 2 the number of undiscovered plants and animals in the giant forest.
- 3 the number of plants and animals already known to scientists.
- 4 the number of plants and animals known to local villagers.

**3C** Why is it important to maintain a high level of biodiversity?

- 1 so that the forest is not cut down
- 2 so that many plant and animal specimens can be collected and stored
- 3 so that scientists may discover new plants to use as drugs and to use in different ways in the future
- 4 so that the locations of plants and animals can be recorded



**3D** Some people think that it was not ethical for scientists to go on the expedition to the giant forest because . . .

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- 2 scientists may help to map the area.
- 3 scientists may put information about the area's food chains on the internet.
- 4 scientists may carry new diseases to the people in the area.

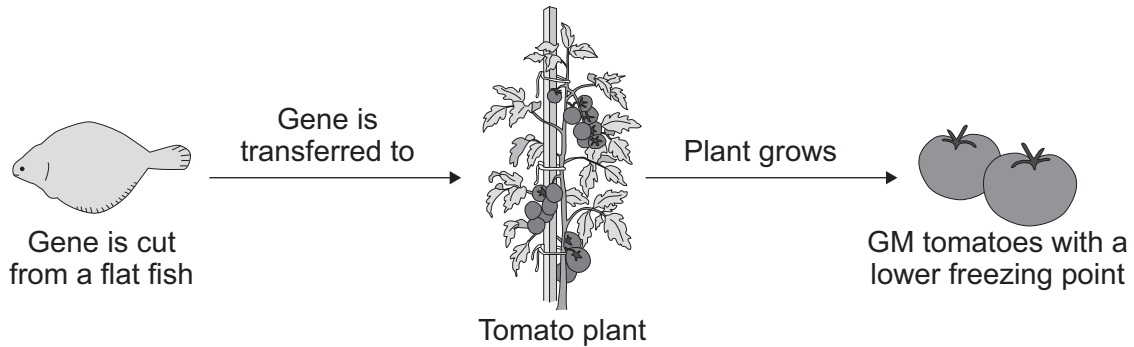
**Turn over for the next question**

**Turn over ►**

**QUESTION FOUR**

Scientists have produced genetically modified (GM) tomatoes. The GM tomatoes freeze at a lower temperature than non-GM tomatoes. GM tomatoes are less likely to be damaged in storage.

The diagram shows how the scientists produced the GM tomatoes by genetic engineering.



**4A** The scientists removed the gene from the flat fish by using . . .

- 1 hormones.
- 2 enzymes.
- 3 very small scissors.
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**4B** The scientists wanted to produce large numbers of plants identical to the new tomato plants quickly.

Which would be the best way of doing this?

- 1 reproducing the new embryo plant sexually
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- 4C** One ethical reason for allowing the GM crops to be grown is that . . .
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- 4D** Some people object to GM crops because GM crops . . .
- 1 could be made resistant to insect attack.
  - 2 could have a longer shelf-life.
  - 3 could be made resistant to weedkillers.
  - 4 could transfer genes to wild plants.

**Turn over for the next question**

**Turn over ►**

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**QUESTION FIVE**

Some living organisms are used as indicators of pollution.

**5A** A river with very few species of invertebrates is likely to have a low concentration of dissolved . . .

- 1 carbon dioxide.
- 2 fertiliser.
- 3 oxygen.
- 4 pesticide.

**5B** An area with very few lichen species is most likely to be polluted by . . .

- 1 carbon dioxide.
- 2 fertiliser.
- 3 methane.
- 4 sulfur dioxide.

Lichens grow on rocks at the top of the seashore. Waves often cover some of the lichens.

In an investigation on a rocky seashore, scientists recorded each type of lichen they found in a 25 cm quadrat, from low-tide level upwards. The same quadrats were used to repeat the investigation on a similar area of the shore nearby.

It was important to complete the investigation in one week so that climatic conditions were as similar as possible. This meant that the scientists needed the help of students to complete the work on time.

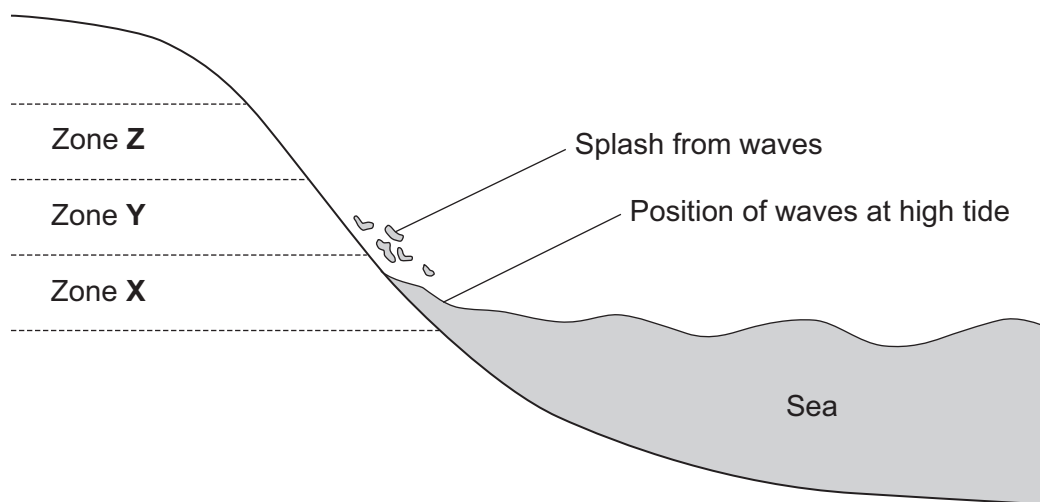
**5C** The investigation might have produced unreliable results because . . .

- 1 the investigation was carried out in different climatic conditions.
- 2 the investigation was not repeated.
- 3 the quadrats were different sizes.
- 4 the students may not have been experts at identifying lichens.

**5D** The table shows the results of the investigation.

Zone	Colour of lichens	Number of types of lichen	Description of lichens
X	black	2	crusty
Y	orange	3	leafy
Z	grey	6	tufted

The diagram shows the positions of the lichen zones on the rocks.



The results suggest that . . .

- 1 grey lichens are able to tolerate being covered by sea water.
- 2 orange lichens grow at the lowest level on the shore.
- 3 tufted lichens grow on the highest parts of the shore.
- 4 crusty lichens get washed off the rocks by the tide.

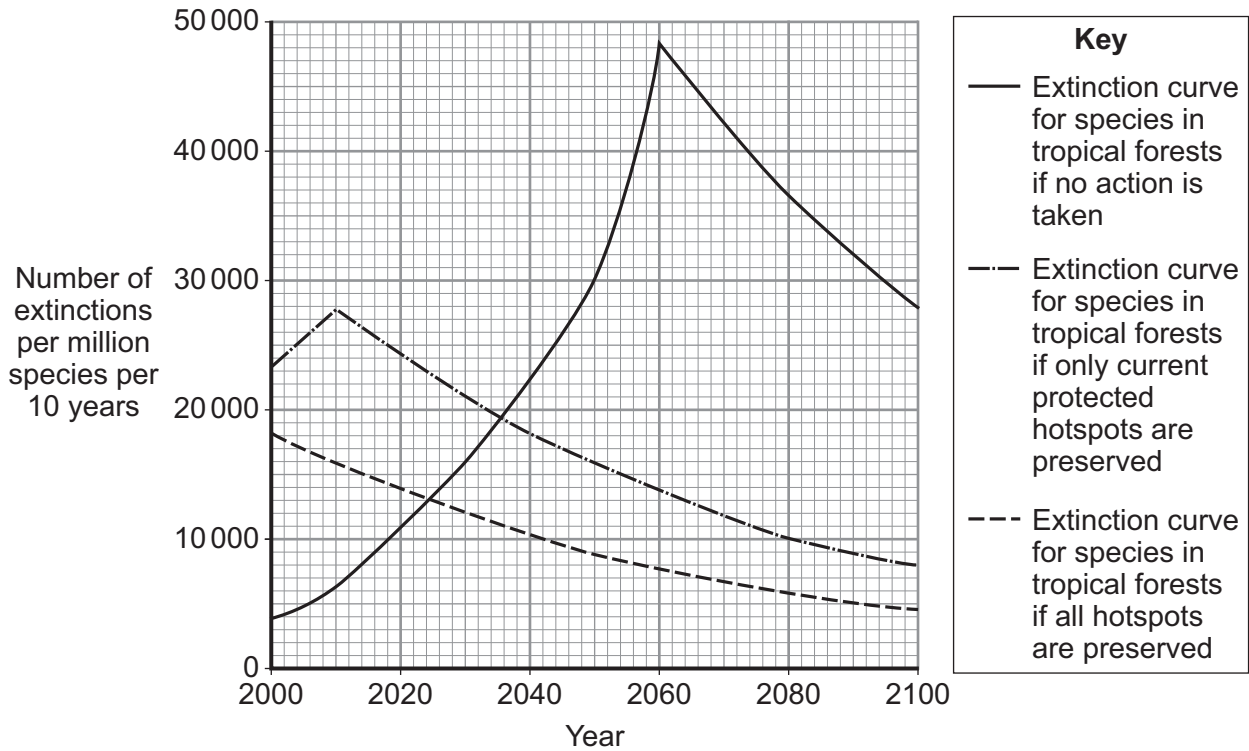
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**QUESTION SIX**

The graph shows the predicted number of extinctions of species in tropical forests in the 21st century.

A decade is 10 years.

Hotspots are areas with a very large biodiversity.



Scientists estimate that now there are about 10 000 000 species in the tropical forests.

**6A** How many of these species are likely to become extinct in the decade beginning 2010 if only current protected hotspots are preserved?

- 1 80 000
- 2 180 000
- 3 280 000
- 4 480 000

---

**6B** If no action is taken, the number of extinctions in tropical forests will begin to drop after 2060.

This is because . . .

- 1 Earth is warming up.
- 2 there will be less pollution.
- 3 we will have found new sources of energy.
- 4 most of the hotspots will have been destroyed by 2060.

**6C** Disease has little effect as a cause of organisms becoming extinct.

This is probably because . . .

- 1 new diseases do not have much effect.
- 2 immunity to disease is inherited.
- 3 diseases cannot spread from one species to another.
- 4 organisms have developed resistance to most diseases.

**6D** Alien species are plants and animals that have been introduced to a new environment.

Alien species may cause extinction of organisms in tropical forests because alien species . . .

- 1 have the same distribution in the forests.
- 2 are similar to existing predators in the forests.
- 3 are similar to existing competitors in the forests.
- 4 may be better adapted to the forests.

**Turn over for the next question**

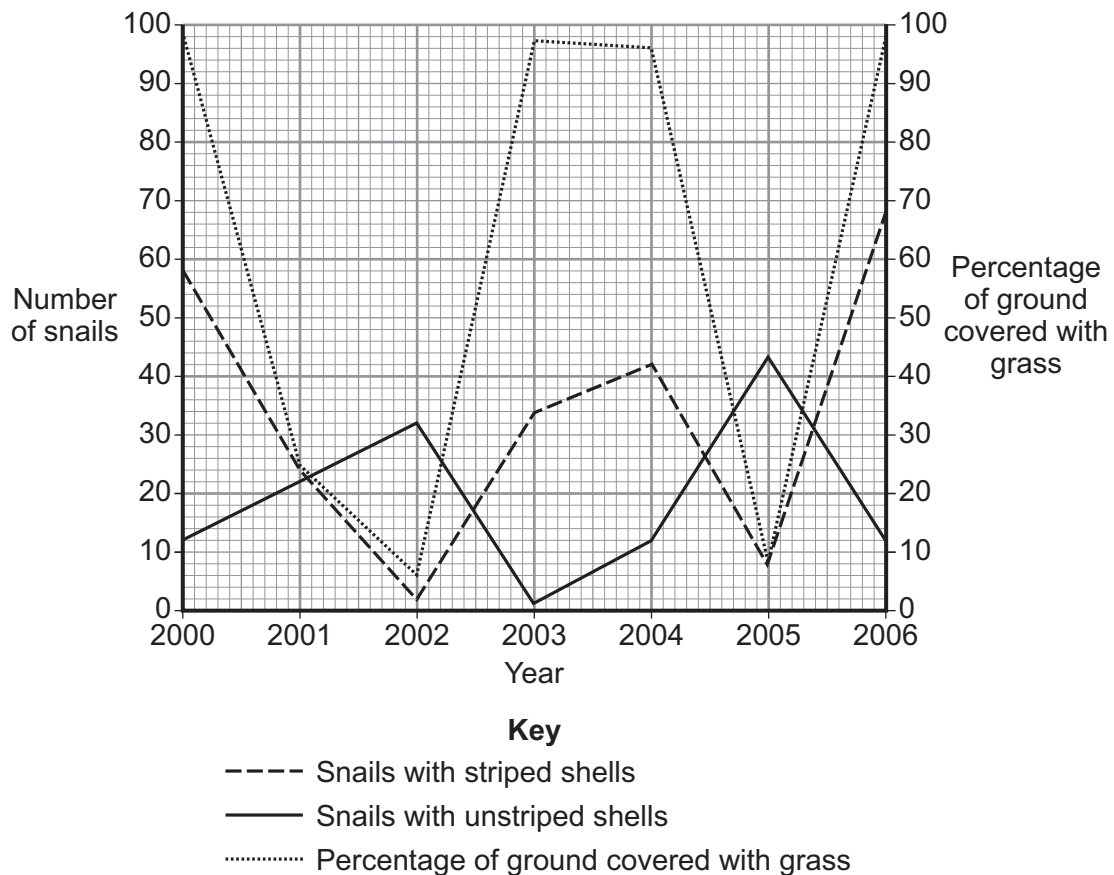
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## QUESTION SEVEN

A scientist studied a population of snails that lived in grassland. Some of the snails had striped shells, others had unstriped shells. Birds feed on both types of snail.

The scientist counted the number of snails in the population in September each year for seven years. At the same time each year, she also estimated the area of ground covered with grass.

Her results are shown in the graph.



**7A** What was the difference between the numbers of snails with striped shells between 2002 and 2006?

- 1 20
- 2 35
- 3 56
- 4 66



**7B** What percentage of all the snails counted in 2000 had unstriped shells?

- 1 12.0
- 2 17.1
- 3 20.6
- 4 48.3

**7C** Which is the best conclusion that can be drawn from the data?

- 1 Snails with striped shells are always more common than snails with unstriped shells.
- 2 When there is plenty of grass there are more snails with unstriped shells.
- 3 The total number of snails is directly proportional to the percentage of ground covered in grass.
- 4 There is a higher proportion of snails with striped shells when there is plenty of grass cover.

**7D** The results for the striped snails most probably depend on . . .

- 1 camouflage.
- 2 disease.
- 3 humidity.
- 4 temperature.

**Turn over for the next question**

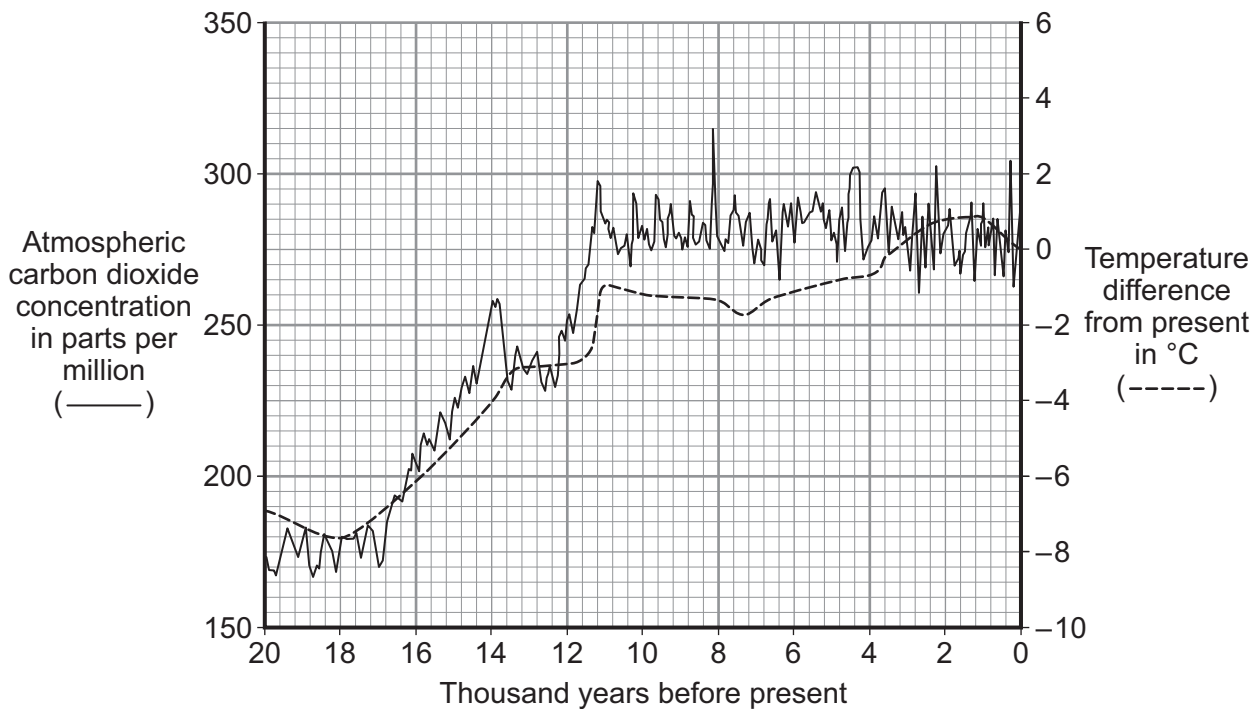
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**QUESTION EIGHT**

Scientists have analysed the carbon dioxide concentration in air bubbles trapped in deep ice in Antarctica.

The scientists have used the air bubbles to help to calculate the probable air temperature in the past.

The graph shows their results.



**8A** The mean temperature in Antarctica today is  $-20^{\circ}\text{C}$ .

What was the mean temperature in Antarctica 14 000 years ago?

- 1  $0^{\circ}\text{C}$
- 2  $-16^{\circ}\text{C}$
- 3  $-24^{\circ}\text{C}$
- 4  $-26^{\circ}\text{C}$

**8B** Over the past 20 000 years, the temperature of the atmosphere has . . .

- 1 decreased steadily.
- 2 fluctuated, but shown an overall decrease.
- 3 fluctuated, but shown an overall increase.
- 4 increased steadily.

**8C** The data . . .

- 1 proves that carbon dioxide causes the greenhouse effect.
- 2 shows an exact correlation between carbon dioxide concentration and the air temperature.
- 3 shows partial correlation between carbon dioxide concentration and the air temperature.
- 4 shows that air temperature depends only on carbon dioxide concentration.

**8D** How does an increase in the carbon dioxide concentration in the atmosphere lead to an increase in atmospheric temperature?

- 1 More of the radiation of the Sun passes into the atmosphere.
- 2 The atmosphere radiates more energy back to Earth.
- 3 The Earth absorbs energy from the atmosphere.
- 4 The sea absorbs more energy from the Sun.

**Turn over for the next question**

**Turn over ►**

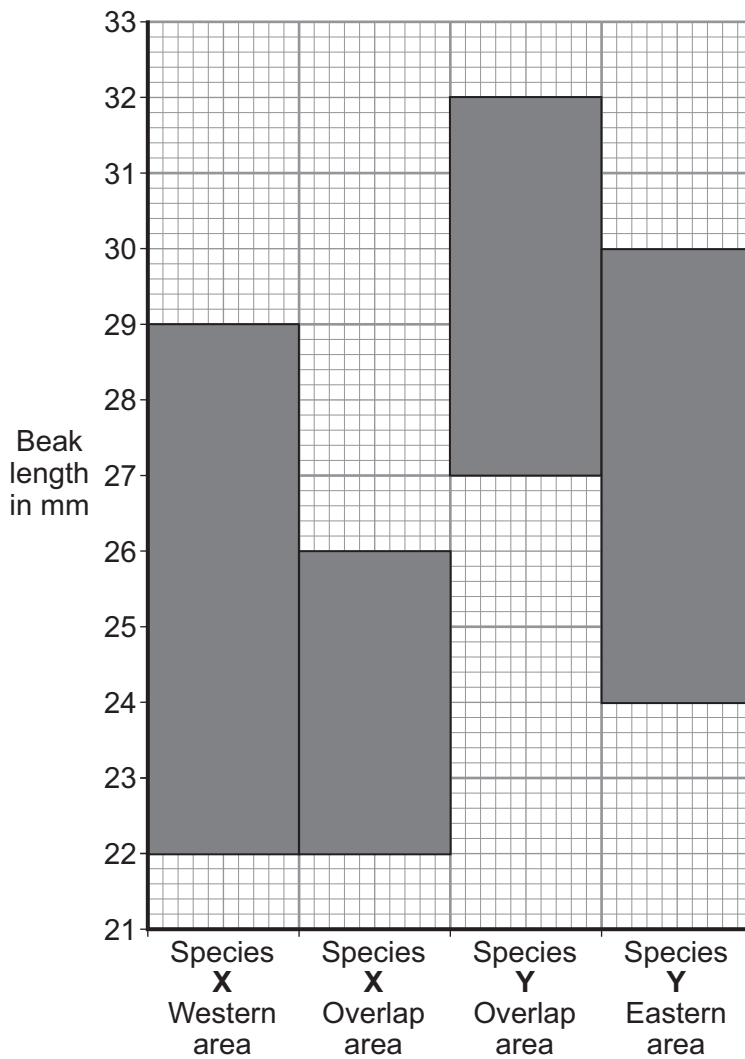
**QUESTION NINE**

Two species of nuthatch (small birds living on the ground) live in areas across central Asia. One species lives mainly in the west and the other species lives mainly in the east.

Some of each species live in the middle of the area. This region is called the overlap area. Both species feed on similar sized insects on the ground.

Scientists measured the beak lengths of all the birds of both species in the three areas.

The results in the graph show the ranges of beak lengths.



**9A** What is the range of beak length for species Y?

- 1 22 to 26 mm
- 2 22 to 29 mm
- 3 24 to 32 mm
- 4 27 to 32 mm

- 9B** Compared with the mean beak size in the non-overlap areas, . . .
- 1 the mean beak length of species **X** increases in the overlap area.
  - 2 the mean beak length of species **Y** increases in the overlap area.
  - 3 the mean beak length of both species increases in the overlap area.
  - 4 the mean beak length of both species decreases in the overlap area.
- 9C** The range of beak sizes for both species is different in the overlap area.  
The most likely cause of this difference is . . .
- 1 increased competition for food.
  - 2 competition for mates.
  - 3 a different climate.
  - 4 competition for places to build nests.
- 9D** The change in beak length of species **X** and species **Y** has been caused by changes . . .
- 1 in the genetic material of the birds.
  - 2 in the insect populations.
  - 3 in the climate of the overlap area.
  - 4 in the predators of the birds.

**END OF TEST**

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