Questions

Q1.
The graph shows the concentration of glucose in the blood of two people and how this changes over a two-hour period.

(i) Calculate the difference in the blood glucose concentration between person A and person B at 90 minutes.

\[
\text{answer} = \quad \text{mmol/dm}^3
\]

(ii) Using the information from the graph, describe the change in blood glucose concentration for person B during this two-hour period.

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(iii) State which hormone a type 1 diabetic, such as person A, would use to control their blood glucose concentration.

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Q2.

* Explain how blood glucose levels are controlled in people who do **not** have diabetes.
Q3.

Humans regulate the glucose concentration of their blood. A scientist recorded the blood glucose concentration of an individual over a seven-hour period. The results are shown in the table.

<table>
<thead>
<tr>
<th>time of day</th>
<th>blood glucose concentration / mg per 100 cm$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>06.00</td>
<td>76</td>
</tr>
<tr>
<td>07.00</td>
<td>77</td>
</tr>
<tr>
<td>08.00</td>
<td>124</td>
</tr>
<tr>
<td>09.00</td>
<td>91</td>
</tr>
<tr>
<td>10.00</td>
<td>83</td>
</tr>
<tr>
<td>11.00</td>
<td>81</td>
</tr>
<tr>
<td>12.00</td>
<td>79</td>
</tr>
<tr>
<td>13.00</td>
<td>130</td>
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</tbody>
</table>

(i) Describe the trend in blood glucose concentration for this seven-hour period.

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(ii) Suggest reasons for the changes in blood glucose concentration.

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(iii) Complete the sentence by putting a cross(×) in the box next to your answer.

Excess blood glucose is converted into

A glucagon in the liver
B glucagon in the pancreas
C glycogen in the liver
D glycogen in the pancreas
Q4.

Adrian is 180 cm tall and has a mass of 120 kg. A person who has a high Body Mass Index (BMI) is more likely to develop Type 2 diabetes. Calculate Adrian's BMI using the equation.

\[
\text{BMI} = \frac{\text{mass in kilograms}}{(\text{height in metres})^2}
\] (2)
Q5.

The graph shows the percentage of the population with type 2 diabetes and the mean body mass of the population, from 1990 to 2000.

(i) Use the equation to calculate the body mass index (BMI) for a person with a body mass of 78 kg and a height of 1.7 m.

\[
\text{BMI} = \frac{\text{mass / kg}}{(\text{height in metres})^2}
\]

(ii) Use the chart to find the BMI category for this person.

Complete the sentence by putting a cross (\[x\]) in the box next to your answer.

The BMI category for this person is

- A underweight
- B normal range
- C overweight
- D obese
Q6.
Explain how type 2 diabetes can be controlled without the use of drugs.

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Q7.
(i) Complete the sentence by putting a cross (x) in the box next to your answer.
A person with diabetes cannot control

A  the water content of their blood
B  the glucose content of their blood
C  their body temperature
D  their body mass index

(ii) Explain how Type 1 diabetes can be controlled.

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Q8.

The graph shows the percentage of the population with type 2 diabetes and the mean body mass of the population, from 1990 to 2000.

(i) Use information from the graph to describe the correlation between type 2 diabetes and body mass shown from 1993 to 2000.

(ii) Suggest how a change in body mass may cause a person to develop type 2 diabetes.
Q9. Diabetes

(a) In the UK, there has been an increase in the percentage of the population with type 2 diabetes.

(i) The population of the UK between 1996 and 2005 was 60 million. Calculate the increase in the number of people with type 2 diabetes between 1996 to 2005.

\[
\text{answer} = ................. \text{ people}
\]

(ii) Suggest two reasons for this increase in the number of people with type 2 diabetes.

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(b) Explain how type 2 diabetes can be controlled without the use of drugs.

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*(c) Explain how blood glucose levels are controlled in people who do not have diabetes.

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## Mark Scheme

Q1.

<table>
<thead>
<tr>
<th>Question Number</th>
<th>Answer</th>
<th>Acceptable answers</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>correct readings from graph (1) 12 – 5 correct answer (1) = 7 (mmol/dm³)</td>
<td></td>
<td>(2)</td>
</tr>
<tr>
<td>(ii)</td>
<td>A description including <strong>two</strong> of the following points • increases from 0 minutes to 60 minutes / peaks at 60 minutes • decrease between 60 and 90 minutes • increases between 90 and 120 minutes • some creditable data manipulation to show an increase/decrease between two time points</td>
<td></td>
<td>(2)</td>
</tr>
<tr>
<td>(iii)</td>
<td>insulin</td>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Question Number</td>
<td>Indicative Content</td>
<td>Mark</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
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<td></td>
</tr>
</tbody>
</table>
| QWC             | **An explanation linking some of the following points**  
|                 | **When blood glucose is high**  
|                 | • insulin is released from the pancreas  
|                 | • the insulin converts the excess glucose  
|                 | • into glycogen  
|                 | • which is stored in the liver  
|                 | • blood glucose levels are reduced  
|                 | **When blood glucose levels are low**  
|                 | • glucagon is released from the pancreas  
|                 | • the glucagon converts glycogen from the liver  
|                 | • into glucose  
|                 | • into glucose  
|                 | This is a homeostatic mechanism which maintains the correct glucose levels in the bloodstream                                                                                                                                                                                                                                                                                                                                                     | (6)  |

<table>
<thead>
<tr>
<th>Level</th>
<th>0</th>
<th>No rewardable content</th>
</tr>
</thead>
</table>
| 1     | 1 - 2 | • a limited explanation of blood glucose regulation including the role of hormones, specific hormones do not need to be mentioned  
|       |     | • the answer communicates ideas using simple language and uses limited scientific terminology  
|       |     | • spelling, punctuation and grammar are used with limited accuracy |
| 2     | 3 - 4 | • a simple explanation of blood glucose regulation including the role of insulin or glucagon and some of the body organs involved  
|       |     | • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately  
|       |     | • spelling, punctuation and grammar are used with some accuracy |
| 3     | 5 - 6 | • a detailed explanation of blood glucose regulation including the role of the liver and pancreas and the methods of reducing and raising blood glucose concentrations  
|       |     | • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately  
|       |     | • spelling, punctuation and grammar are used with few errors |
### Q3.

<table>
<thead>
<tr>
<th></th>
<th>Answer</th>
</tr>
</thead>
</table>
| (i) | A description including two of the following points  
• initial / at the start increase in concentration (1)  
• 06.00 to 08.00 / 12.00 to 13.00 (1)  
• decrease in concentration after 08.00 / fall in concentration between 08.00 and 12.00 (1)  
• increased again at 13.00 (1) |
| (ii) | • increase due to food intake (1)  
• decrease due to glucose being used up / stored / insulin released / doing exercise(1) |
| (iii) | C glycogen in the liver |

Acceptable answers: accept specific times e.g. at 8.00 concentration high  
Mark: (2)

### Q4.

<table>
<thead>
<tr>
<th></th>
<th>Answer</th>
</tr>
</thead>
</table>
|   | Body Mass Index calculation:  
\[
\frac{120}{1.8^2} \quad (1) 
\] |

Acceptable answers: ecf for correct manipulation with incorrect figures  
Mark: (2)

### Q5.

<table>
<thead>
<tr>
<th></th>
<th>Answer</th>
</tr>
</thead>
</table>
| (i) | Calculation \((1.7 \times 1.7) = 2.89\) (1)  
78 / 2.89 = 27 (1) |

Acceptable answers: Two marks for correct bald answer  
Ecf for incorrect numbers but correct calculation 26.98 / 26.9  
Accept continued decimal places  
Mark: (2)

<table>
<thead>
<tr>
<th></th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ii)</td>
<td>C □ overweight</td>
</tr>
</tbody>
</table>

Mark: (1)
<table>
<thead>
<tr>
<th>Question Number</th>
<th>Answer</th>
<th>Acceptable answers</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>An explanation including <strong>two</strong> of the following points • diet to lose weight (1) • reduce the amount of carbohydrates / glucose (1) • take more exercise so reduce blood glucose levels (1)</td>
<td>accept sugar for glucose</td>
<td>(2)</td>
</tr>
</tbody>
</table>
### Q7.

<table>
<thead>
<tr>
<th>Answer</th>
<th>Acceptable answers</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>B – the glucose content of their blood</td>
<td>(1)</td>
</tr>
</tbody>
</table>
| (ii)   | An explanation linking three of the following points:  
  - (the hormone) insulin (1)  
  - (insulin) is injected (into subcutaneous fat) (1)  
  - use a low carbohydrate/healthy diet (1)  
  - (increase) exercise (1)  
  - to lower blood glucose levels / when blood glucose levels get too high / regulate glucose levels(1) | use of epipen (3) |

### Q8.

<table>
<thead>
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<th>Mark</th>
</tr>
</thead>
</table>
| (i)    | A description including the following points:  
  - as mean mass increases so does the percentage of population with type 2 diabetes (1)  
  - correct readings from the graph to illustrate the comparative point (1) | accept positive correlation ORA (2) |
| (ii)   | A suggestion linking two of the following:  
  - increasing body mass leads to over weight / obesity  
  - don't respond to insulin / reference to insulin resistance | (2) |
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>(a)(i)</td>
<td>substitution (1) 4.8 &amp; #150; 2.6 = 2.2 (%) evaluation (1) 2.2 \times 600,000 = 1320,000 = 1320,000</td>
<td>give full marks for correct answer, no working</td>
<td>2</td>
</tr>
<tr>
<td>(a)(ii)</td>
<td>Any two of the following points • (increase in people who are) overweight / have a high BMI / are obese (1) • (increased number of people) who do not take enough exercise (1) • increased calorie intake (1) • increase in elderly population (1)</td>
<td>(Increased number of people) who eat too much / eat the wrong types of food / eat too much fat / sugar / carbohydrates</td>
<td>2</td>
</tr>
<tr>
<td>(b)</td>
<td>An explanation including two of the following points • diet to lose weight (1) • reduce the amount of carbohydrates / glucose (1) • take more exercise so reduce blood glucose levels (1)</td>
<td>accept sugar for glucose</td>
<td>2</td>
</tr>
<tr>
<td>QWC <em>(c)</em></td>
<td>An explanation linking some of the following points When blood glucose is high • insulin is released from the pancreas • the insulin converts the excess glucose • into glycogen • which is stored in the liver • blood glucose levels are reduced When blood glucose levels are</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Level</td>
<td>0</td>
<td>No rewardable content</td>
<td></td>
</tr>
<tr>
<td>-------</td>
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<tr>
<td>1</td>
<td>1 - 2</td>
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