Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
COMBINED SCIENCE: TRILOGY

H

Higher Tier
Biology Paper 2H

Friday 7 June 2019 Afternoon Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:
- a ruler
- a scientific calculator.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

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 write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 1 Some students investigated the effect of drinking caffeine on reaction time.

They used a drink containing 32.25 mg of caffeine per 100 cm^3

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^3 of water
   - group **B** drink 200 cm^3 of the caffeine drink
   - group **C** drink 400 cm^3 of the caffeine drink
   - group **D** drink 600 cm^3 of the caffeine drink.
4. Repeat step 2 after 15 minutes.

0 1 . 1 Describe how to do the ruler-drop test.

[3 marks]

hold a ruler (just) above the (open) hand of the other student
drop the ruler and other student catches it
record where the ruler is caught

Question 1 continues on the next page

Do not write outside the box

0 1 . 2 **Table 1** shows the mass of caffeine taken in by each student.

Table 1

Group	Mass of caffeine in mg
A	0
B	64.5
C	129.0
D	**X**

Calculate value **X**.

[1 mark]

X = 193.5 mg

0 1 . 3 Why did group **A** drink water instead of the caffeine drink?

[1 mark]

To compare the effect of no caffeine.

Do not write outside the box

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

Table 2

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

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

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

[1 mark]

Reaction time = 0.217 s

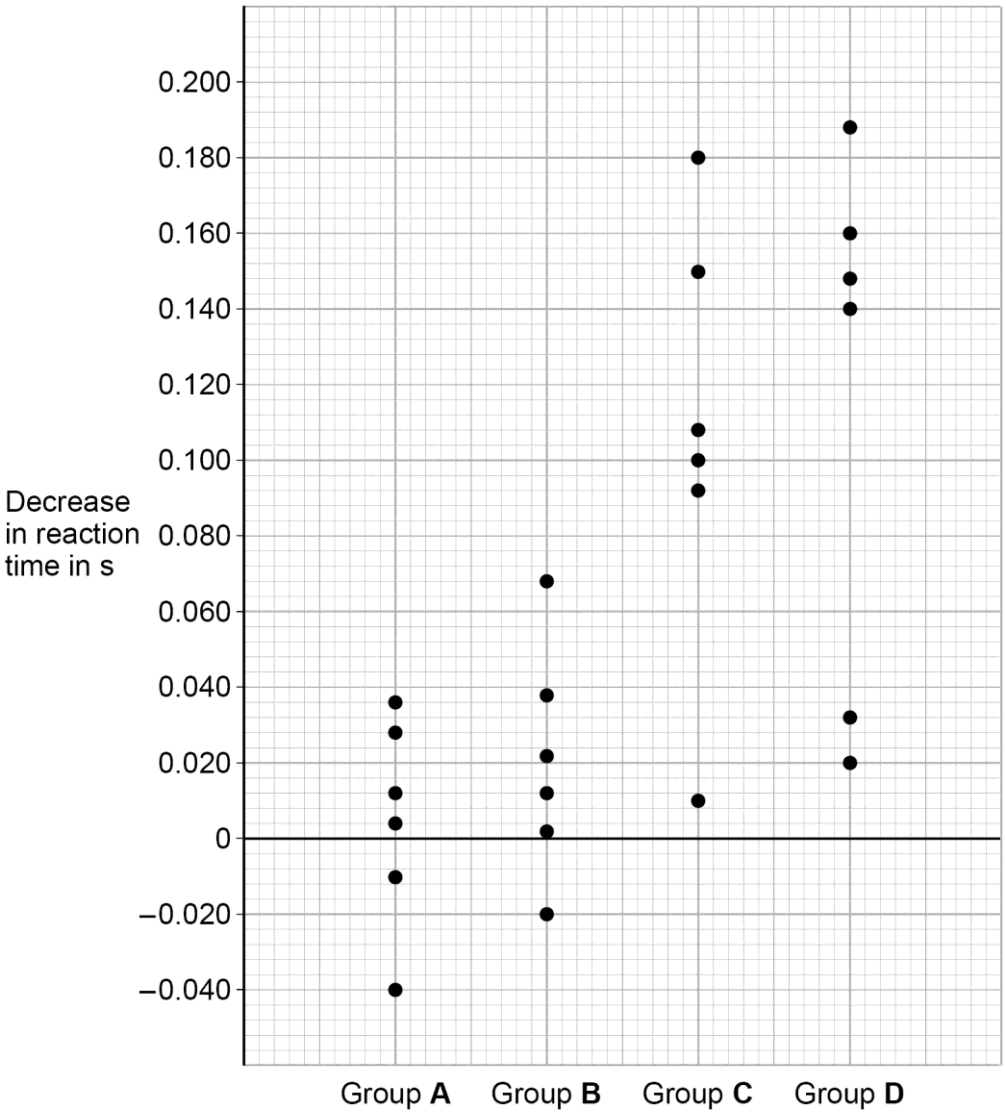
Question 1 continues on the next page

Turn over ►

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

Figure 1 shows the results for each student.

Figure 1



0 1 . 5 Describe the effect of the mass of caffeine taken in on the decrease in reaction time.

[1 mark]

as mass of caffeine increases the decrease / change in reaction time increases

Do not write outside the box

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

Give the reason why the value was negative.

[1 mark]

their reaction time was greater (after the drink)

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

[1 mark]

0.17

0 1 . 8 Suggest **two** variables that should have been controlled in this investigation.

[2 marks]

1 Same sex

2 Same height

0 1 . 9 Explain why the ruler-drop test does **not** involve a reflex action.

[2 marks]

not automatic (because) it involves the (conscious part of the) brain

13

Turn over for the next question

Do not write outside the box

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]

Methane

0 2 . 2 Global warming causes climate change.

Give **two** effects of climate change.

[2 marks]

1 Extreme weather

2 ice caps melting

Question 2 continues on page 10

Do not write outside the box

There are no questions printed on this page

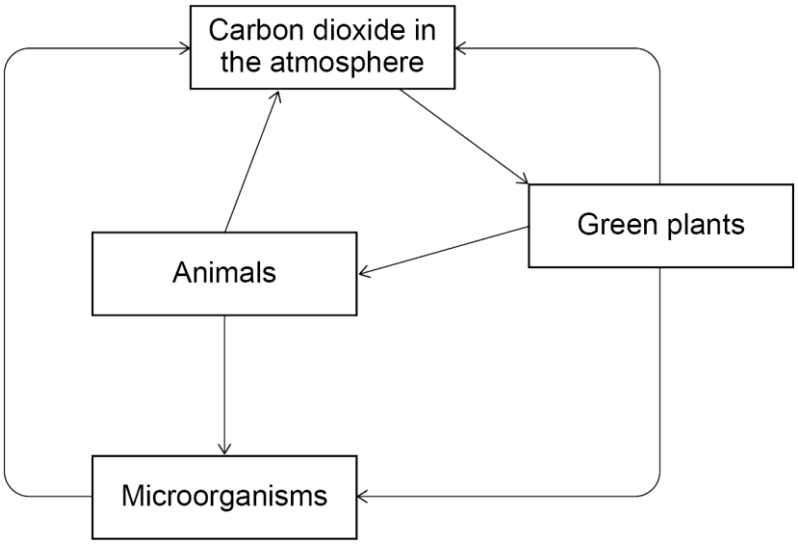
DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 2 . 3 Plants take in carbon dioxide from the atmosphere.

Figure 2 shows part of the carbon cycle.

Figure 2



Describe how carbon from the atmosphere is cycled through living organisms.

[6 marks]

Photosynthesis
• (carbon dioxide is) taken in through stomata / leaves
• (carbon dioxide is) used in photosynthesis
• to make glucose / carbohydrate
• (glucose used) to make other carbon compounds or named example such as proteins, lipids
• (glucose) stored as starch
Feeding
• plants are eaten / consumed by animals
• which use the carbon compounds to make other carbon compounds
Decay
• when plants / animals die they are decomposed / decayed
• by microorganisms
• which use the carbon compounds to make other carbon compounds
Respiration
• plants / animals / microorganisms respire
• (respiration) releases carbon dioxide back into the atmosphere

Do not write outside the box

9

Turn over for the next question

Do not write outside the box

0 3 . 1 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.	✓

0 3 . 2 Scientists have genetically engineered a variety of wheat to be resistant to herbicides.

The herbicide resistant variety of wheat will give a higher yield than the non-herbicide resistant variety.

Explain why.

[3 marks]

wheat not affected by spraying / herbicide
(so) wheat gets more light / water / nitrates / ions / minerals
(so) more photosynthesis / glucose / proteins (for more yield)

Do not write outside the box

0 3 . 3 Give **two** examples of genetic engineering in use today.

Do **not** refer to herbicide resistance in your answer.

[2 marks]

1 crops resistant to frost

2 crops resistant to drought

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]

identify genes linked to (certain) disease
so can lead to better prevention / treatment of that disease

9

Turn over for the next question

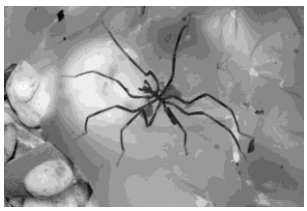
Do not write outside the box

0 4 Animals have adaptations to survive in their environment.

These adaptations may be structural, behavioural or functional.

0 4 . 1 Draw **one** line 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

Do not write outside the box

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]

• growing on other plants means support to absorb more light (for photosynthesis)
• bright colours attract pollinators
or
bright colours attract insects to transfer pollen
• large quantities of pollen (increases the likelihood of pollen transfer) and so more seeds / reproduction
• tiny / light seeds will travel long distances to grow in new areas

Question 4 continues on the next page

Do not write outside the box

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]

- mutations for purple flower (in ancestral species)
- isolation or change in environment e.g. area had more insects
- (plants with purple flowers) survive and breed
- (plants with purple flowers) pass on allele / gene / DNA / mutation

0 4 . 4 The DNA code determines the sequence of amino acids which are joined together to form a specific protein.

Table 3 shows part of the amino acid sequence for the colour pigment protein in five orchid species.

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

Table 3

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

Key:
ala = alanine
gly = glycine
isoleu = isoleucine
leu = leucine
tyr = tyrosine

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

Give a reason for your answer.

[2 marks]

Species D

Reason because it has the lowest number of amino acids different (in the sequence)

12

Turn over for the next question

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 5 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.

0 5 . 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. ☐

Question 5 continues on the next page

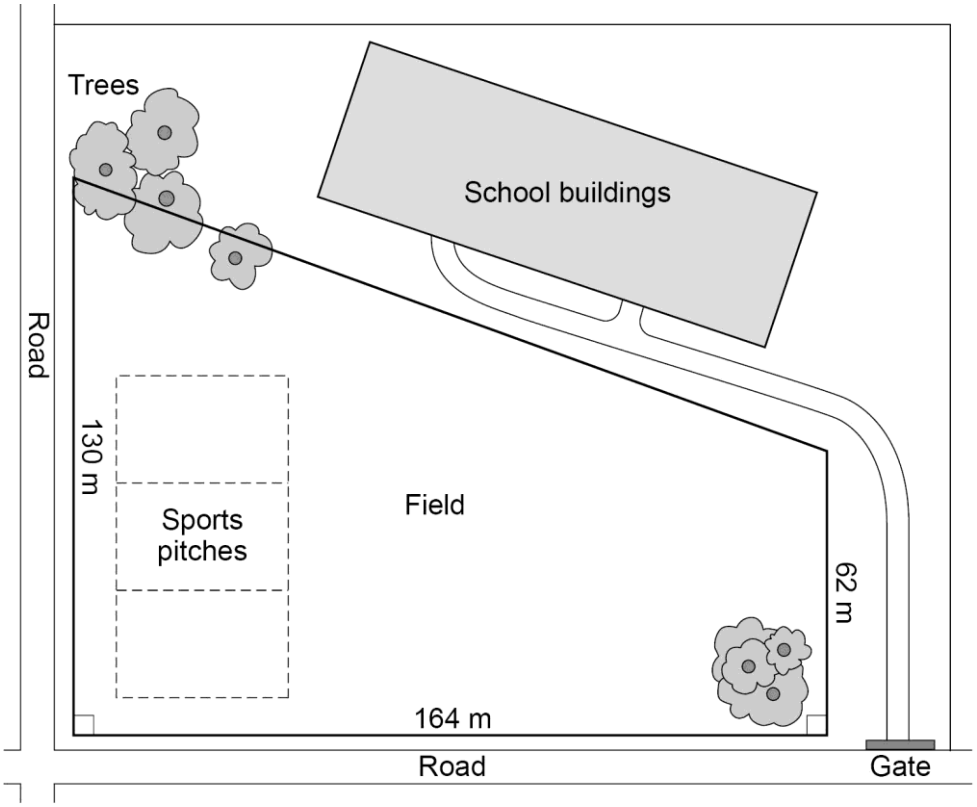
Do not write outside the box

0 5 . 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 shows the school site and the dimensions of the school field.

Figure 3



Do not write outside the box

Calculate the population of daisy plants on the school field.

Give your answer in standard form to 2 significant figures.

[5 marks]

Area of field = $62 \times 164 + 164 \times 68 \div 2$

$= 15744\ m^2$

$= 15744 \times 4 \times 7.65$

$= 481766.4$

Population of daisy plants = 4.8×10^5

Question 5 continues on the next page

Do not write outside the box

0 5 . 3 The students noticed a very uneven distribution of daisy plants in the field.

Explain how different biotic factors **and** abiotic factors could have caused an uneven distribution of daisy plants.

Use **Figure 3** on page 20.

[6 marks]

- trees over / in field
- (which) reduce light for photosynthesis
- (so) fewer daisies there
- trees over / in field
- (which) take water / nitrates / ions from the soil
- (so) fewer daisies there
- trampling on sports pitches
- (will) kill plants
- (so) fewer daisies there
- competition from plants / grasses on field
- (will) use up water / nitrates / ions / space
- (so) fewer daisies there
- gardener may water / fertilise / mow field
- (which provides) more water / nitrates / ions
- (so) more / fewer daises grow there
- more insects / disease / animals in some areas
- (may) eat / kill plants
- (so) fewer daisies there
- school buildings
- (which) reduce light for photosynthesis
- (so) fewer daisies near school
- pollution / toxins from vehicles on roads
- (which will) reduce growth
- (so) fewer daisies near roads
- wrong pH or lack of ions or poor drainage or poor / wet / dry soil in some areas
- (which will) slow growth
- (so) fewer daisies there

13

Do not write outside the box

0 6 This question is about homeostasis.

0 6 . 1 Define the term homeostasis.

[2 marks]

regulation / control / maintenance of internal conditions (of a cell / body) for optimum (cell / enzyme activity)

0 6 . 2 Name the hormone released if the blood glucose concentration falls too low.

[1 mark]

glucagon

Question 6 continues on the next page

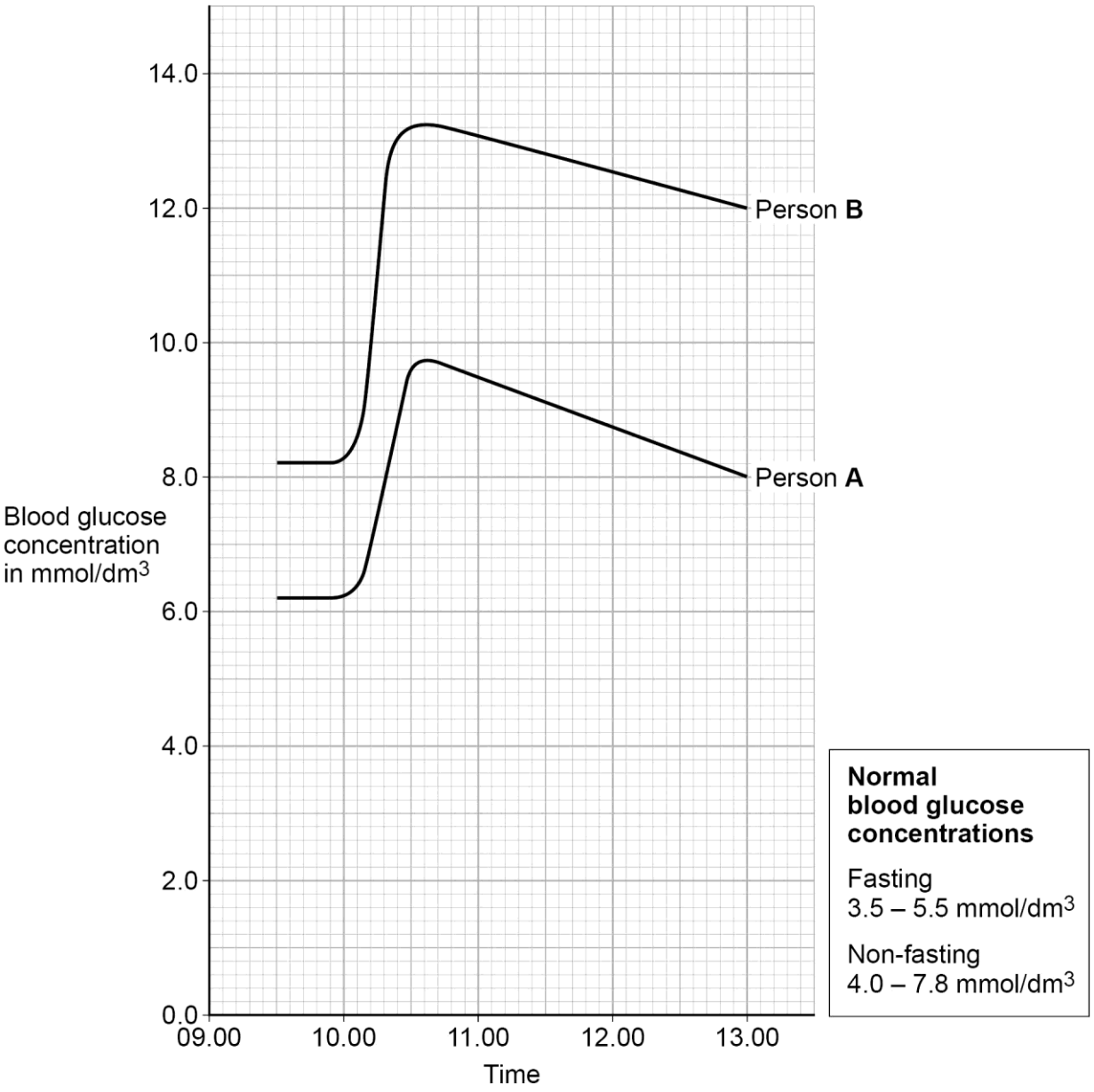
Two people were sent to a hospital to find out if they have diabetes.

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 shows the results.

Figure 4



Do not write outside the box

Person **A** and person **B** have diabetes.

0 6 . 3 Describe how **Figure 4** shows that person **B** has diabetes.

Use data from **Figure 4**.

[3 marks]

• fasting blood glucose is higher than normal range
• reached a very high concentration after glucose drink

Question 6 continues on the next page

Do not write outside the box

0 6 . 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

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

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

Give a reason for each answer.

[2 marks]

Person **A**

Type of diabetes 2

Reason pancreas producing lots of insulin but body cells cannot respond to it.

Person **B**

Type of diabetes 1

Reason pancreas not producing enough insulin to control concentration of glucose in the blood.

Do not write outside the box

0 6 . 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.

Starving children may die from eating many lychee fruits but children who have eaten during the day are not affected.

Explain why.

[6 marks]

starving children have used up their glycogen stores
(so) would need (liver enzyme) to release glucose from fats
as enzyme is stopped from working they get low / no glucose
(cell) respiration is insufficient (so they die)
children that are not starving have glycogen stores in liver / muscle
(so) glucagon will continue to release glucose (into the blood for them)

14

END OF QUESTIONS

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED