

(Control of blood glucose (insulin, glucagon, diabetes))

Q1.(2019)

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

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]

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Q2.a)(2019)

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]

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Q2.b)(2019)

## Homeostasis and Response

<http://www.pcfgstudy.com>

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.

Suggest **three** variables that the scientists should have controlled in the investigation.  
[3 marks]

- 1 \_\_\_\_\_  
\_\_\_\_\_
- 2 \_\_\_\_\_  
\_\_\_\_\_
- 3 \_\_\_\_\_  
\_\_\_\_\_

### Q2.c)(2019)

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 ( $\pm$ ) the mean value.

The scientists gave each group's result as:

mean  $\pm$  standard deviation

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

Which of the results is the most precise?

[1 mark]

Tick ( $\checkmark$ ) **one** box.

Mean =  $171.6 \pm 16.3$  ☐

Mean =  $177.2 \pm 15.4$  ☐

Mean =  $182.5 \pm 18.2$  ☐

Mean =  $205.2 \pm 19.4$  ☐

### Q3.(2019)

## Homeostasis and Response

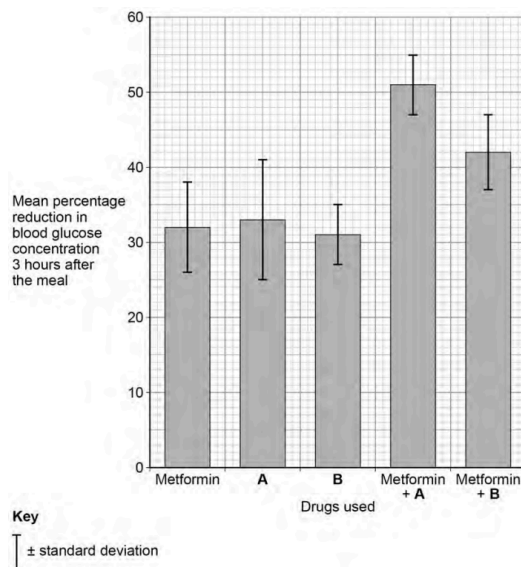
<http://www.pcfgstudy.com>

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 $\text{mg}/100 \text{ cm}^3$ $\pm$ standard deviation | 177.2 $\pm$ 15.4 | 182.5 $\pm$ 18.2 | 171.6 $\pm$ 16.3 | 205.2 $\pm$ 19.4 | 206.5 $\pm$ 19.6 |

Figure 9



## Homeostasis and Response

<http://www.pcfgstudy.com>

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.

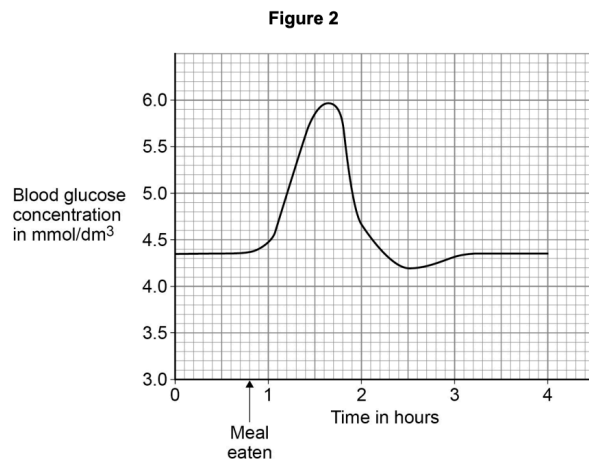
**[6 marks]**

[illegible]

Q4.a(2022)

It is important to control the concentration of glucose in the blood.

**Figure 2** shows how the concentration of glucose in the blood of a person changed over 4 hours.



Give **one** time when the concentration of **insulin** in the person's blood would be high.

Use **Figure 2**.

[1 mark]

Time = \_\_\_\_\_ hours

Q4.b)(2022)

Explain the effect a high concentration of insulin has on blood glucose concentration.

[3 marks]

Effect \_\_\_\_\_

Explanation \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

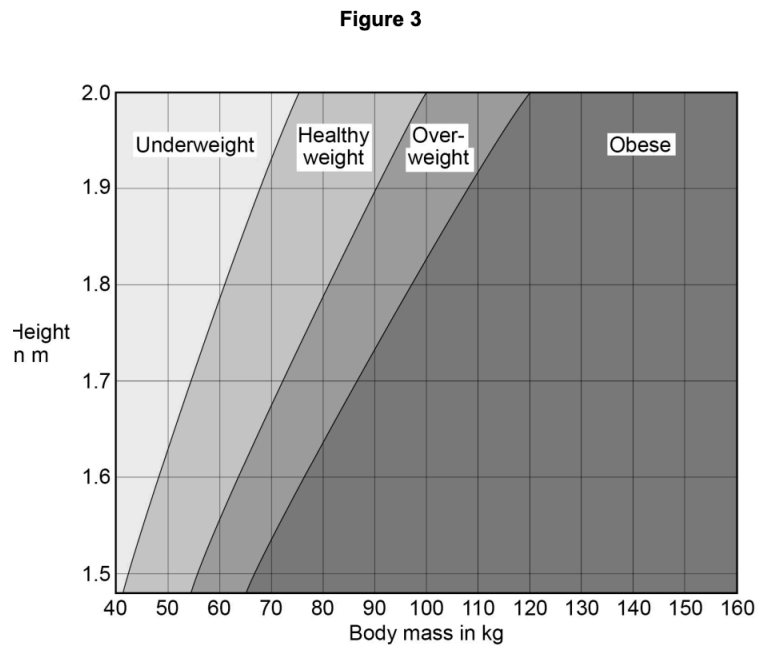
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Q5.a)(2022)

People with diabetes have difficulty controlling the concentration of glucose in their blood.

Type 2 diabetes is linked to obesity.

**Figure 3** shows how to find if an adult's body mass is healthy for their height.



Person **A**:

- is 1.75 m in height
- has a body mass of 52 kg.

What is person **A**'s weight category?

[1 mark]

Tick (✓) **one** box.

|                |                          |
|----------------|--------------------------|
| Underweight    | <input type="checkbox"/> |
| Healthy weight | <input type="checkbox"/> |
| Overweight     | <input type="checkbox"/> |
| Obese          | <input type="checkbox"/> |

Person **B** is 1.9 m in height.

Give the range of body masses that would put person **B** in the healthy weight category.

[1 mark]

Range from \_\_\_\_\_ kg to \_\_\_\_\_ kg

Q5.c)(2022)

Person **C** is obese.

A doctor thinks that person **C** has Type 2 diabetes.

The doctor tests a sample of blood from person **C**.

Table 2 shows:

- the results of the blood test
- the mean results for people who do **not** have diabetes.

Table 2

|                                     | Concentration in blood |                                          |
|-------------------------------------|------------------------|------------------------------------------|
|                                     | Person C               | Mean for people who do not have diabetes |
| Cholesterol in mmol/dm <sup>3</sup> | 6.21                   | 5.20                                     |
| Glucose in mmol/dm <sup>3</sup>     | 9.56                   | 4.51                                     |
| Insulin in arbitrary units          | 24.32                  | 14.83                                    |

Type 2 diabetes occurs when body cells have a reduced response to insulin.

Give **two** ways the results of the blood test show that person **C** might have Type 2 diabetes.

[2 marks]

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

Q5.d)(2022)

Give **two** ways that a person can reduce the chance of developing Type 2 diabetes.

**[2 marks]**

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_