B5
HOMEOSTASIS & RESPONSE
TEST 1

GCSE
BIOLOGY
AQA - COMBINED SCIENCE

Materials
For this paper you must have:
• Ruler
• Pencil, Rubber, Protractor and Compass
• Scientific calculator, which you are expected to use when appropriate

Instructions
• Answer all questions
• Answer questions in the space provided
• All working must be shown
• Do all rough work in this book. Cross out any rough work you don't want to be marked

Information
• The marks for the questions are shown in brackets
A person with Type 1 diabetes does not produce enough of the hormone insulin.

(a) Where is the hormone insulin produced?

Tick one box.

- Brain
- Pancreas
- Pituitary
- Thyroid

(b) How does insulin travel around the body?

___________________________________________________________________
___________________________________________________________________

(1)
The same concentration and volume of glucose solution was given to two people.

- Person with Type 1 diabetes.
- Person without Type 1 diabetes.

The figure below shows how the blood glucose concentration of these two people changed after they each drank a glucose solution.

Look at the figure above.

Compare the blood glucose concentrations of the two people.

Include similarities and differences in your answer.
(d) People with diabetes may be asked to control their diet.

Explain how this can help to reduce the risk of developing health problems.

Blood sugar levels in the body are controlled by insulin.

(a) How does insulin travel around the body?
(b) The table below shows the blood sugar levels for two people after eating a meal.

<table>
<thead>
<tr>
<th>Time after eating in hours</th>
<th>Blood sugar levels in mg per 100 cm³ of blood</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Person A</td>
</tr>
<tr>
<td>0</td>
<td>70</td>
</tr>
<tr>
<td>1</td>
<td>150</td>
</tr>
<tr>
<td>2</td>
<td>90</td>
</tr>
<tr>
<td>3</td>
<td>80</td>
</tr>
<tr>
<td>4</td>
<td>75</td>
</tr>
</tbody>
</table>

Use data from the table above to complete the graph in the figure below.

Plot the points for person A. The first two points have been plotted for you.

Draw a line through all the points.

(c) How long after the meal is person B's insulin production at its peak?

___________________________________________________________________
___________________________________________________________________

(1)
(d) What is the greatest decrease in the blood sugar level of person B in an hour?

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___________________________________________________________________

Decrease = ___________________ mg per 100 cm³

(2)

(e) Estimate how long after eating the meal it will take for person B’s blood sugar level to return to the level before the meal.

Show your working on the figure above.

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___________________________________________________________________

(2)

(Total 9 marks)
Our nervous system controls our reactions.

**Figure 1** shows the part of the nervous system involved in the rapid response to a stimulus.

(a) What is this type of rapid response called?

Tick one box.

- Circular action
- Fast action
- Forced action
- Reflex action

(1)
(b) Features of the nervous system are labelled A, B, C, D and E on Figure 1.

Draw one line from each feature to the correct label from Figure 1.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effector</td>
<td>A</td>
</tr>
<tr>
<td>Relay neurone</td>
<td>B</td>
</tr>
<tr>
<td>Sensory neurone</td>
<td>C</td>
</tr>
</tbody>
</table>

(c) Two students compare their reactions using a ruler.

This is the method used.

1. Student A sits with his elbow on a table top.
2. Student B holds the ruler so the bottom of the ruler is level with the top of student A's thumb.
3. Student B drops the ruler.
4. Student A catches the ruler.
5. Record the drop distance.
6. Repeat steps 1 to 5 four more times.
7. Repeat the whole experiment with student A dropping the ruler and student B catching it.
Both students are right-handed.

The students are testing the hypothesis:

**the drop distance of the ruler is smaller when a right-handed person uses their right hand to catch the ruler.**

Student A uses his right hand to catch the ruler.

Student B uses her left hand to catch the ruler.

Complete the sentence.

Use an answer from the box.

<table>
<thead>
<tr>
<th>control</th>
<th>dependent</th>
<th>independent</th>
</tr>
</thead>
</table>

The drop distance was the ________________________________ variable.

(1)
(d) The table below shows the students’ results.

<table>
<thead>
<tr>
<th>Student</th>
<th>Drop distance in cm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Test 1</td>
</tr>
<tr>
<td>Student A</td>
<td>17.5</td>
</tr>
<tr>
<td>Student B</td>
<td>20.5</td>
</tr>
</tbody>
</table>

Figure 2 shows student B’s Test 2 result.

![Figure 2](image_url)

Use Figure 2 to complete the missing result for Test 2.

Write the answer in the table above.

(1)
(e) What was the resolution of the ruler the students used?

Tick one box.

0.1 cm

0.5 cm

1 cm

10 cm

(1)

(f) One of the results in the table above is anomalous.

Identify the anomalous result.

Give the reason why you chose your answer.

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(2)
(g) The students are testing the hypothesis:

the drop distance of the ruler is smaller when a right-handed person uses their right hand to catch the ruler.

The results in the table above are not a good test of the hypothesis.

What is one reason why?

Tick **one** box.

- The drop distances are very variable
- The drop distance for Student A is sometimes bigger than the drop distance for Student B
- The results are for the left and right hands of different people
- The drop distances are not measured accurately enough

(1)
(Total 10 marks)
Car drivers need quick reactions to avoid accidents.

A student uses a computer program to measure reaction time.

The computer screen shows a traffic light on red. The traffic light then changes to green.

The diagram below shows the change the person sees on the computer screen.

When the traffic light changes to green the person has to click the computer mouse as quickly as possible.

The computer program works out the time taken to react to the light changing colour.

(a) Special cells detect the change in colour.

   (i) What word is used to describe special cells that detect a change in the environment?

    Draw a ring around the correct answer.

   receptor cells  reflex cells  stimulus cells

   (1)

   (ii) Where in the body are the special cells that detect the change in colour of the traffic lights?

    ————————————————————————————————————

   (1)

(b) The student used the computer program on one computer to measure the reaction times of people of different ages.

   (i) Give one variable the student should control so that a fair comparison can be made between the people of different ages.

    ————————————————————————————————————

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   (1)
The student did each measurement three times to calculate a mean value.

The table shows the results.

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Mean reaction time in milliseconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>242</td>
</tr>
<tr>
<td>30</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>221</td>
</tr>
<tr>
<td>60</td>
<td>258</td>
</tr>
<tr>
<td>75</td>
<td>364</td>
</tr>
<tr>
<td>90</td>
<td>526</td>
</tr>
</tbody>
</table>

The reaction times for the 30-year-old person were 192, 174 and 180 milliseconds.

Calculate the mean reaction time of the 30-year-old person.

\[
\text{Mean reaction time} = \frac{192 + 174 + 180}{3} \text{ milliseconds}
\]

\[
\text{Mean reaction time} = \frac{546}{3} = 182 \text{ milliseconds}
\]

(iii) Which one of the following is an advantage of repeating each test three times and not doing the test just once?

Tick (✔) one box.

- Any anomalies can be identified. [ ]
- The results will be more precise. [ ]
- There will be no errors. [ ]

(1)
(iv) Some people think that old people should **not** be allowed to drive a car.

Why is it more dangerous for old people to drive cars?

Use information from the table above to support your answer.

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(2)
(Total 7 marks)

Neurones pass information around the body.

(a) Why are reflex reactions important?

_________________________________________________________________

(b) Caffeine is a drug found in coffee.

After a person drinks coffee information passes through neurones in the nervous system more quickly.

Suggest a hypothesis for the effect of caffeine concentration on reaction time.

_________________________________________________________________
_________________________________________________________________
Two students investigated the effect of caffeine concentration on reaction time.

This is the method used.

1. Student A drinks a cup of coffee.
2. Student B holds a ruler above Student A's hand.
3. Student B drops the ruler.
4. Student A catches the ruler as quickly as she can.
5. The distance the ruler falls is recorded.

Suggest how this method could be improved to produce valid results.

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(6)
(Total 8 marks)
Students investigated the effect of lack of sleep on reaction time.

This is the method used.

1. Each student sleeps for a different amount of time.
2. Each student then completes a reaction time test on the computer five times.

The computer program asks the students to press a key on the keyboard when they hear a sound played at random.

The table below shows the results of the investigation.

<table>
<thead>
<tr>
<th>Student</th>
<th>Number of hours of sleep</th>
<th>Reaction time in milliseconds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Test 1</td>
</tr>
<tr>
<td>A</td>
<td>8</td>
<td>229.6</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>298.3</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>211.2</td>
</tr>
<tr>
<td>D</td>
<td>2</td>
<td>449.3</td>
</tr>
<tr>
<td>E</td>
<td>1</td>
<td>712.0</td>
</tr>
</tbody>
</table>

(a) Calculate the percentage decrease in mean reaction time when the number of hours of sleep increases from 1 hour to 8 hours.

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Percentage decrease in reaction time = _____________

(2)
(b) Apart from using a computer program, describe one other method of measuring reaction time.

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(2)

(c) A computer program measures reaction time accurately.

Suggest one other reason why the students used a computer program to measure reaction time.

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(1)

(d) A student concluded that lack of sleep increases reaction time.

Suggest two reasons why the data generated from the students’ method may not allow a valid conclusion to be made.

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2. _________________________________________________________________
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(2)
Scientists investigated the effect of lack of sleep and the effect of alcohol consumption on the human nervous system.

This is the method used.

1. Each person completes an accuracy test using a computer.
2. Their average score is taken as 100%.
3. Half of the group are kept awake for 24 hours.
4. The other half of the group drink alcohol until their blood alcohol level reaches 0.12%.
5. Each person repeats the accuracy test at regular intervals using a computer.

**Figure 1** and **Figure 2** show the results of the investigation.

![Figure 1](image1)

![Figure 2](image2)

(e) Mean relative performance is a comparison with the person’s original score. For example, 50% means their accuracy on the test was half of their original score.

If your blood alcohol concentration is above 0.08% it is against the law to drive in the UK.

A newspaper states the following:

**Driving whilst tired is as dangerous as driving after drinking alcohol.**
Evaluate the newspaper’s statement.

Use information from Figure 1 and Figure 2.

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(4)
(Total 13 marks)

Thyroxine is produced by the thyroid gland and released into the blood.

(a) What type of chemical is thyroxine?

___________________________________________________________________

(1)

The diagram shows how the release of thyroxine is controlled.

Key

←—— Negative feedback or effect

←—— Positive feedback or effect

Cold weather

Stress → Pituitary gland

Thyroid gland

Thyroxine
(b) Explain how the body regulates the amount of thyroxine that is produced if the body is not stressed or cold.

Use information shown in the diagram.

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(2)

Thyroxine stimulates basal metabolic rate.

One important chemical reaction of metabolism is respiration.

(c) Explain how the feedback mechanism in the diagram maintains normal body temperature in cold weather.

Use the information in the diagram and your own knowledge.

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(3)

(d) People in stressful situations produce a chemical that reduces the activity of the pituitary gland.

Explain how this can cause people to gain weight.

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(3)

(Total 9 marks)
The figure below shows how the concentrations of the reproductive hormones in the blood of a woman change over 28 days.

(a) Name hormones A and B.

A

B

(2)

(b) Use information from the figure above to explain what happens on Day 14.

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(2)
In Vitro Fertilisation (IVF) treatment can be used to help women become pregnant. IVF uses some of the hormones shown in the figure above.

Explain why IVF increases the chance of some women becoming pregnant.

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(6)
(Total 10 marks)
People with Type 1 diabetes cannot control the concentration of glucose in their blood. This is because they do not produce the hormone insulin.

The same concentration and volume of glucose solution is given to two people.

- Person with Type 1 diabetes.
- Person without Type 1 diabetes.

**Figure 1** shows how the blood glucose concentration of these people changes after they each drink a glucose solution.
(a) The blood glucose concentration increases at a faster rate in the person with diabetes compared to the person without diabetes.

Calculate how much faster the rate of increase in blood glucose concentration is in the person with diabetes.

Give the rate of increase for the first 30 minutes after drinking the glucose solution.

Give your answer in units / h.

________________________________________________________

________________________________________________________

___________________ Units / h

(2)

(b) The blood glucose concentration of the person without diabetes starts to change 30 minutes after drinking the glucose solution.

Explain why the blood glucose concentration changes.

________________________________________________________

________________________________________________________

________________________________________________________

________________________________________________________

(2)
People with diabetes should try to keep their blood glucose concentration within the same range as a person without diabetes.

Most people with Type 1 diabetes regularly check their blood glucose concentration using a meter, as shown in Figure 2.

The meter reading is used to estimate how much insulin they need to inject.

**Figure 2**

![Glucose meter, test strip, and blood](https://www.examqa.com)

**Figure 3** shows a new system.

It is connected to the person all the time.

**Figure 3**

The new system:

- gives better control of blood glucose concentration
- reduces the number of times the glucose concentration falls too low.
Evaluate the two systems as methods for controlling blood glucose concentrations for people with Type 1 diabetes.

Give a justified conclusion to your evaluation.

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(d) How does the body respond if slightly too much insulin is injected into the body.

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(5) (Total 13 marks)
Hormones are released from glands.

(a) Which gland produces hormones to control other glands in the endocrine system?

Tick one box.

- Adrenal
- Ovary
- Pituitary
- Thyroid

(1)
(b) The figure below shows the level of adrenaline in a man’s bloodstream while he was watching a 12-minute film.

![Diagram of adrenaline levels over time with points A and B marked.]

Calculate the percentage increase in adrenaline after point B.

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___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Percentage increase in adrenaline = ______________________

(2)

(c) Suggest why the percentage increase in adrenaline after point B is different from the percentage increase after point A.

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(2)
(d) Adrenaline causes changes in the body to prepare for a ‘fight or flight’ response.

What changes in the man’s body are caused by adrenaline?

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(2)
(Total 7 marks)