

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Education
Advanced Subsidiary Examination
June 2013

Human Biology

HBIO2

Unit 2 Humans – their origins and adaptations

Monday 03 June 2013 9.00 am to 10.30 am

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 are expected to use a calculator where appropriate.
- 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 3 H B I O 2 0 1

WMP/Jun13/HBIO2

HBIO2

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

- 1 (a)** The bodies of humans who live in hot and sunny countries have a large surface area to volume ratio.

Explain the advantage of this adaptation.

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(2 marks)

- 1 (b)** Other than a large surface area to volume ratio, suggest **one** adaptation of humans who live in hot and sunny countries.

Explain the advantage of this adaptation.

Adaptation

Explanation

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(2 marks)

4



2 (a) Early humans were hunter-gatherers.

Give **two** principal characteristics of the hunter-gatherer way of life.

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(2 marks)

2 (b) Early humans domesticated dogs.

Suggest **one** use of domesticated dogs to early humans.

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(1 mark)

2 (c) Between 8000 and 12 000 years ago some humans became farmers and started cultivating maize.

Describe **two** effects farming had on early human societies.

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(2 marks)

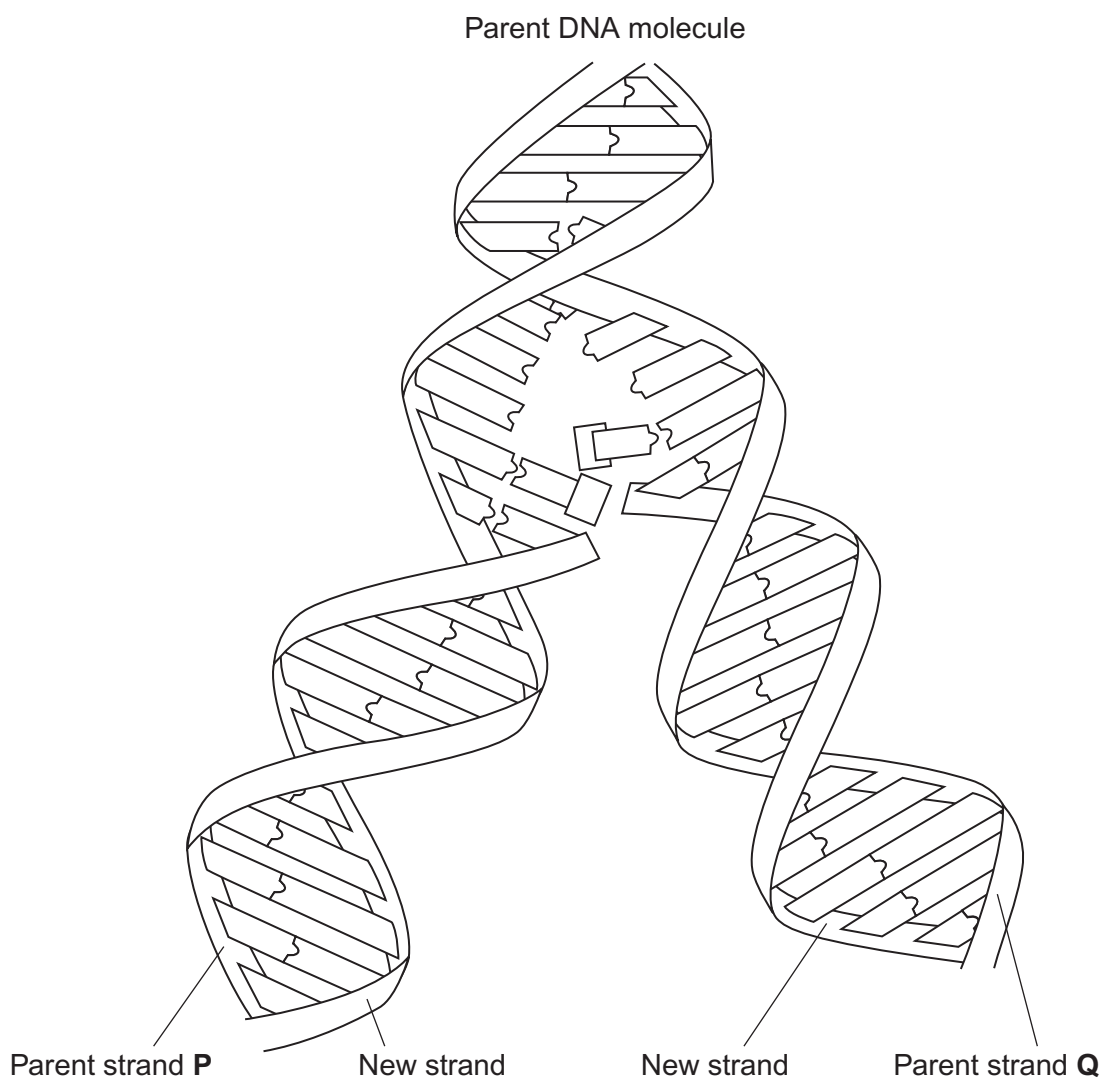
5

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- 3 **Figure 1** shows a molecule of DNA undergoing replication.

Figure 1



- 3 (a) Name the type of DNA replication shown.

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(1 mark)

- 3 (b) Name the stage of the cell cycle during which DNA replication occurs.

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(1 mark)



- 3 (c)** Describe the role of DNA polymerase in DNA replication.

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(1 mark)

- 3 (d)** During DNA replication an enzyme, DNA helicase, separates the parent DNA molecule into two single strands.

Name the type of bond broken by DNA helicase.

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(1 mark)

- 3 (e)** The parent DNA molecule was analysed to find the proportion of each type of base.

Some of the results are shown in **Table 1**.

Table 1

	Percentage of total bases			
	A	T	G	C
Parent strand P		16	22	
Parent strand Q		35		

Calculate the missing values and complete **Table 1**.

(2 marks)

6

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ANSWER IN THE SPACES PROVIDED**



4 (a) Give **two** differences between the nucleotides found in DNA and RNA.

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(2 marks)

4 (b) A student was asked to describe the relationship between genes, proteins and enzymes. She said 'genes contain the code to make proteins, and proteins such as enzymes influence the phenotype of an organism.'

4 (b) (i) Explain what she meant by saying 'genes contain the code to make proteins.'

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(2 marks)

4 (b) (ii) What is the phenotype of an organism?

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(1 mark)

4 (b) (iii) Two organisms of the same species have the same genes but have different phenotypes.

Explain why.

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(1 mark)



5 (a) Give **two** differences between mitosis and meiosis.

Mitosis	Meiosis

(2 marks)

5 (b) The following describes **one** stage of mitosis.

- The centromeres split and chromatids separate.
- The chromatids move to opposite poles of the cell.

5 (b) (i) Name this stage of mitosis.

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(1 mark)

5 (b) (ii) Describe what happens to the chromatids immediately after this stage.

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(1 mark)



5 (c) Cell division is controlled by genes. If this control is removed, tumours can grow which may lead to cancer.

5 (c) (i) Name **one** type of gene that prevents tumour growth.

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(1 mark)

5 (c) (ii) Some people inherit a greater risk of developing cancer.

Explain what causes the increased risk.

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(2 marks)

5 (c) (iii) Name **one** environmental factor that can cause a mutation in a gene.

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(1 mark)

8

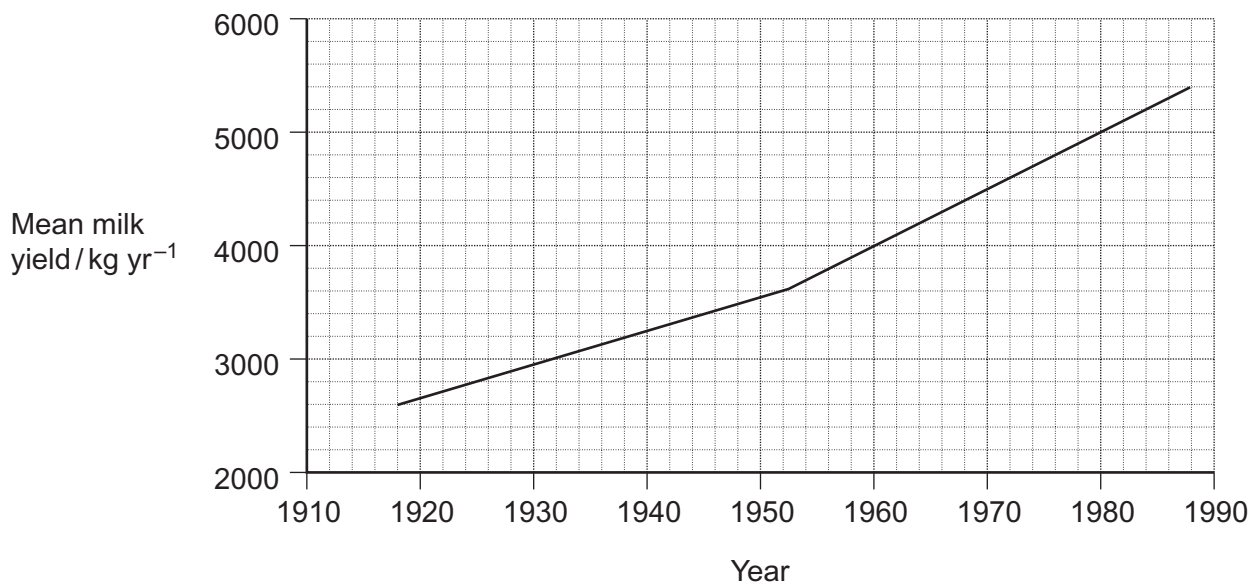
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- 6 **Figure 2** shows change in mean milk yield of a breed of cow from 1918 to 1988.

Figure 2



- 6 (a) (i) Describe the change in mean milk yield.

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(2 marks)

- 6 (a) (ii) Calculate the percentage change in mean milk yield from 1960 to 1980.

Answer
(2 marks)



- 6 (a) (iii)** Using information from **Figure 2**, a farmer predicted that by the year 2000 the mean milk yield would be over 6000 kg yr^{-1} .

Describe how the farmer could have used information from this graph to make the prediction.

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(2 marks)

- 6 (b)** The change in milk yield shown in **Figure 2** is a result of selective breeding.

What is selective breeding?

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(2 marks)

8

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- 7 *Echinococcus multilocularis* is a parasite of foxes. The number of people becoming infected with *E. multilocularis* is increasing. This is because more foxes are living in cities. People and foxes become infected by ingesting eggs of *E. multilocularis* present in fox faeces.

Scientists in Switzerland investigated foxes in cities to find out how many were infected with *E. multilocularis*.

Their results are shown in **Table 2**.

Table 2

Season	Foxes	Number investigated	Number infected	Percentage infected
Winter	Adult females	39	16	41
	Young females	22	8	36
	Adult males	29	13	45
	Young males	39	24	62
Summer	Adult females	22	5	23
	Young females	31	5	16
	Adult males	12	4	33
	Young males	28	5	18

- 7 (a) (i) *E. multilocularis* eggs survive well at low temperatures but are easily damaged at high temperatures.

Do the data in **Table 2** support this statement? Explain your answer.

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(1 mark)



- 7 (a) (ii) A student studying the data in **Table 2** concluded that the chance of animals being infected with the parasite increases with age.

Do the data support this conclusion? Give **two** reasons for your answer.

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(2 marks)

- 7 (b) In foxes, *E. multilocularis* lives in the small intestine. It has the following adaptations:

- hooks and suckers on its head
- no digestive system
- production of thousands of eggs which are released into faeces
- resistance to all known disinfectants.

Suggest **one** advantage of each adaptation:

- 7 (b) (i) hooks and suckers on its head

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- 7 (b) (ii) no digestive system

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- 7 (b) (iii) production of thousands of eggs which are released into faeces

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- 7 (b) (iv) resistance to all known disinfectants.

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(4 marks)



8 (a) What is a species?

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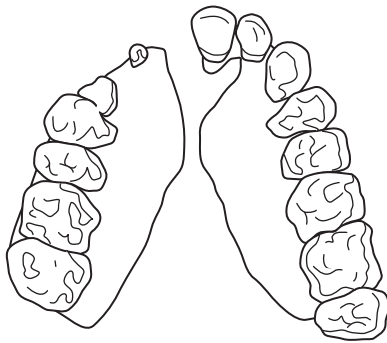
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(1 mark)

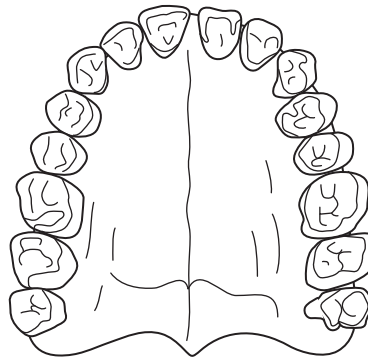
8 (b) *Ramapithecus* was a species that was thought to be an evolutionary link between apes and humans. The first incomplete specimens of *Ramapithecus* were found in Nepal in 1932.

Figure 3 shows a jaw of *Ramapithecus* found in 1932 and a jaw of a modern human.

Figure 3



Ramapithecus jaw specimen



Modern human jaw

When the specimens were found, scientists concluded that the *Ramapithecus* jaw was like a human jaw.

Use information from **Figure 3** to suggest **two** features that caused them to reach this conclusion.

Feature 1

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Feature 2

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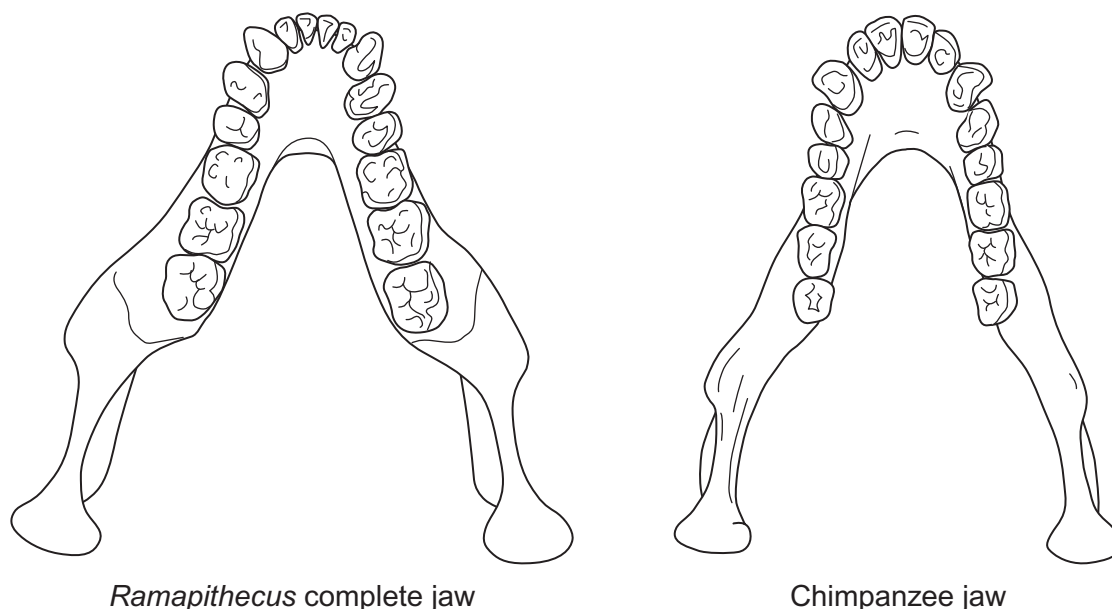
(2 marks)



- 8 (c)** More complete specimens of *Ramapithecus* were found in 1975. These specimens showed that *Ramapithecus* was less human-like than had been thought.

Figure 4 shows a jaw of *Ramapithecus* found in 1975 and a jaw of a chimpanzee.

Figure 4



After this discovery, scientists concluded that *Ramapithecus* is not an evolutionary link between apes and humans.

Use information from **Figure 3** and **Figure 4** to suggest **two** features shared by the jaws of *Ramapithecus* and chimpanzees that led scientists to conclude this.

Feature 1

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Feature 2

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(2 marks)

Question 8 continues on the next page

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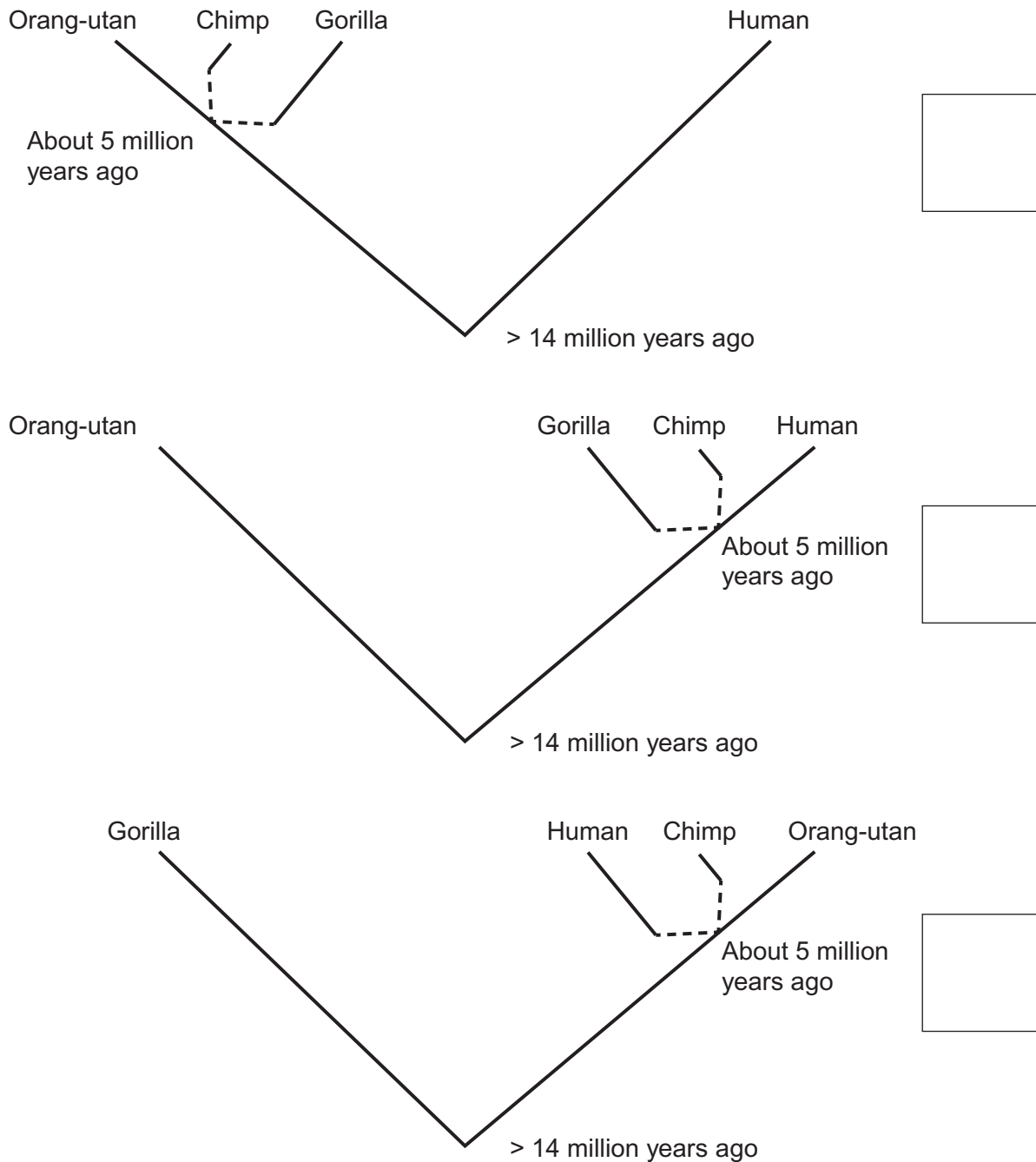
- 8 (d)** In 1932, it was believed that the ancestors of humans had split from other apes 14 million years ago. Recent studies show that there was an early split between orang-utan ancestors and the common ancestors of chimps, gorillas and humans.

- 8 (d) (i)** Select which **one** of the phylogenetic trees in **Figure 5** represents what recent studies show.

Tick the box to show which tree you have selected.

(1 mark)

Figure 5



8 (d) (ii) Recent studies of these phylogenetic relationships use techniques that were not possible in 1932.

Give **two** of these techniques.

1

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2

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(2 marks)

8

Turn over for the next question

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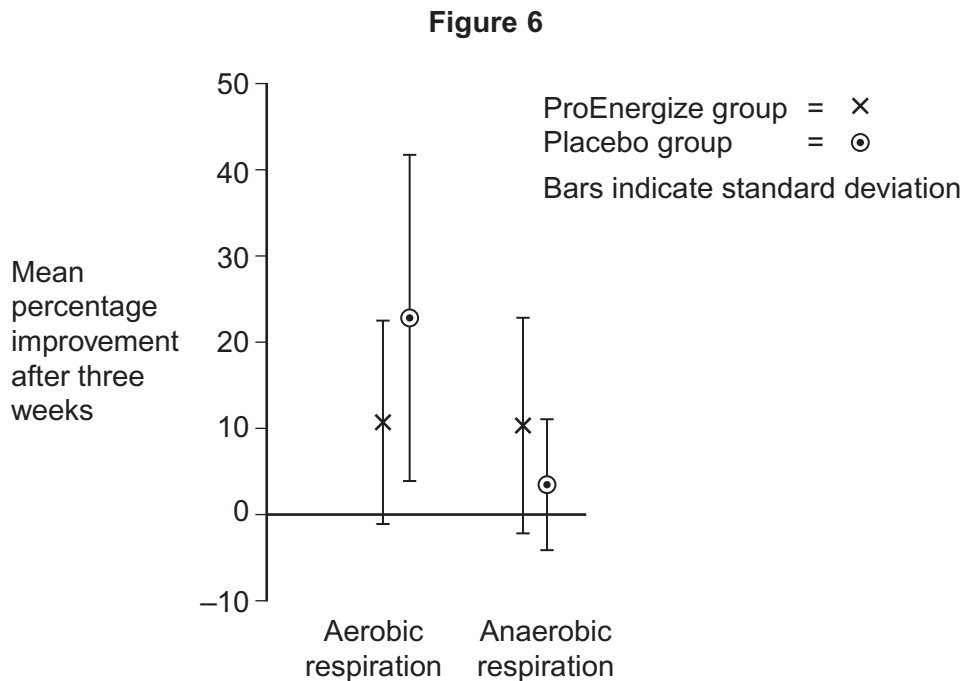
- 9 The manufacturer of a sports supplement, called ProEnergize, claims it can increase energy and delay muscle fatigue during exercise. Sports scientists investigated whether these claims were true.

The scientists recruited 24 rugby players and divided them into two equal groups at random. They measured each rugby player's performance in exercises where

1. aerobic respiration supplied the energy
2. anaerobic respiration supplied the energy.

The rugby players then trained as usual for three weeks. One group received ProEnergize each day and the other received a placebo. After three weeks, each rugby player's performance was measured again in the same exercises and the percentage improvement calculated.

The results are shown in **Figure 6**.



- 9 (a) Use all the information to evaluate the manufacturer's claim for ProEnergize.

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(3 marks)



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- 9 (b) (i)** During the exercises, each rugby player's breathing rate increased.

Describe how this increase is controlled.

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(4 marks)

(Extra space)

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- 9 (b) (ii)** After completing the exercises, each rugby player's breathing rate remained high for a few minutes.

Suggest **one** reason why.

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(1 mark)



- 10** Scientists completed a study of three populations of one species of dung beetle, *Onthophagus taurus*, in three European countries. Some male dung beetles have large horns and others have small horns. Their studies showed that males with large horns fight each other to mate with females. Males with small horns do not fight but mate with females while males with large horns are fighting each other. **5**

The scientists concluded that fighting or not fighting works best for beetles depending on the proportion of females in the population. In populations with a higher proportion of females, fighting is most successful and beetles with large horns mate more frequently. In populations with a lower proportion of females, fighting is less successful, so natural selection favours beetles with small horns. **10**

- 10 (a)** Complete the following table showing the classification of the dung beetle, *Onthophagus taurus*.

Kingdom	Animalia
	Arthropoda
	Insecta
	Coleoptera
	Scarabaeidae
Genus	
Species	

(2 marks)



Explain how natural selection may lead to the evolution of a population of dung beetles with small horns.

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Give **one** way in which Lamarck's theory was different from that of Charles Darwin.

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Question 10 continues on the next page

10 (c) (ii) Does this study of dung beetles prove Lamarck's theory of evolution was wrong?

Explain your answer.

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(2 marks)

10 (d) The scientists concluded that fighting or not fighting works best for beetles depending on the proportion of females in the population (lines 7 and 8).

Evaluate the scientists' conclusion.

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(4 marks)

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10 (e) The scientists thought that the three populations of dung beetle in the three European countries could become separate species.

10 (e) (i) Explain how new species of beetle could arise.

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(4 marks)

(Extra space)

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10 (e) (ii) Describe how the evolution of new species would affect the diversity of dung beetle populations across Europe.

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(1 mark)

20

END OF QUESTIONS



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