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| Centre Number       |  |  |  |  |  | Candidate Number |  |  |  |  |
| Surname             |  |  |  |  |  |                  |  |  |  |  |
| Other Names         |  |  |  |  |  |                  |  |  |  |  |
| Candidate Signature |  |  |  |  |  |                  |  |  |  |  |



General Certificate of Education  
Advanced Subsidiary Examination  
June 2011

# Human Biology

## HBIO2

**Unit 2 Humans – their origins and adaptations**

**Thursday 26 May 2011 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                   |      |
| 3                   |      |
| 4                   |      |
| 5                   |      |
| 6                   |      |
| 7                   |      |
| 8                   |      |
| 9                   |      |
| 10                  |      |
| TOTAL               |      |



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

WMP/Jun11/HBIO2

## HBIO2

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

**1 (a)** The following statements describe stages of mitosis.

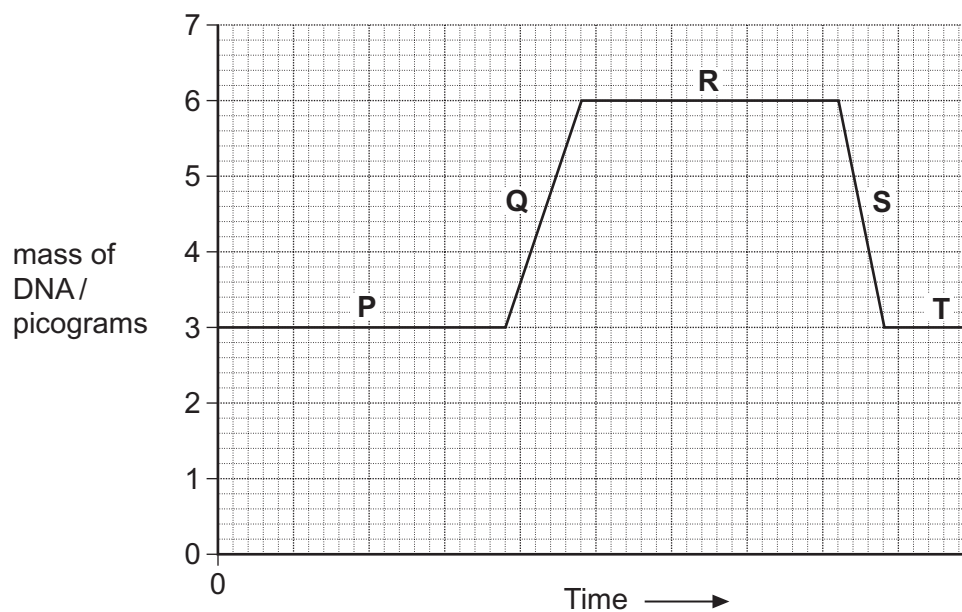
- A** chromosomes align at the centre of the cell attached to spindle fibres
- B** chromatids are in groups at the poles
- C** chromosomes become visible
- D** chromatids move towards the poles

Complete the table by entering the appropriate letter.

| Stage of mitosis | Letter of description of the stage |
|------------------|------------------------------------|
| Prophase         |                                    |
| Metaphase        |                                    |
| Anaphase         |                                    |
| Telophase        |                                    |

(3 marks)

**1 (b)** The graph shows changes in the mass of DNA in a cell during one cell cycle. Five stages have been identified on the graph.



1 (b) (i) Which letter represents the stage when DNA is replicating?

(1 mark)

1 (b) (ii) Explain the change in the DNA content during stage S.

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(1 mark)

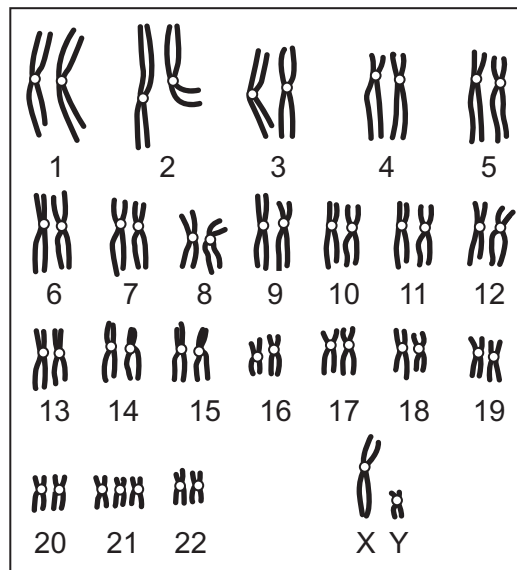
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- 2** The diagram shows the chromosomes of a person who has a genetic disorder.



- 2 (a)** Name the genetic disorder. Explain how you arrived at your answer.

Name .....

Explanation .....

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(3 marks)

- 2 (b)** The chromosomes making up the pair labelled 19 are homologous. Explain what this means.

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(2 marks)



- 3 (a)** Complete the table to give **two** differences between DNA and RNA.

| Difference | DNA | RNA |
|------------|-----|-----|
| 1          |     |     |
| 2          |     |     |

(2 marks)

- 3 (b)** Describe the part played by RNA in protein synthesis.

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(3 marks)

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ANSWER IN THE SPACES PROVIDED**



- 4 (a)** Humans adapted to live in a hot environment have a body shape that helps them to maintain a constant body temperature. Describe their body shape and explain how it helps them to maintain a constant body temperature.

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(2 marks)

(Extra space) .....

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- 4 (b)** Some humans adapted to living at high altitudes have
- higher numbers of red blood cells
  - a special form of haemoglobin.

Explain the benefit of

higher numbers of red blood cells

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a special form of haemoglobin.

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(4 marks)



- 5 (a)** Describe the role of tumour suppressor genes in preventing the formation of a tumour.

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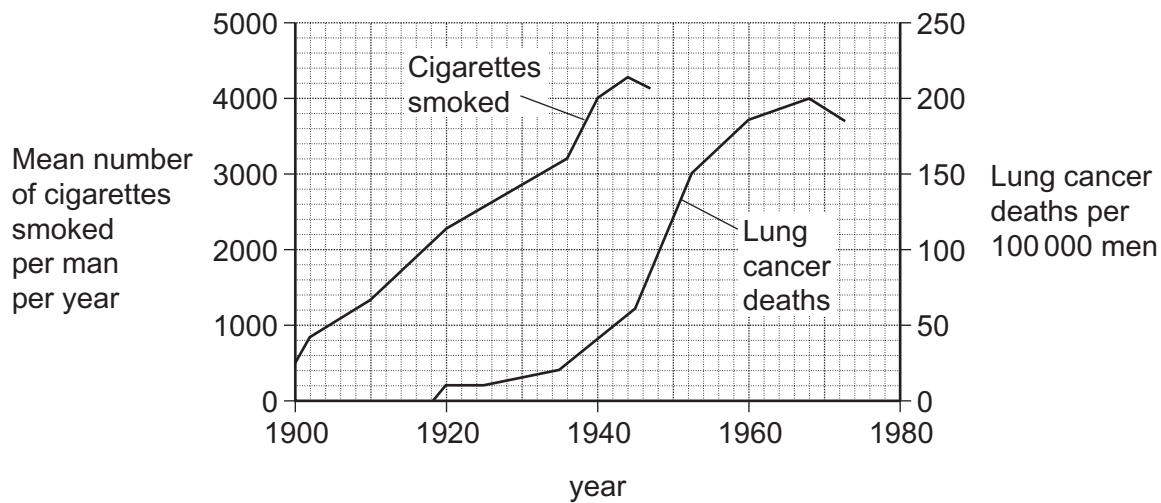
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(2 marks)

- 5 (b)** Scientists collected data about the mean number of cigarettes smoked by men in the UK. They also collected data about the number of deaths from lung cancer in men in the UK. The graph shows their results.





These data suggest that smoking may cause lung cancer. They do not prove that smoking causes lung cancer. Explain why.

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(4 marks)

(Extra space) .....

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6

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**6** Triglycerides can be used as an energy source during exercise.

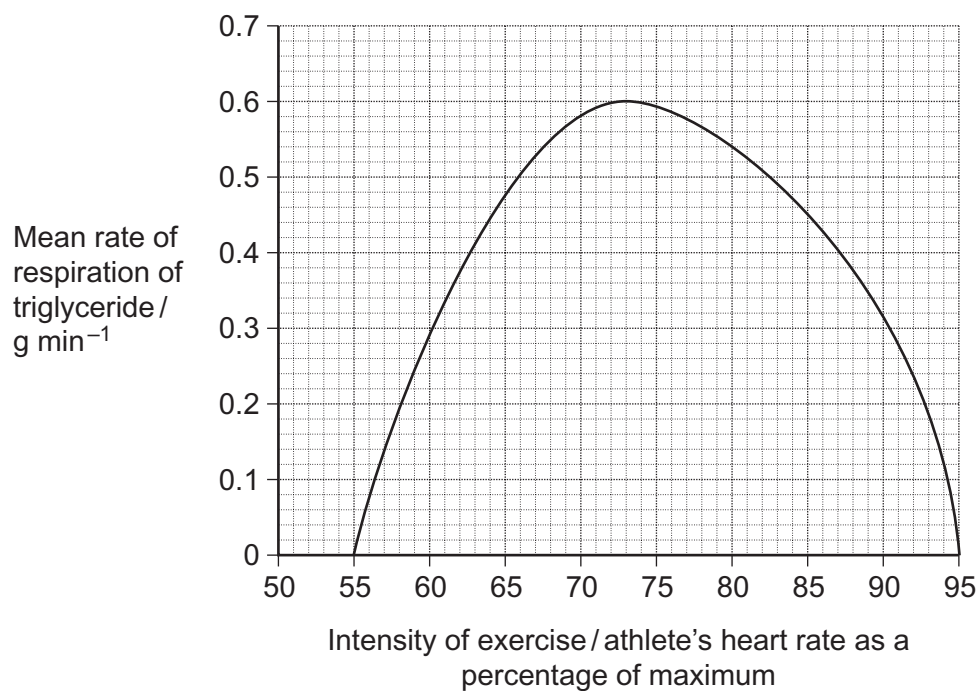
**6 (a)** Name **two** other substances that can be used as an energy source during exercise.

1 .....

2 .....

(2 marks)

**6 (b)** Sports scientists investigated the rate of respiration of triglycerides by athletes at different intensities of exercise. They measured the intensity of exercise by its effect on each athlete's heart rate. The graph shows their results.



- 6 (b) (i)** Describe how the rate of respiration of triglyceride changes as the intensity of the exercise increases.

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(2 marks)

- 6 (b) (ii)** In a separate investigation, the sports scientists used each athlete's oxygen uptake to measure the intensity of the exercise. Both oxygen uptake and heart rate are valid measures of the intensity of exercise. Explain why.

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(4 marks)

(Extra space) .....

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8

**Turn over for the next question**

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**7** *Toxocara canis* is a parasite of dogs. It can also live in humans.

**7 (a)** Give **two** features of *T.canis* that adapt it to life as a parasite.

1 .....

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2 .....

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(2 marks)

**7 (b)** Describe **two** ways in which *T.canis* can transfer from dog hosts to human hosts.

1 .....

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2 .....

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(2 marks)



- 7 (c)** Health workers investigated children living in a city centre and children living in the outskirts of the same city. In each area, they recorded how many children had been infected by *T.canis* and what type of contact the children had with dogs. The table shows their results.

| Type of contact with dogs                   | City centre        |                                       | Outskirts of city  |                                       |
|---------------------------------------------|--------------------|---------------------------------------|--------------------|---------------------------------------|
|                                             | Number of children | Percentage infected by <i>T.canis</i> | Number of children | Percentage infected by <i>T.canis</i> |
| Dogs live outside at home                   | 32                 | 12.5                                  | 98                 | 50.0                                  |
| Dogs live inside the home                   | 5                  | 0.0                                   | 25                 | 36.0                                  |
| Children play with dogs                     | 22                 | 9.1                                   | 67                 | 50.7                                  |
| Children sleep in same room as dogs         | 1                  | 0.0                                   | 3                  | 66.7                                  |
| Faeces of dogs present in household rubbish | 29                 | 10.3                                  | 87                 | 49.4                                  |

- 7 (c) (i)** The health workers reported that these results suggest an overall difference in the percentage of children infected between the city centre and the outskirts of the city. Describe this difference.

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..... (1 mark)

- 7 (c) (ii)** Conclusions drawn from these results should be treated with caution. Suggest why.

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..... (2 marks)



**8 (a)** Humans have an extended childhood. Explain the benefit of this.

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(2 marks)

**8 (b)** Humans can communicate using facial expressions, such as smiling and looking angry.

**8 (b) (i)** Explain the benefit of being able to interpret these facial expressions.

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(2 marks)

**8 (b) (ii)** Psychologists investigated the ability of people of different ages to identify different facial expressions. They showed photographs of different facial expressions to two groups of volunteers. The volunteers in one group were all less than 40 years old. The volunteers in the other group were all more than 40 years old. The results are shown in **Figure 1** and **Figure 2**.

**Figure 1 Less than 40 years old**

| Facial expression shown to volunteers | Facial expression identified by volunteers / % |       |         |       |
|---------------------------------------|------------------------------------------------|-------|---------|-------|
|                                       | Happy                                          | Angry | Neutral | Other |
| Happy                                 | 97.3                                           | 0.0   | 0.8     | 1.9   |
| Angry                                 | 0.6                                            | 77.0  | 3.3     | 19.1  |
| Neutral                               | 1.8                                            | 4.9   | 83.6    | 9.7   |

**Figure 2 More than 40 years old**

| Facial expression shown to volunteers | Facial expression identified by volunteers / % |       |         |       |
|---------------------------------------|------------------------------------------------|-------|---------|-------|
|                                       | Happy                                          | Angry | Neutral | Other |
| Happy                                 | 95.8                                           | 0.5   | 1.3     | 2.4   |
| Angry                                 | 1.6                                            | 65.1  | 5.7     | 27.6  |
| Neutral                               | 1.3                                            | 2.9   | 77.1    | 18.7  |



The psychologists' hypothesis was 'The ability to identify facial expressions decreases with age.' Do these data support this hypothesis?  
Give evidence from the tables to support your answer.

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(4 marks)

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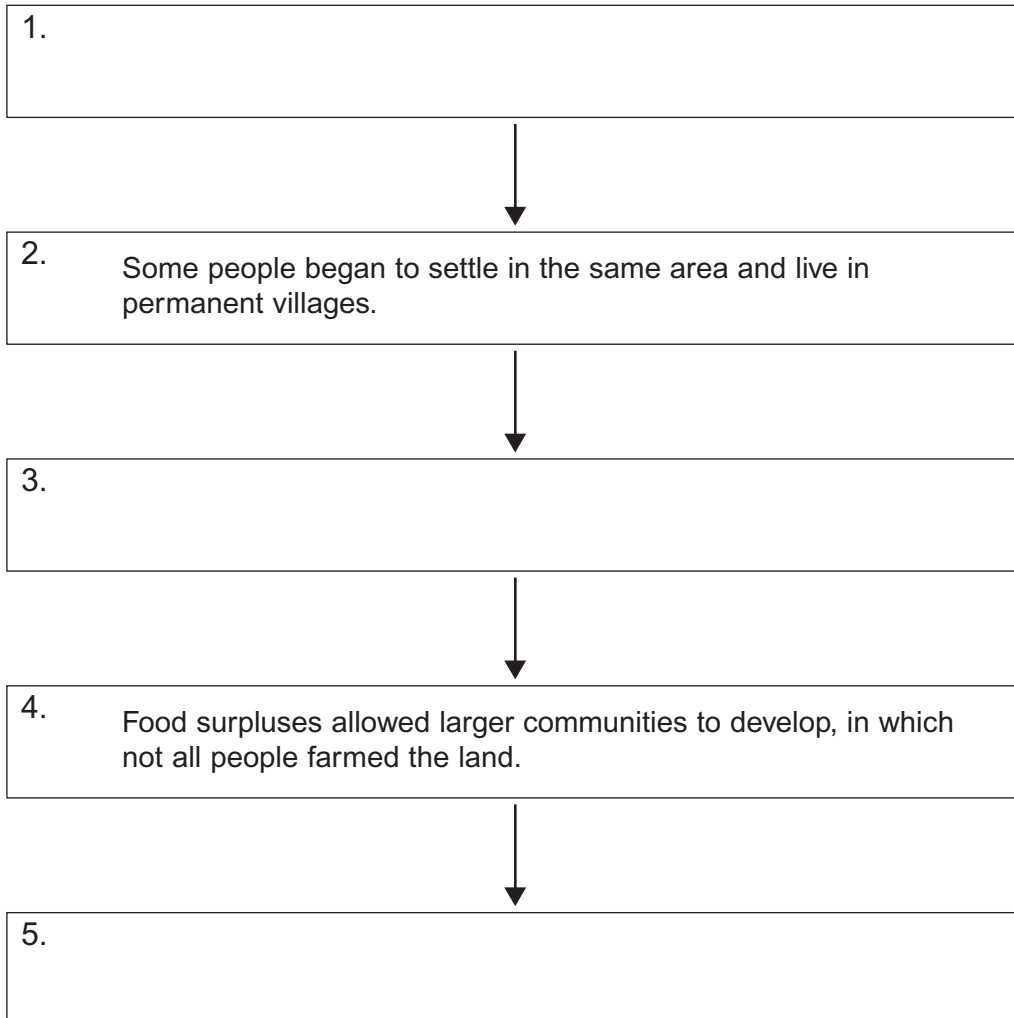




**9 (a)** The following statements describe stages in the development of settled human communities.

- Improved farming techniques generated food surpluses.
- Different people developed different skills as societies became more complex.
- Some crop plants and stock animals were domesticated.

Complete the flow chart by writing the appropriate statement in boxes 1, 3 and 5.



(2 marks)

**Question 9 continues on the next page**

**Turn over ►**



- 9 (b)** In 2008, archaeologists working at several sites in Mexico found
- cooking pots over 9000 years old, which contained starch grains from maize plants
  - burnt wood and cutting tools
  - pollen grains from maize plants.

Biologists have shown that maize is genetically similar to teosinte. Teosinte is a wild grass found in Mexico.

The archaeologists concluded that

- maize was domesticated from teosinte about 10 000 years ago
- the Mexicans of the time cleared woodland for the cultivation of maize.

Explain how the evidence supports the conclusion that

- 9 (b) (i)** maize was domesticated from teosinte about 10 000 years ago

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- 9 (b) (ii)** the Mexicans of the time cleared woodland for the cultivation of maize.

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(5 marks)



- 9 (b) (iii)** Clearing woodland and planting maize in its place may have reduced the biodiversity of the area. Explain how.

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(Extra space)

(3 marks)

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10

**Turn over for the next question**

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10 Read the following passage.

In 2009, a scientific journal published several articles written by biologists from around the world about the discovery of the fossil hominid *Ardipithecus ramidus*. The biologists described several hundred bones from at least 36 individuals. The most complete specimen is of an adult female nicknamed "Ardi". The biologists dated these specimens at 4.4 million years old and think that *A. ramidus* is the nearest fossil yet found to the common ancestor of humans and chimpanzees. 5

Biologists had thought that the common ancestor would be more like a chimpanzee than a human. However *A. ramidus* was bipedal like modern humans, and not a knuckle walker like chimpanzees. Knuckle walking allows an animal to walk on four limbs but still have long fingers for other tasks, such as climbing. The bipedalism of *A. ramidus*, together with other evidence, suggests that the common ancestor of humans and chimpanzees spent its time in woodland, both in the trees and on the ground. 10

One hypothesis as to how *A. ramidus* might fit into the evolution of humans is that *A. ramidus* evolved into *Australopithecus*, which then evolved into early humans. 15  
A different hypothesis is that both *A. ramidus* and *Australopithecus* evolved from the common ancestor. *A. ramidus* became extinct and *Australopithecus* evolved into early humans. Both hypotheses suggest that chimpanzees followed a different line of evolution.

DNA analysis shows that humans and chimpanzees share 98% of their DNA. 20  
Knowing this, and the rate of mutation of DNA in primates, biologists calculated that humans and chimpanzees began to evolve along two different lines about six million years ago.

10 (a) To what genus does the fossil hominid belong? (line 2)

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.....  
(1 mark)

10 (b) Give **two** ways in which biologists might have dated the fossil specimens of *A. ramidus*. (lines 4 to 5)

1 .....  
.....  
2 .....  
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(2 marks)



- 10 (c)** Many biologists believe that this research provides the most reliable evidence yet about the features of a common ancestor of humans and chimpanzees. Suggest why they believe it to be so reliable. (lines 1 to 4)

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(3 marks)

(Extra space) .....

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- 10 (d) (i)** Give **three** advantages of bipedalism.

1 .....

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2 .....

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3 .....

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(3 marks)

**Question 10 continues on the next page**

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[illegible]

- 10 (d) (iii)** What evidence would biologists need to help them to decide between the two hypotheses that explain how *A. ramidus* might fit into the evolution of early humans (lines 14 to 19)?  
Explain how this evidence could help them to decide.

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(3 marks)

(Extra space) .....

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- 10 (e)** Mutations introduce new genetic material into the genome of a species. Biologists have calculated the rate at which mutations occur in primates. They have been able to use this information to estimate the age of the common ancestor of humans and chimpanzees (lines 20 to 23). Suggest how.

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(2 marks)

END OF QUESTIONS



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