

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Education
Advanced Subsidiary Examination
January 2012

Human Biology

HBIO2

Unit 2 Humans – their origins and adaptations

Wednesday 18 January 2012 1.30 pm to 3.00 pm

For this paper you must have:

- a ruler with millimetre measurements
- a calculator.

Time allowed

- 1 hour 30 minutes

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You will be marked on your ability to:
 - use good English
 - organise information clearly
 - use accurate scientific terminology.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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5	
6	
7	
8	
9	
10	
TOTAL	



J A N 1 2 H B I O 2 0 1

WMP/Jan12/HBIO2

HBIO2

Answer **all** questions in the spaces provided.

1 (a) **Figure 1** compares DNA and RNA molecules.

Complete **Figure 1**.

Figure 1

Part of molecule	Part of molecule found in		
	DNA only	DNA and RNA	RNA only
Bases	Thymine	Adenine, Cytosine	
Sugar phosphate backbone		Phosphate group	Ribose

(3 marks)

1 (b) Explain **one** way in which the structures of DNA and RNA are suited to their functions.

DNA

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RNA

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(2 marks)



2 (a) Give **two** processes in the body which involve increases in cell numbers by mitosis.

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(2 marks)

2 (b) Describe the behaviour of chromosomes and chromatids during the following stages of mitosis.

Metaphase

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Anaphase

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(4 marks)

6

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ANSWER IN THE SPACES PROVIDED**



3 (a) What is a gene?

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(2 marks)

3 (b) In the body, the enzyme PAH catalyses a reaction at the start of a metabolic pathway.

Some babies inherit a condition called phenylketonuria. This is caused by inheriting alleles of the gene for PAH where one base has changed in the DNA. Because of this change, these babies make a form of PAH which has the wrong shape.

3 (b) (i) What is meant by a metabolic pathway?

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(2 marks)

3 (b) (ii) Explain how inheriting the allele for phenylketonuria leads to a baby making a form of PAH which has the wrong shape.

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(2 marks)

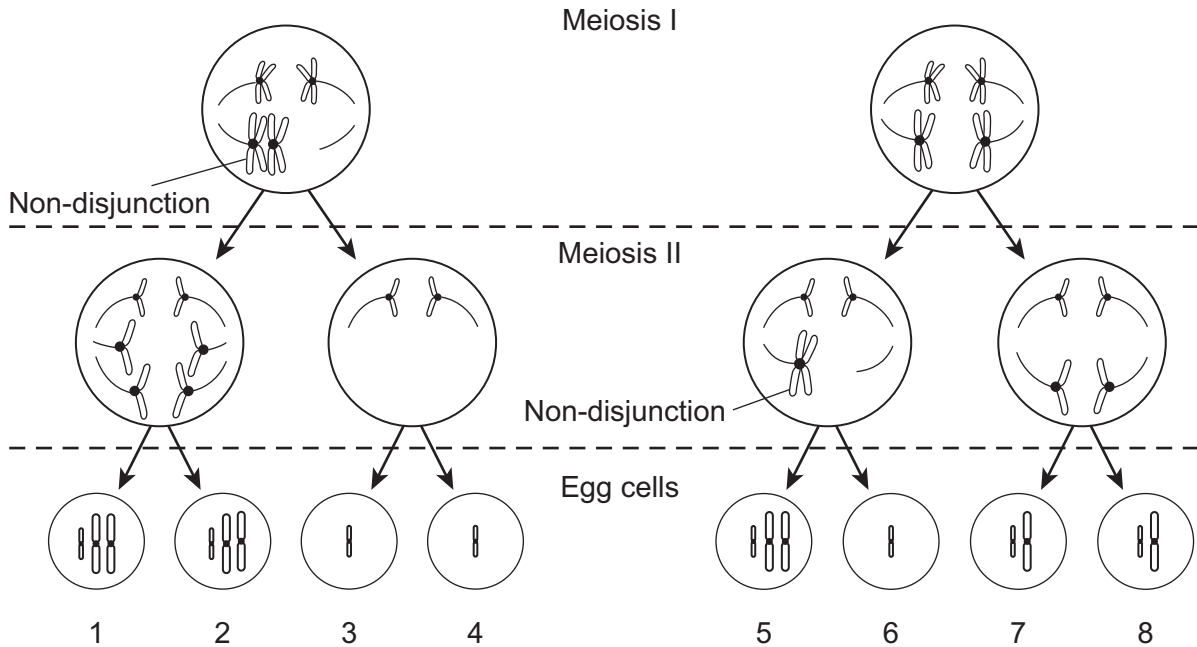
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- 4 In humans, non-disjunction involving chromosome 21 can lead to a child being born with Down's syndrome.
Figure 2 shows two ways in which non-disjunction can take place during meiosis.

Figure 2



- 4 (a) Use **Figure 2** to explain what is meant by *non-disjunction*.

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(2 marks)



- 4 (b)** More than one of the egg cells, numbered 1 to 8, could produce zygotes that would develop into a child with Down's syndrome. Give the numbers of these cells and explain the reason for your choices.

Explain your answer.

Cell(s)

Explanation

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(Extra space) (3 marks)

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5

Turn over for the next question

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- 5 (a)** *Toxocara* is a parasite which can infect humans. Explain how infection of humans with this parasite is associated with domestic cats and dogs.

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(2 marks)

Salmonella enteritidis is a bacterium that can cause food poisoning. This bacterium is a parasite which can be transmitted by eating undercooked chicken eggs. In the human gut, it feeds, reproduces and produces a toxin that damages cells lining the gut.

- 5 (b)** Give **three** features of a parasite shown by *Salmonella enteritidis*.

1

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3

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(3 marks)



5 (c) **Figure 3** shows the classification of *Salmonella enteritidis*.

Complete **Figure 3**.

Figure 3

Kingdom	Eubacteria
Phylum	Proteobacteria
Class	Gammaproteobacteria
Order	Enterobacteriales
	Enterobacteriaceae
Genus	
Species	

(2 marks)

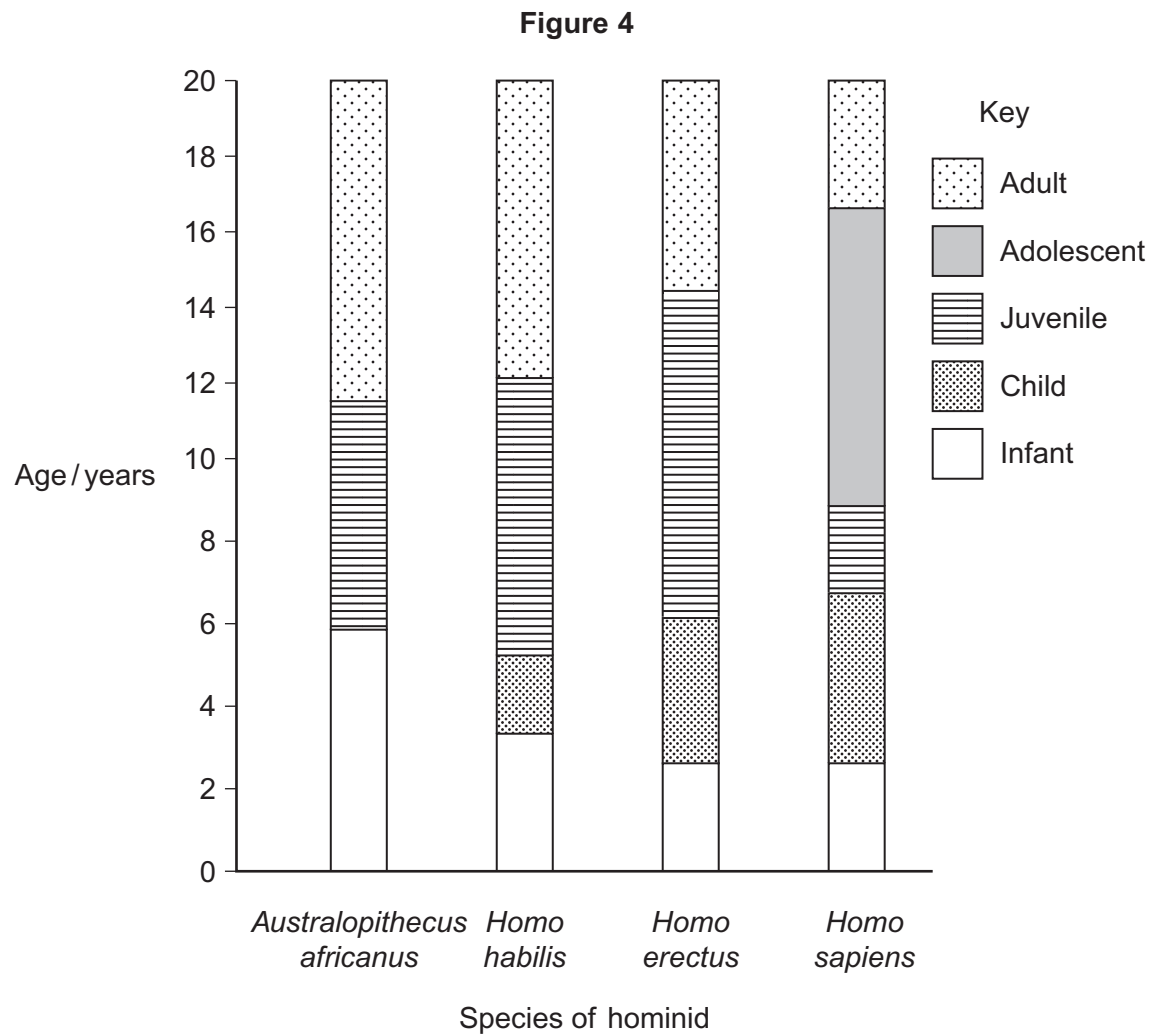
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- 6 **Figure 4** shows estimates of the number of years spent in different stages of development up to the age of 20 years in four species of hominid.



- 6 (a) Describe how the number of years spent as a child changed as hominids evolved.

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(2 marks)



- 6 (b)** Being an adolescent means that someone has reached puberty but is still undergoing physical, psychological and social development before becoming an adult.

Suggest why an adolescent period of development is only shown for *Homo sapiens*.

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(2 marks)

- 6 (c)** By the age of 5, children can correctly identify the facial expressions, *happy*, *sad* and *angry*.

Suggest the benefits of being able to identify these expressions at an early age.

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(3 marks)

(Extra space)

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7

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7 (a) Farming in Britain has resulted in deforestation. Give **two** reasons why.

1

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2

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(2 marks)

People have introduced species of trees to Britain. Some of these species have spread widely because few British species of insect can feed on them.

Students carried out a survey of some species of trees in a local wood to see how many species of insects were feeding on their leaves. Their results are shown in **Figure 5**.

Figure 5

Species of tree	Number of species of insects feeding on leaves
Oak	284
Horse chestnut	4
Birch	229
Fir	16
Scots pine	91

7 (b) Using these data, the students concluded that horse chestnut and fir had been introduced to Britain.

Evaluate this conclusion.

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(3 marks)

(Extra space)

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- 7 (c)** Large plantations of Scots pine and fir have been created in Britain. Plantations are areas where only one species of tree is planted.

Using all the information provided, suggest how creating these plantations may have affected biodiversity in these areas.

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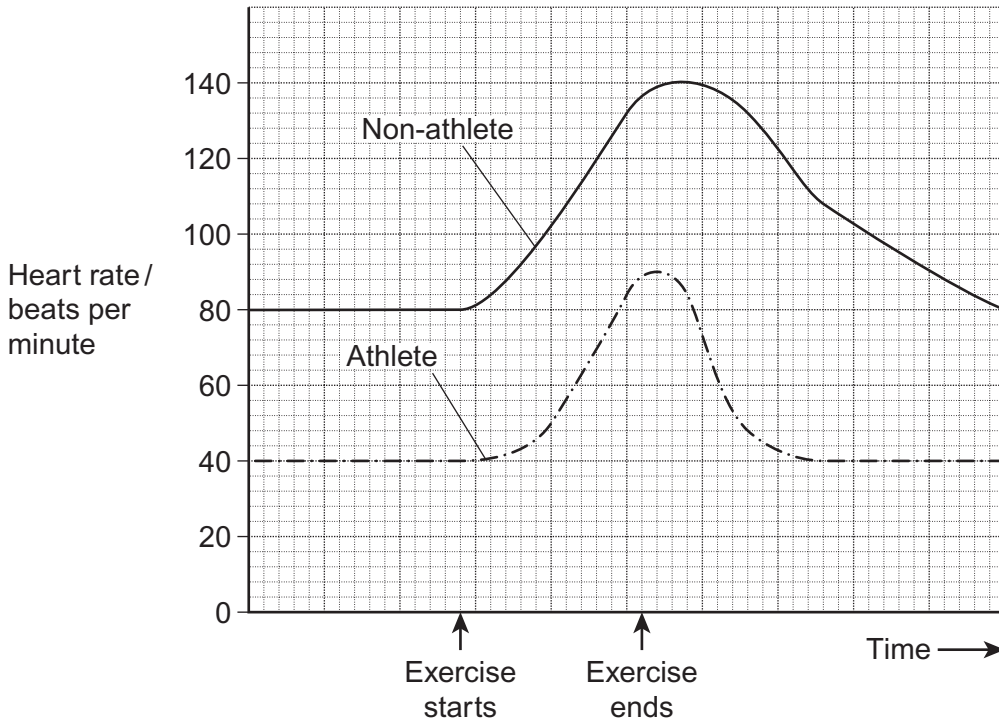
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- 8 Exercise leads to changes in heart rate. A scientist measured the heart rates of two men before, during and after carrying out the same amount of exercise. One man was an athlete, the other was not.

Figure 6 shows her results.

Figure 6



- 8 (a) (i) Describe **two** differences in the heart rate for the athlete and the non-athlete.

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(2 marks)

- 8 (a) (ii) Suggest **one** reason for the differences you described in (a)(i).

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(2 marks)



- 8 (b) **Figure 7** shows information about the sources of ATP available in a leg muscle at the start of a running race.

Figure 7

Feature of ATP source	Source of ATP				
	ATP stored in muscle cells	Creatine phosphate stored in muscle cells	Anaerobic respiration of glucose	Aerobic respiration of glucose	Respiration of triglycerides
Maximum rate of production of ATP per second / arbitrary units		73	40	23	7
How long source supplies ATP after running starts / seconds	<1	4	120 to 180	4000 to 8000	≥10 000

- 8 (b) (i) Suggest which energy sources would be used for a 1500 metre race lasting about 210 seconds. Give a reason for your answer.

Energy sources for 1500 m race

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Reason

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(2 marks)

- 8 (b) (ii) Top athletes can complete a marathon in about 8000 seconds. Just before a marathon, many athletes eat food that they believe increases the carbohydrate in their muscles, rather than food that increases triglycerides as well. Use the information in **Figure 7** to suggest why they do this.

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(2 marks)

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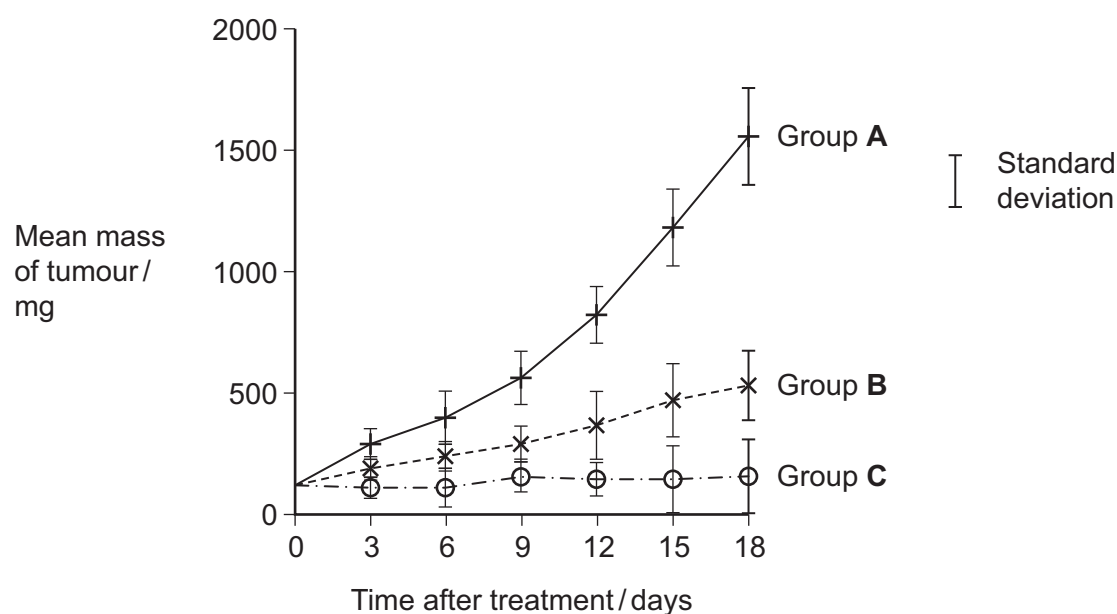


- 9 Researchers investigated the effects of radiotherapy and a substance called TA on the growth of colon tumours in mice. Mice with colon tumours were divided into three groups, **A**, **B** and **C**. Each group contained 10 mice.

- Group **A** were treated with a salt solution.
- Group **B** were treated with a salt solution containing TA.
- Group **C** were treated with a salt solution containing TA and were also given radiotherapy.

Their results are shown in **Figure 8**.

Figure 8



- 9 (a) Describe the differences between the effects of the treatments.

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(3 marks)

(Extra space)

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9 (b) Another group of researchers found that TA could increase metastasis of human lung and brain tumours.

9 (b) (i) What is metastasis?

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(1 mark)

9 (b) (ii) Evaluate the possible use of TA to treat cancer in humans. Use evidence from the research in mice and humans to support your answer.

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(4 marks)

(Extra space)

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- 10** Evidence from fossil skeletons makes scientists believe that approximately 100 000 years ago *Homo sapiens*, *Homo neanderthalensis* and *Homo erectus* were all alive on Earth. By about 30 000 years ago, only *Homo sapiens* survived. The *Out of Africa hypothesis* and the *Multi-regionalism hypothesis* try to explain how *Homo sapiens* evolved and replaced other hominid species. 5

The *Out of Africa hypothesis* suggests that *Homo sapiens* evolved in Africa and then spread around the world. It also suggests that more than a million years earlier, populations of *Homo erectus* had spread out of Africa. These populations became geographically isolated and evolved into new species such as *Homo neanderthalensis*. As *Homo sapiens* spread, they caused the extinction of all the other hominid species. 10

The *Multi-regionalism hypothesis* suggests that populations of *Homo erectus* evolved into *Homo sapiens* in many places. According to this hypothesis, all people today are descendants of populations of *Homo erectus* that spread from Africa about two million years ago. The hypothesis suggests that there was enough interbreeding between different populations to prevent them becoming different species. At the same time, 15 natural selection did cause enough variation between populations to produce the races of people seen today.

- 10 (a) (i)** Give **two** methods that the scientists could have used to date fossil evidence that *Homo sapiens*, *Homo neanderthalensis* and *Homo erectus* were all alive 100 000 years ago (lines 1 to 3).

1

2 (2 marks)

- 10 (a) (ii)** Give **two** ways in which biologists could distinguish between a fossil skeleton of *Homo erectus* and a fossil skeleton of *Homo sapiens* (lines 1 to 3).

1

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2

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(2 marks)



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Explain how geographic isolation of populations of *Homo erectus* could have resulted in the evolution of new species.

[illegible]

(Extra space)

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- 10 (b) (iii)** The *Multi-regionalism hypothesis* suggests that interbreeding between different populations of *Homo erectus* prevented them from becoming different species (lines 14 to 17).

Explain why interbreeding would prevent new species forming.

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(2 marks)



- 10 (c)** The *Multi-regionalism hypothesis* suggests that natural selection caused enough variation between populations to produce the races of people seen today (lines 15 to 17). Some of these races evolved in cold climates where there was little sunshine. Suggest **two** adaptations of body form that these races may have evolved.

Explain **one** benefit to individuals of each adaptation.

Adaptation

Benefit

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Adaptation

Benefit

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(4 marks)

- 10 (d)** The *Out of Africa hypothesis* suggests that as *Homo sapiens* spread, they caused the extinction of all the other hominid species (line 10).

Suggest how *Homo sapiens* could have caused these extinctions.

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(3 marks)

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END OF QUESTIONS



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