



**Surname** \_\_\_\_\_

**Other Names** \_\_\_\_\_

**Centre Number** \_\_\_\_\_

**Candidate Number** \_\_\_\_\_

**Candidate Signature** \_\_\_\_\_

**GCSE**

**COMBINED SCIENCE: TRILOGY**

**Higher Tier**

**Biology Paper 2H**

**H**

**8464/B/2H**

**Friday 7 June 2019 Afternoon**

**Time allowed: 1 hour 15 minutes**

**At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.**

**[Turn over]**



JUN198464B2H01

**For this paper you must have:**

- **a ruler**
- **a scientific calculator.**

## **INSTRUCTIONS**

- **Use black ink or black ball-point pen.**
- **Answer ALL questions in the spaces provided.**
- **Do all rough work in this book. Cross through any work you do not want to be marked.**
- **In all calculations, show clearly how you work out your answer.**



## **INFORMATION**

- **The maximum mark for this paper is 70.**
- **The marks for questions are shown in brackets.**
- **You are expected to use a calculator where appropriate.**
- **You are reminded of the need for good English and clear presentation in your answers.**

**DO NOT TURN OVER UNTIL TOLD TO DO SO**



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**Some students investigated the effect of drinking caffeine on reaction time.**

**They used a drink containing 32.25 mg of caffeine per 100 cm<sup>3</sup>**

**This is the method used.**

- 1. Divide the students into four groups, A, B, C and D.**
- 2. Measure and record the reaction time of each student using the ruler-drop test.**
- 3. Students in:**
  - group A drink 200 cm<sup>3</sup> of water**
  - group B drink 200 cm<sup>3</sup> of the caffeine drink**
  - group C drink 400 cm<sup>3</sup> of the caffeine drink**
  - group D drink 600 cm<sup>3</sup> of the caffeine drink.**
- 4. Repeat step 2 after 15 minutes.**





01.2

**TABLE 1** shows the mass of caffeine taken in by each student.

**TABLE 1**

<b>Group</b>	<b>Mass of caffeine in mg</b>
<b>A</b>	<b>0</b>
<b>B</b>	<b>64.5</b>
<b>C</b>	<b>129.0</b>
<b>D</b>	<b>X</b>

**Calculate value X. [1 mark]**

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**X = \_\_\_\_\_ mg**



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**Why did group A drink water instead of the caffeine drink? [1 mark]**

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**[Turn over]**



**TABLE 2** was used to convert the results of the ruler-drop test into reaction times.

**TABLE 2**

<b>Distance in cm</b>	<b>Reaction time in s</b>
<b>2</b>	<b>0.064</b>
<b>4</b>	<b>0.090</b>
<b>6</b>	<b>0.111</b>
<b>8</b>	<b>0.128</b>
<b>10</b>	<b>0.143</b>
<b>12</b>	<b>0.156</b>
<b>14</b>	<b>0.169</b>
<b>16</b>	<b>0.181</b>
<b>18</b>	<b>0.192</b>
<b>20</b>	<b>0.202</b>
<b>22</b>	<b>0.212</b>
<b>24</b>	<b>0.221</b>
<b>26</b>	<b>0.230</b>

<b>Distance in cm</b>	<b>Reaction time in s</b>
<b>28</b>	<b>0.239</b>
<b>30</b>	<b>0.247</b>
<b>32</b>	<b>0.256</b>
<b>34</b>	<b>0.263</b>
<b>36</b>	<b>0.271</b>
<b>38</b>	<b>0.278</b>
<b>40</b>	<b>0.286</b>
<b>42</b>	<b>0.293</b>
<b>44</b>	<b>0.300</b>
<b>46</b>	<b>0.306</b>
<b>48</b>	<b>0.313</b>
<b>50</b>	<b>0.319</b>
<b>52</b>	<b>0.326</b>



0	1	.	4
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**Estimate the reaction time for a student who recorded a distance of 23 cm  
[1 mark]**

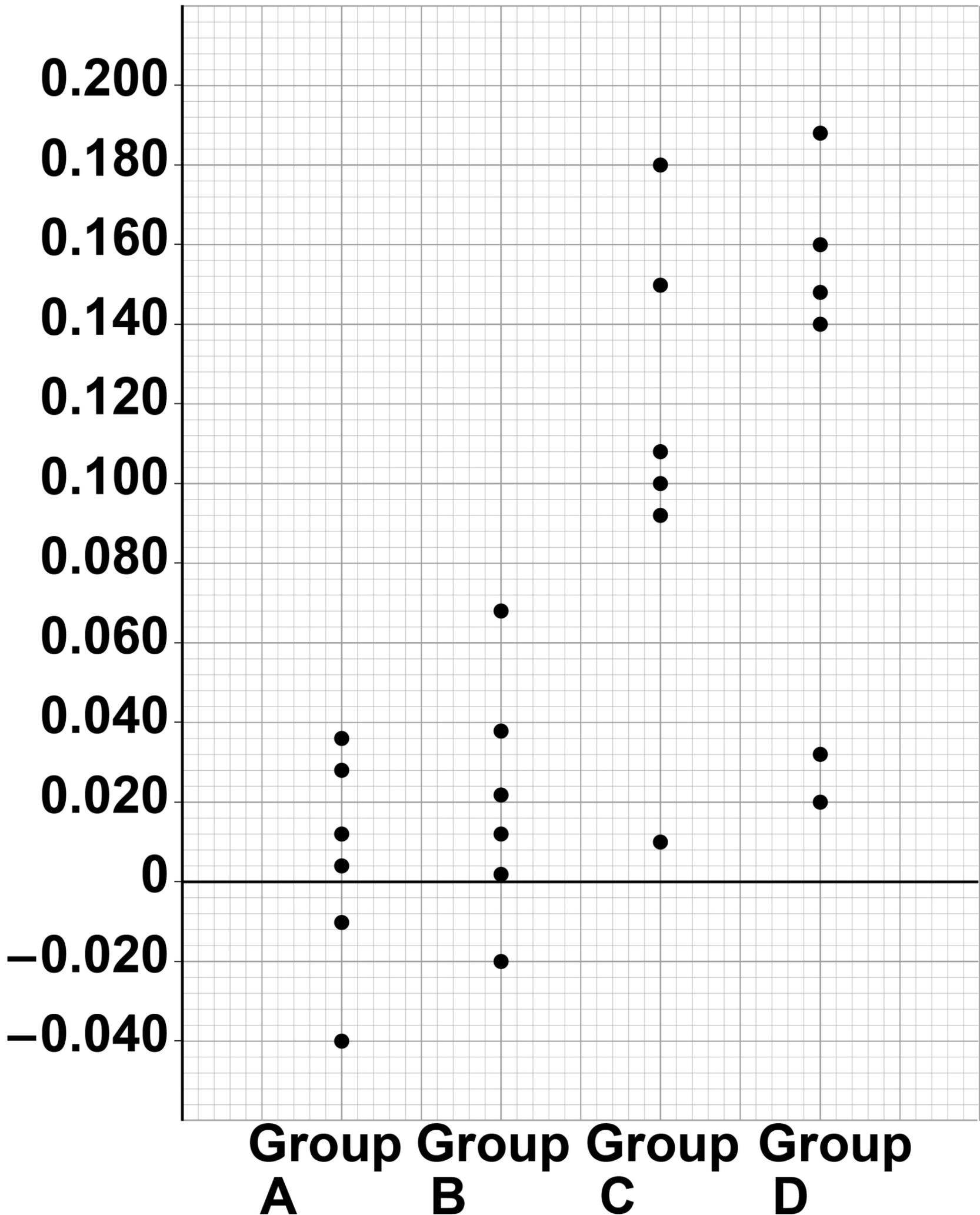
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**Reaction time = \_\_\_\_\_ s**

**[Turn over]**

**FIGURE 1****Decrease  
in reaction  
time in s**

**Students calculated the decrease in their reaction time after the drink compared with before the drink.**

**FIGURE 1, on page 10, shows the results for each student.**

**0 1 . 5**

**Describe the effect of the mass of caffeine taken in on the decrease in reaction time. [1 mark]**

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**[Turn over]**



0	1	.	6
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**For three students the decrease in reaction time was negative.**

**Give the reason why the value was negative. [1 mark]**

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0	1	.	7
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**What is the range of results for group C? [1 mark]**

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0 1 . 8

**Suggest TWO variables that should have been controlled in this investigation.**

**[2 marks]**

1 \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2 \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**[Turn over]**

0 1 . 9

**Explain why the ruler-drop test does NOT involve a reflex action. [2 marks]**

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**13**

0 2

**There has been a rapid increase in the percentage of carbon dioxide in the atmosphere since 1960.**

0 2 . 1

**Carbon dioxide is a greenhouse gas that contributes to global warming.**

**Name ONE other greenhouse gas.  
[1 mark]**

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**[Turn over]**



02.2

**Global warming causes climate change.**

**Give TWO effects of climate change.  
[2 marks]**

**1** \_\_\_\_\_

\_\_\_\_\_

**2** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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**[Turn over]**

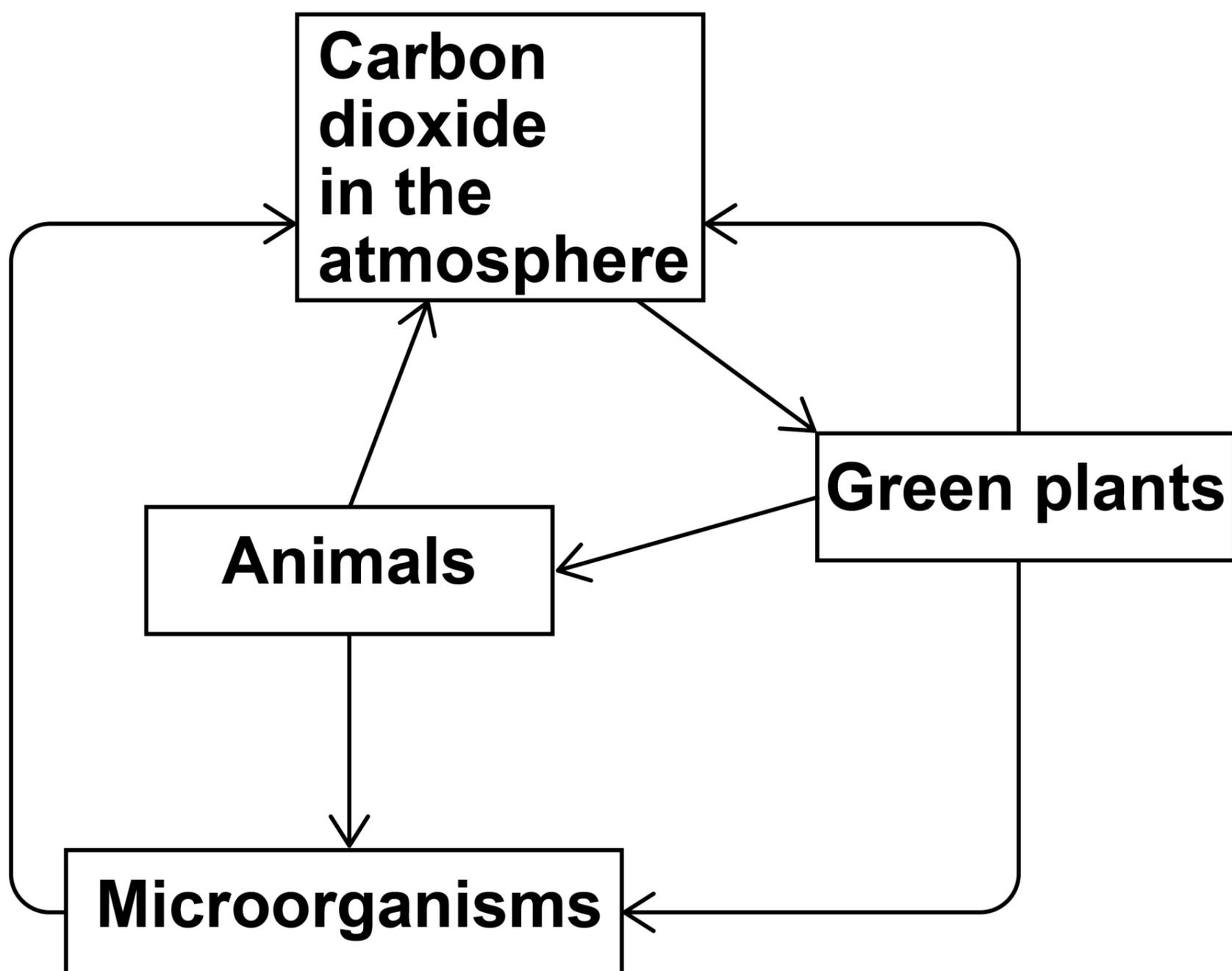


**0 2 . 3**

**Plants take in carbon dioxide from the atmosphere.**

**FIGURE 2 shows part of the carbon cycle.**

**FIGURE 2**







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**[Turn over]**



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**Vectors are used in the process of genetic engineering.**

**Which TWO statements are correct?  
[2 marks]**

**Tick (✓) TWO boxes.**

**Vectors are enzymes used to ‘cut open’ the DNA molecule.**

**Vectors are used to insert genes into cells.**

**Vectors are used to isolate the required gene.**

**Vectors are used to stimulate cell division.**

**Vectors are usually plasmids or viruses.**





03.3

**Give TWO examples of genetic engineering in use today.**

**Do NOT refer to herbicide resistance in your answer. [2 marks]**

1 \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2 \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

0 3 . 4

**Scientists working on the ‘Human Genome Project’ have now mapped the entire genetic code of humans.**

**Explain ONE way this could be important for people in the future. [2 marks]**

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**[Turn over]**

9

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**Animals have adaptations to survive in their environment.**

**These adaptations may be structural, behavioural or functional.**

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**Draw ONE line, on the opposite page, from each animal adaptation to the type of adaptation it is. [2 marks]**

**ANIMAL  
ADAPTATION****TYPE OF  
ADAPTATION**

**Male palm cockatoos use sticks to beat on hollow branches to attract females.**

**Structural**

**The harmless hornet moth has black and yellow stripes to look like a bee or wasp.**

**Behavioural**

**Sea spiders have automatic muscle contractions that move oxygen around their bodies.**

**Functional**

**[Turn over]**



**Plants also have adaptations.**

**There are more than 28 000 known species of orchid plants.**

**0 4 . 2**

**Many orchid plants:**

- **grow attached to other types of plants**
- **have brightly coloured flowers**
- **produce large quantities of pollen**
- **produce thousands of tiny, light seeds.**

**Describe how these adaptations help orchid plants to survive and compete.  
[4 marks]**

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**A rare orchid has been found in the mountains in China.**

**The orchid has pale yellow flowers.**

**DNA analysis of the genome shows that it is an ancestral species.**

**All other present day orchids evolved from this ancestral species millions of years ago.**

**0 4 . 3**

**One present day species has bright purple flowers.**

**Describe how an orchid with bright purple flowers may have evolved from the ancestral species which has pale yellow flowers. [4 marks]**

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**TABLE 3**

<b>Species</b>	<b>Amino acid sequence</b>	<b>Flower colour</b>
<b>Ancestral species</b>	<b>ala-leu-gly-isoleu-tyr-gly-ala-leu-gly-ala</b>	<b>pale yellow</b>
<b>Species A</b>	<b>ala-isoleu-gly-ala-tyr-gly-ala-tyr-gly-ala</b>	<b>pale yellow</b>
<b>Species B</b>	<b>ala-leu-ala-isoleu-tyr-gly-ala-tyr-gly-ala</b>	<b>pink</b>
<b>Species C</b>	<b>ala-isoleu-gly-ala-gly-tyr-gly-leu-gly-ala</b>	<b>bright red</b>
<b>Species D</b>	<b>ala-leu-gly-isoleu-tyr-tyr-ala-leu-gly-ala</b>	<b>purple</b>

**KEY:**

**ala = alanine**

**gly = glycine**

**isoleu = isoleucine**

**leu = leucine**

**tyr = tyrosine**

**[Turn over]**



**0 4 . 4**

**The DNA code determines the sequence of amino acids which are joined together to form a specific protein.**

**TABLE 3, on page 32, shows part of the amino acid sequence for the colour pigment protein in five orchid species.**

**34**

**The rest of the amino acid sequence is the same for all the species.**



**Suggest which orchid species is most closely related to the ancestral species.**

**Give a reason for your answer. [2 marks]**

**Species** \_\_\_\_\_

**Reason** \_\_\_\_\_

**35**

**[Turn over]**

<hr/> <b>12</b>
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0	5
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**Some students estimated the population of daisies in a school field.**

**This is the method used.**

- 1. Find a place where some daisies are growing.**
- 2. Put the quadrat down.**
- 3. Count and record the number of daisies in the quadrat.**
- 4. Repeat steps 1–3 at four different places in the field.**
- 5. Calculate the mean number of daisies per quadrat.**
- 6. Use the data to estimate the total number of daisies in the field.**

**05.1**

**Which TWO improvements would increase the validity of this method? [2 marks]**

**Tick (✓) TWO boxes.**

**Do not put any quadrats near trees.**

**Repeat for another ten quadrats.**

**Use a long tape measure.**

**Use a random method to place the quadrats.**

**Use the same person to place all the quadrats.**

**[Turn over]**



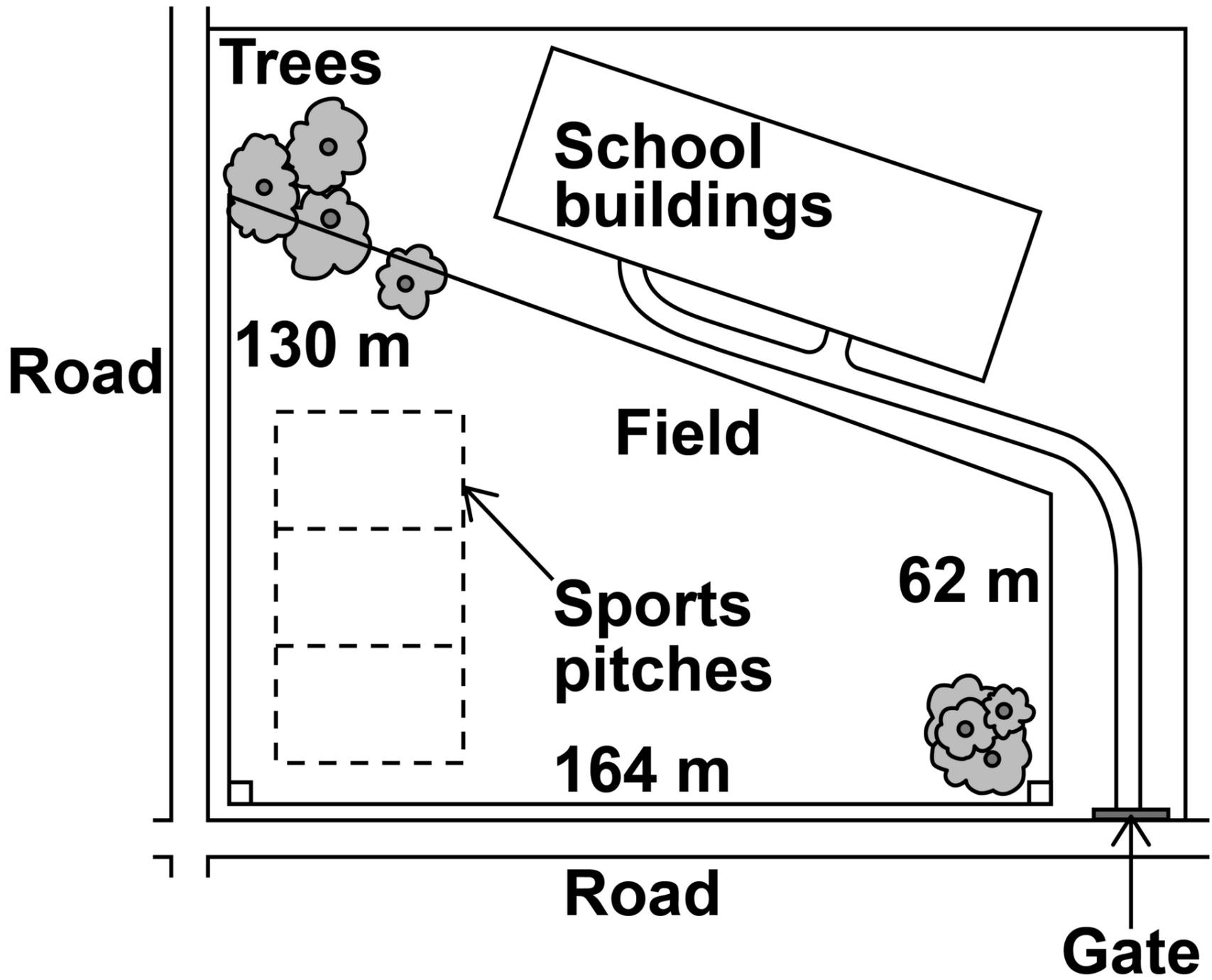
**05.2**

**With an improved method the students calculated the mean number of daisy plants to be 7.65 per quadrat.**

**The students used a quadrat measuring 50 cm × 50 cm**

**FIGURE 3, on the opposite page, shows the school site and the dimensions of the school field.**

FIGURE 3



[Turn over]

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**[Turn over]**

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<b>13</b>



06

**This question is about homeostasis.**

06.1

**Define the term homeostasis. [2 marks]**

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**Name the hormone released if the blood glucose concentration falls too low.**

**[1 mark]**

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**[Turn over]**



**Two people were sent to a hospital to find out if they have diabetes.**

**This is the method used at the hospital.**

- **Do not eat or drink after midnight. This is called fasting.**
- **Measure blood glucose concentration at 9.30 am**
- **Drink a glucose solution at 10.00 am**
- **Measure blood glucose concentration for the next 3 hours.**

**FIGURE 4, on the opposite page, shows the results.**

**FIGURE 4**

**Blood glucose concentration in  $\text{mmol/dm}^3$**



**Normal blood glucose concentrations**

**Fasting  $3.5 - 5.5 \text{ mmol/dm}^3$**

**Non-fasting  $4.0 - 7.8 \text{ mmol/dm}^3$**



**[Turn over]**

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**06.4**

**Person A and person B had a test to measure the concentration of insulin in their blood when they were fasting.**

**TABLE 4 shows the results.**

**TABLE 4**

<b>Person</b>	<b>Fasting blood insulin concentration in arbitrary units</b>
<b>A</b>	<b>280</b>
<b>B</b>	<b>20</b>
<b>Normal range</b>	<b>50–175</b>

**Suggest which type of diabetes person A and person B have.**

**Give a reason for each answer.  
[2 marks]**

**Person A**

**Type of diabetes** \_\_\_\_\_

**Reason** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

**Person B**

**Type of diabetes** \_\_\_\_\_

**Reason** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

**[Turn over]**



**06.5**

**Toxic hypoglycaemia syndrome (THS) has caused the deaths of hundreds of starving children in some tropical countries.**

- **The starving children have had nothing to eat all day.**
- **The starving children then eat many lychee fruits.**
- **The lychee fruits contain a molecule which stops an enzyme in the liver working.**
- **This enzyme normally converts stored fats into glucose.**

**Children who have eaten during the day are NOT affected by eating many lychee fruits.**





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**END OF QUESTIONS**

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<b>14</b>



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For Examiner's Use	
Question	Mark
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<b>TOTAL</b>	

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