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



General Certificate of Education  
Advanced Subsidiary Examination  
January 2010

# Human Biology

## HBIO2

Unit 2 Humans – their origins and adaptations

Tuesday 19 January 2010 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                  |      |
| 11                  |      |
| TOTAL               |      |



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

WMP/Jan10/HBIO2

## HBIO2

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

1 (a) (i) What is a species?

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(1 mark)

1 (a) (ii) Name **one** species of hominid other than *Homo sapiens*.

.....

(1 mark)

1 (b) Complete the table showing the classification of *Homo sapiens*.

|         |           |
|---------|-----------|
| Kingdom |           |
|         | Chordata  |
|         | Mammalia  |
|         | Primata   |
|         | Hominidae |
| Genus   |           |
| Species |           |

(2 marks)

4



- 2 (a) Give **two** ways in which the structure of DNA is different from that of RNA.

1 .....

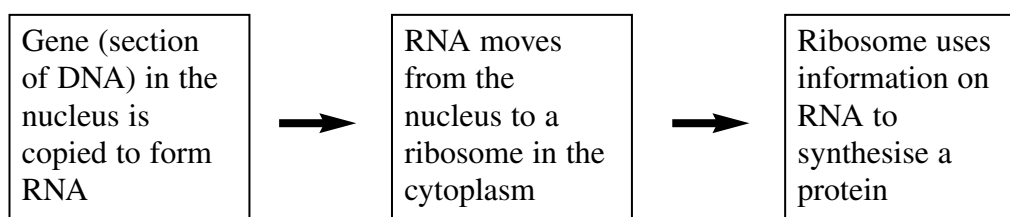
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2 .....

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(2 marks)

- 2 (b) (i) The flowchart summarises the main stages in the synthesis of a protein.



The RNA molecule carries information for a specific protein. Explain how this information is carried.

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(2 marks)

- 2 (b) (ii) The protein synthesised is an enzyme that influences the synthesis of melanin. Melanin is a dark pigment found in the skin. How might different alleles of the gene result in different phenotypes?

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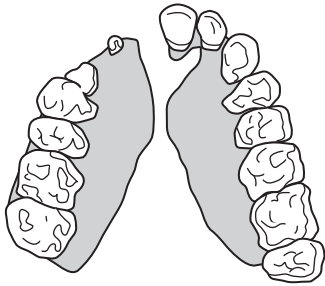
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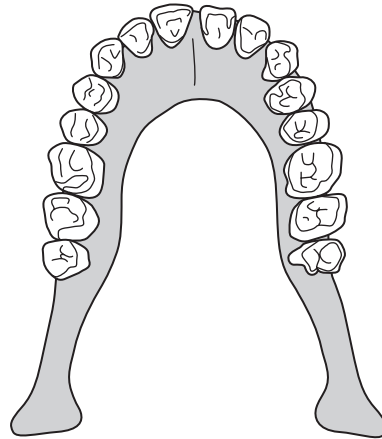
- 3 In 1932, biologists thought that *Ramapithecus* was a link in the evolution of humans from apes. Present day biologists no longer think this is the case.

The diagram shows four jawbones.

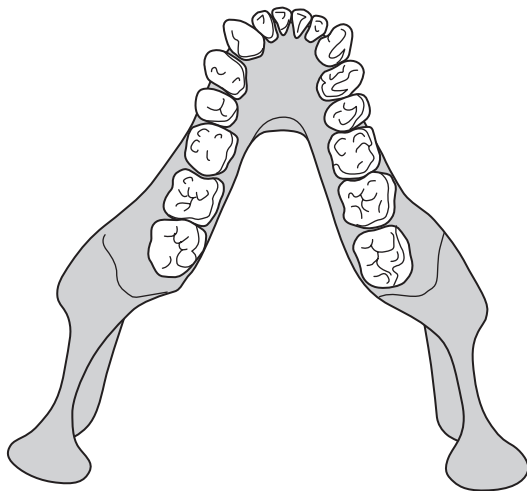
Reconstruction of jawbone  
of *Ramapithecus* made from  
several fragments in 1932



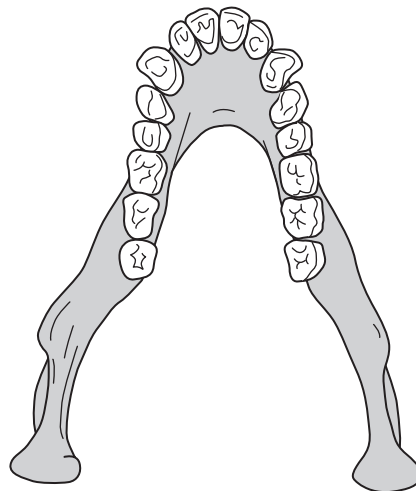
Jawbone of modern human



Complete jawbone  
of *Ramapithecus*  
found in 1977



Jawbone of  
chimpanzee  
(an ape)



- 3 (a) Use the drawings to suggest why biologists no longer think that *Ramapithecus* is a link in the evolution of humans from apes.

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(2 marks)

- 3 (b) The conclusion drawn in 1932 was based on unreliable evidence. Use the diagram to describe and explain **one** way in which that evidence was unreliable.

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(2 marks)

**Turn over for the next question**

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**Turn over ►**

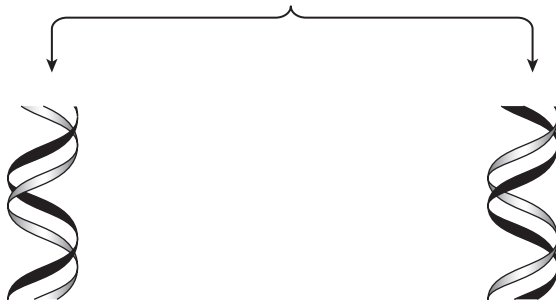


- 4 The bases in DNA nucleotides contain nitrogen. Researchers grew bacteria on a medium containing  $^{15}\text{N}$  ('heavy' nitrogen) for several generations. They then transferred the bacteria to a medium containing  $^{14}\text{N}$  ('ordinary' nitrogen). They analysed DNA from the bacteria at three stages:
1. whilst the bacteria were growing on the  $^{15}\text{N}$  medium
  2. after one division of the bacteria on the  $^{14}\text{N}$  medium
  3. after two divisions of the bacteria on the  $^{14}\text{N}$  medium
- The diagram shows their results.

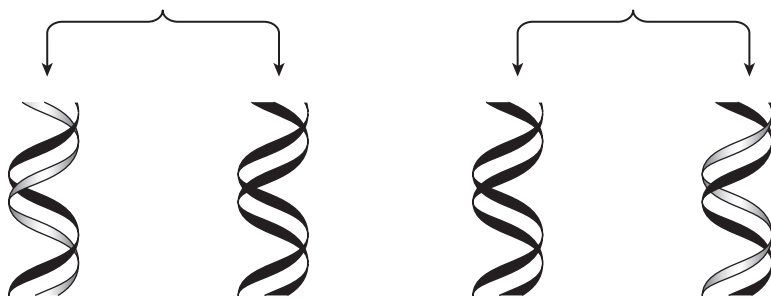
Bacteria are grown on  $^{15}\text{N}$  medium



Bacteria are then transferred to  $^{14}\text{N}$  medium



DNA after one  
division on the  
 $^{14}\text{N}$  medium



DNA after two  
divisions on the  
 $^{14}\text{N}$  medium

- 4 (a) Describe how the proportion of DNA that contained  $^{15}\text{N}$  changed at each division when bacteria were grown on the  $^{14}\text{N}$  medium.

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(2 marks)

- 4 (b) The change in the proportion of DNA containing  $^{15}\text{N}$  is due to the way in which DNA replicates. Explain how.

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(2 marks)

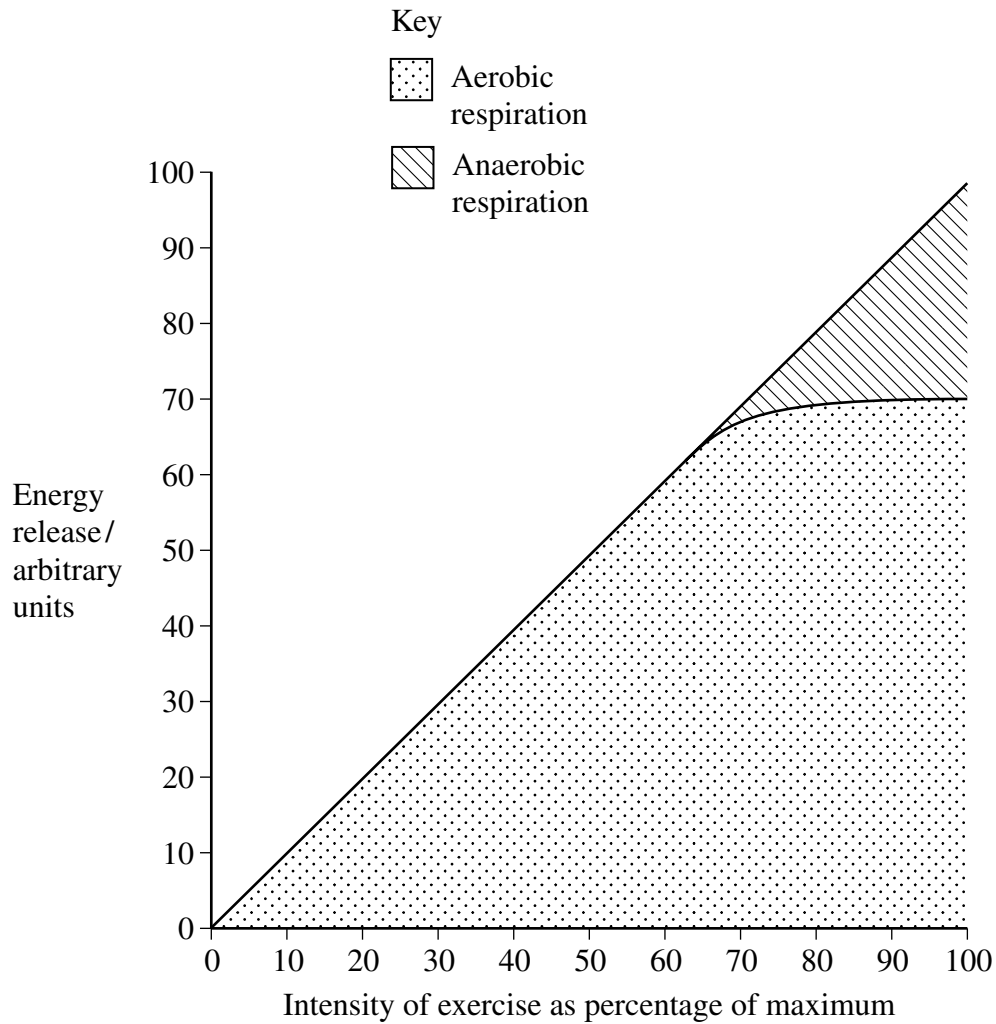
4

**Turn over for the next question**

**Turn over ►**



- 5 Sports scientists measured the energy released by aerobic respiration and anaerobic respiration at different intensities of exercise. The graph shows their results.



- 5 (a) (i) Describe how the pattern of energy release changed as the intensity of the exercise increased.

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(3 marks)

(Extra space) .....

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- 5 (a) (ii) Muscles fatigue quickly during intense exercise. Explain what causes them to fatigue.

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(2 marks)

- 5 (b) Oxygen is carried to muscles in red blood cells. Explain how oxygen in a red blood cell gets into a nearby muscle cell.

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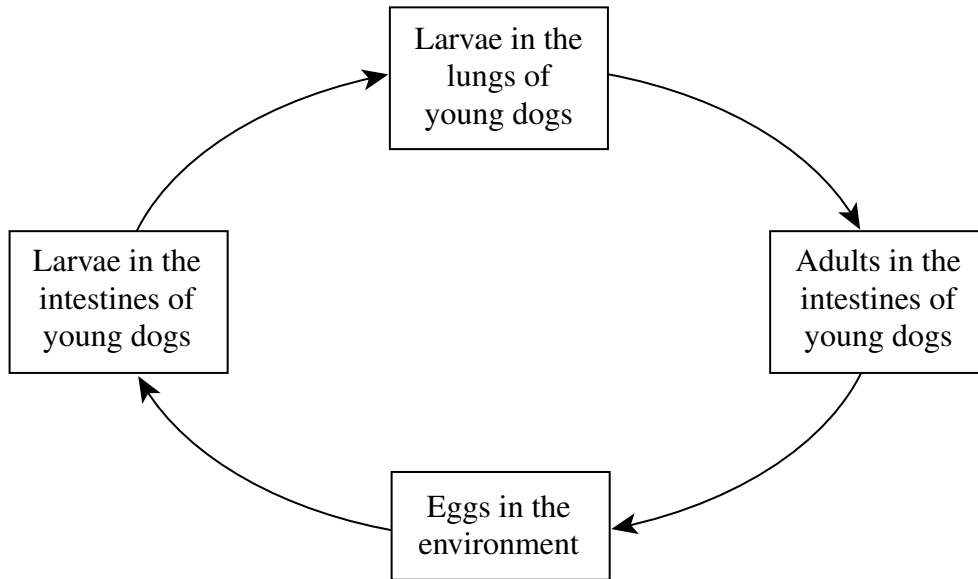
(2 marks)

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**Turn over ►**



- 6** (a) The diagram shows part of the life cycle of *Toxocara canis*, which is a parasite of dogs and humans.



- 6** (a) (i) What is a parasite?

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(2 marks)

- 6** (a) (ii) Describe how larvae in the intestines of young dogs become adult worms in the dogs' intestines.

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(2 marks)



- 6 (a) (iii) Humans are sometimes referred to as the 'accidental host' of *Toxocara canis*. Suggest what this means.

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(1 mark)

- 6 (b) Tapeworms are parasites that live in the small intestines of humans. They have several adaptations that enable them to live in the small intestines including:
- suckers on their heads
  - a thick cuticle covering their bodies.

Complete the table by suggesting **one** advantage to the tapeworm of each adaptation.

| Adaptation                         | Advantage of adaptation |
|------------------------------------|-------------------------|
| Suckers on head                    |                         |
| Body is covered by a thick cuticle |                         |

(2 marks)

7

**Turn over for the next question**

**Turn over ►**



7 (a) Modern humans have a fully opposable thumb. This may be the result of a mutation in a gene that is present in all primates.

7 (a) (i) A fully opposable thumb might have given early humans a survival advantage. Suggest how.

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(2 marks)

7 (a) (ii) Natural selection could have resulted in the fully opposable thumb becoming widespread in early humans. Suggest how.

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(3 marks)

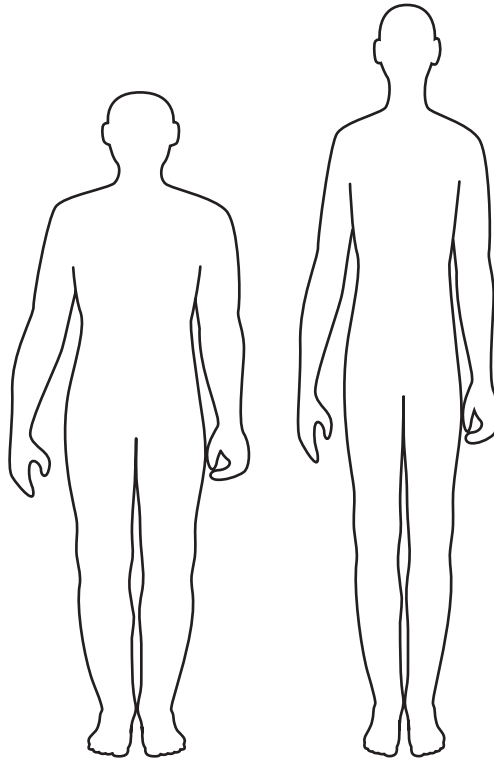
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- 7 (b) The diagram shows two body shapes. They are drawn to the same scale. Explain how body shape **B** is better adapted to life in a hot climate than body shape **A**.

Body Shape **A**Body Shape **B**

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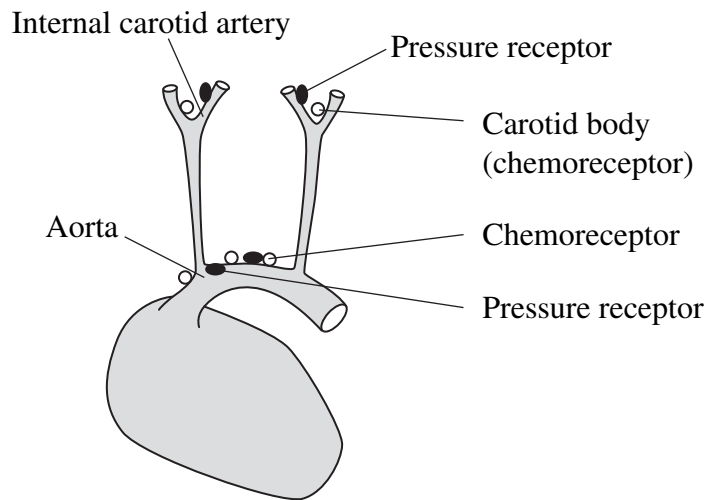
(2 marks)

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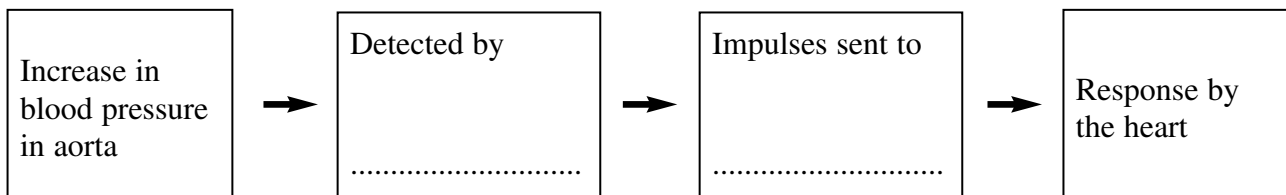
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8 The diagram shows the sites of some receptors near to the heart.



8 (a) The flowchart shows how an increase in blood pressure leads to a response by the heart.



8 (a) (i) Complete the flowchart by naming the structures missing from boxes 2 and 3. (2 marks)

8 (a) (ii) An increase in blood pressure also causes a widening of small arteries leading to the muscles. Explain the importance of this response when we exercise.

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(2 marks)

- 8** (b) An increase in the concentration of carbon dioxide in the blood plasma leads to an increase in cardiac output. Describe how.

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(Extra space) ..... (3 marks)

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**Turn over for the next question**

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- 9 (a) Some biologists believe language evolved at the same time as humans became hunters. Suggest **one** advantage of language to a society that depends on hunting.

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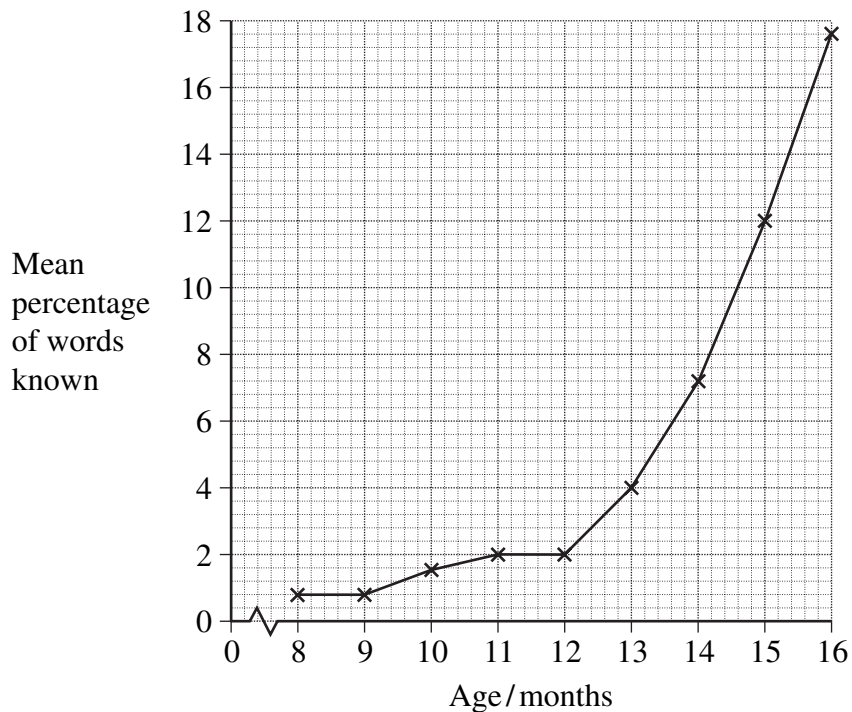
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(2 marks)

- 9 (b) Researchers investigated the number of words known by children of different ages. They used a list of common words and recorded how many of these words were known by each child. The graph shows their results.



The researchers concluded that these results are evidence of a childhood 'vocabulary explosion'.

- 9 (b) (i) Use the graph to describe what is meant by the phrase 'vocabulary explosion'.

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(2 marks)





- 9 (b) (ii) In some children, the pattern of vocabulary development shown in the graph does not take place. Suggest why this could result in these children being socially withdrawn.

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(2 marks)

6

**Turn over for the next question**

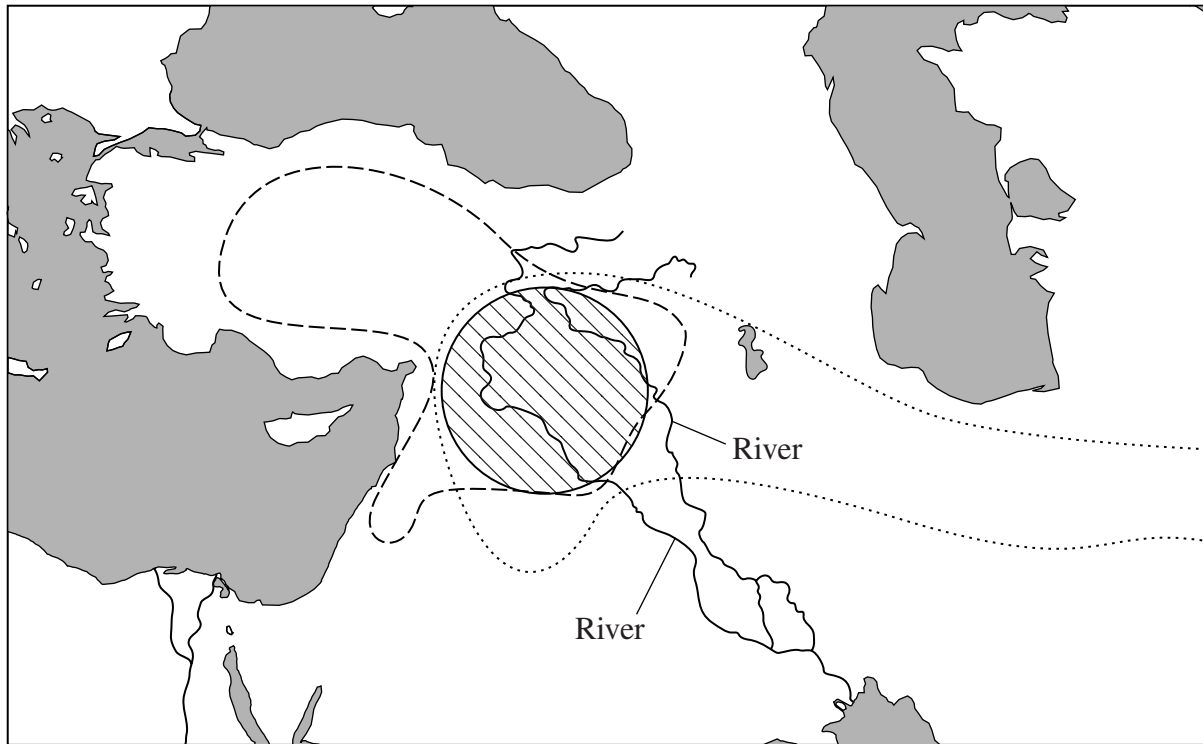
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**10** (a) The map shows part of the Middle East as it was 12 000 years ago. It shows:

- the distribution of some wild species of wheat and barley
- the distribution of wild species of lentils and beans
- a core area where archaeologists have found evidence of early farming.

The seeds of wheat, barley, lentils and beans contain high concentrations of protein, vitamins and minerals.



**Key**



Oceans/lakes



Core area



Area where wild beans and lentils were found



Area where wild wheat and barley were found



Use information from the map to suggest why early farming in the core area was successful.

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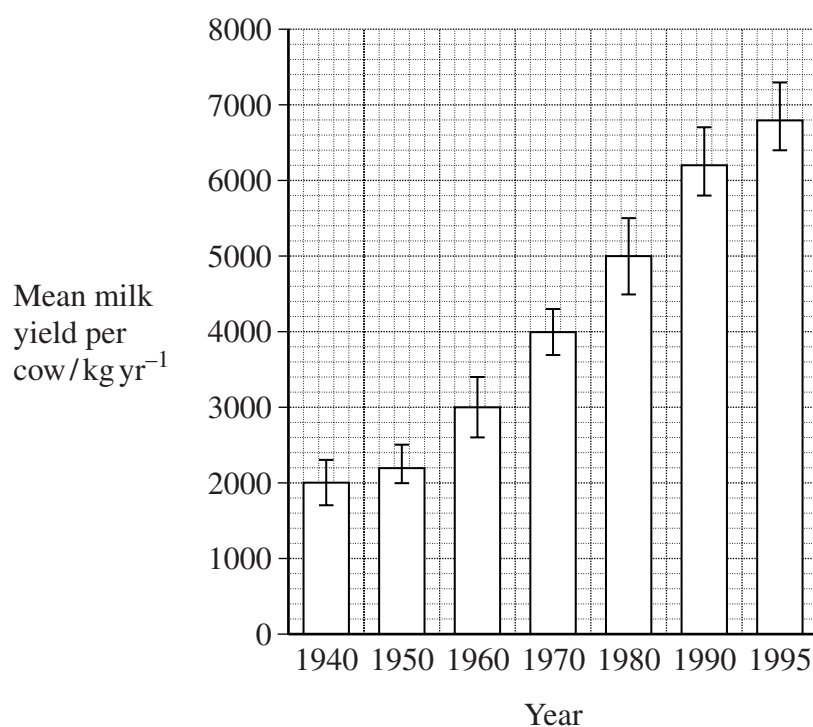
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**Question 10 continues on the next page**

**Turn over ►**



- 10** (b) Farmers have tried to increase milk yield through selective breeding of cattle. The bar chart below shows the change in mean milk yield per cow in the USA from 1940 to 1995. The standard deviations are also shown.



- 10** (b) (i) What information does standard deviation give about the milk yield per cow?

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(1 mark)



- 10** (b) (ii) Some cattle breeders concluded that selective breeding improved the milk yield per cow. Evaluate this conclusion.

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(4 marks)

(Extra space) .....

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8

**Turn over for the next question**

**Turn over ►**



**11** Read the passage below.

For fifty years, a person's body has been a community of trillions of cells. One day, a normal body cell becomes a cancer cell. The immune system does not attack it. The body treats the cancer cell as one of its own, which it is. The body also treats it as if it is still under normal control, which it isn't. The cancer cell divides again and again, until there is a mass made of billions of cells. Even at this stage, the body shows no obvious sign or symptom of this mass, which now has its own blood supply.

5

By now, some clumps of cancer cells have broken away from the original mass. They have been carried in the blood and have started to form new masses in other parts of the body. Eventually, the original mass reaches the ten-billion cell size and the person notices a lump.

10

People have often asked why our bodies have not evolved adaptations that give us an effective defence against cancer. The main reason seems to be that most cancers occur in people who are over the age of fifty.

Use information from the passage as well as your own knowledge to answer the following questions.

**11** (a) (i) Explain why the body 'treats a cancer cell as one of its own' (line 3),

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(2 marks)



**11** (a) (ii) Explain why the cancer cell is **not** 'still under normal control' (lines 3 and 4).

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(6 marks)

(Extra space) .....

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**Question 11 continues on the next page**

**Turn over ►**



**11** (b) During development of the cancer, 'some clumps of cancer cells have broken away from the original mass' (line 7).

**11** (b) (i) Name this process.

.....  
(1 mark)

**11** (b) (ii) Explain why a benign tumour is more easy to treat than a cancer.

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(3 marks)  
(Extra space) .....

**11** (c) Evaluate the statement 'one day a normal body cell becomes a cancer cell' (lines 1 and 2).

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(2 marks)





**11** (d) Most cancers develop in people who are over fifty.

**11** (d) (i) Explain why this is the case.

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(2 marks)

**11** (d) (ii) Explain how this could prevent us from evolving an effective defence against cancer.

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(4 marks)

(Extra space) .....

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**END OF QUESTIONS**



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Question 3: Illustrator, D L Cramer, Ph.D.

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