B5 - Test 3
HOMEOSTASIS & RESPONSE

GCSE
AQA
BIOLOGY

Materials
For this paper you must have:
• Ruler
• Pencil and Rubber
• 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

Information
• The marks for the questions are shown in brackets
Figure 1 shows a reflex in the iris of the human eye in response to changes in light levels.

(a) Describe the changes in the pupil and iris going from A to B in Figure 1.

Explain how these changes occur.

Refer to the changes in light level in your answer.

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Some people wear glasses to improve their vision.

Figure 2 shows light entering the eye in a person with blurred vision.

Figure 3 shows how this condition is corrected with glasses.

Compare Figure 2 and Figure 3.

Explain how the blurred vision is corrected.

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(2)
(Total 6 marks)
Two students investigated reflex action times.

This is the method used.

1. Student A sits with her elbow resting on the edge of a table.
2. Student B holds a ruler with the bottom of the ruler level with the thumb of Student A.
3. Student B drops the ruler.
4. Student A catches the ruler and records the distance, as shown in the diagram below.
5. Steps 1 to 4 were then repeated.

(a) Suggest two ways the students could improve the method to make sure the test would give valid results.

1 ....................................................................................................................
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2 ....................................................................................................................
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(b) The table below shows Student A’s results.

<table>
<thead>
<tr>
<th>Test Number</th>
<th>Distance ruler dropped in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>117</td>
</tr>
<tr>
<td>2</td>
<td>120</td>
</tr>
<tr>
<td>3</td>
<td>115</td>
</tr>
<tr>
<td>4</td>
<td>106</td>
</tr>
<tr>
<td>5</td>
<td>123</td>
</tr>
<tr>
<td>6</td>
<td>125</td>
</tr>
<tr>
<td>7</td>
<td>106</td>
</tr>
</tbody>
</table>

What is the **median** result?

Tick one box.

- [ ] 106
- [ ] 115
- [ ] 116
- [ ] 117
- [ ] 123
(c) The mean distance the ruler was dropped is 116 mm.

Calculate the mean reaction time.

Use the equation:

\[ \text{reaction time in s} = \sqrt{\frac{\text{mean drop distance in cm}}{490}} \]

Give your answer to 3 significant figures

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Mean reaction time = ............................................ s

(3)

(d) The students then measured Student A's reaction time using a computer program.

This is the method used.

1. The computer shows a red box at the start.
2. As soon as the box turns green the student has to press a key on the keyboard as fast as possible.
3. The test is repeated five times and a mean reaction time is displayed.

Student A's mean reaction time was 110 ms.

Using a computer program to measure reaction times is likely to be more valid than the method using a dropped ruler.

Give two reasons why.

1 .................................................................................................................................................. 
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2 ..................................................................................................................................................
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(2)
(e) A woman has a head injury.

Her symptoms include:

• finding it difficult to name familiar objects
• not being able to remember recent events.

Suggest which part of her brain has been damaged.

......................................................................................................................................
(1)

(f) A man has a head injury.

He staggers and sways as he walks.

Suggest which part of his brain has been damaged.

......................................................................................................................................
(1)

Humans keep their internal conditions almost constant.

Body temperature is kept within a narrow range.

When the core body temperature is too low, this is detected by the thermoregulatory centre in the brain.

Describe how the body responds when a decrease in core body temperature is detected.

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(3) (Total 6 marks)
Many runners drink sports drinks to improve their performance in races.

A group of students investigated the effects of three brands of sports drink, A, B and C, on the performance of three runners on a running machine. One of the runners is shown in the image below.

Table 1 gives information for each drink.

Table 1

<table>
<thead>
<tr>
<th>Nutrient per dm³</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose in g</td>
<td>63</td>
<td>31</td>
<td>72</td>
</tr>
<tr>
<td>Fat in g</td>
<td>9</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Ions in mg</td>
<td>312</td>
<td>332</td>
<td>495</td>
</tr>
</tbody>
</table>
(a) (i) In the investigation, performance was measured as the time taken to reach the point of exhaustion.

Exhaustion is when the runners could not run anymore.

All three runners:
• ran on a running machine until the point of exhaustion
• each drank 500 cm$^3$ of a different brand of sports drink
• rested for 4 hours to recover
• ran on the running machine again and recorded how much time they ran until the point of exhaustion.

The speed at which the runners ran was the same and all other variables were controlled.

The students predicted that the runner drinking brand B would run for the shortest time on the second run before reaching the point of exhaustion.

Use information from Table 1 to suggest an explanation for the students’ prediction.

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(ii) If the balance between ions and water in a runner’s body is not correct, the runner’s body cells will be affected.

Describe one possible effect on the cells if the balance between ions and water is not correct.

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(2)
(b) When running, a runner's body temperature increases.

Describe how the brain monitors body temperature.

<table>
<thead>
<tr>
<th>Nutrient per dm³</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose in g</td>
<td>63</td>
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<td>312</td>
<td>332</td>
<td>495</td>
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</table>

(c) (i) **Table 2** is repeated here to help you answer this question.
People with diabetes need to be careful about drinking too much sports drink.

Use information from Table 2 to explain why drinking too much sports drink could make people with diabetes ill.

(ii) Other than paying attention to diet, how do people with diabetes control their diabetes?

The diagram below shows how a nerve impulse passing along a relay neurone causes an impulse to be sent along another type of neurone, neurone X.

(a) What type of neurone is neurone X?

(1)
(b) Describe how information passes from the relay neurone to neurone X. Use the diagram to help you.

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(3)

(c) Scientists investigated the effect of two toxins on the way in which information passes across synapses. The table below shows the results.

<table>
<thead>
<tr>
<th>Toxin</th>
<th>Effect at the synapse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curare</td>
<td>Decreases the effect of the chemical on neurone X</td>
</tr>
<tr>
<td>Strychnine</td>
<td>Increases the amount of the chemical made in the relay neurone</td>
</tr>
</tbody>
</table>

Describe the effect of each of the toxins on the response by muscles.

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(2)

(Total 6 marks)

The graph shows the core body temperature and the skin surface temperature of a cyclist before, during and after a race.
(a) (i) When the cyclist finished the race, his core body temperature started to decrease.

How long did the race last?

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(ii) Describe and explain the different patterns shown in the core body temperature and skin surface temperature between 09.15 and 10.15.

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(b) During the race, the cyclist's blood glucose concentration began to decrease.

Describe how the body responds when the blood glucose concentration begins to decrease.

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(Total 12 marks)

7 The diagram shows the structures involved in the knee-jerk reflex. When the person is hit at point P, the lower leg is suddenly raised.

(a) Name the structures labelled A, B and C.

A ....................................................................................................................
B ....................................................................................................................
C ....................................................................................................................

(3)
(b) How is information passed across a synapse?

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(1)

(c) What is the effector in this response?

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(1)

(Total 5 marks)

Diagram 1 shows cells from the light-sensitive layer in the eye.

![Diagram 1](image)

(a) On Diagram 1, add labels to name part A and part B of the light-sensitive cell.

(2)

(b) There is a junction between the connecting neurone and the neurone carrying the impulse to the brain.

(i) What name is given to the junction?

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(1)

(ii) In what form is information passed across the junction?

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(1)
Diagram 2 shows a bee flying towards a man's eye.

In the *blink reflex*, light from the bee reaches the light-sensitive cell in the eye. The muscles in the eyelid shut the man's eye before the bee hits the eye.

Describe the pathway taken by the nerve impulse in the *blink reflex*.

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Humans maintain an almost constant body temperature.

(a) Describe the role of blood vessels in the control of body temperature.

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(4)

(b) An athlete can run a marathon in 2 hours 15 minutes on a dry day in outside temperatures up to 35 °C.

If the air is dry, his body will not overheat.

In humid conditions the same athlete can run the marathon in the same time. However, in humid conditions, if the outside temperature goes over 18 °C then his body will overheat.

Suggest an explanation for the athlete overheating in humid conditions.

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(3)

(Total 7 marks)
The diagram shows the nervous pathway used to coordinate the knee-jerk reflex. When the person is hit at point P, the lower leg is suddenly raised.

(a) Name neurones A, B and C.

A ..........................................................................................................................................................  
B ..........................................................................................................................................................  
C ..........................................................................................................................................................  

(b) The receptor in the muscle in the leg is sensitive to a stimulus.

Suggest the stimulus.

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(1)

(3)
One group of scientists is working in a hot desert and another group is working in a tropical rainforest.

The table shows information about the scientists and the conditions in the desert and the rainforest.

<table>
<thead>
<tr>
<th>Information</th>
<th>Hot desert</th>
<th>Rainforest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean core body temperature of scientists in °C</td>
<td>37.3</td>
<td>38.9</td>
</tr>
<tr>
<td>Air temperature in °C</td>
<td>36.0</td>
<td>35.5</td>
</tr>
<tr>
<td>Mean percentage concentration of moisture in the air</td>
<td>9.0</td>
<td>92.0</td>
</tr>
<tr>
<td>Mean wind speed at ground level in metres per second</td>
<td>12.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

(a) Both groups of scientists are doing similar jobs. The jobs cause the scientists to sweat a lot.

Use information from the table to explain the difference in the mean core body temperature of the two groups of scientists.

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(2)
(b) Changes to blood vessels in the skin help to decrease body temperature.

Explain how.

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(2)
(Total 4 marks)