

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
March 2007



SCIENCE A
Unit Biology B1b (Evolution and Environment)

BLY1B

BIOLOGY
Unit Biology B1b (Evolution and Environment)

Monday 12 March 2007 Morning Session

For this paper you must have:

- a black ball-point pen
- an objective test answer sheet.

You may use a calculator.

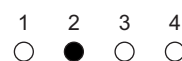
Time allowed: 30 minutes

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 'Evolution and Environment' 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.

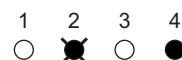
Instructions for recording answers

- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:

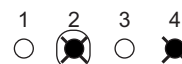


- Do **not** extend beyond the circles.

- 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 **SIX**.

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

Polar bears are adapted for life in the arctic.



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

- A** black skin
- B** small ears
- C** thick fur
- D** white fur

The polar bear is camouflaged by its . . . **1**

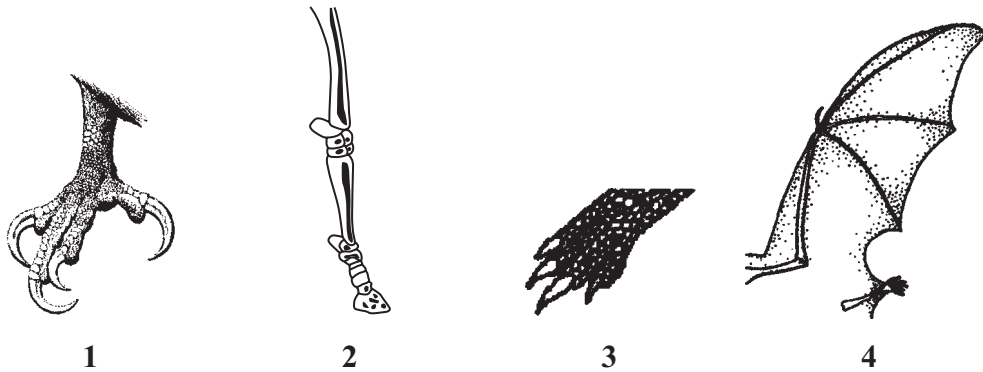
Its surface area is reduced by having . . . **2**

The polar bear is insulated by air trapped in its . . . **3**

Heat from the sun is absorbed by its . . . **4**

QUESTION TWO

The drawings show the limbs of four animals. (The drawings are not to scale.)



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

- A** limb is adapted for burrowing
- B** limb is adapted for flying
- C** limb is adapted for gripping branches
- D** limb is adapted for running

Turn over for the next question

Turn over ►

QUESTION THREE

This question is about global warming.

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

A carbon dioxide

B greenhouse

C ice caps

D sea

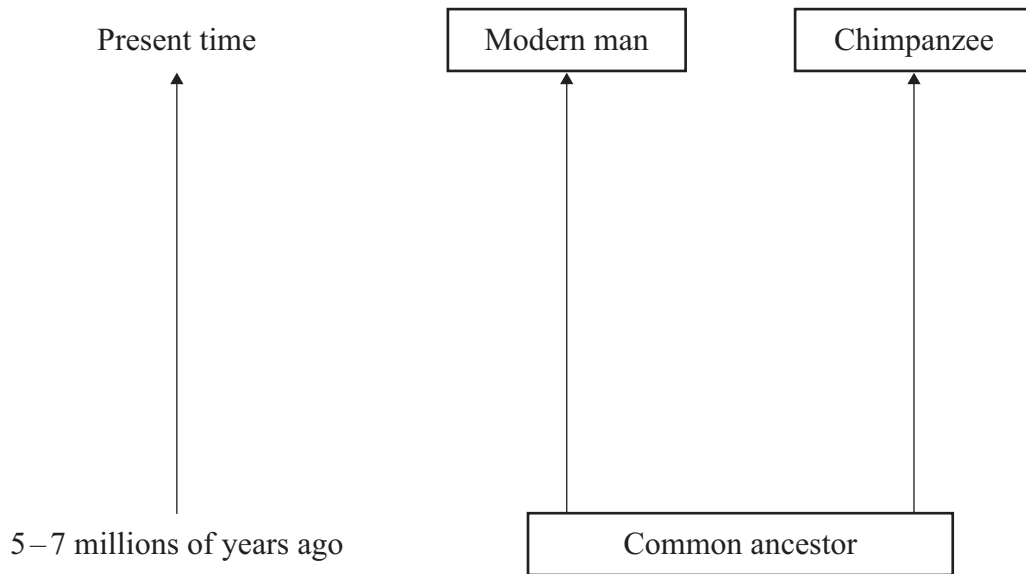
Methane and . . . **1** . . . in the atmosphere absorb much of the energy radiated by the Earth.

This can increase the . . . **2** . . . effect and cause the Earth's atmosphere to become warmer.

An increased temperature of only a few degrees Celsius may melt the . . . **3** . . . and cause a rise in . . . **4** . . . levels.

QUESTION FOUR

The diagram shows part of the pathway of human evolution from a common ancestor to modern man (Homo sapiens).



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

- A** evolved
- B** genes
- C** natural selection
- D** survived

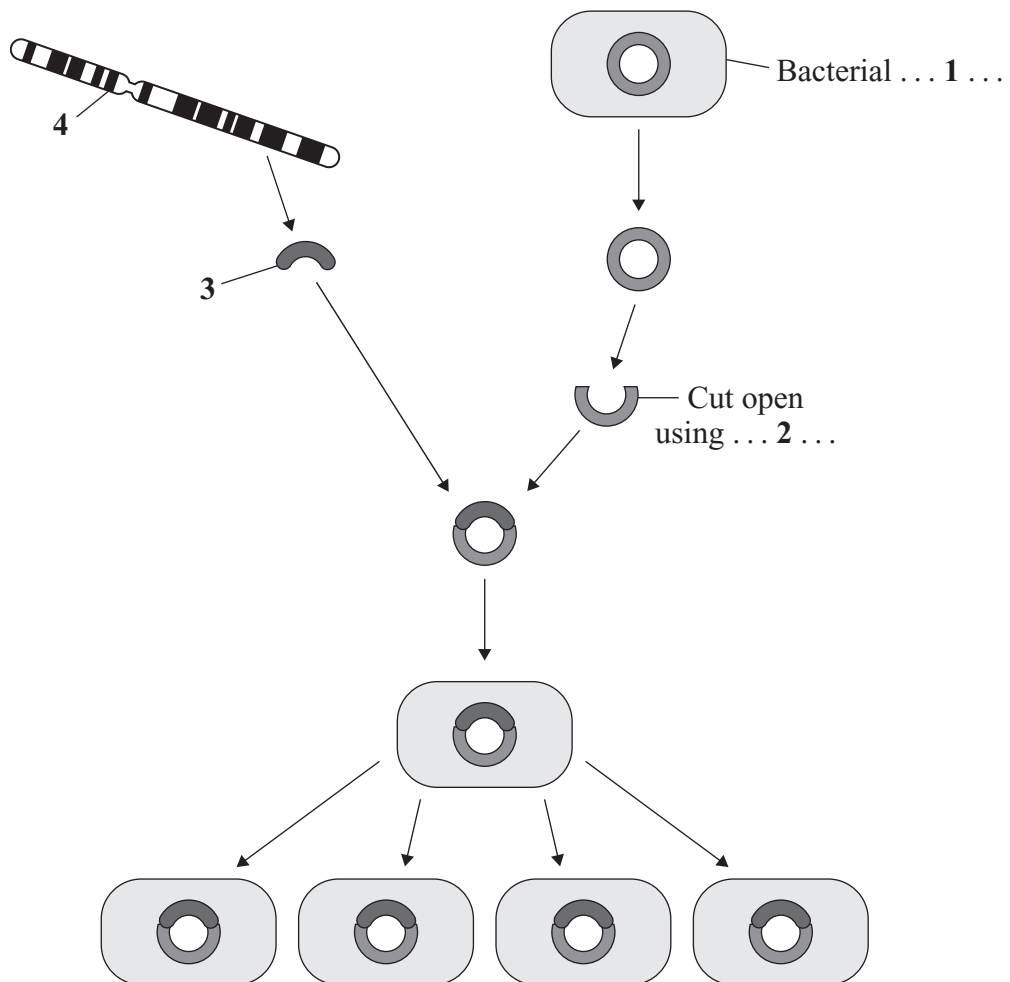
Modern man and chimpanzees . . . **1** . . . from a common ancestor as a result of . . . **2**

Differences in the . . . **3** . . . of different individuals meant that some . . . **4** . . . to breed more successfully than others.

Turn over ►

QUESTION FIVE

The diagram shows some of the steps involved in genetic engineering.



Match words, **A**, **B**, **C** and **D**, with the labels **1–4** on the diagram.

- A** cell
- B** chromosome
- C** enzyme
- D** gene

QUESTION SIX

It may be possible to clone humans.

There are a number of reasons why scientists might want to do this.

There are a number of reasons why governments might wish to ban human cloning.

Decisions must be made about whether human cloning should be allowed.

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

- A** A cloned human could have an identical twin 30 years younger than himself or herself.
- B** Many cloned animals have died early in their lives.
- C** The first scientist to clone a human will be famous.
- D** The techniques needed to clone humans could be used to produce human organs for transplants.

	Reason
1	It is an ethical reason why scientists would want to clone humans.
2	It is an unethical reason why scientists would want to clone humans.
3	It is a reason why governments might wish to ban human cloning.
4	It is an issue about which society needs to decide.

Turn over for the next question

Turn over ►

SECTION TWOQuestions **SEVEN** to **NINE**.

Each of these questions has four parts.

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

QUESTION SEVENThe table shows the numbers of four different organisms at two sites (**X** and **Y**) in a river.

Site	Mayfly larvae	Shrimps	Waterlice	Leeches
X	4	36	86	104
Y	80	140	4	10

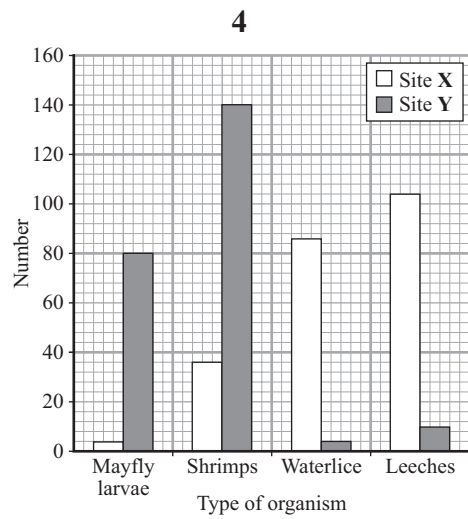
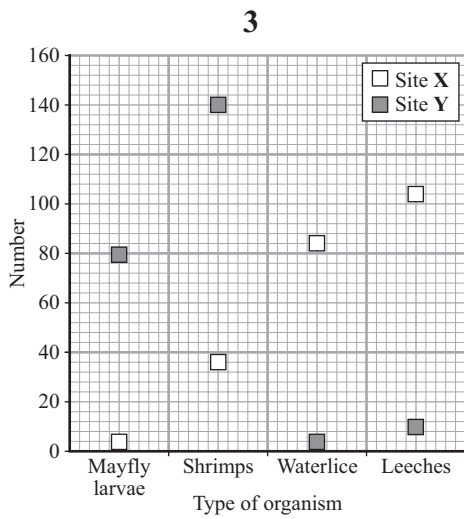
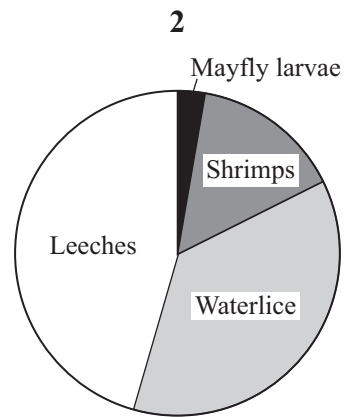
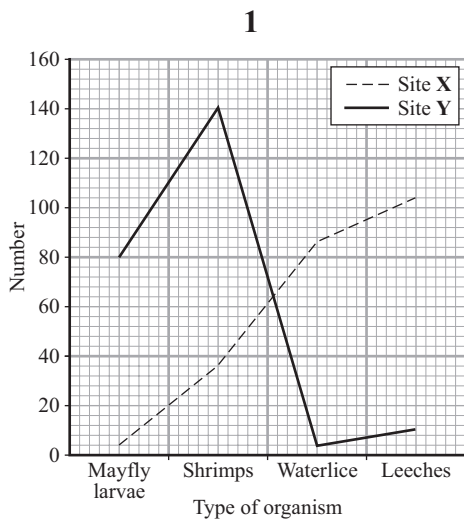
7A Which organism has the greatest difference in number between sites **X** and **Y**?

- 1 leeches
- 2 mayfly larvae
- 3 shrimps
- 4 waterlice

7B The different types of organism in the table are examples of . . .

- 1 indicator species.
- 2 air pollution species.
- 3 lichen species.
- 4 pollution species.

7C The best way of displaying the data from the table would be as . . .



7D Mayfly larvae prefer water with high levels of oxygen.

Which line in the table, about the oxygen content of the water at sites X and Y, is correct?

	Oxygen content of water	
	Site X	Site Y
1	low	low
2	low	high
3	high	high
4	high	low

Turn over ►

QUESTION EIGHT

Toads eat flying insects.

Wasps have a black and yellow striped body, and a sting.

Hoverflies have a black and yellow striped body, but do not have a sting.



Wasp



Hoverfly

In an experiment, a young toad which had never encountered wasps or hoverflies was presented with a wasp. The toad attempted to eat the wasp but quickly released it. Two days later the toad was presented with a hoverfly. The toad did not attempt to eat the hoverfly.

8A The toad probably released the wasp because . . .

- 1 it had an unpleasant taste.
- 2 the toad did not like the black and yellow colouring of the wasp.
- 3 the toad was not hungry.
- 4 the wasp stung the toad.

8B The toad probably did not attempt to eat the hoverfly because . . .

- 1 hoverflies do not taste very nice.
- 2 hoverflies have a nasty sting.
- 3 it was not hungry.
- 4 its colours acted as a warning.

8C In order to improve the experiment, . . .

- 1 a second wasp should be offered to the toad two days later.
- 2 it could be repeated with several young toads.
- 3 the toad should only be offered hoverflies.
- 4 the wasp's sting should be removed.

8D Ancestors of hoverflies did not have black and yellow striped bodies. The black and yellow stripes on the body of modern hoverflies are likely to have been produced . . .

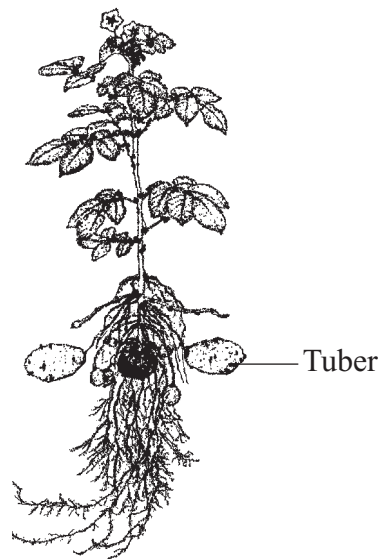
- 1 as a result of mutations.
- 2 when wasps died out.
- 3 when new competitors evolved.
- 4 when the ancestors of modern hoverflies became extinct.

Turn over for the next question

Turn over ►

QUESTION NINE

The diagram shows a potato plant.



Potato tubers are produced by cell division. Potato plants can reproduce sexually and asexually.

The tubers can be removed and replanted. This produces more potato plants of the same type.

The masses of the tubers of 15 potato plants of the same type were measured using an electronic balance. The results are shown in the table.

Plant number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mass of tubers in kg	2.5	1.7	2.3	4.1	2.2	1.9	2.5	3.8	4.6	1.9	3.6	1.3	2.5	2.9	1.2

9A What was the range of the mass of the tubers on the potato plants?

- 1** 1.2–2.5 kg
- 2** 1.2–4.6 kg
- 3** 1.3–4.6 kg
- 4** 1–15 kg

9B The sensitivity of the balance is . . .

- 1 0.001 kg
- 2 0.01 kg
- 3 0.1 kg
- 4 1.0 kg

9C Which of the following is **not** a possible reason for the difference in mass of the tubers produced by the potato plants?

- 1 Some of the plants were growing in the shade.
- 2 The plants received different amounts of nutrients.
- 3 The tubers were produced by sexual reproduction.
- 4 The plants were watered at different time intervals.

9D A plant nursery wants to produce large numbers of young plants quickly and cheaply.

Which technique would be used?

- 1 growing the seeds produced by sexual reproduction
- 2 taking cuttings
- 3 transplanting embryo plants to other plants
- 4 using genetic engineering

END OF TEST

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

HIGHER TIER

SECTION ONE

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

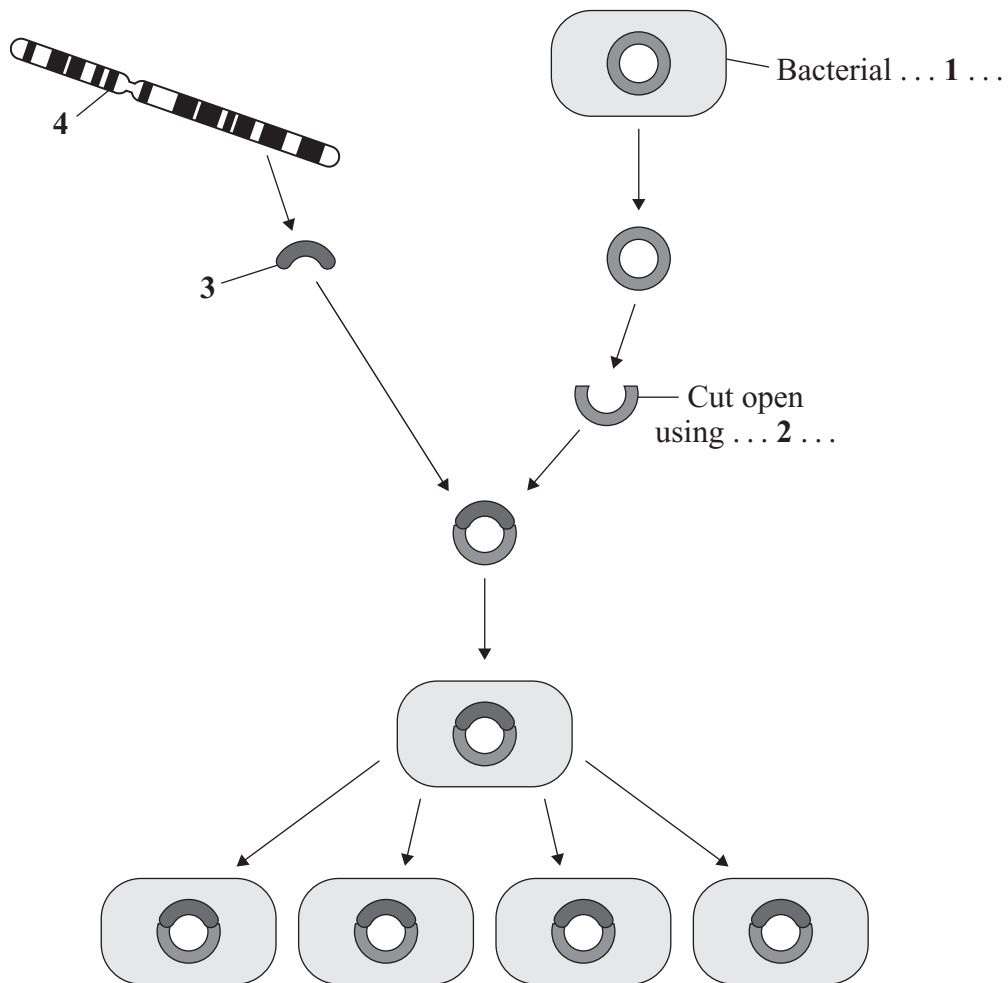
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows some of the steps involved in genetic engineering.



Match words, **A**, **B**, **C** and **D**, with the labels **1–4** on the diagram.

- A** cell
- B** chromosome
- C** enzyme
- D** gene

QUESTION TWO

Some inherited diseases could be avoided if the nucleus of a fertilised egg is put into the cytoplasm of another woman's egg. This would mean that the child would have one father and two mothers. Some scientists want to carry out research into this way of preventing such diseases.

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

- A** parents
- B** politicians
- C** scientists
- D** society

Whether this type of research should be allowed will be decided by . . . **1**

It is the role of . . . **2** . . . to ensure that the conclusions from the research are fully presented so that a balanced account can be discussed by . . . **3**

If the research is successful, then it is the decision of the . . . **4** . . . whether to go ahead with the procedure.

Turn over ►

SECTION TWOQuestions **THREE** to **NINE**.

Each of these questions has four parts.

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

QUESTION THREE

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3A The toad probably released the wasp because . . .

- 1 it had an unpleasant taste.
- 2 the toad did not like the black and yellow colouring of the wasp.
- 3 the toad was not hungry.
- 4 the wasp stung the toad.

3B The toad probably did not attempt to eat the hoverfly because . . .

- 1 hoverflies do not taste very nice.
- 2 hoverflies have a nasty sting.
- 3 it was not hungry.
- 4 its colours acted as a warning.

3C In order to improve the experiment, . . .

- 1 a second wasp should be offered to the toad two days later.
- 2 it could be repeated with several young toads.
- 3 the toad should only be offered hoverflies.
- 4 the wasp's sting should be removed.

3D Ancestors of hoverflies did not have black and yellow striped bodies. The black and yellow stripes on the body of modern hoverflies are likely to have been produced . . .

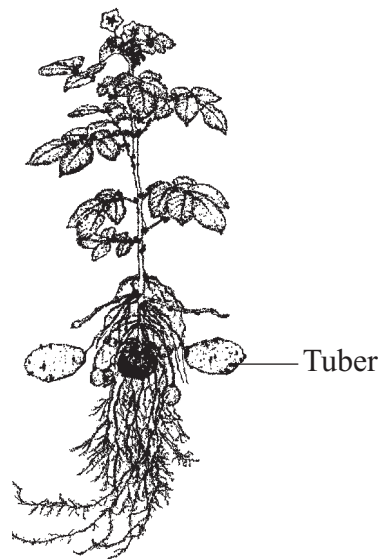
- 1 as a result of mutations.
- 2 when wasps died out.
- 3 when new competitors evolved.
- 4 when the ancestors of modern hoverflies became extinct.

Turn over for the next question

Turn over ►

QUESTION FOUR

The diagram shows a potato plant.



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4A What was the range of the mass of the tubers on the potato plants?

- 1** 1.2–2.5 kg
- 2** 1.2–4.6 kg
- 3** 1.3–4.6 kg
- 4** 1–15 kg

4B The sensitivity of the balance is . . .

- 1 0.001 kg
- 2 0.01 kg
- 3 0.1 kg
- 4 1.0 kg

4C Which of the following is **not** a possible reason for the difference in mass of the tubers produced by the potato plants?

- 1 Some of the plants were growing in the shade.
- 2 The plants received different amounts of nutrients.
- 3 The tubers were produced by sexual reproduction.
- 4 The plants were watered at different time intervals.

4D A plant nursery wants to produce large numbers of young plants quickly and cheaply.

Which technique would be used?

- 1 growing the seeds produced by sexual reproduction
- 2 taking cuttings
- 3 transplanting embryo plants to other plants
- 4 using genetic engineering

Turn over for the next question

Turn over ►

QUESTION FIVE

5A What is an animal's territory?

- 1 an area defended by an animal against other members of the same species
- 2 an area defended by an animal against all other animals
- 3 the place where animals compete with other animals
- 4 an area to which an animal has become adapted

5B Which of the following is **not** an adaptation to living in arctic conditions?

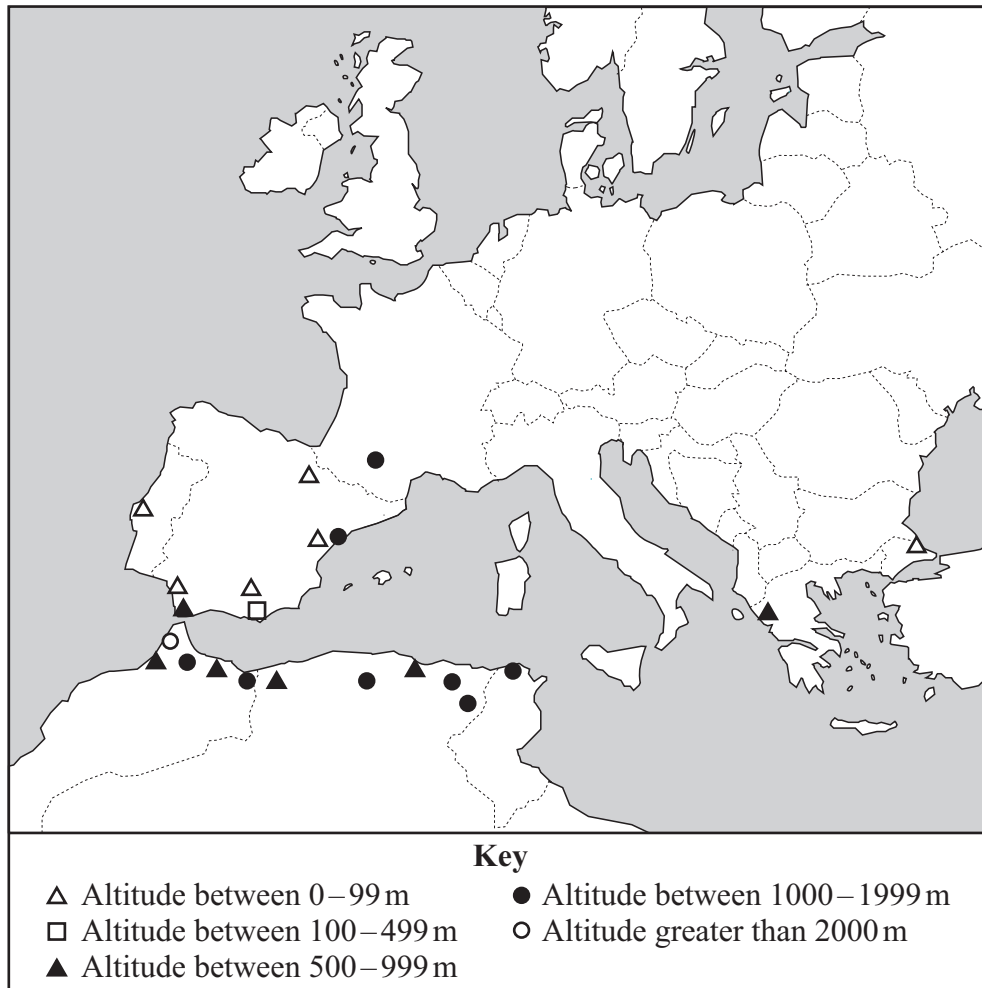
- 1 white fur of polar bears
- 2 thick layer of body fat in seals
- 3 small ears of arctic foxes
- 4 large wings of birds

5C Which line, **1**, **2**, **3** or **4**, in the table is correct?

	Adaptation for protection against predators	
	Plants	Animals
1	long roots of cacti	warning colours of some snakes
2	thorns on berberis plants	camouflage colours of flatfish
3	poisonous seeds of the henbane plant	long neck of the giraffe
4	waxy leaves of the agave plant	long beak of humming birds

5D The distribution of plants is affected by altitude (height above sea level in metres).

The map shows the altitudes of the only known sites where a rare plant grows.



The plant grows mainly at altitudes . . .

- 1 between 0–99 m
- 2 between 100–499 m
- 3 between 500–999 m
- 4 between 1000–1999 m

Turn over ►

QUESTION SIX

Read the passage.

GM Plants

There is a lot of concern about genetic engineering and its possible effects on the environment.

The practice of producing genetically modified (GM) food plants by adding genes for different characteristics may be a disaster in the making.

Scientists can add genes such as those for herbicide resistance, insecticide production, vitamin A production and other genes to improve growth, to plants that normally lack these characteristics.

There is evidence that some varieties of butterfly are disappearing, possibly due to eating pollen from GM crops.

There are fears that genes may escape from the organisms in which they were placed by cross-breeding, creating 'superweeds' that cannot be killed easily.

The GM crops may themselves also become weeds and spread rapidly through the environment.

Of further concern is the potential danger to humans of eating GM foods. The genes may react in the body and cause long-term effects which are at present unknown.

6A Which technique is used to produce large numbers of identical genetically modified plants?

- 1 artificial cross-breeding of plants
- 2 embryo transplants
- 3 tissue culture
- 4 transferring wanted genes to developing plant cells

6B Which genetic modification to plants directly benefits human health?

- 1 herbicide resistance
- 2 increased growth
- 3 insecticide resistance
- 4 vitamin A production

6C Which concern about GM crops is supported by scientific evidence?

- 1 Crops will become weeds and spread rapidly through the environment.
- 2 Herbicides will not be able to kill 'superweeds'.
- 3 Humans will be harmed by eating GM crops.
- 4 Some varieties of butterfly will disappear.

6D A scientist wants to find out if a gene for herbicide-resistance can be transferred to weeds from GM crop plants.

How could he investigate this?

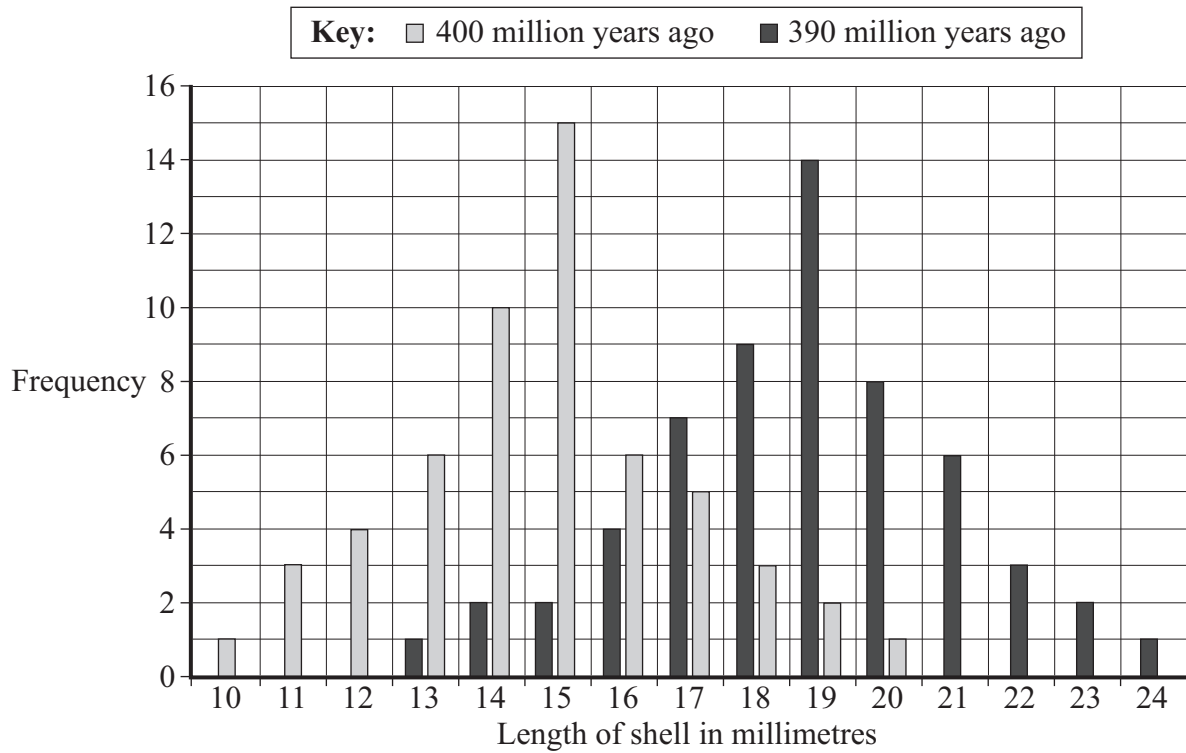
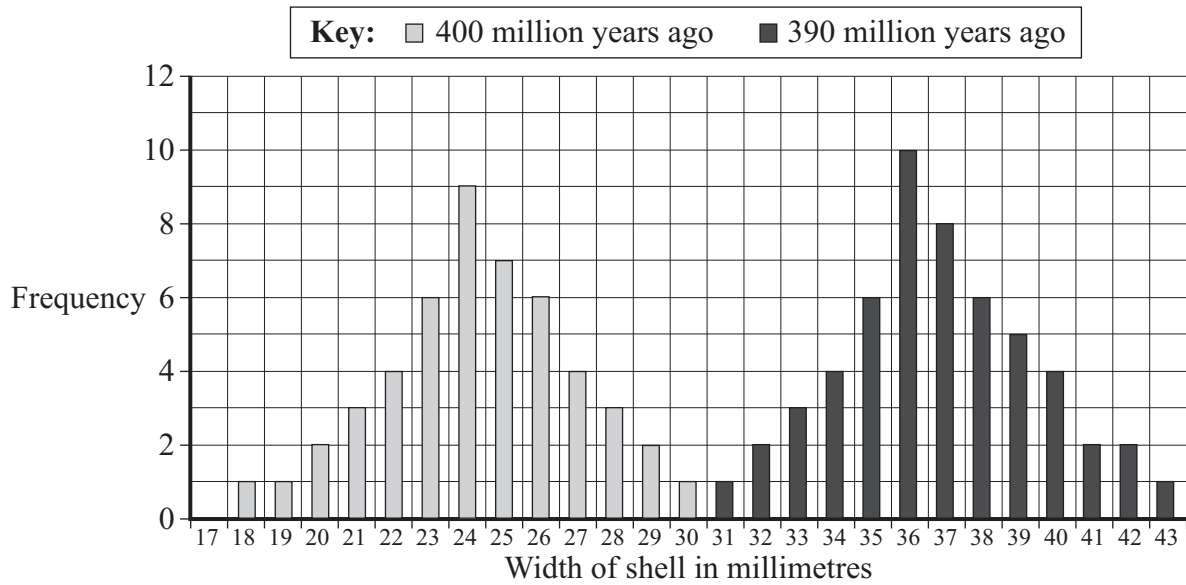
- 1 collect weeds from a number of different environments and study their genes
- 2 collect weeds from areas where GM crops are grown and spray the weeds with herbicide
- 3 cross-breed GM herbicide-resistant crop plants with weeds
- 4 grow the seeds from weeds growing close to GM crops and spray with herbicide

Turn over for the next question

Turn over ►

QUESTION SEVEN

The bar charts give some information about the width and length of the shells of fossil snails.



7A What conclusion can be drawn from these data?

- 1 More than half of the younger fossil shells are greater than 18 mm in length.
- 2 None of the older fossil shells are both longer and narrower than younger fossil shells.
- 3 All of the younger fossil shells are both shorter and wider than the older fossil shells.
- 4 None of the younger fossil shells are greater than 30 mm in width.

7B Which of the following statements is supported by these data?

- 1 As the snails evolved they became shorter.
- 2 As the snails evolved they became wider.
- 3 Snails with shells less than 18 mm wide did not exist before 400 million years ago.
- 4 Snails with shells shorter than 13 mm died out 400 million years ago.

7C Modern species of snail of similar types are much like those living 390 million years ago.

A likely reason for this is that . . .

- 1 mutations do not occur in these snail species.
- 2 snails have only a small number of genes.
- 3 snails have no predators.
- 4 the environment in which they live has changed very little.

7D The close similarity of some modern species to those living 390 million years ago suggests that . . .

- 1 Darwin's theory of evolution was incorrect.
- 2 natural selection does not take place in burrowing animals.
- 3 shells do not evolve.
- 4 some species evolve more slowly than others.

Turn over ►

QUESTION EIGHT

Read the passage.

EVOLUTION

Charles Darwin proposed his theory of evolution in 1859.

His theory of evolution by natural selection was only gradually accepted.

Other theories at the time included Lamarck's theory. This stated that organisms inherited characteristics that had been developed during the lifetime of their parents.

8A Which of the following best describes Darwin's theory of evolution?

- 1 Individuals with characteristics suited to their environment are more likely to survive and reproduce.
- 2 Only individuals with characteristics suited to their environment will survive.
- 3 Species become extinct if they do not match the environment in which they live.
- 4 Species survive only if they have similar characteristics to their parents.

8B One reason why Darwin's theory of evolution by natural selection was only gradually accepted could have been because . . .

- 1 at that time scientists did not know how characteristics were inherited.
- 2 Darwin had not carried out any experiments.
- 3 Darwin was not an accepted scientist.
- 4 there was no scientific evidence to support the theory.

8C Darwin's and Lamarck's theories are similar in that they both . . .

- 1 depend on information about the characteristics of organisms being passed from parent to offspring.
- 2 rely on parents being able to alter the characteristics of their offspring.
- 3 state that evolution depends on changes in the environment.
- 4 state that evolution happens very rapidly.

- 8D** When it was first put forward, the theory of evolution by natural selection was based on . . .
- 1 a series of controlled experiments.
 - 2 hearsay.
 - 3 observations of the natural world.
 - 4 unreliable evidence.

Turn over for the next question

Turn over ►

QUESTION NINE

Lichens are sensitive to the concentration of sulfur dioxide in different pollution zones.

Table 1 shows the range of sulfur dioxide concentrations in different pollution zones.

Table 2 shows which species of lichen are found in each pollution zone.

Lichens that can live in the red pollution zone are the most tolerant of sulfur dioxide.

Table 1

Pollution zone	Sulfur dioxide concentration in $\mu\text{g per m}^3$
red	greater than 75
brown	55 to 75
orange	45 to 54
yellow	35 to 44
blue	10 to 34
green	less than 10

Table 2

Species of lichens	Pollution zone
Desmococcus viridis	red
Evernia prunastri	brown
Physcia adscendens	brown
Xanthoria polycarpa	brown
Physcia aipolia	orange
Melanelia species	orange
Cetraria chlorophylla	yellow
Graphis scripta	yellow
Menegazzia terebrata	blue
Parmotrema arnoldii	blue
Usnea rigida	blue
Lobaria pulmonaria	green

9A What is the maximum concentration of sulfur dioxide that *Menegazzia terebrata* can tolerate?

- 1 9 μg of sulfur dioxide / m^3
- 2 34 μg of sulfur dioxide / m^3
- 3 39 μg of sulfur dioxide / m^3
- 4 more than 40 μg of sulfur dioxide / m^3

9B **Table 3** shows the concentration of sulfur dioxide in the air in four areas, **P**, **Q**, **R** and **S**.

Table 3

Area	Concentration of sulfur dioxide in μg per cubic metre
P	89
Q	12
R	43
S	56

Which line, **1**, **2**, **3** or **4**, in **Table 4** is correct?

Table 4


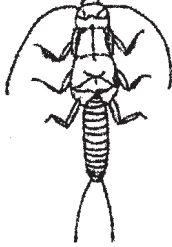



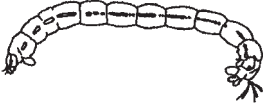
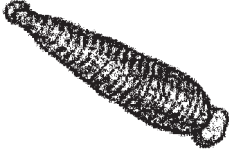

	Area	Pollution zone	Species found
1	P	red	<i>Desmococcus viridis</i> and <i>Evernia prunastri</i>
2	Q	brown	<i>Physcia adscendens</i> and <i>Xanthoria polycarpa</i>
3	R	yellow	<i>Cetraria chlorophylla</i> and <i>Graphis scripta</i>
4	S	blue	<i>Parmotrema arnoldii</i> and <i>Lobaria pulmonaria</i>

Question 9 continues on the next page

Turn over ►

9C **Table 5** shows some species of invertebrates and the level of pollution to which they are tolerant.

Table 5

LOW 0 to 60 units of pollution		
		
Mayfly nymph	Stonefly nymph	
INTERMEDIATE 61 to 120 units of pollution		
		
Caddis fly larva	Freshwater shrimp	Crane fly larva
HIGH 121 units of pollution and above		
		
Blood worm	Leech	Flatworm

A student found several caddis fly larvae in a habitat.

This suggests that the habitat . . .

- 1 had a pollution level above 120 units.
- 2 had a pollution level that could not be measured.
- 3 was unpolluted.
- 4 had a pollution level between 61 and 120 units.

9D Pollution levels can be measured using digital meters. A digital meter was used to test a sample of water six times. The meter gave readings of 67, 69, 75, 73, 62 and 71.

The differences in the readings are most likely to have been caused by . . .

- 1 an anomaly.
- 2 human error.
- 3 random error.
- 4 using the wrong instrument.

END OF TEST

There are no questions printed on this page