Please write clearly in block capitals.

Centre number ___________________________ Candidate number ___________________________
Surname __________________________________________________________
Forename(s) _________________________________________________________
Candidate signature _________________________________________________

GCSE SCIENCE A 1
Foundation Tier Unit 5

Tuesday 16 May 2017 Afternoon Time allowed: 1 hour 30 minutes

Materials
For this paper you must have:
• a ruler
• a calculator
• the Chemistry Data Sheet and Physics Equations Sheet booklet (enclosed).

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 90.
• 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 12(b) 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.

<table>
<thead>
<tr>
<th>Question</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
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<tr>
<td>3</td>
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<td>4</td>
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<tr>
<td>5</td>
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<td>6</td>
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<td>7</td>
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<td>8</td>
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<td>11</td>
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<td>12</td>
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<tr>
<td>13</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

TOTAL
There are no questions printed on this page
Biology Questions

1. It is important that the amount of water in the body is controlled.

1 (a) Excess water is lost in urine.

Which organ produces urine?

Tick one box. [1 mark]

- Lung
- Kidney
- Skin

Question 1 continues on the next page
Figure 1 shows the volume of water lost from a boy’s body on a hot day and on a cold day.

1 (b) (i) Calculate the total volume of water lost on a cold day.

[1 mark]

Total volume lost = ________________ cm³
1 (b) (ii) Compare the volume of water lost on a hot day with that lost on a cold day in breath, in sweat and in urine.  

[3 marks]

Breath ______________________________________________________________________________
_____________________________________________________________________________________

Sweat ______________________________________________________________________________
_____________________________________________________________________________________

Urine _______________________________________________________________________________
_____________________________________________________________________________________

1 (b) (iii) Give one reason for the difference in the volume of water lost in sweat on a hot day compared to that lost on a cold day.  

[1 mark]

_____________________________________________________________________________________
_____________________________________________________________________________________

Turn over for the next question
Receptors are cells in the nervous system that detect changes in the environment.

2 (a) (i) What is a change in the environment called? [1 mark]

Draw a ring around the correct answer.

a reaction     a reflex     a response     a stimulus

2 (a) (ii) Figure 2 shows a light receptor cell.

Name parts A and B.

Use the correct answers from the box. [2 marks]

<table>
<thead>
<tr>
<th>cell membrane</th>
<th>cell wall</th>
<th>cytoplasm</th>
<th>nucleus</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2 (a) (iii) There are other structures in the nervous system.

Draw **one** line from each structure to its description.

[3 marks]

<table>
<thead>
<tr>
<th>Structure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brain</td>
<td>An electrical impulse</td>
</tr>
<tr>
<td>Effector</td>
<td>A muscle or a gland</td>
</tr>
<tr>
<td>Synapse</td>
<td>A coordinator</td>
</tr>
<tr>
<td></td>
<td>A gap between two neurones</td>
</tr>
</tbody>
</table>

Question 2 continues on the next page
2 (b) A group of 30 students investigated the sensitivity of different parts of the body to touch.

The students worked in pairs, as shown in Figure 3.

**Figure 3**

One student was blind-folded.

The second student:
- had two small pointed sticks with the points exactly 0.5 cm apart
- gently touched both points, at the same time, onto different parts of the blind-folded student’s body.

The blind-folded student said if she felt one or two points.

The students then swapped over and repeated the investigation.

The results for all 30 students are shown in Table 1.

**Table 1**

<table>
<thead>
<tr>
<th>Part of body tested</th>
<th>Number of students who felt two points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forehead</td>
<td>14</td>
</tr>
<tr>
<td>Lips</td>
<td>26</td>
</tr>
<tr>
<td>Fingertips</td>
<td>29</td>
</tr>
<tr>
<td>Back of hand</td>
<td>12</td>
</tr>
</tbody>
</table>
2 (b) (i) Plot the results on the bar chart. 

The result for the forehead is already plotted. 

[2 marks]

2 (b) (ii) Which part of the body shown in Table 1 is the most sensitive to touch?

Suggest one reason why this part of the body needs to be the most sensitive. 

[2 marks]
3 Plant growth is controlled by hormones.

3 (a) (i) The shoots of plants grow towards the light.

What is this plant response called? [1 mark]

Draw a ring around the correct answer.

gravitropism  horticulture  photosynthesis  phototropism

3 (a) (ii) The roots of plants grow downwards.

What is this plant response called? [1 mark]

Draw a ring around the correct answer.

gravitropism  horticulture  photosynthesis  phototropism

3 (b) Plant hormones are used in some weed killers.

A student wanted to find the best weed killer to kill dandelion weeds.

The student:
- marked out squares on a lawn where dandelions were growing
- used four different weed killers, W, X, Y and Z
- used each weed killer at a different concentration
- poured some of the weed killer solution onto the marked square being tested
- counted the number of dandelion plants still alive after 2 weeks.
Figure 4 shows how she set up the investigation.

Figure 4

- Weed killer W concentration: 10%
- Weed killer X concentration: 20%
- Weed killer Y concentration: 100%
- Weed killer Z concentration: 50%

This investigation would not give valid results.

How could the student improve the investigation to find the best weed killer to kill the dandelion weeds?

Suggest three improvements. [3 marks]

Improvement 1 ______________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

Improvement 2 ______________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

Improvement 3 ______________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
Chemistry Questions

4  This question is about limestone.

4 (a)  Figure 5 shows a limestone quarry.

Figure 5

Limestone is quarried using explosives.

Suggest two disadvantages of quarrying.

[2 marks]

1  ___________________________________________________________________________________

_____________________________________________________________________________________

2  ___________________________________________________________________________________

_____________________________________________________________________________________

4 (b)  Limestone is mainly calcium carbonate. The formula of calcium carbonate is CaCO₃

How many different elements are in calcium carbonate?

[1 mark]

___________________________________________
This question is about copper.

A building is covered in 3000 kg of copper metal. 1950 kg of the copper used is recycled copper.

How could the percentage of recycled copper used in the building be calculated? [1 mark]

Tick (✓) one box.

\[
\frac{1050}{3000} \times 100 \quad [\text{ ] }
\]

\[
\frac{1950}{3000} \times 100 \quad [\text{ ] }
\]

\[
\frac{3000}{1950} \times 100 \quad [\text{ ] }
\]

Copper is a useful building material.

Give two reasons why. [2 marks]

Tick (✓) two boxes.

Copper can be hammered into shape. [ ]

Copper does not conduct electricity. [ ]

Copper does not react with water. [ ]

Copper is an alkali metal. [ ]

Copper is brittle. [ ]
5 (b) Give one advantage of using recycled copper rather than extracting copper from its ore. [1 mark]

Tick (✓) one box.

- Recycled copper is more reactive.
- Recycling uses less energy.
- Recycling uses up more copper ore.

Turn over for the next question
6 This question is about titanium.

6 (a) Give one reason why titanium is used in the manufacture of aeroplanes. [1 mark]

Tick (✓) one box.

- Titanium is corrosion resistant.
- Titanium does not conduct heat.
- Titanium is cheap to extract.

6 (b) Some alloys are used in the manufacture of aeroplanes.

Figure 6 shows the composition of one alloy.
Complete Table 2.

Use the Chemistry Data Sheet to help you answer this question.

Table 2

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name of element</th>
<th>Percentage (%) of metal in alloy</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>Vanadium</td>
<td>4</td>
</tr>
<tr>
<td>Al</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ti</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6 (c) Why are alloys used rather than pure metals?

[1 mark]
7 Magnesium is used in the production of titanium.

7 (a) Magnesium is extracted from magnesium ore.

Magnesium ore is mainly magnesium carbonate.

7 (a) (i) In the first stage of the extraction process, magnesium carbonate is heated to produce magnesium oxide.

What type of reaction is this? [1 mark]

Draw a ring around the correct answer.

combustion     decomposition     electrolysis

7 (a) (ii) The word equation for the reaction is:

magnesium carbonate $\rightarrow$ magnesium oxide + carbon dioxide

42 kg 20 kg

Calculate the mass of carbon dioxide produced when 42 kg of magnesium carbonate is heated. [1 mark]

Mass of carbon dioxide = ________________ kg

7 (a) (iii) Describe how you would test for carbon dioxide. [2 marks]

Solution used _______________________________________________________________________
____________________________________________________________________________________

Result ______________________________________________________________________________
_____________________________________________________________________________________


7 (b) Figure 7 shows the steps in the industrial process to extract titanium from titanium oxide.

**Figure 7**

Step 1: 
- Titanium oxide + chlorine + carbon → Titanium chloride + carbon dioxide

Step 2: 
- Magnesium + titanium chloride → Magnesium chloride + titanium
- Magnesium chloride → Magnesium + chlorine

Step 3: 
- Carbon + chlorine → Carbon dioxide

7 (b) (i) Which substance is a waste product of the process? [1 mark]

Tick (✓) one box.

- Carbon
- Carbon dioxide
- Titanium oxide

7 (b) (ii) Titanium is produced in Step 2.

Suggest two reasons why magnesium chloride is then converted into magnesium and chlorine in Step 3. [2 marks]

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

Turn over ▶
8 Potassium and argon are elements.

8 (a) Complete Table 3 to show the number of protons, neutrons and electrons in an atom of potassium and in an atom of argon.

[2 marks]

<table>
<thead>
<tr>
<th></th>
<th>Potassium</th>
<th>Argon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass number</td>
<td>39</td>
<td>40</td>
</tr>
<tr>
<td>Number of protons</td>
<td>19</td>
<td>18</td>
</tr>
<tr>
<td>Number of neutrons</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Number of electrons</td>
<td></td>
<td>18</td>
</tr>
</tbody>
</table>

8 (b) Use the correct answer from the box to complete the sentence.

[1 mark]

Potassium and argon are different elements because their atoms have different numbers of ___________________________.

3
Physics Questions

9 Figure 8 shows the arrangement of particles in a solid, a liquid and a gas.

9 (a) Draw one line from each arrangement of particles to the correct state of matter.

[2 marks]

Figure 8

<table>
<thead>
<tr>
<th>Arrangement of particles</th>
<th>State of matter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Solid</td>
</tr>
<tr>
<td></td>
<td>Liquid</td>
</tr>
<tr>
<td></td>
<td>Gas</td>
</tr>
</tbody>
</table>

9 (b) Use the correct answers from the box to complete each sentence.

Each word can be used once, more than once or not at all.

[4 marks]

solid  liquid  gas

The particles vibrate around fixed positions in a ____________________ .
The state of matter in which the particles have the most energy is a ________________ .
Evaporation is when a ________________ becomes a ________________ .

6
A student investigated four insulating materials, A, B, C and D.

Figure 9 shows four identical beakers, each wrapped in one of the materials.

The student:
- poured the same volume of water at 90 °C into each beaker
- placed a lid on each beaker
- measured the temperature of the water in each beaker after 10 minutes
- calculated the temperature change.

10 (a) What was the dependent variable in the investigation? [1 mark]

Tick (√) one box.

change in temperature of the water

starting temperature of the water

thickness of material

volume of water
10 (b) **Figure 10** shows the student’s results.

![Figure 10]

10 (b) (i) Use the correct answer from the box to complete the sentence.

[1 mark]

| categoric | continuous | control |

The student drew a bar chart because the type of material

is a _______________ variable.

10 (b) (ii) Which material, A, B, C or D, is the best insulator?

Tick (✓) one box.

A □ B □ C □ D □

Give a reason for your answer.

[2 marks]

_____________________________________________________________________________________

_____________________________________________________________________________________
11 (a) **Table 4** gives some information about two oil-filled heaters, **Heater A** and **Heater B**.

**Table 4**

<table>
<thead>
<tr>
<th></th>
<th>Heater A</th>
<th>Heater B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power rating in kW</td>
<td>2.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Automatic timer</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Number of temperature settings</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Design feature</td>
<td>Has a carry handle</td>
<td>Protection against overheating</td>
</tr>
</tbody>
</table>

11 (a) (i) **Give one advantage and one disadvantage of **Heater A** compared to **Heater B**.**

[2 marks]

Advantage of **Heater A** ______________________________________________________________
__________________________________________________________________________________

Disadvantage of **Heater A** _________________________________________________________
__________________________________________________________________________________

11 (a) (ii) **Heater A** is used for 6 hours.

Calculate how much energy, in kWh, is transferred by **Heater A**.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

__________________________________________________________________________________
__________________________________________________________________________________

Energy transferred = _________________ kWh
11 (b) **Heater A** heats the air in a room by the process of convection.

11 (b) (i) Complete the sentences to describe how the air in the room is heated. [4 marks]

Air particles near to the heater gain _________________ and move apart.

This makes the air near to the heater _________________ dense.

The warmer air _________________ and cooler air falls to replace it.

This movement of air is called a convection _________________.

11 (b) (ii) The mass of the air in the room is 50 kg.

**Heater A** raises the temperature of the air by 6 °C.

The specific heat capacity of air is 1000 J/kg °C.

Calculate the energy that the heater transfers to the room.

Use the correct equation from the Physics Equations Sheet.

Tick (✓) the correct unit. [3 marks]

<table>
<thead>
<tr>
<th>Unit</th>
<th>Tick (✓)</th>
</tr>
</thead>
<tbody>
<tr>
<td>joules</td>
<td></td>
</tr>
<tr>
<td>seconds</td>
<td></td>
</tr>
<tr>
<td>watts</td>
<td></td>
</tr>
</tbody>
</table>

Energy transferred = ________________________________
Biology Questions

12 In 2015 scientists announced that they might have discovered a new type of antibiotic produced by soil bacteria. This would be the first new antibiotic to be discovered in over 25 years.

12 (a) Suggest why the development of a new type of antibiotic is very important. [2 marks]

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

12 (b) In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A new drug must be tested before it can be sold.

Figure 11 shows a timeline for the stages of testing one new drug.

Figure 11

<table>
<thead>
<tr>
<th>Time in years</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>Laboratory testing</td>
</tr>
<tr>
<td>Clinical testing</td>
</tr>
</tbody>
</table>

Describe what happens at each stage of drug testing.

Give the reasons for each stage.

You should include how the tests are designed to obtain valid results. [6 marks]

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________


12 (c) Independent scientists do not work for the companies making or testing the drug.

Suggest why the results of the tests have to be reviewed by independent scientists.

[1 mark]
There are no questions printed on this page
Chemistry Questions

13 Figure 12 shows the electronic arrangement of an atom.

Figure 12

13 (a) What is the name of the element represented in Figure 12?

Use the Chemistry Data Sheet to help you answer this question.

[1 mark]

_________________________________________________

13 (b) Explain what the electronic arrangement tells you about the reactivity of this element.

[2 marks]

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

Turn over for the next question
14 Fuels have many different uses.

14 (a) (i) Some power stations use coal as the fuel.

The elements in coal include carbon, hydrogen, nitrogen, oxygen and sulfur.

When coal burns, several pollutant gases are produced.

Name **two** of the pollutant gases produced.

For each pollutant gas, describe the effect the gas has on the environment. [4 marks]

Gas _________________________________
Effect _______________________________________________________________________________
_____________________________________________________________________________________

Gas _________________________________
Effect _______________________________________________________________________________
_____________________________________________________________________________________

14 (a) (ii) Some power stations use biofuels.

Suggest **one** advantage of using a biofuel rather than coal. [1 mark]

_____________________________________________________________________________________
_____________________________________________________________________________________


14 (b) Petrol is often used as the fuel in cars.

Which element is removed from petrol, before petrol is burnt in cars? [1 mark]

Tick (✓) one box.

- carbon
- hydrogen
- nitrogen
- oxygen
- sulfur

Turn over for the next question
Physics Questions

15 Figure 13 shows Sankey diagrams for a fossil fuel power station and for a combined heat and power (CHP) station. A CHP station uses waste energy from the electricity it generates to provide heating and hot water for nearby buildings.

Figure 13

Fossil fuel power station

Input energy from fuel

Electricity

Waste energy

CHP station

Input energy from fuel

Electricity

Energy used to provide heating and hot water for nearby buildings

Waste energy

15 (a) (i) Determine the efficiency of the fossil fuel power station.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Efficiency = ______________________________

15 (a) (ii) What happens to the waste energy from a fossil fuel power station?

[1 mark]

15 (a) (iii) Which is more efficient, a fossil fuel power station or a CHP station?

Give a reason for your answer.

[1 mark]
15 (b) A heat exchanger in a CHP station transfers energy from hot gases to cold water.

*Figure 14* shows the heat exchanger.

**Figure 14**

![Heat Exchanger Diagram]

15 (b) (i) Why is the pipe made from copper rather than plastic?  

[1 mark]

_____________________________________________________________________________________

_____________________________________________________________________________________

15 (b) (ii) Suggest two improvements that could be made to this heat exchanger to increase the rate of energy transfer.

For each improvement give one reason why this would increase the rate of energy transfer.

[4 marks]

Improvement 1 _____________________________________________________________  
_____________________________________________________________________________________

Reason _____________________________________________________________  
_____________________________________________________________________________________

Improvement 2 _____________________________________________________________  
_____________________________________________________________________________________

Reason _____________________________________________________________  
_____________________________________________________________________________________

END OF QUESTIONS
There are no questions printed on this page