

Surname	Centre Number	Candidate Number
Other Names		0

**GCSE**

4471/02



W15-4471-02

**ADDITIONAL SCIENCE/BIOLOGY****BIOLOGY 2  
HIGHER TIER**

A.M. WEDNESDAY, 7 January 2015

1 hour

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	8	
2.	7	
3.	3	
4.	6	
5.	6	
6.	4	
7.	3	
8.	5	
9.	6	
10.	6	
11.	6	
<b>Total</b>	<b>60</b>	

**ADDITIONAL MATERIALS**

In addition to this paper you may require a calculator and a ruler.

**INSTRUCTIONS TO CANDIDATES**

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

**INFORMATION FOR CANDIDATES**

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication (QWC) used in your answers to questions **4** and **11**.

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Answer all questions.

1. The black-faced lion tamarin (*Leontopithecus caissara*) is a species of monkey living in the rainforests of South America.



- (a) The black-faced lion tamarin is classified as Critically Endangered on the IUCN red list and listed on Appendix 1 of CITES. There are only about 400 individuals remaining in the wild.



- (i) On the sliding scale above suggest what will happen to the black-faced lion tamarin unless measures are taken to conserve the species. [1]

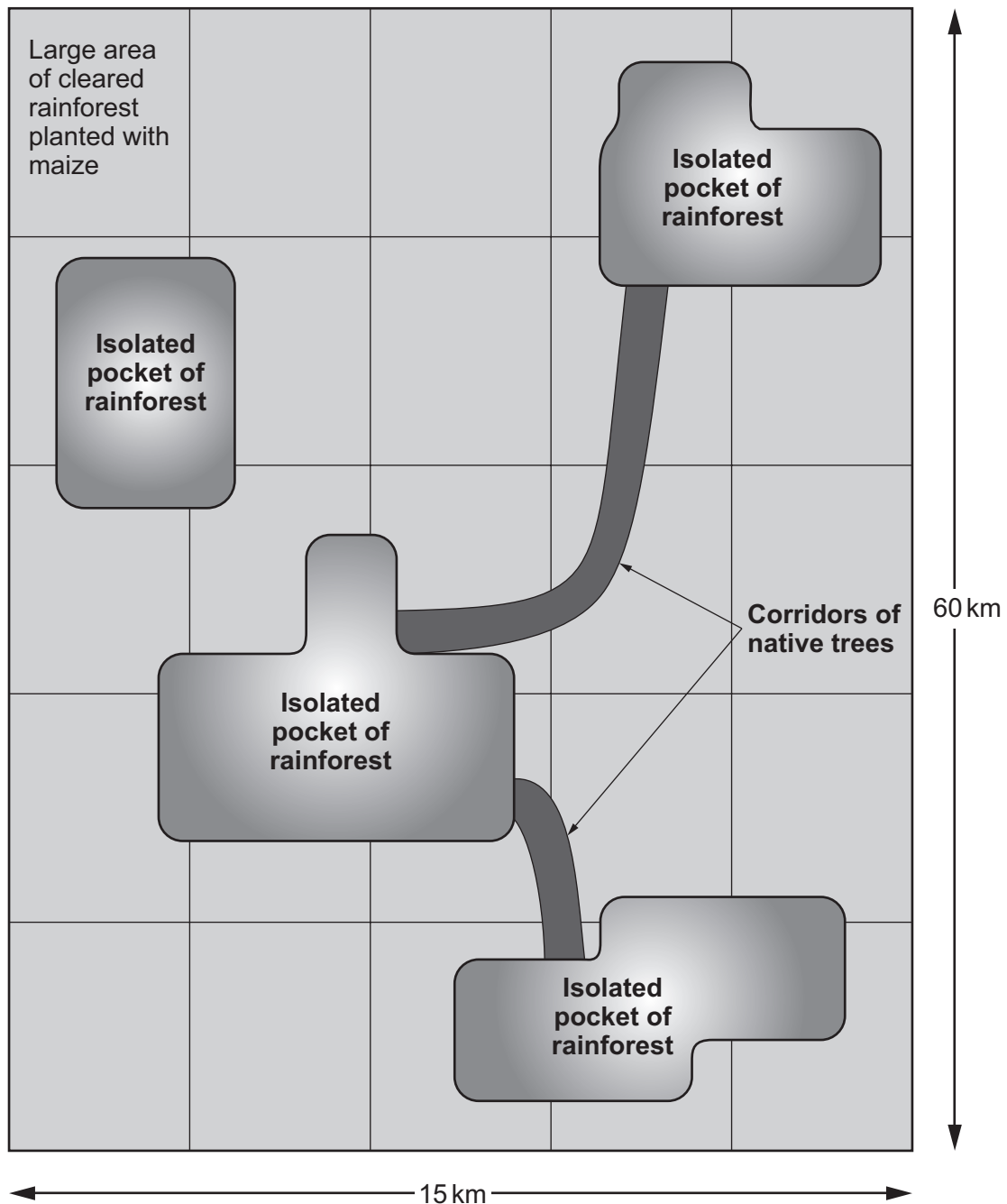
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- (ii) If conservation measures fail, state what will happen to the biodiversity of the habitat in which the black-faced lion tamarin lives. [1]

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- (b) The rainforest habitat of the black-faced lion tamarin has been cleared to grow maize. Small populations of the monkey now live in isolated pockets of rainforest. The local people are being paid to start local plant nurseries and to plant corridors of native trees which link up the isolated pockets of rainforest.

The diagram shows an aerial view of  $900 \text{ km}^2$  of rainforest which has been cleared and planted with maize.



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(i) Suggest **one** reason why the local people are prepared to give up some of their farmland in order to create the corridors of native trees. [1]

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(ii) Suggest ways in which the corridor system shown in the diagram opposite can be improved. [2]

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(iii) How will the corridor system help conserve and increase the numbers of the black-faced lion tamarin in the rainforest? [2]

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(c) State **one other** way in which endangered species can be conserved. [1]

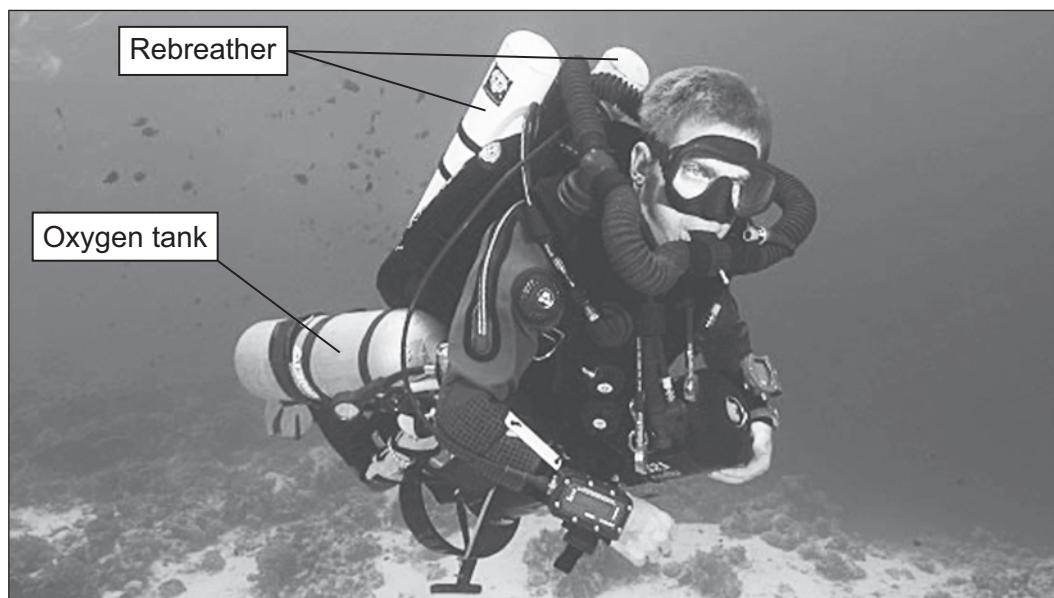
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8

## 2. Look, no bubbles!

SCUBA diver wearing a rebreather



In standard SCUBA equipment when you breathe in through the mouthpiece you get a lungful of fresh air from the tank on your back. When you breathe out, the expired air goes out from the equipment into the water in the form of bubbles.

Modern SCUBA equipment contains a rebreather. This allows you to breathe the same air many times and produces no bubbles.

- (a) (i) Complete the following table to show the composition of inspired and expired air. [2]

gas	inspired air (%)	expired air (%)
oxygen	.....	16
carbon dioxide	.....	4
nitrogen	79	.....
water vapour	varies	1

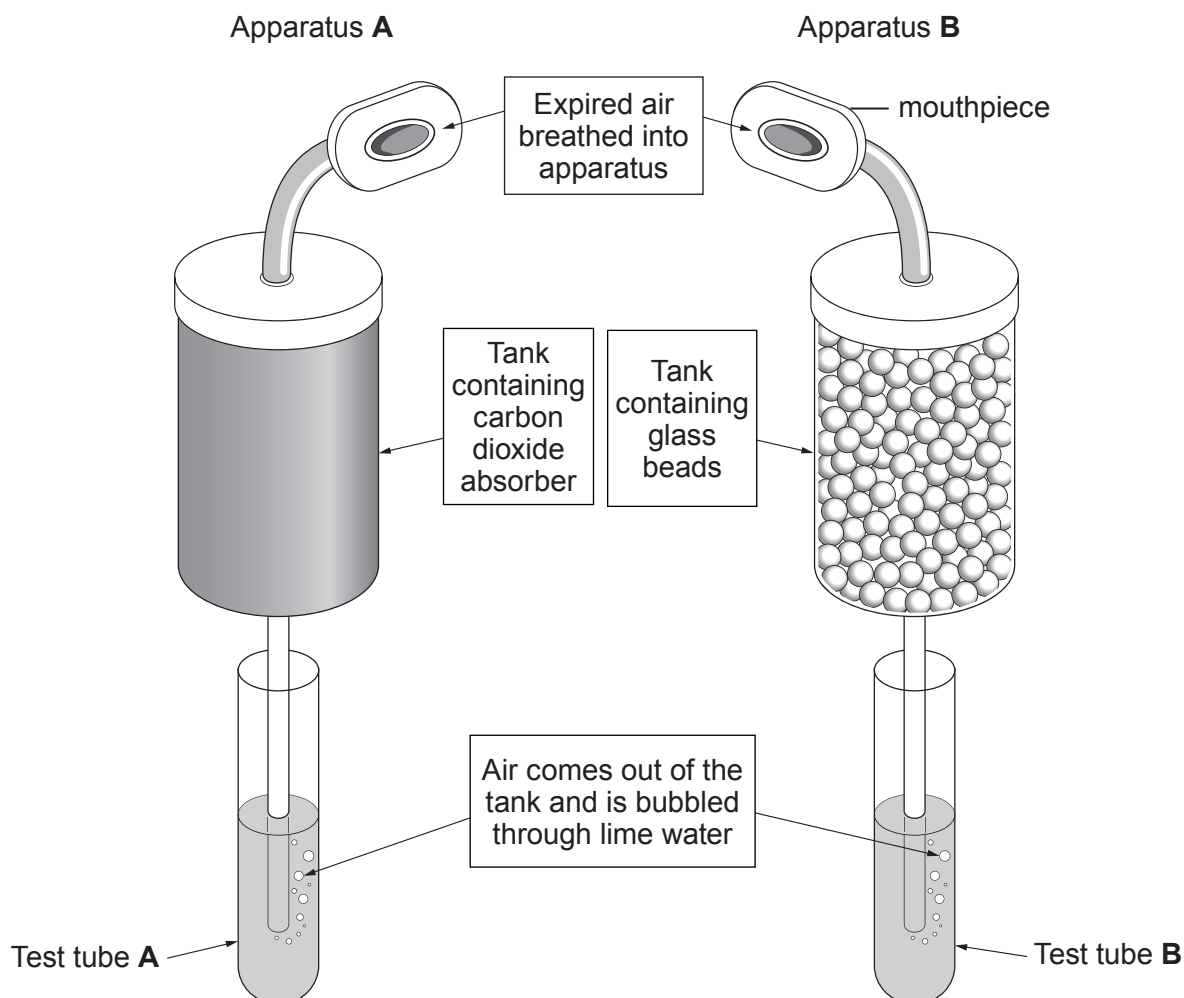
- (ii) Use the table to state why it is possible for a diver to use a rebreather. [1]

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- (iii) Expired air contains 4% carbon dioxide. This concentration of carbon dioxide in air is poisonous. Rebreathers also contain a tank which absorbs the carbon dioxide making the air rebreathable for the diver.  
Suggest the name of the chemical compound which absorbs the carbon dioxide.

[1]

A scientist tested the air coming out of the tank using apparatus **A** and **B** as shown below.



- (b) What result would you expect to see in test tubes **A** and **B** after bubbling the expired air through lime water for 2 minutes? [2]

Test tube **A**

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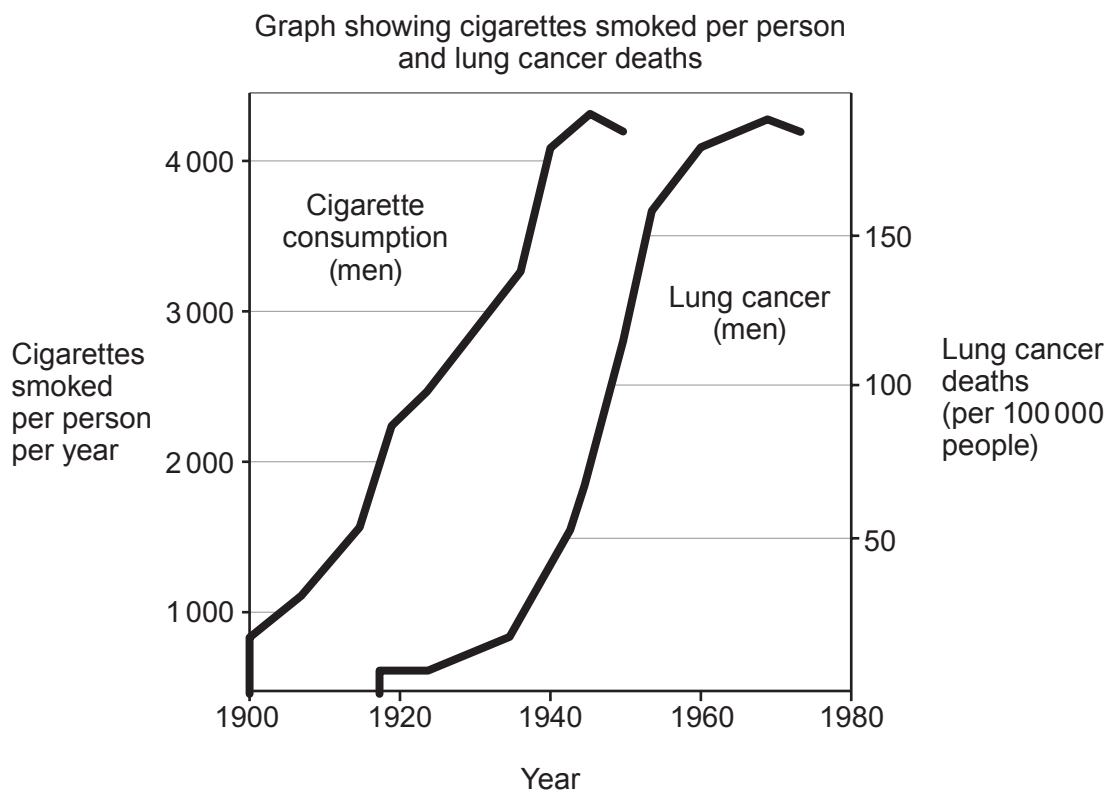
Test tube **B**

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- (c) Apart from not producing any bubbles, suggest **one other** advantage to a diver using a rebreather. [1]

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3. The major rise in cigarette smoking amongst the UK population occurred at the start of the 20<sup>th</sup> century.



- (a) From the graph, describe fully the relationship between cigarette smoking and lung cancer deaths in men. [2]

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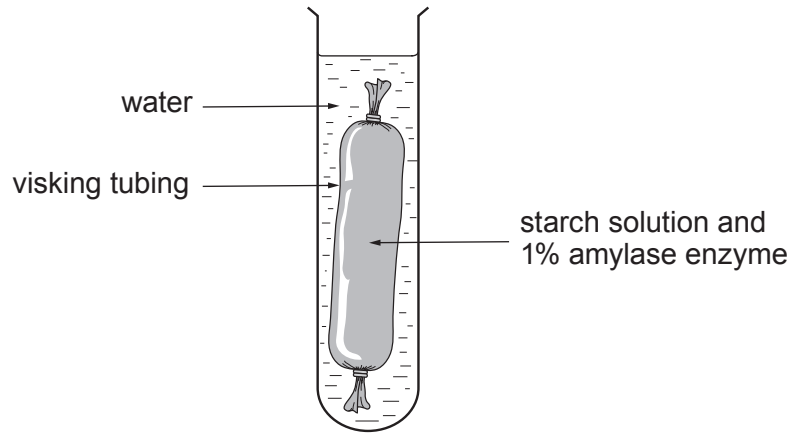
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- (b) The link between smoking and lung cancer was first made by Sir Richard Doll, Professor of Medicine at the University of Oxford. Use the information in the graph to suggest when he first made the public aware of the link between cigarette smoking and lung cancer. [1]

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- 4. An experiment was set up using visking tubing as a model gut. This is shown in the following diagram. The visking tubing was filled with a starch solution and 1% amylase enzyme. After 30 minutes the water surrounding the visking tubing was tested and found to contain glucose but no starch.



Explain why glucose appeared in the water surrounding the visking tubing but no starch was found. Include in your account a description of how the water was tested for glucose using Benedict's solution and for starch using iodine solution giving the expected observations.  
 [6 QWC]

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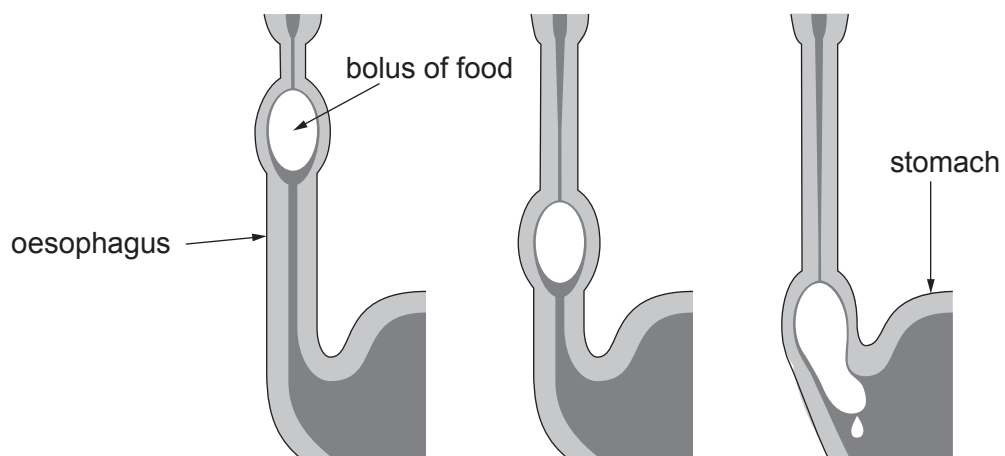
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5. The diagram shows a process occurring in the human digestive system.



- (a) (i) Name the process shown in the diagram.

[1]

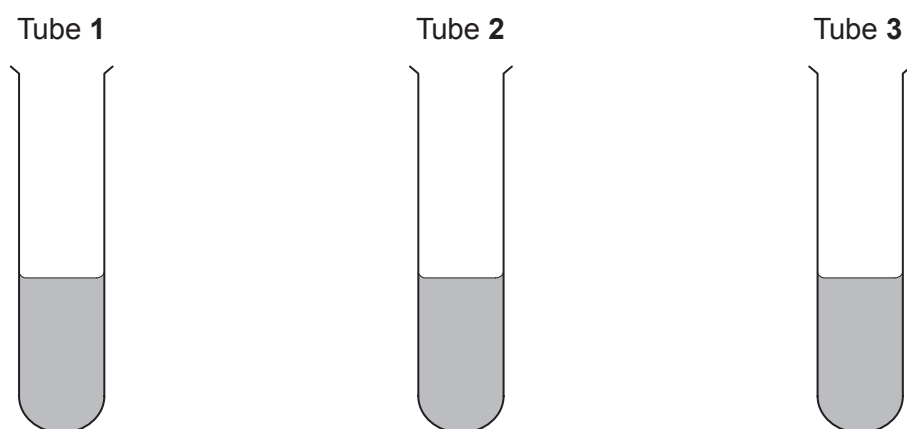
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- (ii) Explain how the bolus of food is moved along the oesophagus.

[2]

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The apparatus shown below was used to investigate the effect of washing-up liquid (detergent) on the digestion of fat by lipase.



Contents Tube 1	Contents Tube 2	Contents Tube 3
full fat milk (50 cm <sup>3</sup> )	full fat milk (50 cm <sup>3</sup> )	full fat milk (50 cm <sup>3</sup> )
washing-up liquid (5 cm <sup>3</sup> )	water (5 cm <sup>3</sup> )	washing-up liquid (5 cm <sup>3</sup> )
water (5 cm <sup>3</sup> )	2% boiled lipase solution (5 cm <sup>3</sup> )	2% lipase solution (5 cm <sup>3</sup> )

The 3 tubes were left at 20 °C for 60 minutes and the pH of the contents of each tube was measured every 15 minutes. The results are shown in the table below.

Time (minutes)	pH		
	Tube 1	Tube 2	Tube 3
0 (start)	8.5	6.7	8.5
15	8.5	6.7	7.4
30	8.5	6.7	6.6
45	8.5	6.7	6.3
60	8.5	6.7	5.9

(b) Explain the results for Tube 3.

[3]

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6. (a) Name **two** scientists whose work led to the discovery of the structure of DNA. [2]

I. ....

II. ....

(b) A section of a single strand of DNA has the following sequence of bases:

**A T C T G T A C A G**

(i) What will be the complementary sequence of bases to that shown above? [1]

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(ii) State the maximum number of amino acids that could be coded by the sequence shown. [1]

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In 2012 specimens of the slug *Arion flagellus* were found in a garden in the Amman Valley in South Wales. The species had spread to Wales after being accidentally introduced on food imported from Spain. It eats other slugs and snails and other crop pests.

(a) What scientific term describes *Arion flagellus* as an invasive species introduced from another country? [1]

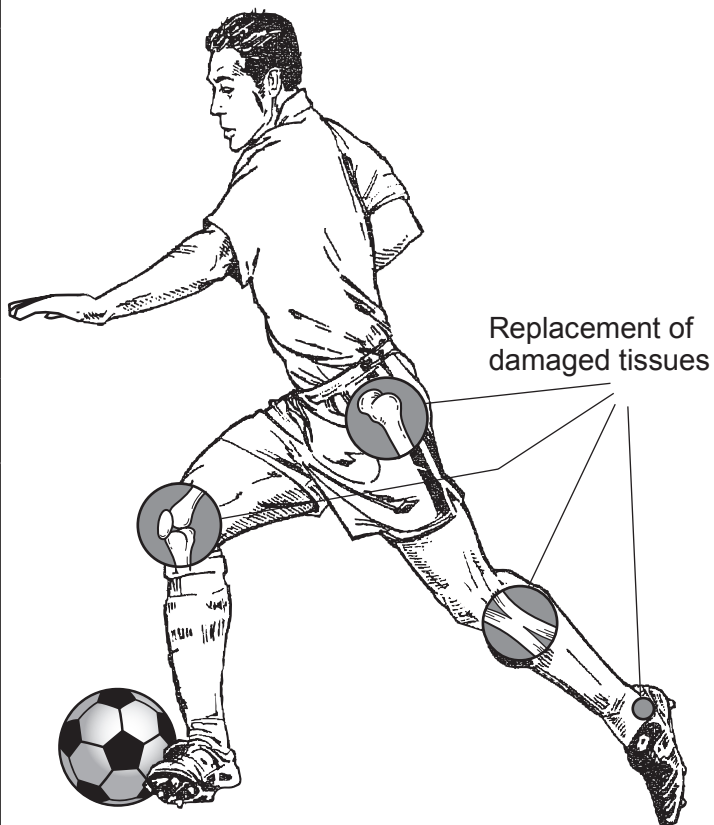
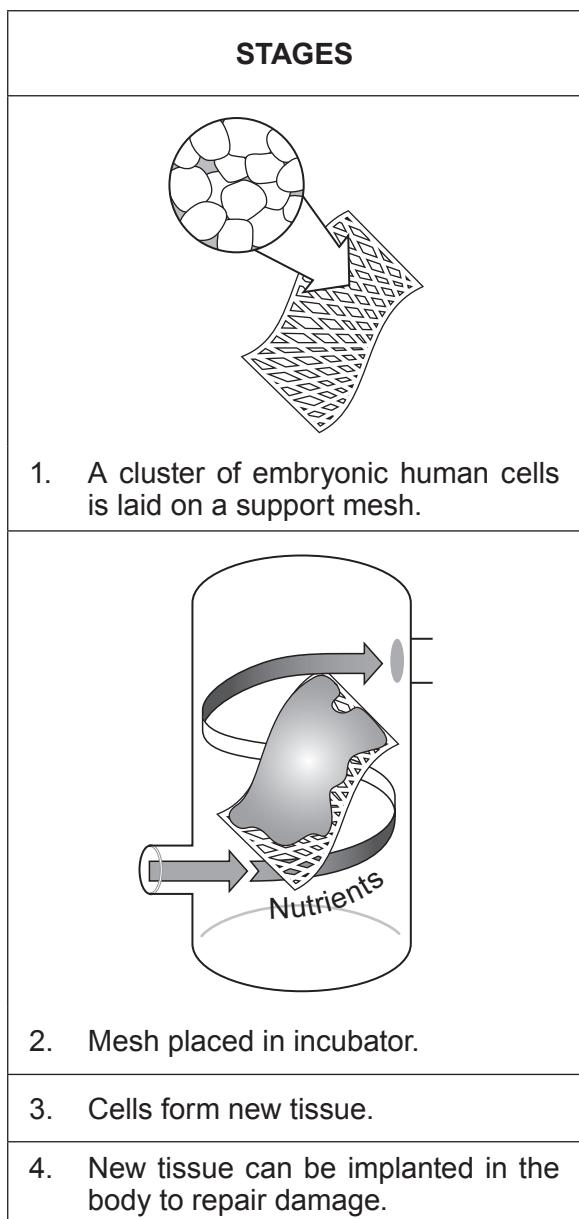
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(b) What would long term field trials need to find out about this species before it could be used to control crop pests in Wales? [2]

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8. The diagram shows how some parts of joints can be replaced. The stages in the procedure are shown in the left hand column.



- (a) What general name is given to cells such as the embryonic human cells shown in **Stage 1** of the diagram? [1]

.....

- (b) Tick (✓) **one** box in **each** column in the table below to identify some features of cell division that would take place in **Stage 3** in the diagram. [3]

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function of cell division	part of cell where control of cell division occurs	number of chromosomes in each cell
increases the number of cells <input type="checkbox"/>	cytoplasm <input type="checkbox"/>	twice as many as in the cells in Stage 1 <input type="checkbox"/>
increases the size of each cell <input type="checkbox"/>	nucleus <input type="checkbox"/>	same number as in the cells in Stage 1 <input type="checkbox"/>
keeps the number of cells the same <input type="checkbox"/>	cell membrane <input type="checkbox"/>	half as many as in the cells in Stage 1 <input type="checkbox"/>

- (c) Suggest a possible ethical issue related to the technology shown in the diagram. [1]

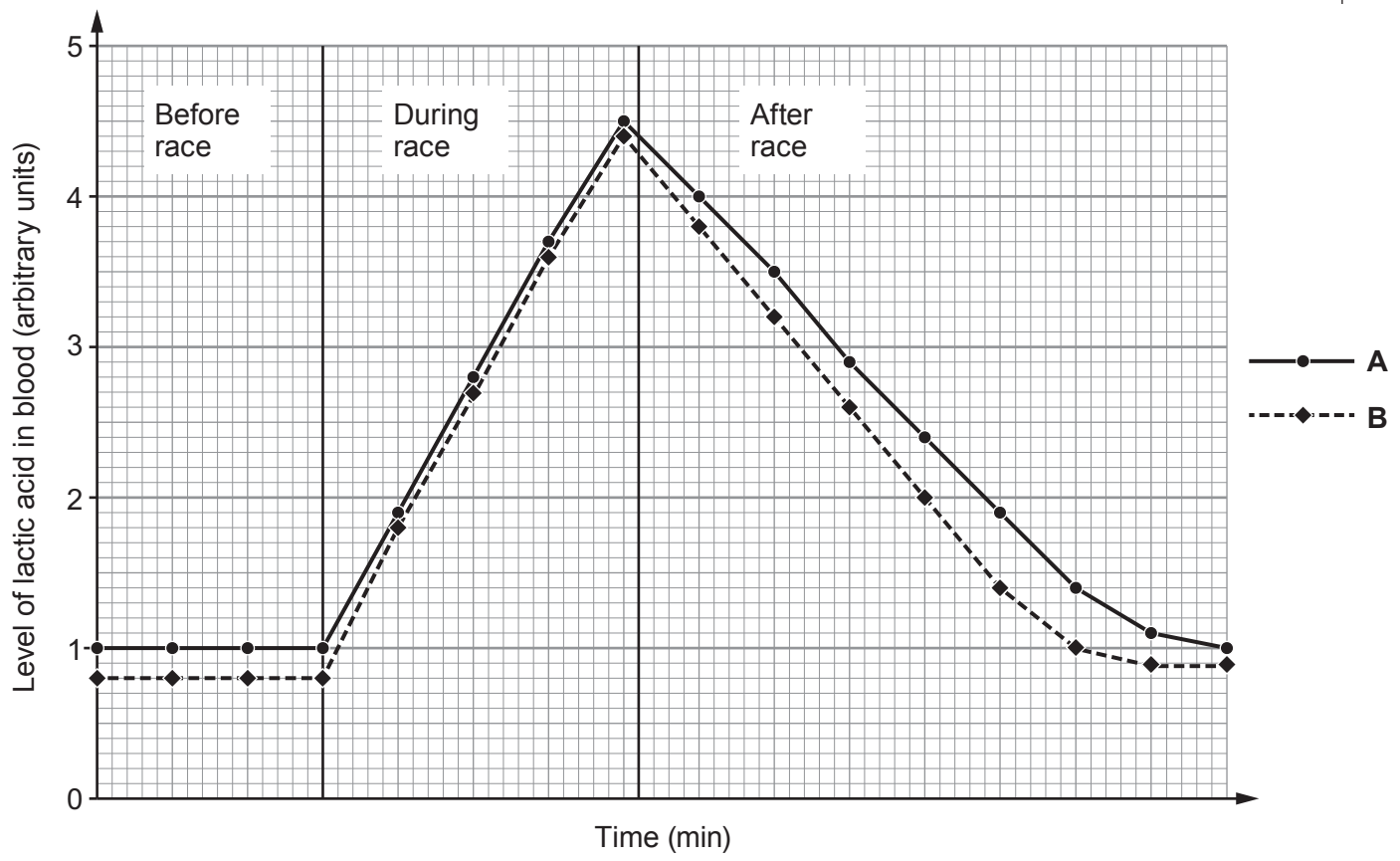
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9. The concentration of lactic acid in the blood of an athlete was measured before, during and after a race. The athlete then followed a two week period of increased regular exercise to improve fitness. The lactic acid measurements were then repeated, as before, for a race of the same distance. The graph shows the results.



- (a) Give reasons why line B shows evidence that it represents the results **after** the two week period of exercise. [2]

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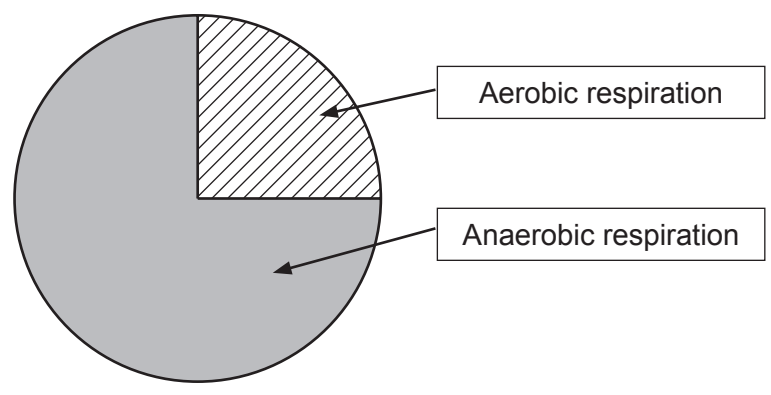
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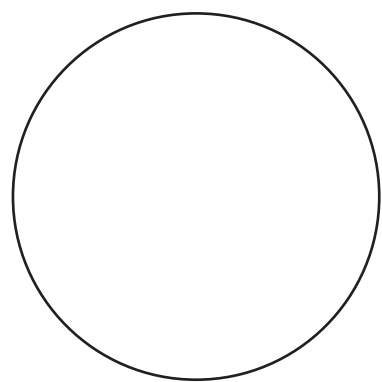
(b) The pie chart below shows the proportions of aerobic respiration and anaerobic respiration taking place in an athlete during a 100 m race.



(i) State the proportions as a ratio. [1]

..... anaerobic respiration : ..... aerobic respiration

(ii) Complete a pie chart, in the circle below, to suggest the expected proportions of aerobic and anaerobic respiration in an athlete during a **1500m race**. Use the same key as above. [1]



(c) Why is aerobic respiration more efficient than anaerobic respiration? [2]

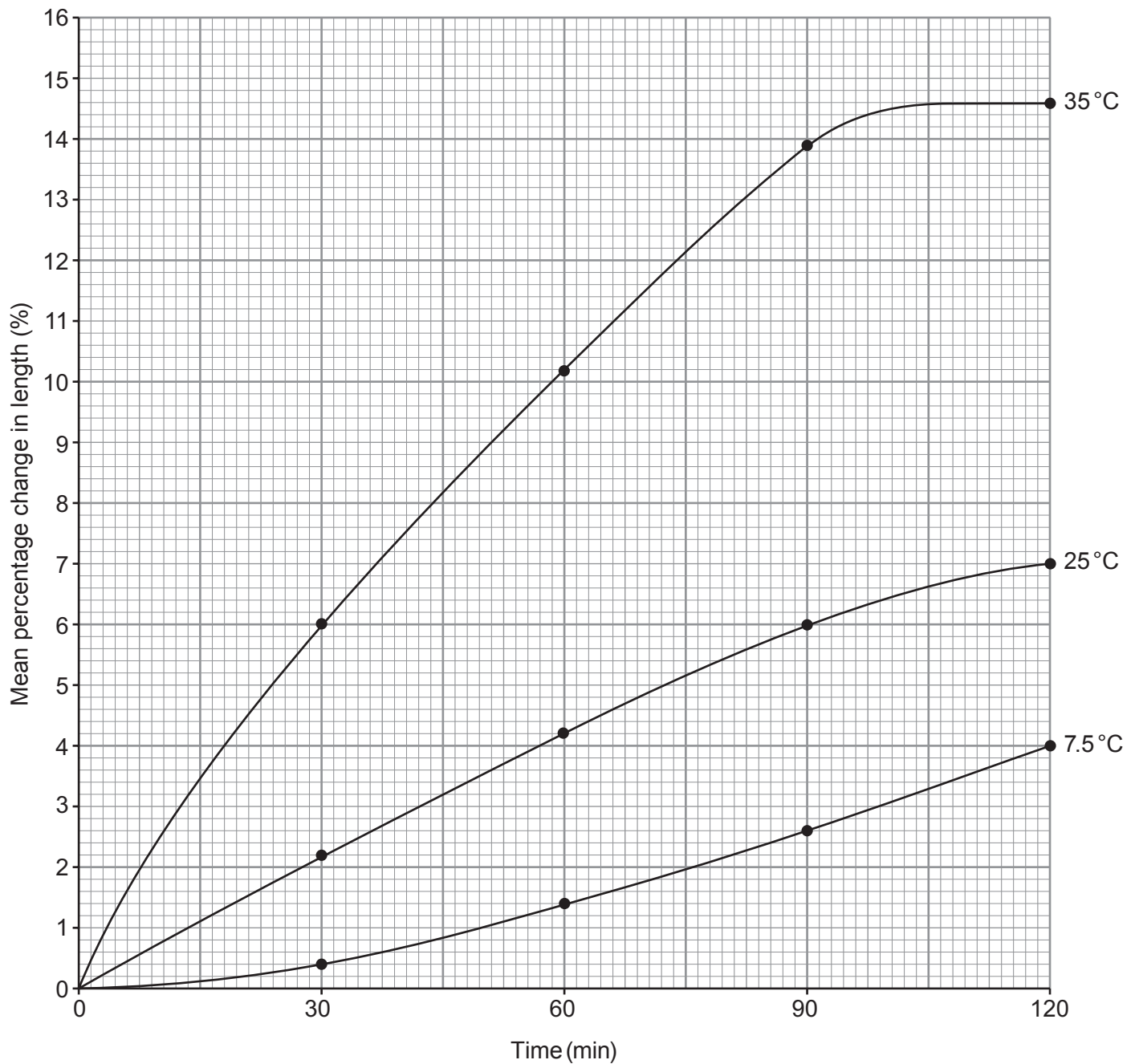
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10. Five identical cylinders of potato were placed in water at each of the following temperatures: 7.5°C, 25°C and 35°C. After 30 minutes, they were removed and the length of each cylinder measured. This was repeated every 30 minutes for 120 minutes. The mean percentage change in length for the cylinders was plotted on the graph below.



- (a) Explain why the cylinders increased in length and name the process involved. [4]

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- (b) Suggest why at 60 minutes the percentage increase in length of the cylinders at 35 °C is greater than the increase in length at 25 °C. [1]

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- (c) The cylinders at 35 °C have reached their maximum length by 120 minutes. State how this length is maintained. [1]

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**Turn over for Question 11.**

- 11. Describe the process of photosynthesis with reference to the production of materials in plant cells. In your account, identify relevant limiting factors. [6 QWC]

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