Please write clearly in block capitals.

Centre number ____________  Candidate number ____________

Surname ____________________________
Forename(s) ____________________________
Candidate signature ____________________________

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GCSE BIOLOGY
Higher Tier  Unit Biology B3

Friday 9 June 2017  Morning  Time allowed: 1 hour

Materials
For this paper you must have:
• a ruler.
You may use a calculator.

Instructions
• Use black ink or black ball-point pen.
• Fill in the boxes at the top of this page.
• Answer all questions.
• You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
• Do all rough work in this book. Cross through any work you do not want to be marked.

Information
• The marks for questions are shown in brackets.
• The maximum mark for this paper is 60.
• You are expected to use a calculator where appropriate.
• You are reminded of the need for good English and clear presentation in your answers.
• Question 3 should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

Advice
• In all calculations, show clearly how you work out your answer.

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For Examiner’s Use
Examiner’s Initials

Question  Mark
1
2
3
4
5
6
7
8
9
TOTAL

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<thead>
<tr>
<th>Centre number</th>
<th>Candidate number</th>
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<tbody>
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Forename(s) ________________________________________________________________________  
Candidate signature ________________________________________________________________________  

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Please write clearly in block capitals.
Large areas of forest are cut down each year. This is called deforestation.

Apart from decay, describe how the removal of trees from forests can lead to global warming.

_____________________________________________________________________________________
_____________________________________________________________________________________

After trees have been cut down, branches and leaves are left on the ground to decay.

**Figure 1** shows how the rate of decay changes with the mean annual temperature in different environments.

**Figure 1**

![Graph showing the rate of decay versus mean annual temperature](image)

1 (b) (i) The mean annual temperature in forest A is 10 °C.

What is the rate of decay in forest A?

Rate of decay = ____________________________ arbitrary units

1 (b) (ii) Forest B has a mean annual temperature of 30 °C.

Use information from **Figure 1** to predict the rate of decay in forest B.

Rate of decay = ____________________________ arbitrary units
Describe how decay in forests contributes to global warming.

[2 marks]
There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED
Each year people need to have treatment for heart problems.

Figure 2 shows a human heart.

Figure 2

2 (a) (i) Name part X in Figure 2. [1 mark]

2 (a) (ii) Name part Y in Figure 2. [1 mark]

2 (a) (iii) There are valves inside the heart.

What is the function of these valves? [1 mark]

Question 2 continues on the next page
2 (b) Some patients need to have their heart valves replaced.

Table 1 shows the percentage of patients who died from different causes after having heart valve replacements.

Two types of heart valve were used:
- mechanical – made of metal and plastic
- pig tissue – made from pig heart tissue on a metal frame.

The data was collected over 15 years and 400 patients were involved.

Table 1

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>Percentage of patients who died</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mechanical valve</td>
</tr>
<tr>
<td>Blood clots blocking coronary arteries</td>
<td>9</td>
</tr>
<tr>
<td>Bleeding</td>
<td>26</td>
</tr>
<tr>
<td>Second operation</td>
<td>5</td>
</tr>
<tr>
<td>Bacterial heart infection</td>
<td>4</td>
</tr>
<tr>
<td>Heart valves stopped working</td>
<td>0</td>
</tr>
</tbody>
</table>

Use information from Table 1 and your own knowledge to answer the following question.

A patient decides to have a mechanical valve replacement rather than a pig tissue valve replacement.

Suggest reasons for and against choosing a mechanical valve.

[4 marks]
Some people have narrowed arteries.

Describe how stents can be used to prevent a heart attack in a person with narrowed arteries.

[2 marks]
There are no questions printed on this page
In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Humans need to remove (excrete) waste products from the bloodstream.

Describe the processes that produce waste products and how the products are removed from the body.

In your answer you should include the names of the organs involved in producing waste products and those involved in removing the waste products.

You should not refer to faeces in your answer. [6 marks]

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Human activities pollute the air with smoke and gases. One of these gases is sulfur dioxide.

What effect does sulfur dioxide have on our environment? [1 mark]

Tick (✓) one box.

- Causes acid rain
- Causes global warming
- Causes more carbon sequestering
- Causes sea levels to rise

Figure 3 shows how the mass of sulfur dioxide produced from UK sources changed from 2001 to 2013.
4 (b) (i) The mass of sulfur dioxide produced from all UK sources has decreased.

Use information from Figure 3 to complete the following calculation of the percentage decrease in the mass of sulfur dioxide produced.

[2 marks]

Total mass of sulfur dioxide produced in 2001 = ___________ thousand tonnes

Total mass of sulfur dioxide produced in 2013 = 480 thousand tonnes

Decrease in mass of sulfur dioxide produced = ___________ thousand tonnes

Percentage decrease working out: __________________________________________________________

_____________________________________________________________________________________

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Percentage decrease = ________________

4 (b) (ii) Use data from Figure 3 to describe the pattern in the mass of sulfur dioxide produced from the UK transport industry from 2001 to 2013.

[2 marks]

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Turn over for the next question
5 Plants have transport systems.

5 (a) In Table 2, name two tissues that transport substances through a plant. For each tissue, name one substance that it transports. [2 marks]

Table 2

<table>
<thead>
<tr>
<th>Tissue</th>
<th>Substance transported</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

5 (b) A student investigated the rate of transpiration in four different plant species, A, B, C and D.

He set up the apparatus for plant A as shown in Figure 4.

Figure 4

In each experiment he:

- recorded the mass of the apparatus at the start of the experiment
- recorded the mass every 5 minutes for 30 minutes
- repeated the experiment with plants B, C and D.
Figure 5 shows his results.

![Graph showing mass of apparatus in g over time for different plants]

Table 3 shows information about the four plant species.

<table>
<thead>
<tr>
<th>Plant species</th>
<th>Mean number of stomata per mm$^2$ of leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bellflower</td>
<td>42.74</td>
</tr>
<tr>
<td>Caraway</td>
<td>117.50</td>
</tr>
<tr>
<td>Goosegrass</td>
<td>6.94</td>
</tr>
<tr>
<td>Clover</td>
<td>387.33</td>
</tr>
</tbody>
</table>

5 (b) (i) The student concluded that plant D was clover.

Use information from Figure 5 and Table 3 to suggest an explanation for the student’s conclusion.

[3 marks]

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5 (b) (ii)  The student carried out another experiment using plant A.

The student used the same apparatus and method.

In this experiment the apparatus was placed in a clear plastic box for the 30 minutes, as shown in Figure 6.

**Figure 6**

![Clear plastic box](image)

415.0 g

Explain what would happen to the rate of water loss due to transpiration in this experiment compared to the first investigation.

[3 marks]

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6 Many people drink sports drinks after exercise.

Table 4 shows some data about five different sports drinks, P, Q, R, S and T.

Table 4

<table>
<thead>
<tr>
<th>Sports drink</th>
<th>Concentration of the drink in arbitrary units</th>
<th>Sodium ions in mg</th>
<th>Potassium ions in mg</th>
<th>Substance X in g</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>260</td>
<td>45</td>
<td>21</td>
<td>10</td>
</tr>
<tr>
<td>Q</td>
<td>170</td>
<td>48</td>
<td>24</td>
<td>9</td>
</tr>
<tr>
<td>R</td>
<td>270</td>
<td>112</td>
<td>38</td>
<td>2</td>
</tr>
<tr>
<td>S</td>
<td>280</td>
<td>25</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>T</td>
<td>493</td>
<td>6</td>
<td>3</td>
<td>13</td>
</tr>
</tbody>
</table>

6 (a) Substance X in Table 4 is used during exercise.

Substance X releases energy during exercise.

What is substance X? [1 mark]

_____________________________________

6 (b) A sports scientist investigated the effectiveness of sports drinks. She made the following statements:

- the best sports drinks have a slightly lower concentration than blood plasma
- the mean concentration of blood plasma is 280 arbitrary units
- the closer the ratio of sodium ions to potassium ions is to 2:1, the more effective the sports drink.

6 (b) (i) Calculate the ratio of sodium ions to potassium ions in drink R. [1 mark]

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Ratio = ______________________________
6 (b) (ii) The scientist stated:

'sports drink P is the most effective sports drink'

Use information from part (b) and Table 4 to give reasons why the scientist made this statement.

[2 marks]

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6 (b) (iii) Blood cells were placed in a sample of sports drink T.

The concentration inside the blood cells was 280 arbitrary units.

Explain what would happen to the blood cells.

[3 marks]

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There are no questions printed on this page
A climber falls down a mountain slope into a small pool of cold water. He is injured and cannot move. He starts to get cold.

7 (a) How does the body detect a decrease in blood temperature? [1 mark]
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7 (b) The man starts shivering.

Explain how shivering helps to raise his body temperature. [3 marks]
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7 (c) Apart from shivering, explain how the man’s body responds to raise his core body temperature. [3 marks]
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Turn over
Some people have coeliac disease. Coeliac disease affects the small intestine.

Symptoms of coeliac disease include:
- weight loss
- low levels of vitamins and minerals in the body
- tiredness.

Figure 7 shows the lining of the small intestine of a healthy person and the lining of the small intestine of a person with coeliac disease.
8 (a) Explain how the changes in the villi of a person with coeliac disease may cause the person to lose weight and have low amounts of vitamins and minerals in their body. [5 marks]

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8 (b) Some of the uptake of glucose in the small intestine occurs by active transport. Describe the process of active transport. [2 marks]

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Turn over for the next question
9 (a) In a healthy person, blood sugar levels are kept within a narrow range.

Describe what happens in a healthy person when the pancreas detects a rise in blood sugar level.

[2 marks]

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9 (b) Glycogen storage disorder is an inherited condition affecting a small number of people.

In some people with the disorder, glycogen does not form properly.

After exercise, a person with this type of glycogen storage disorder can feel very tired and can become unconscious.

Explain why the person has these symptoms after exercise.

[4 marks]

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END OF QUESTIONS
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