Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Biology

Advanced

Unit 4: The Natural Environment and Species Survival

Tuesday 10 January 2017 – Afternoon
Time: 1 hour 30 minutes

Paper Reference
WBI04/01

You must have:
Calculator, HB pencil, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 90.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*
- Candidates may use a calculator.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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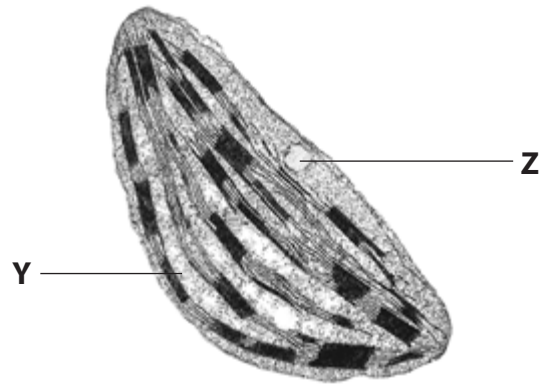
P 4 8 3 5 7 A 0 1 2 4

Pearson

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 The electron micrograph below shows a chloroplast.



Magnification ×10 000

(a) (i) Place a cross (☒) in the box next to the name of the part labelled **Y**.

(1)

- ☒ **A** cytoplasm
- ☒ **B** matrix
- ☒ **C** stroma
- ☒ **D** tonoplast

(ii) Place a cross (☒) in the box next to the name of the part labelled **Z**.

(1)

- ☒ **A** lysosome
- ☒ **B** nucleolus
- ☒ **C** nucleus
- ☒ **D** starch grain

(b) Thylakoid membranes in chloroplasts are phospholipid bilayers with proteins and chlorophyll molecules embedded in them.

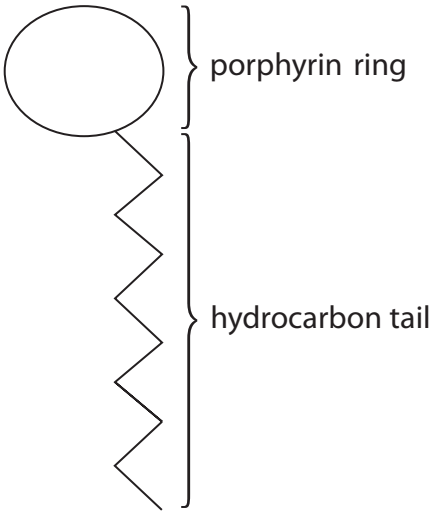
(i) Explain why the phospholipids are arranged in a bilayer.

(3)

(ii) Describe the role of the proteins in the thylakoid membrane in the formation of ATP.

(3)

(iii) The diagram below shows a simplified structure of a chlorophyll molecule.



Place a cross (☒) in the box next to the name of the ion found in the porphyrin ring.

(1)

☒ **A** calcium

☒ **B** magnesium

☒ **C** nitrate

☒ **D** phosphate

(iv) Suggest why the chlorophyll molecule has a hydrocarbon tail.

(2)

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(Total for Question 1 = 11 marks)

2 Some bacterial and viral infections result in death.

(a) The table below shows some features of bacteria and viruses.

For each feature, place one cross (☒) in the appropriate box in each row, to show whether the feature is found in bacteria and viruses, bacteria only, viruses only or not found in either.

(4)

Feature	Bacteria and viruses	Bacteria only	Viruses only	Not found in either bacteria or viruses
Cytoplasm	☒	☒	☒	☒
Nucleic acids	☒	☒	☒	☒
Protein coat	☒	☒	☒	☒
Ribosomes	☒	☒	☒	☒

(b) Describe the sequence of symptoms that result in the death of a person infected with *Mycobacterium tuberculosis* (TB).

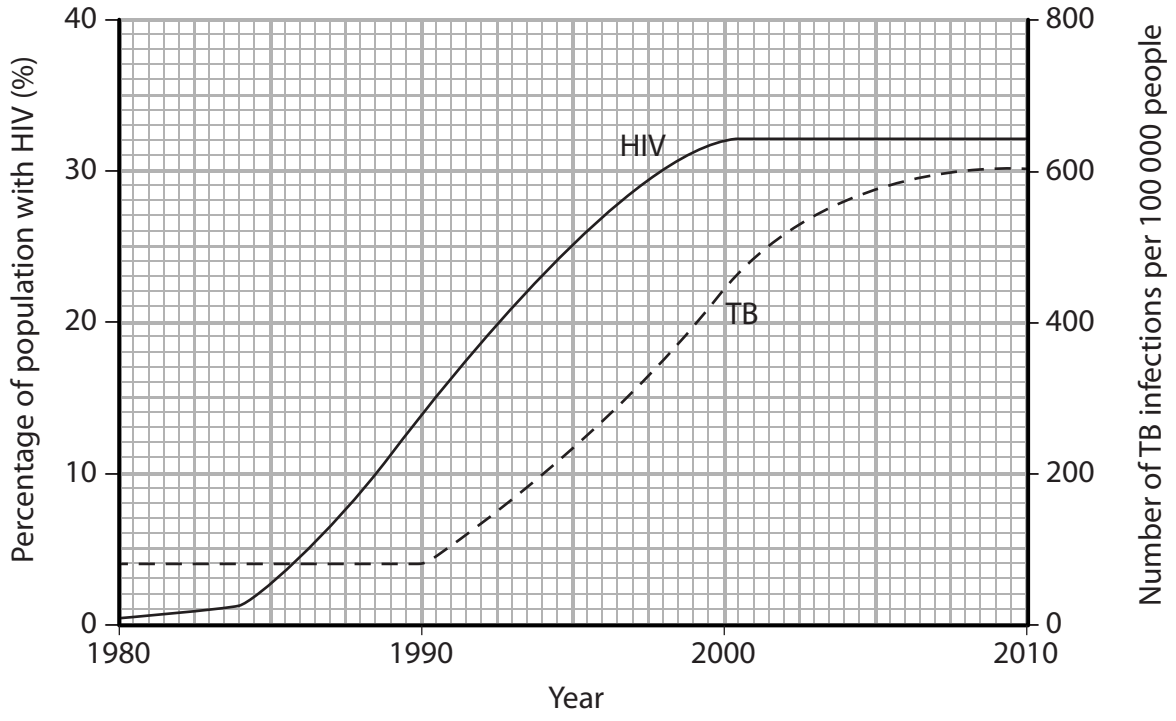
(3)

(c) Infection with Human Immunodeficiency Virus (HIV) can result in the death of a person because the T helper cells are destroyed.

Explain how infection with HIV results in the T helper cells being destroyed.

(3)

(d) The graph below shows the percentage of a population with HIV and the number of new infections with *Mycobacterium tuberculosis* (TB) from 1980 to 2010.



Describe the evidence shown in this graph that suggests there is a correlation between infection with HIV and TB infection.

(3)

(Total for Question 2 = 13 marks)

3 Bone marrow contains pluripotent stem cells that result in the production of platelets, white blood cells and red blood cells.

Myeloma is a cancer that affects bone marrow. As a result, abnormal plasma cells reduce the number of stem cells in the bone marrow.

Myeloma can lead to bleeding problems, an increase in infections and anaemia. Anaemia results in tiredness, weakness and breathing problems.

Myeloma can be diagnosed using blood tests, genetic tests and by looking at samples of blood and bone marrow under a microscope.

(a) Describe the role of plasma cells in the immune response.

(2)

(b) Suggest why the stem cells in the bone marrow are considered to be pluripotent.

(1)

*(c) Suggest why myeloma can lead to bleeding problems, an increase in infections and anaemia.

(6)

(d) (i) Suggest how blood and bone marrow samples could be used to diagnose myeloma.

(2)

(ii) Suggest why genetic tests can be used to diagnose myeloma.

(2)

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(Total for Question 3 = 13 marks)

***4** A large area of peatland has recently been discovered in the Democratic Republic of the Congo.

Peatland was formed thousands of years ago from partly decomposed plant material.

Scientists have commented:

'because the area holds so much organic matter, it means that a large amount of carbon is locked into the ground'

'it adds a little piece to that jigsaw puzzle of where all the carbon goes in the atmosphere'

'investigating this carbon-rich material could shed light on 10 000 years of environmental change in this little-studied region'

Explain the meaning of these three comments.

(6)

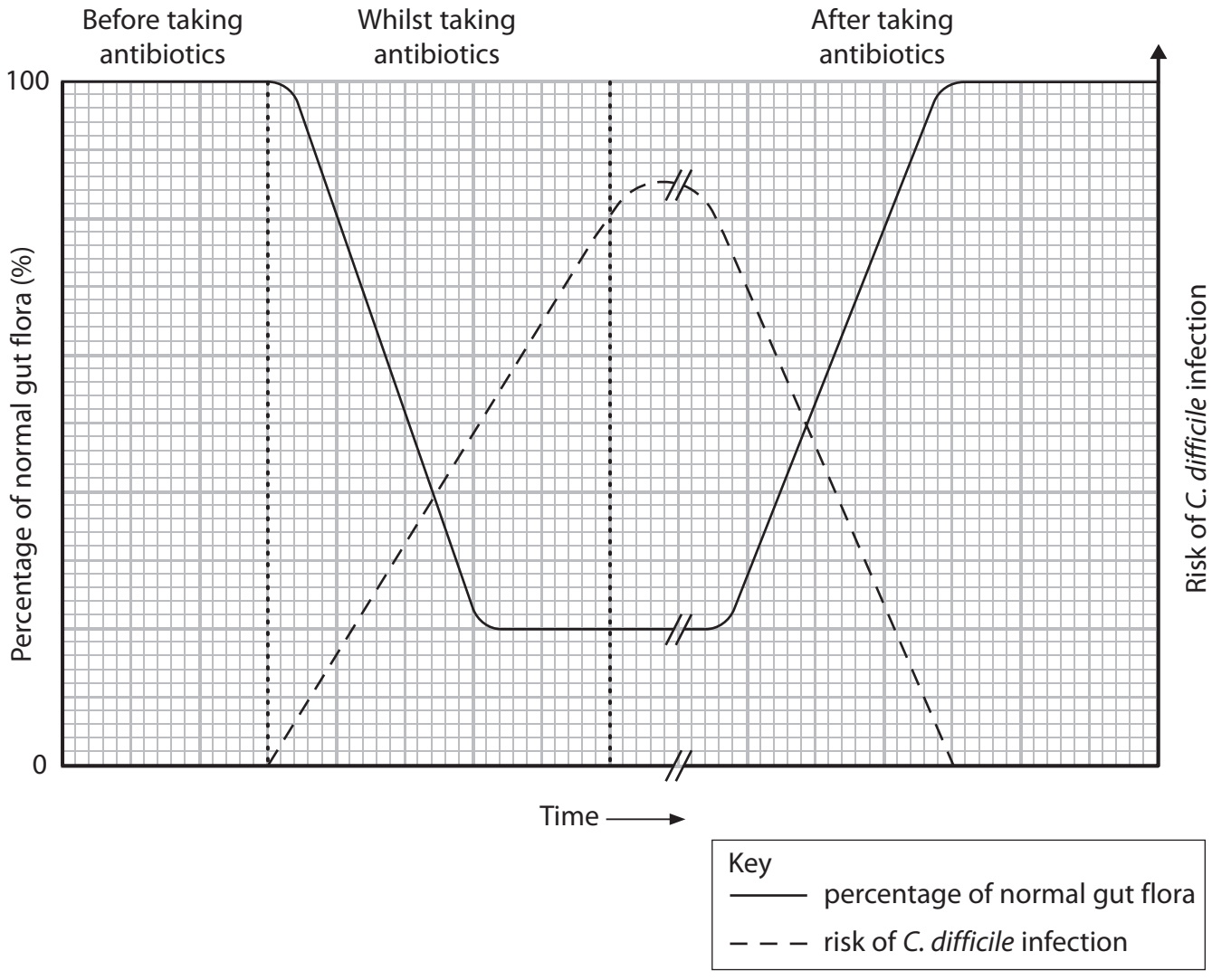
(Total for Question 4 = 6 marks)

5 *Clostridium difficile* (*C. difficile*) is a bacterium that is present in the gut flora of the human digestive system.

This bacterium does not cause any problems in healthy people.

People taking antibiotics are at risk of developing *C. difficile* infections.

The graph below shows the proportion of gut flora before, during and after taking antibiotics. The graph also shows the risk of *C. difficile* infection.



(a) Explain how gut flora protect the body from infection.

(2)

(b) Using the information in the graph, explain why people taking antibiotics are at risk of developing *C. difficile* infections.

(2)

(c) Some types of *C. difficile* are resistant to antibiotics.

Whilst the antibiotic is being taken, resistant *C. difficile* have an advantage over non-resistant *C. difficile*.

When the antibiotic is no longer being taken, the resistant *C. difficile* do not have this advantage.

(i) Explain why resistant *C. difficile* have an advantage whilst taking the antibiotic, but not afterwards.

(3)

(ii) Explain why the development of *C. difficile* infections is an example of an 'evolutionary race'.

(2)

(iii) Describe **two** ways in which codes of practice relating to antibiotic prescription could help to reduce this evolutionary race.

(2)

(d) After taking antibiotics, the gut flora return to 100%.

The time taken for the gut flora to return to 100% is variable. This depends on the type of antibiotic being taken.

Suggest why the time taken for the gut flora to return to 100% depends on the type of antibiotic being taken.

(2)

(Total for Question 5 = 13 marks)

6 Glaciers are long, large masses of ice that formed thousands of years ago.

As a result of changes in the climate, 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.

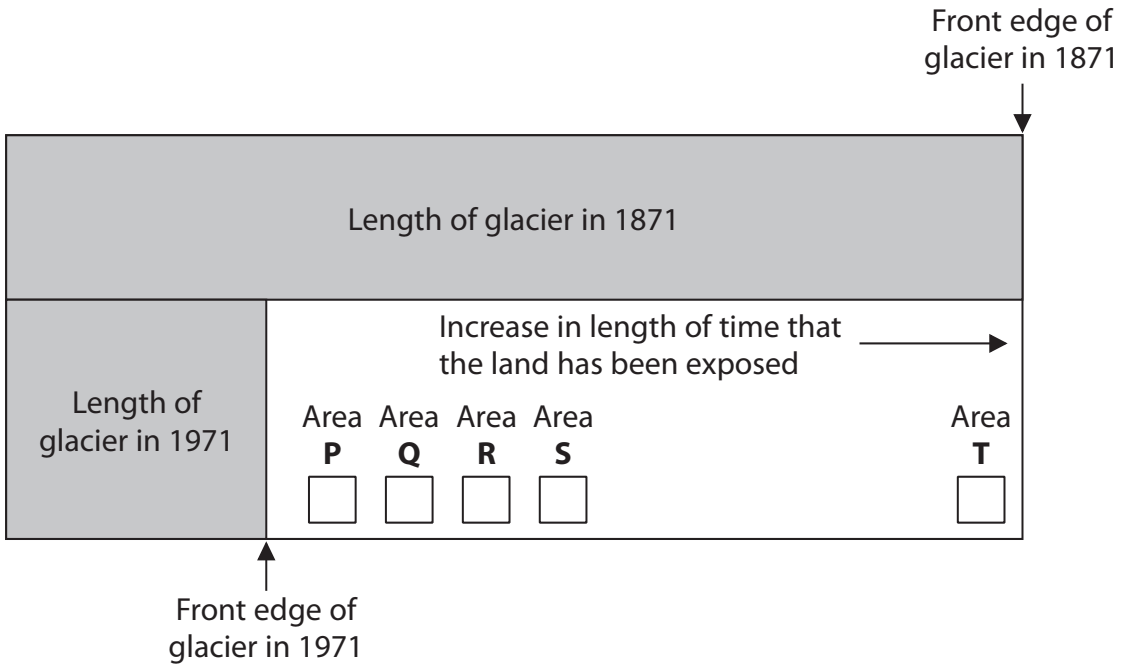
(a) Explain why more ice is melting.

(3)

(b) Glacier Bay is on the coast of Alaska. This bay was formed when ice melted and the length of the glacier was reduced.

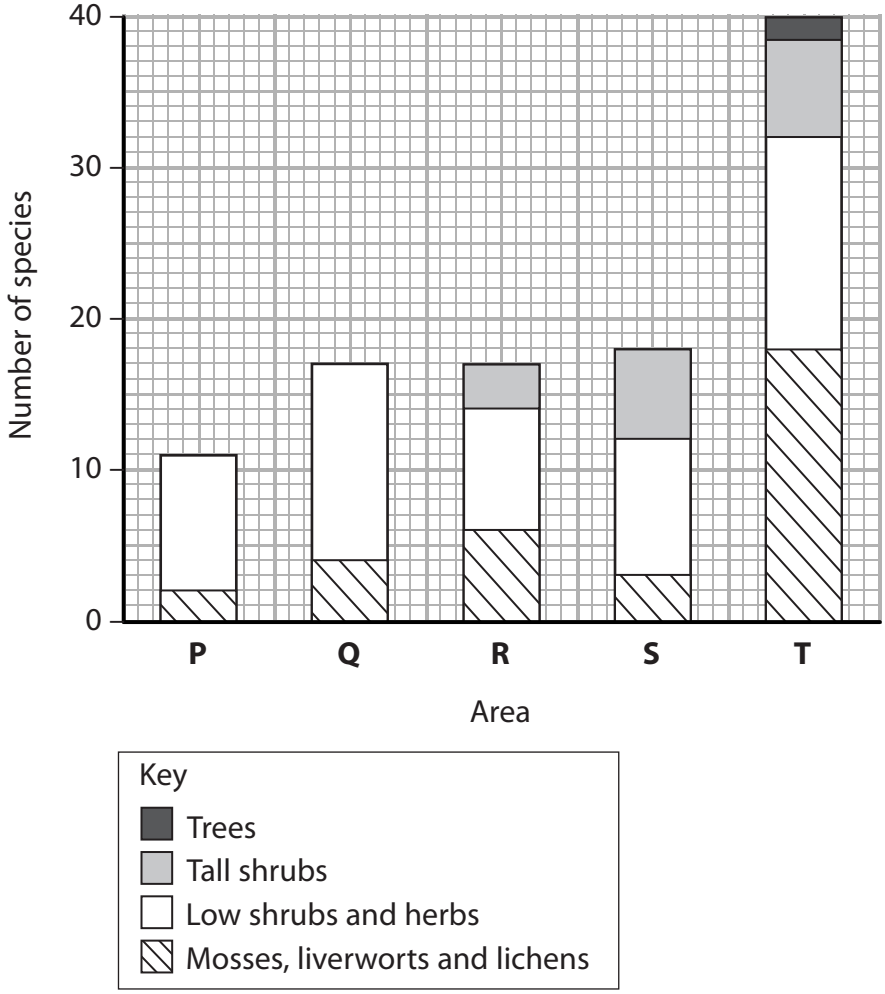
In 1971, scientists studied the distribution of plant species in Glacier Bay. They looked at five different areas: **P**, **Q**, **R**, **S** and **T**.

The diagram below shows the length of the glacier in 1871 and its length in 1971. The position of each of the five areas studied are also shown.



1 cm on the diagram is equivalent to the decrease in length of glacier in 10 years.

The graph below shows the results of this study.



(i) Describe the changes in these species from 1871 to 1971.

(3)

(ii) Explain why the species in areas **P** and **T** are different.

(4)

(iii) Ten years later, a group of students repeated this study at Glacier Bay.

Suggest what changes these students might have found in area **Q**.

(3)

(Total for Question 6 = 13 marks)

7 The photograph below shows a rhododendron bush.

Magnification ×0.05

A gardener planted a mixture of plants around a rhododendron bush. Not all of these plants grew.

The gardener was told that rhododendron bushes release poisons into the soil. These poisons can kill some plants.

The gardener wanted to know how near to the rhododendron bush plants could be grown.

(a) Calculate the width of this rhododendron bush at its widest point.

(2)

Answer .....

(b) Describe an investigation to determine how near to the rhododendron bush the gardener could grow new plants.

(4)

(c) The rhododendron bush could also affect the growth of other plants by reducing water availability and light.

(i) Describe how water availability and light could be measured.

(4)

(ii) Explain how water availability and light could be affected by the rhododendron bush.

(2)

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(Total for Question 7 = 12 marks)

8 Brown bears are found in North America, Canada and Alaska.

The photograph below shows a brown bear in Alaska.

Magnification ×0.03

(a) Between 2006 and 2009, there were several cases of homes being broken into by brown bears. These were all in the Swan Valley area in North America.

Four brown bears were captured. These bears had paw sizes that matched the tracks left in the ground around these homes.

Analysis of DNA from blood and fur left in the homes did not match these four brown bears.

(i) State **one** precaution that had to be taken when the blood and fur samples were collected.

(1)

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(ii) Explain the role of the polymerase chain reaction (PCR) in the analysis of the DNA of these bears.

(2)

(b) In 2007, the brown bear was a threatened species in Alberta, Canada.

A study was carried out to determine the number of bears in the area. Fur was collected from trees that the bears had rubbed against and their DNA analysed.

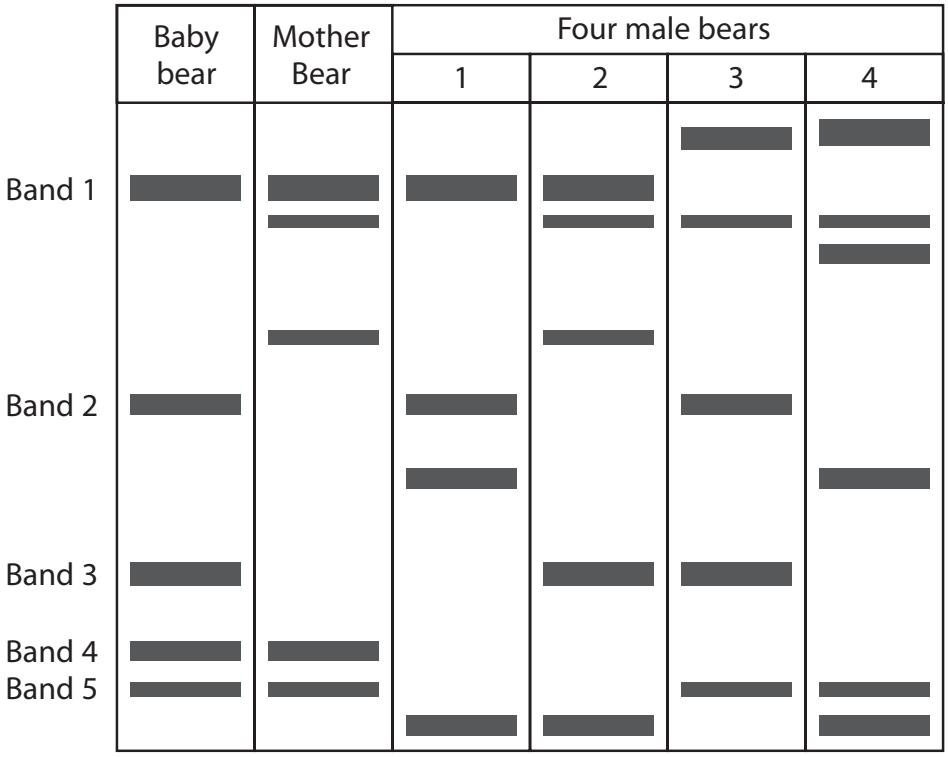
(i) Explain how DNA analysis would help the scientists to determine the number of bears in the area.

(3)

(ii) Suggest **one** reason why this study can only estimate the number of bears in the area.

(1)

(c) The diagram below shows the DNA profiles of a baby bear, the mother bear and four male bears.



Use the information in the diagram to explain which of the four male bears is the father of the baby bear.

(2)

(Total for Question 8 = 9 marks)

TOTAL FOR PAPER = 90 MARKS

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