Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

General Certificate of Secondary Education
March 2009

SCIENCE A **BLY1BP**
Unit Biology B1b (Evolution and Environment)

BIOLOGY
Unit Biology B1b (Evolution and Environment)

Wednesday 4 March 2009 Morning Session

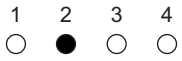
For this paper you must have:
- a black ball-point pen
- an objective test answer sheet.

You may use a calculator.

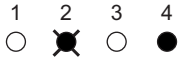
Time allowed: 30 minutes

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.

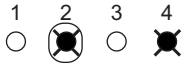
Instructions for recording answers
- Use a **black ball-point pen**.
- For each answer **completely fill in the circle** as shown:



- 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 16 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**.

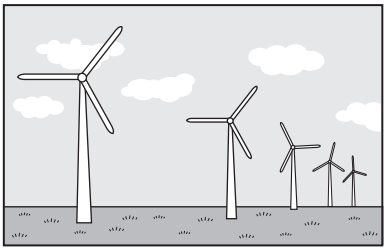
Mark your choices on the answer sheet.

QUESTION ONE

We need to look after the Earth for future generations. Diagrams **1–4** show some ways of doing this.

Glass is made from raw materials from the Earth

1



2

Please switch off the lights when you leave the room

3

4

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

A conserves forests

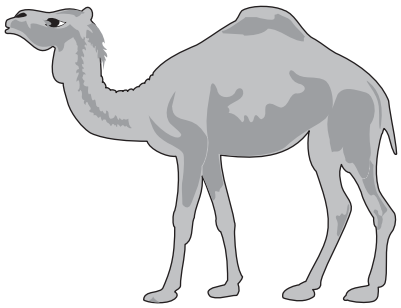
B uses a renewable energy source

C reduces quarrying

D saves electrical energy

QUESTION TWO

Camels are adapted for living in hot, dry conditions.



Match the facts about camels, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A The camel's stomach can hold 200 litres of water.

B The camel produces little urine and does not sweat.

C Camels store fat in a hump.

D Camels can withstand an increase in body temperature of 9 °C without harm.

1	Camels lose very little water each day.
2	It is unlikely for a camel to die from being overheated.
3	Camels can go without drinking water for several days.
4	Camels can go without food for several days.

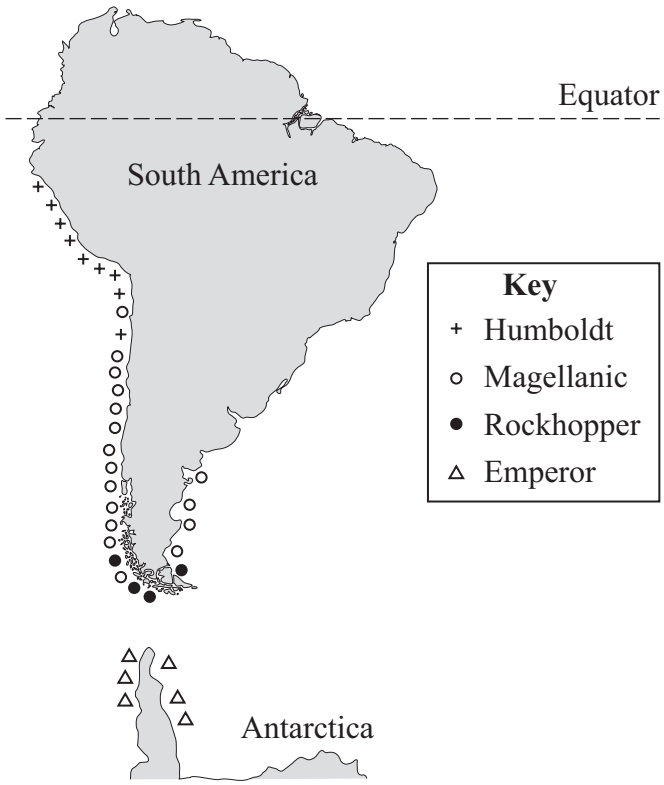
Turn over for the next question

QUESTION THREE

The table shows information about four species of penguin.

	Species of penguin			
	Humboldt	**Rockhopper**	**Emperor**	**Magellanic**
Average height in cm	65	55	120	70
Average mass in kg	4	2.5	35	5

The map shows the distribution of penguins in South America and part of Antarctica.



Match the species of penguin, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table below.

A Humboldt penguin

B Magellanic penguin

C Rockhopper penguin

D Emperor penguin

1	the tallest penguin
2	the penguin that lives nearest to the equator
3	the penguin with the largest range of habitats
4	the penguin with the lowest average mass compared with its height

QUESTION FOUR

Insulin is a drug needed by some people suffering from diabetes.

Bacteria can be genetically engineered to produce insulin.

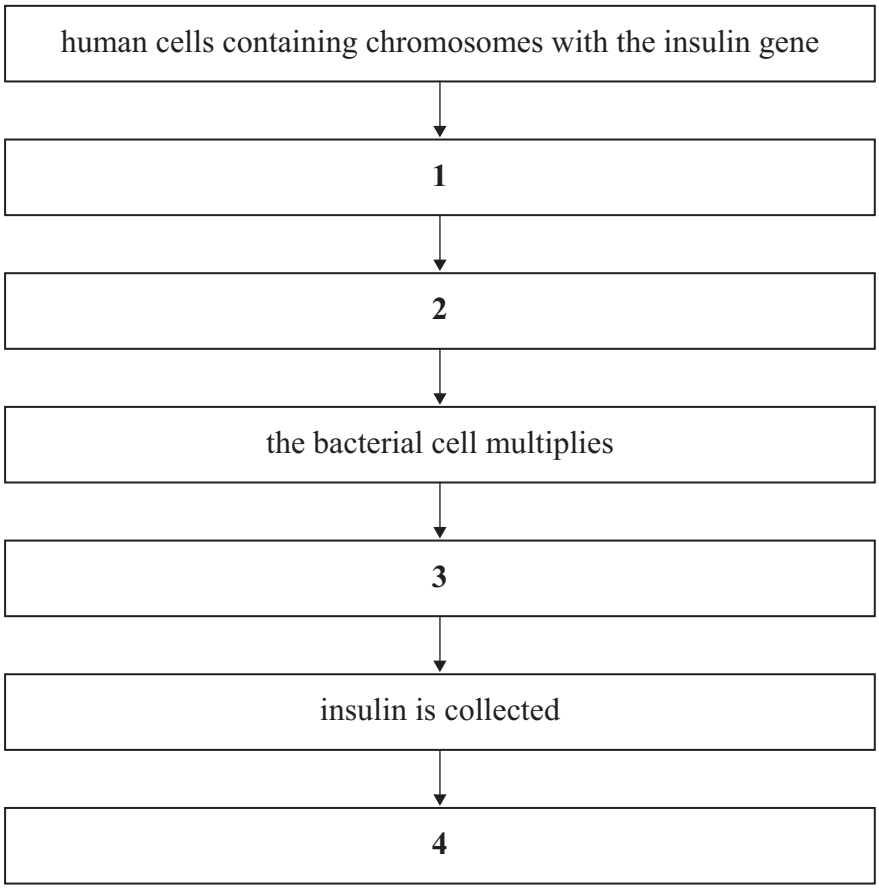
Match statements, **A**, **B**, **C** and **D**, with the labels **1–4** on the flow chart.

A insulin is produced by genetically engineered bacteria

B diabetics inject insulin to control diabetes

C the insulin gene is 'cut out' using enzymes

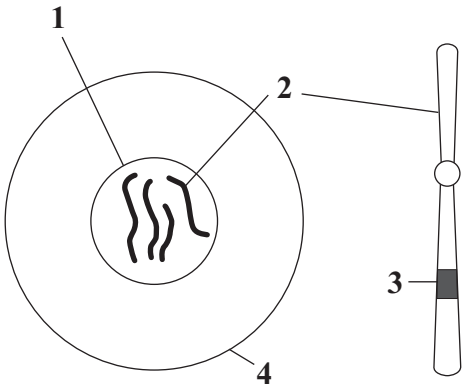
D the insulin gene is transferred into a bacterium



Turn over for the next question

QUESTION FIVE

The diagram shows a human egg.



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

A cell

B nucleus

C chromosome

D gene

Turn over for the next question

SECTION TWO

Questions **SIX** to **NINE**.

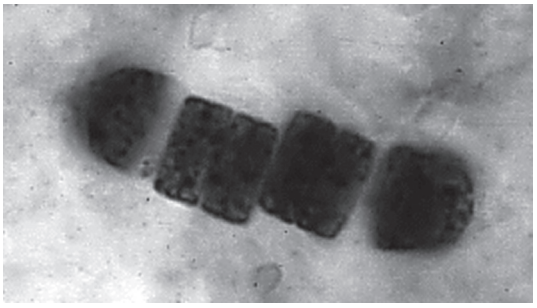
Each of these questions has four parts.

In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION SIX

The photograph shows a fossil which was formed 3 billion years ago.



J.W. Schopf, University of California, *www.ucmp.berkeley.edu*

6A There were probably other types of organism in the area when this fossil was being formed.

Why did these other organisms **not** become fossils?

1 They could move very quickly.

2 They had soft bodies.

3 They evolved.

4 They became extinct.

6B Only a few rocks contain fossils that are more than 3 billion years old.

This is because . . .

1 many fossils have been destroyed.

2 fossils only last for 3 billion years.

3 most of the Earth's rocks are under the oceans.

4 the Earth was created 3 billion years ago.

6C The species that formed this fossil could have died out because . . .

1 it had no method of reproduction.

2 it was crushed by rocks.

3 its ancestors had not become fossils.

4 its environment changed.

6D The theory of evolution states that all living things . . .

1 have evolved from simple life forms.

2 will become extinct.

3 are genetically different.

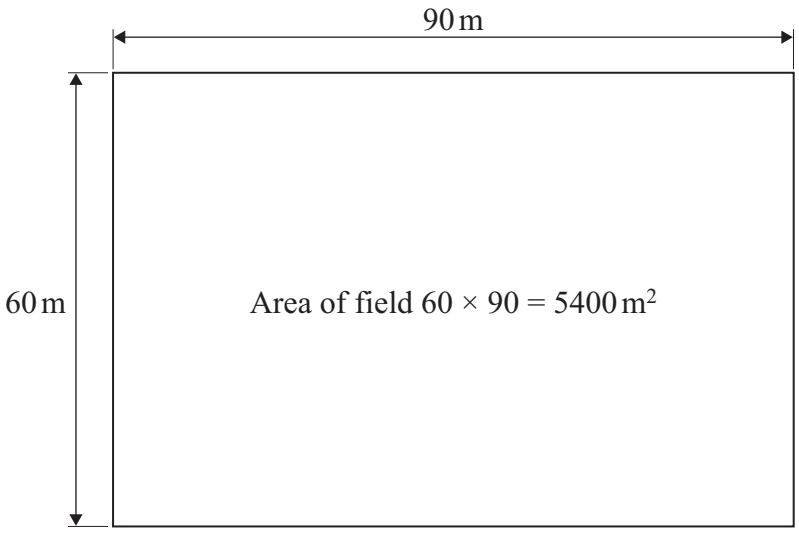
4 evolved from apes.

Turn over for the next question

QUESTION SEVEN

A class of students was set the task of estimating the number of dandelions on the school field.
To do this, they decided to use sampling squares called quadrats.
Each quadrat had an area of 1 m^2.

The diagram shows the dimensions of the school field.



7A They wanted to make their investigation as fair as possible.

Which would be the best way to sample the field?

1 throw all the quadrats near the middle of the field

2 throw the quadrats where there were lots of dandelions to count

3 throw the quadrats randomly around the field

4 make sure all the quadrats had a similar number of dandelions in them

7B Each student collected data by throwing 10 quadrats.

Which would be the best way to improve the reliability of their estimate?

1 count all the dandelions on the field

2 use the results of the student with the highest estimate

3 work out an estimate using all the data collected by all the students

4 use smaller quadrats

These are the results for one student, Mary.

Quadrat number	Number of dandelions
1	3
2	3
3	6
4	2
5	1
6	2
7	0
8	3
9	2
10	0

7C What was the mean number of dandelions per quadrat counted by Mary?

1 1.7

2 1.8

3 2.0

4 2.2

7D Another student, Sharon, calculated a mean of 2.8 dandelions per quadrat from her results.

Estimate the number of dandelions in the whole field by using:

- the mean of 2.8
- information from the diagram on the opposite page
- the equation below.

Estimated number of dandelions on field	=	mean number of dandelions per quadrat	×	number of quadrats that would fit into the field

1 28

2 420

3 15 120

4 54 000

QUESTION EIGHT

Sulfur dioxide is a pollutant gas.

8A Which environmental problem is caused by sulfur dioxide?

1 global warming

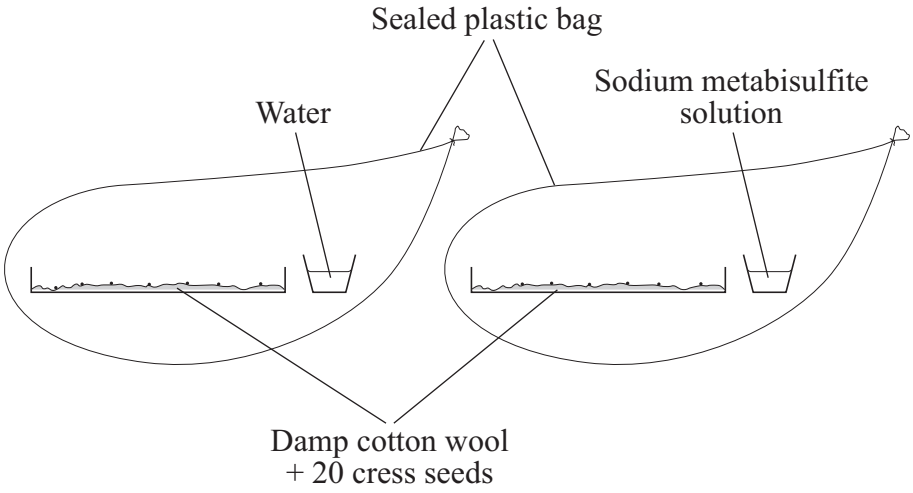
2 acid rain

3 deforestation

4 traffic congestion

A student investigated the effect of sulfur dioxide on the germination of cress seeds.

The diagram shows her apparatus.



- Sodium metabisulfite solution gives off sulfur dioxide.
- Both bags were left in a warm laboratory for 5 days.
- The student then counted the number of seeds that had germinated.

8B The independent variable in this investigation was . . .

1 the number of seeds that germinated.

2 the number of seeds put into each bag.

3 the presence of water or sodium metabisulfite.

4 the temperature in the laboratory.

8C The main reason for using the plastic bags was . . .

1 to keep the seeds warm.

2 to keep the seeds dry.

3 to keep gases inside.

4 to let light in.

8D The student carried out the investigation five times. The table shows the student's results.

Number of seeds that germinated	
Bag containing water	**Bag containing sodium metabisulfite solution**
17	5
15	8
15	5
16	8
17	9

What conclusion can be drawn from these results?

1 Sodium metabisulfite poisons cress seeds.

2 Sulfur dioxide affects the germination of cress seeds.

3 There is 100% germination of cress seeds when sulfur dioxide is **not** present.

4 Water is toxic to a small number of cress seeds.

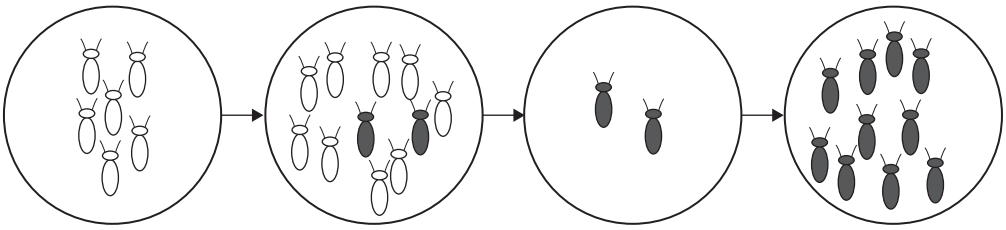
Turn over for the next question

QUESTION NINE

Head lice are insects that live in human hair. Hair can be treated with special shampoo containing an insecticide that kills head lice.

The diagrams show the development of the population of a new strain of head lice that appeared in the hair of pupils attending the same school.

Each diagram represents the number of head lice that were found in the hair of the pupils of one class at intervals over several months.



Stage P
Original population of head lice

Stage Q
Offspring of adults from **Stage P**

Stage R
Population after pupils were treated with shampoo containing the insecticide

Stage S
Population one month later

Key:  and  represent different strains of head lice.

9A A mutation that produced a new strain of head lice occurred . . .

1 during **Stage R**.

2 between **Stage P** and **Stage Q**.

3 between **Stage Q** and **Stage R**.

4 between **Stage R** and **Stage S**.

9B The head lice in **Stage R** . . .

1 must be impossible to kill.

2 must be unable to reproduce.

3 have identical genes to those in **Stage P**.

4 must be resistant to the insecticide in the shampoo.

9C The composition of the population of head lice at **Stage R** is due to . . .

1 competition.

2 camouflage.

3 genetic engineering.

4 natural selection.

9D The head lice at **Stage S** will continue to multiply until . . .

1 all of them die through lack of food.

2 all of them change back to the strain shown in **Stage P**.

3 a new insecticide is developed.

4 they suffer from overcrowding.

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**.

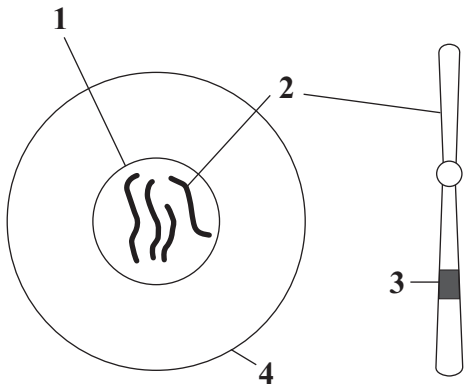
In these questions, match the letters, **A**, **B**, **C** and **D**, with the numbers **1–4**.

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

Mark your choices on the answer sheet.

QUESTION ONE

The diagram shows a human egg.



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

A cell

B nucleus

C chromosome

D gene

QUESTION TWO

Many human activities damage the environment.

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

A oxygen

B sulfur dioxide

C pesticide

D carbon dioxide

1	Lichens can be used as an indicator of this substance.
2	The Kyoto agreement has attempted to control its release.
3	It reduces damage to crop plants by killing invertebrates.
4	Its concentration in freshwater can be assessed by what invertebrates are found.

Turn over for the next question

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.

QUESTION THREE

Sulfur dioxide is a pollutant gas.

3A Which environmental problem is caused by sulfur dioxide?

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2 acid rain

3 deforestation

4 traffic congestion

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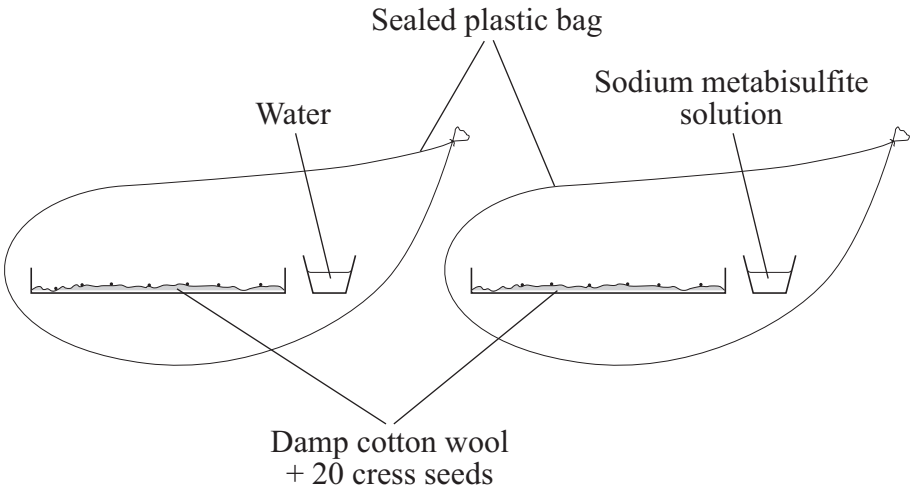

- Sodium metabisulfite solution gives off sulfur dioxide.
- Both bags were left in a warm laboratory for 5 days.
- The student then counted the number of seeds that had germinated.

3B The independent variable in this investigation was . . .

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3C The main reason for using the plastic bags was . . .

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3D The student carried out the investigation five times. The table shows the student's results.

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QUESTION FOUR

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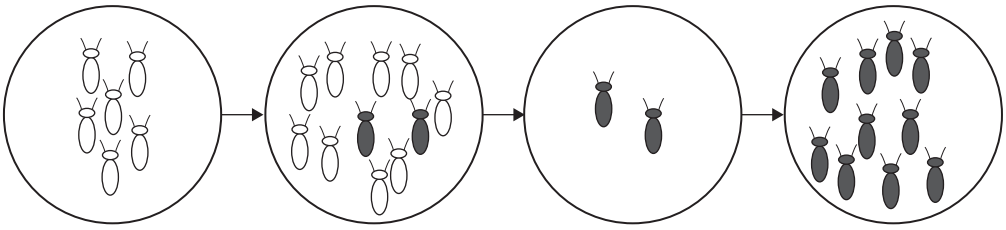
Each diagram represents the number of head lice that were found in the hair of the pupils of one class at intervals over several months.



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Original population of head lice

Stage Q
Offspring of adults from **Stage P**

Stage R
Population after pupils were treated with shampoo containing the insecticide

Stage S
Population one month later

Key:  and  represent different strains of head lice.

4A A mutation that produced a new strain of head lice occurred . . .

1 during **Stage R**.

2 between **Stage P** and **Stage Q**.

3 between **Stage Q** and **Stage R**.

4 between **Stage R** and **Stage S**.

4B The head lice in **Stage R** . . .

1 must be impossible to kill.

2 must be unable to reproduce.

3 have identical genes to those in **Stage P**.

4 must be resistant to the insecticide in the shampoo.

4C The composition of the population of head lice at **Stage R** is due to . . .

1 competition.

2 camouflage.

3 genetic engineering.

4 natural selection.

4D The head lice at **Stage S** will continue to multiply until . . .

1 all of them die through lack of food.

2 all of them change back to the strain shown in **Stage P**.

3 a new insecticide is developed.

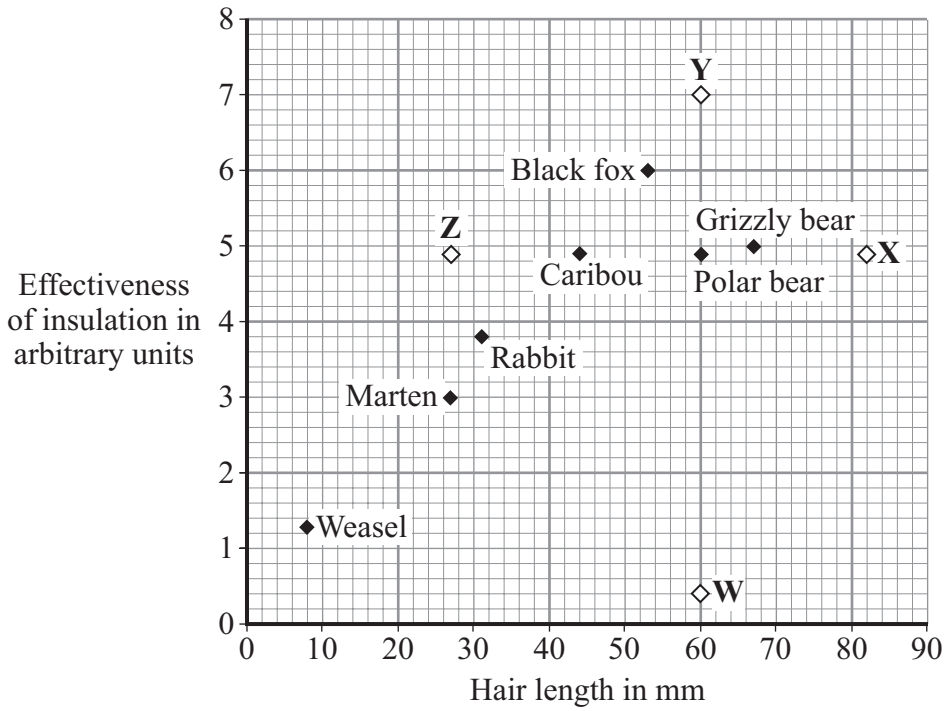
4 they suffer from overcrowding.

Turn over for the next question

QUESTION FIVE

Some animals are adapted for life in cold conditions.

The graph shows the association between hair length and the effectiveness of insulation provided by the dry coats of different animals.



5A From the information in the graph, which one of the following animals is best adapted for life in the Arctic?

1 grizzly bear

2 caribou

3 polar bear

4 black fox

An animal loses heat more rapidly when its coat is wet than when its coat is dry.

5B Which letter on the graph indicates data for a polar bear when its coat is wet?

1 **W**

2 **X**

3 **Y**

4 **Z**

5C Polar bears often swim to catch their food. The black fox lives on land.

Which adaptation would be more suitable for the polar bear than the black fox in reducing the rate of heat loss?

1 larger ears

2 longer hair

3 thicker layer of fat under the skin

4 wider feet

The table compares the grizzly bear with the black bear.

	Grizzly bear	**Black bear**
Hair colour	Varies from black to blonde	Varies from black to white
Ear size	Short	Long
Claw length	10 cm	4 cm
Shoulder muscles	Large	Small

5D Which feature suggests that grizzly bears live in colder regions than black bears?

1 hair colour

2 ear size

3 claw length

4 shoulder muscles

Turn over for the next question

QUESTION SIX

Biofuels can be produced from crops such as sugar cane. After harvesting, the sugar is converted into alcohol by microorganisms. Alcohol can be used in vehicles either on its own or mixed with petrol. This reduces the need to use crude oil as an energy source.

6A Some people have linked global shortages of food to the increase in biofuel production.

This could be because . . .

1 rainforests provide large amounts of food.

2 land previously used for food crops is being used to grow sugar cane for conversion to alcohol.

3 factories making biofuel are often built on farmland.

4 drilling for crude oil damages large areas of farmland.

6B Supporters of the use of biofuel claim that it is more 'environmentally friendly' than using petrol.

This could be because . . .

1 sugar cane plants take in carbon dioxide from the atmosphere.

2 trees 'lock up' large amounts of carbon, for many years, in wood.

3 fields of sugar cane increase the number of different species of animals in an area.

4 burning alcohol releases about the same amount of carbon dioxide as the plants took in when they were growing.

6C Large areas of rainforest might be cut down to provide land to grow sugar cane.

This may be harmful because . . .

1 biodiversity is reduced.

2 less oxygen will be released into the atmosphere.

3 extra methane is released which causes global warming.

4 more carbon dioxide will be released into the atmosphere.

6D The land made available by cutting down trees can only be used to grow sugar cane for about three years. After this, the land can be used to raise cattle.

Increased cattle farming leads to increasing atmospheric temperatures on Earth.

This is mainly because cattle release . . .

1 methane which allows more of the Sun's heat to reach Earth.

2 carbon dioxide which absorbs heat and retains it.

3 methane which absorbs heat and radiates it back to Earth.

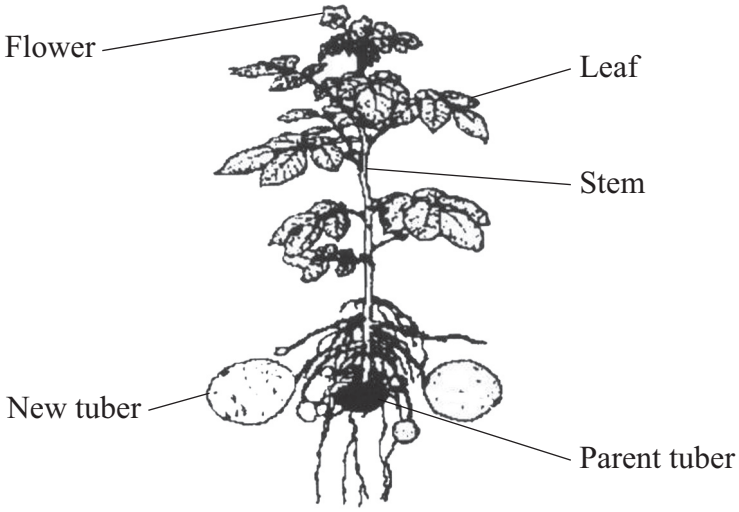
4 carbon dioxide which allows more of the Sun's heat to reach Earth.

Turn over for the next question

QUESTION SEVEN

There are many varieties of potato plant, producing tubers with different qualities.

Potato plants can reproduce both sexually and asexually.



7A How could new varieties of potato be produced?

1 taking small groups of cells from a new tuber and growing them

2 taking cuttings from the leaf or stem of the plant and growing them

3 allowing gametes from different potato plants to fuse together

4 allowing new tubers to stay in the ground and to grow next year

7B Scientists wish to create a variety of potato which will tolerate drought conditions.
They have identified the gene which gives a cactus species the ability to survive with very little water.

What would be the best way of producing drought-resistant potatoes?

1 breed ordinary potato plants with cactus plants

2 use enzymes to cut out the gene from the cactus and transfer it to potato cells

3 selectively breed cactus plants which, over many generations, are more like potatoes

4 grow potato plants in low water conditions over many generations

7C Some people believe that using genetic engineering to develop potatoes that are tolerant to drought conditions should **not** be allowed.

One reason for this is because . . .

1 the new variety of potato may be susceptible to the same diseases as cactus plants.

2 the cost of the technology required outweighs the possible profits.

3 the native potato may compete with the new variety.

4 there are ethical concerns about interfering with natural processes.

7D Herbicide-resistant potatoes have also been produced.

The advantage of this is that . . .

1 old potato plants can easily be killed to make way for new crops.

2 it is easy to kill insects which might feed on the crop.

3 the growth of wild flowers is encouraged, maintaining biodiversity.

4 competition from other plants can be reduced.

Turn over for the next question

QUESTION EIGHT

Read the passage about controlling rabbit numbers.

Before 1859 there were no rabbits in Australia. 24 rabbits were released in 1859.

In 1926, it was estimated that there were 1 000 000 000 rabbits.

The rabbit is a native of southern Europe where its population remained relatively constant until the introduction of myxomatosis, a viral disease that kills rabbits.
The disease was introduced into the populations of Australian and European rabbits in the 1950s. It killed 99.8 % of all rabbits. In recent years, the rabbit population has recovered a little. It is believed that up to 10 % of the rabbit population is now genetically resistant to the disease. In a few areas of Australia, rabbits have destroyed all the acacia plants. Many farmers in Australia now use poisons to control rabbit numbers.

8A Which is a likely reason for the more rapid increase in rabbit numbers in Australia compared with Europe?

1 The rabbits evolved more rapidly in Australia.

2 Some rabbits in Australia were resistant to myxomatosis.

3 The rabbits could breed more rapidly in Australia.

4 The rabbits faced little competition in Australia.

8B Resistance to myxomatosis in rabbits was caused initially by changes in their . . .

1 competitors.

2 environment.

3 genes.

4 reproductive systems.

8C The European lynx, a natural predator of the rabbit, is an endangered species.

The evidence in the passage suggests that this could have been caused by . . .

1 the increased percentage of resistant rabbits.

2 the use of poisons.

3 the loss of the acacia plants.

4 the introduction of myxomatosis.

8D Which is the main reason why Australian farmers *now use poisons to control rabbit numbers*?

1 Poisons will selectively kill genetically resistant rabbits.

2 Poisons are cheaper than using myxomatosis.

3 Myxomatosis is not as effective as it once was in killing rabbits.

4 The rabbit is not a native species in Australia.

Turn over for the next question

QUESTION NINE

There are several theories for the way in which evolution may have happened.

9A Lamarck's theory of evolution was based on the idea that . . .

1 organisms pass on the advantages that they acquire during their lifetime.

2 organisms acquire genes from their parents which may give them advantages.

3 the characteristics that organisms have are controlled by God.

4 offspring have a mixture of their parents' features.

9B In the 1860s there was much opposition to Darwin's theory of evolution.

Which of the following was **not** a reason for this opposition?

1 The theory conflicted with deeply held religious views.

2 Darwin did **not** have sufficient evidence to support his ideas.

3 Darwin was unable to make his ideas known to other scientists.

4 Nobody knew how inheritance worked.

9C When a new island is formed by volcanic action, the environment continues to undergo rapid change for many years. At first there will be no living things present.

A plant seed may be blown to the island by the wind. When this seed begins to grow, the plant may reproduce asexually.

What is the disadvantage of asexual reproduction to the plant species in this case?

1 Only one individual is needed for reproduction.

2 All the offspring will be genetically identical.

3 New plants will be produced quickly.

4 Dense groups of this species will reduce competition from other species.

9D Darwin's theory of evolution through natural selection was based on a number of events.

These events are outlined below.

- **P** Those individuals which are most suited to the environment survive.
- **Q** There is an increase in variation between members of the species.
- **R** Genes that improve survival chances are passed on to the next generation.
- **S** Mutation results in new forms of genes.

Which is the correct sequence for these events?

1 **P → R → S → Q**

2 **Q → R → P → S**

3 **S → Q → P → R**

4 **R → S → Q → P**

END OF TEST

There are no questions printed on this page