Variation and evolution – GCSE Biology

1. No.6

Figure 8 shows what the extinct Siberian rhinoceros (*Elasmotherium sibiricum*) might have looked like.

Figure 8

0 6 . 1 What is the genus of the Siberian rhinoceros?

[1 mark]

Tick (✓) **one** box.

Elasmotherium ☐

Elasmotherium sibiricum ☐

sibiricum ☐

The 'three-domain system' of classification places all living organisms in one of three domains.

0 6 . 2 Which domain was the Siberian rhinoceros in?

[1 mark]

Tick (✓) **one** box.

Archaea ☐

Eukaryota ☐

Prokaryota ☐

0 6 . 3 Who developed the 'three-domain system' of classification?

[1 mark]

Tick (✓) **one** box.

Carl Woese ☐

Charles Darwin ☐

Gregor Mendel ☐

0 6 . 4 The horn of the Siberian rhinoceros is estimated to have been 150 cm long.

Suggest **one** advantage of this adaptation to the Siberian rhinoceros.

[1 mark]

_____

_____

0 6 . 5 The only parts of the Siberian rhinoceros that have been found are fossilised bones.

Give **one** reason why **only** the bones of the body of the Siberian rhinoceros became fossils.

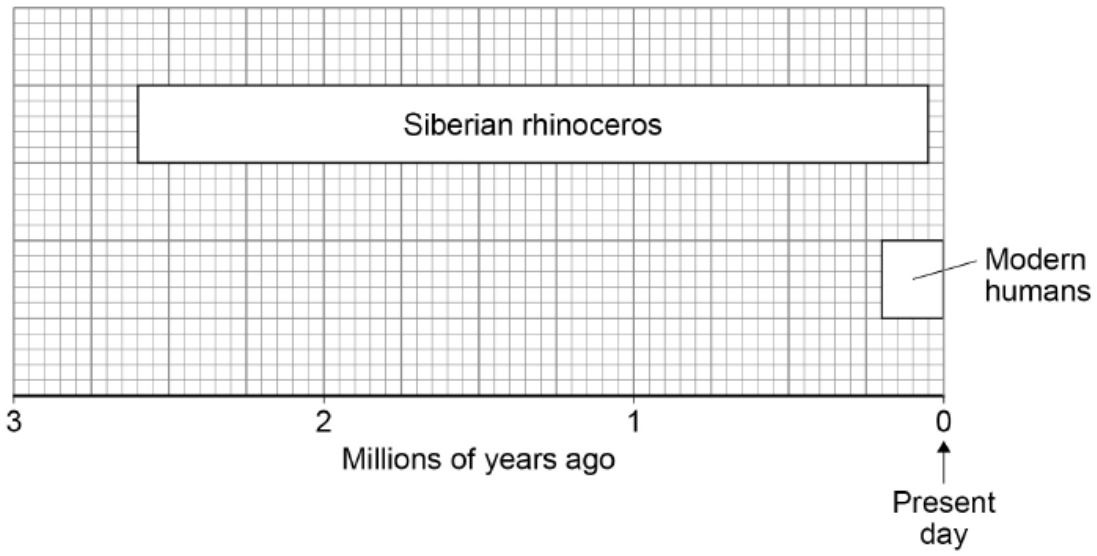
[1 mark]

0 6 . 6 Suggest how scientists can estimate when the Siberian rhinoceros was alive.

[1 mark]

Figure 9 shows when the Siberian rhinoceros existed and when modern humans existed.

Figure 9



0 6 . 7 How many million years ago did the Siberian rhinoceros become extinct?

[1 mark]

_____ million years ago

0 6 . 8 Determine the time in years when both the Siberian rhinoceros and modern humans existed together.

Use **Figure 9** and your answer to Question **06.7**.

[3 marks]

_____

_____

_____

_____

Time = _____ years

0 6 . 9 Suggest **two** factors that may have caused the extinction of the Siberian rhinoceros.

[2 marks]

1 _____

_____

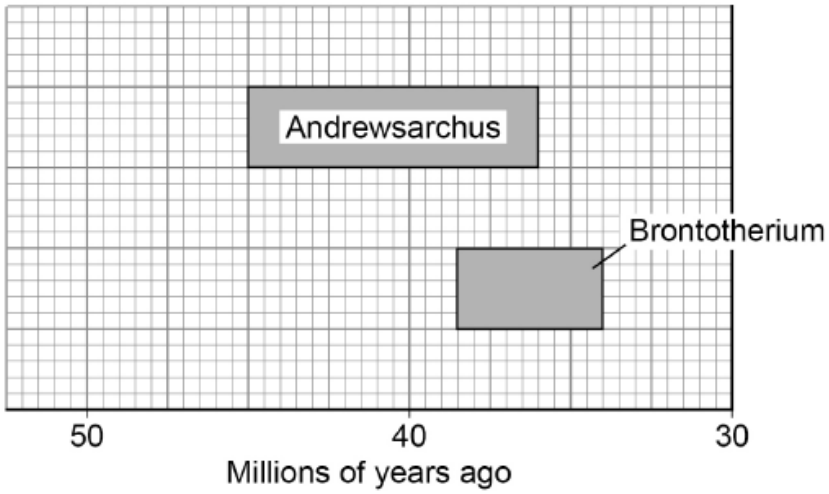
2 _____

_____

2. No.8

Figure 8 shows when two mammals existed in Asia.

Figure 8



0 8 . 1 Determine the number of years both Andrewsarchus and Brontotherium existed together.

[2 marks]

Time = _____ years

0 8 . 2 The oldest fossils of human ancestors found in this area are 700 000 years old.

Andrewsarchus was a carnivore and Brontotherium was a herbivore.

Suggest how the extinction of Andrewsarchus could have resulted in the extinction of Brontotherium.

[3 marks]

0 8 . 3 Information about extinct animals is often **not** clear because the fossil record is incomplete.

Give **three** reasons why the fossil record is **not** clear for older species.

[3 marks]

1

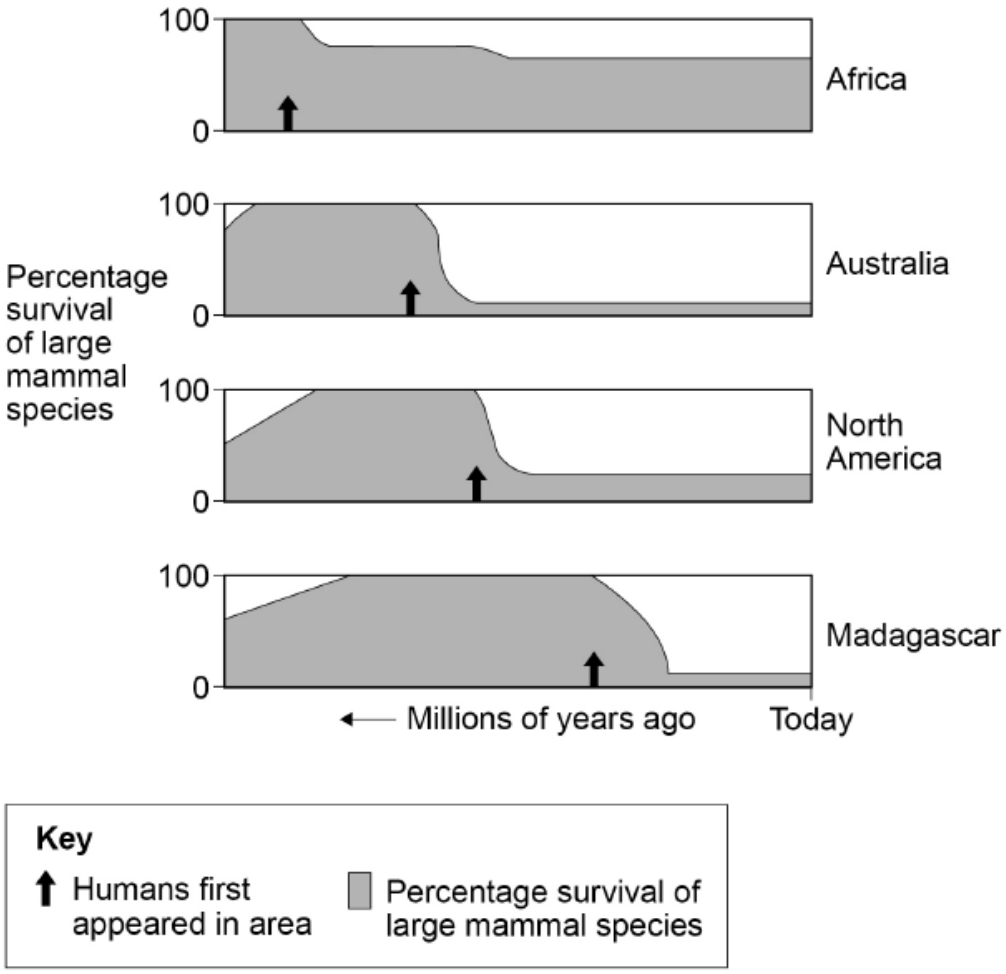
2

3

Figure 9 shows the percentage (%) survival of large mammal species in four areas of the world.

The time at which humans first appeared in each of the four areas is also shown.

Figure 9



A mass extinction is a rapid decrease in biodiversity on Earth.

0 8 . 4 A student stated:

'The data in **Figure 9** shows that humans caused mass extinctions.'

Evaluate the student's statement.

[6 marks]

0 8 . 5 Give **one** disadvantage and **one** advantage of mass extinction events.

Answer in terms of evolution.

[2 marks]

Disadvantage _____

_____

Advantage _____

_____

3. No.6

Two of the substances the body excretes are urea and carbon dioxide.

0 6 . 1 Complete the sentence.

[1 mark]

Choose the answer from the box.

carbohydrate	**lipid**	**protein**	**salt**

A person makes a lot of urea if the person's diet contains

a lot of _____.

0 6 . 2 Why must urea be excreted from the body?

[1 mark]

_____

_____

0 6 . 3 A person produces more carbon dioxide during exercise than when resting.

Complete the sentences.

[2 marks]

Choose answers from the box.

breathing	**digestion**	**egestion**
osmosis	**respiration**	

The process that makes carbon dioxide is _____.

During exercise, extra carbon dioxide can be removed from the body by increasing the rate of _____.

0 6 . 4 Excess water must also be removed from the body.

If a person sweats a lot, less water will be excreted in the urine.

A healthy person did the same amount of exercise on each of 3 days.

Table 2 shows information for the 3 days.

Table 2

Day	Air temperature in °C	Volume of water consumed in cm^3	Relative amount of urine produced by the kidneys
1	30	1500	
2	20	1500	
3	15	2000	

Complete **Table 2**.

[2 marks]

Choose answers from the box.

least	medium	most

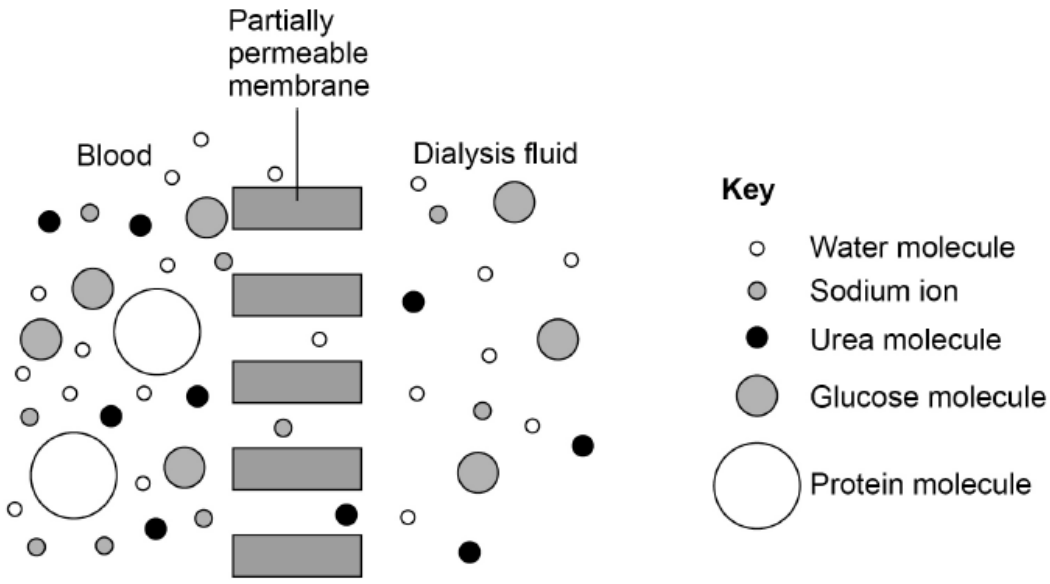
Some people have kidney disease.

Kidney disease may be treated by dialysis or by having a kidney transplant operation.

- During dialysis, a person is connected to a machine that filters the blood.
- Each dialysis session lasts about 6 hours.
- The person has several dialysis sessions each week.

Figure 12 shows how dialysis works.

Figure 12



0 6 . 5 How does urea move out of the blood during dialysis?

[1 mark]

Tick (✓) **one** box.

Diffusion ☐

Digestion ☐

Osmosis ☐

Respiration ☐

0 6 . 6 Which substance in **Figure 12** does **not** pass from the blood into the dialysis fluid?

Give the reason for your answer.

[2 marks]

Substance _____

Reason _____

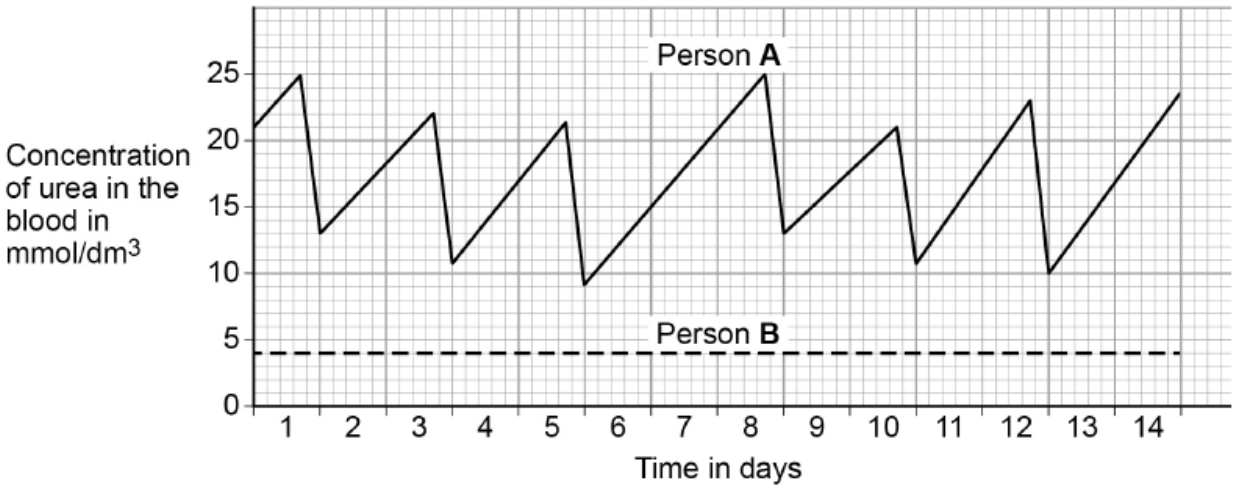
_____

Two people have kidney disease.

- Person **A** is treated by dialysis.
- Person **B** has had a kidney transplant.

Figure 13 shows changes in the urea concentration in the blood of each person over 2 weeks.

Figure 13



0 6 . 7 How many dialysis sessions did person **A** have **each week**?

[1 mark]

_____

0 6 . 8 What happens to the concentration of urea in the blood between dialysis sessions?

[1 mark]

_____

0 6 . 9 Give **two** reasons why a kidney transplant is a better method for treating kidney disease than dialysis.

[2 marks]

1 _____

_____

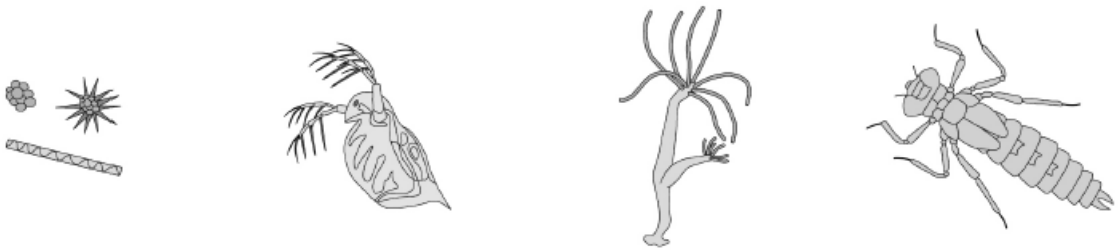
2 _____

_____

4. No.7

Figure 14 shows a food chain in a pond.

Figure 14



0 7 . 1 Which term describes the Daphnia in this food chain?

[1 mark]

Tick (✓) **one** box.

- Apex predator ☐
- Primary consumer ☐
- Producer ☐
- Secondary consumer ☐

0 7 . 2 Draw a pyramid of biomass for the food chain.

Label each trophic level.

[2 marks]

0 7 . 3 Give **one** reason why the total biomass of the Daphnia in the pond is different from the total biomass of the algae.

[1 mark]

_____

_____

Students investigated the size of the population of Daphnia in the pond.

This is the method used.

1. Collect 1 dm^3 of pond water from near the edge of the pond.
2. Pour the water through a fine net.
3. Count the number of Daphnia caught in the net.
4. Repeat steps 1–3 four more times.

Table 3 shows the results.

Table 3

Sample number	Number of Daphnia in 1 dm^3 water
1	5
2	21
3	0
4	16
5	28

0 7 . 4 Calculate the mean number of Daphnia in 1 m^3 of pond water.

1 m^3 = 1000 dm^3

[2 marks]

Mean number of Daphnia in 1 m^3 of pond water = _____

0 7 . 5 The pond was a rectangular shape, measuring:

- length = 2.5 metres
- width = 1.5 metres
- depth = 0.5 metres.

Calculate the estimated number of Daphnia in the pond.

Use your answer from Question **07.4**.

Give your answer in standard form.

[4 marks]

Number of Daphnia in the pond = _____

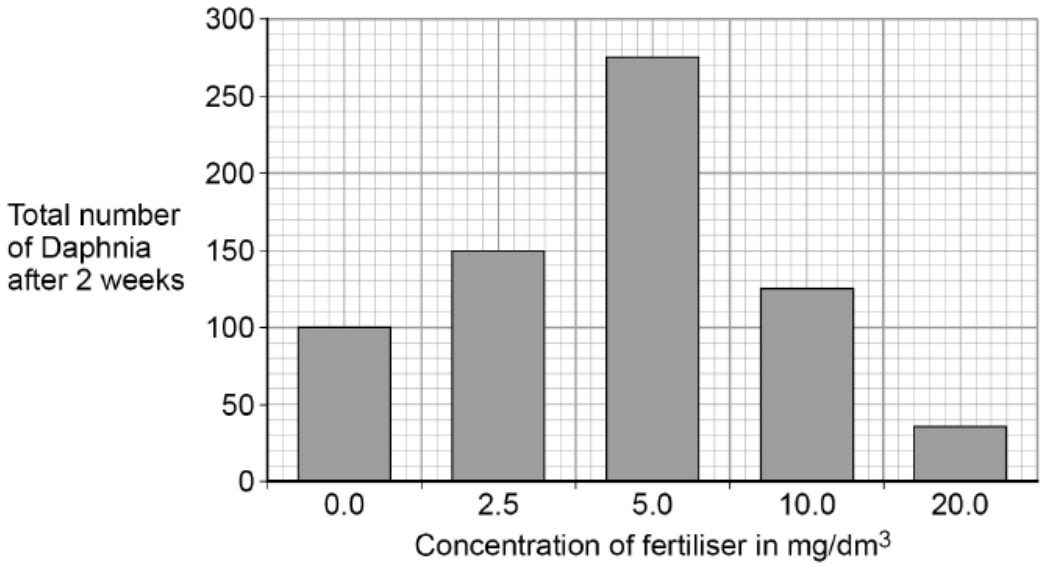
Rainfall can cause fertiliser to be washed from farmland into a pond.

The students investigated the effect of fertiliser on the population of Daphnia in water from the pond.

- The students put 20 Daphnia in each of five different concentrations of fertiliser.
- The students counted the total number of Daphnia in each concentration of fertiliser after 2 weeks.

Figure 15 shows the results.

Figure 15



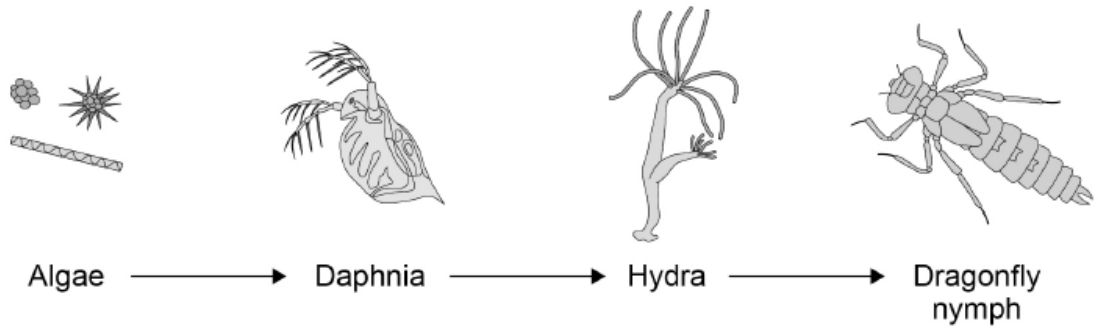
0 7 . 6 A concentration of 5.0 mg/dm^3 of fertiliser caused a large increase in the population of Daphnia.

Explain why.

[2 marks]

0 7 . 7 **Figure 14** is repeated below.

Figure 14



The population of **Hydra** will decrease when 20 mg/dm^3 of fertiliser is added to the pond.

Explain why.

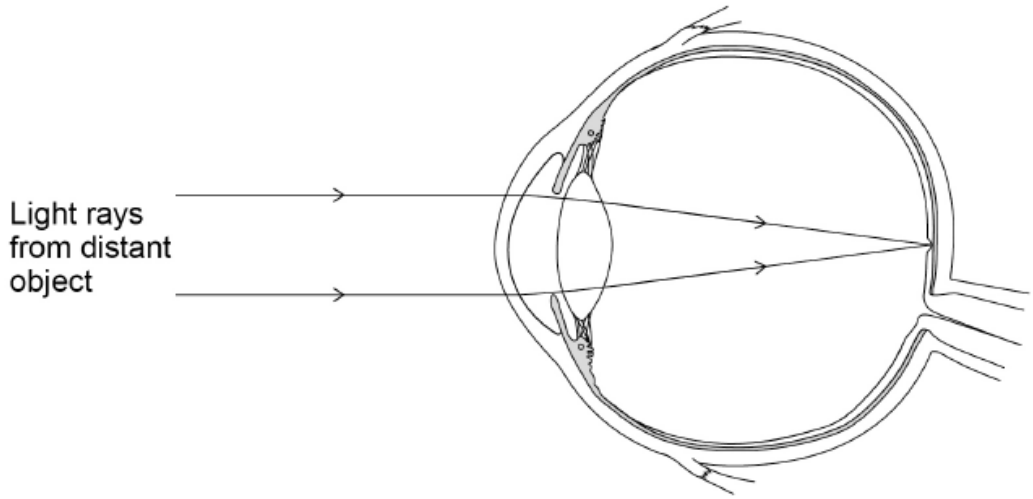
[2 marks]

5. No.4

The human eye can focus on objects at different distances.

Figure 5 shows how a clear image of a **distant** object is formed in a person's eye.

Figure 5



0 4 . 1 Explain how the person's eye could adjust to form a clear image of a **nearer** object.

[6 marks]

0 4 . 2 Explain why a long-sighted person has difficulty seeing near objects clearly.

[2 marks]

0 4 . 3 Long-sightedness can be corrected by wearing spectacles.

Describe how spectacle lenses can correct long-sightedness.

[3 marks]

6. No.8

It is important to keep the blood glucose concentration within narrow limits.

0 8 . 1 A person eats a meal containing a lot of carbohydrate. This causes an increase in the person's blood glucose concentration.

Explain how the hormones insulin **and** glucagon control the person's blood glucose concentration after the meal.

[5 marks]

0 8 . 2 The body cells of a person with Type 2 diabetes do **not** respond to **insulin**.

A person with Type 2 diabetes often has a higher blood **insulin** concentration than a non-diabetic person.

Explain why.

[3 marks]

Metformin is a drug used for treating people who have Type 2 diabetes.

Scientists investigated the effects of metformin and two other drugs, **A** and **B**.

The scientists wanted to see how the drugs affected the blood glucose concentrations of 220 people with Type 2 diabetes.

This is the method used.

1. Put the 220 people into five groups.
2. Treat each group with a different drug or combination of drugs for several weeks.
3. Give each person a meal high in carbohydrate.
4. Measure the blood glucose concentration of each person 30 minutes after the meal and again 3 hours after the meal.

0 8 . 3 Suggest **three** variables that the scientists should have controlled in the investigation.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

The scientists recorded their results as a mean value for each group.

The scientists calculated the 'standard deviation' for each group's result.

Standard deviation is a measure of the spread of the individual results above or below (±) the mean value.

The scientists gave each group's result as:

mean ± standard deviation

The larger the standard deviation, the greater is the spread of results around the mean.

0 8 . 4 Which of the results is the most precise?

[1 mark]

Tick (✓) **one** box.

Mean = 171.6 ± 16.3 ☐

Mean = 177.2 ± 15.4 ☐

Mean = 182.5 ± 18.2 ☐

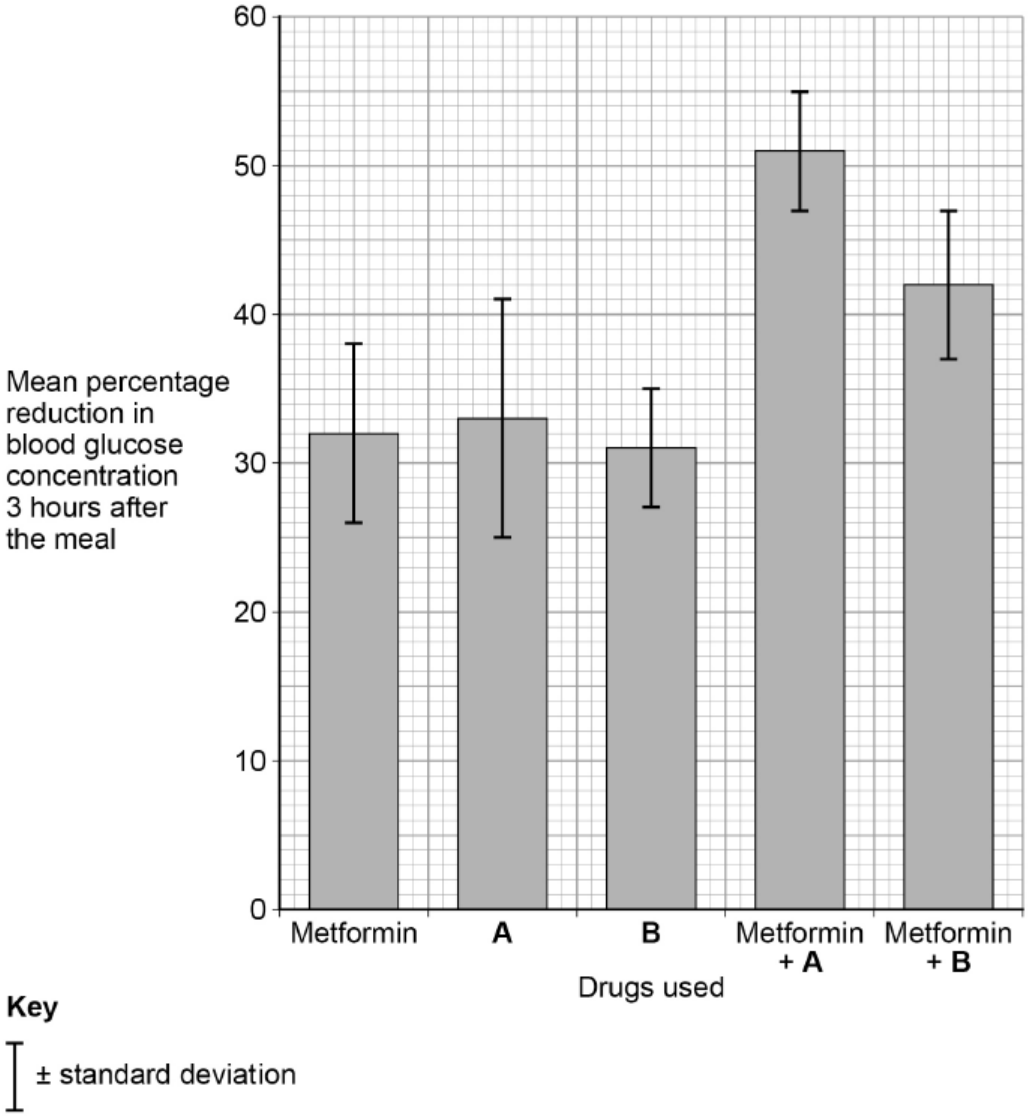
Mean = 205.2 ± 19.4 ☐

Table 3 and **Figure 9** show the scientists' results.

Table 3

Drugs used	**Metformin**	**A**	**B**	**Metformin + A**	**Metformin + B**
Number of people	60	40	25	65	30
Mean blood glucose concentration 30 minutes after the meal in mg/100 cm^3 ± standard deviation	177.2 ± 15.4	182.5 ± 18.2	171.6 ± 16.3	205.2 ± 19.4	206.5 ± 19.6

Figure 9



0 8 . 5 In **Table 3** and **Figure 9** some standard deviations of results overlap.

- An overlap of standard deviations shows the difference between the means is **not** significant.
- **No** overlap of standard deviations shows a significant difference between the means.

A student looked at the scientists' method and the results in **Table 3** and **Figure 9**.

The student stated:

'Metformin works better when used with other drugs.'

Evaluate the student's statement.

[6 marks]