Level 3 Certificate / Extended Certificate
APPLIED SCIENCE

Unit 1  Key Concepts in Science
Section B – Chemistry

Monday 11 June 2018  Afternoon  Time allowed: 1 hour 30 minutes.
You are advised to spend approximately 30 minutes on this section.

Materials
For this paper you must have:
• a calculator
• Periodic Table
• formulae sheet.

Instructions
• Use black ink or black ball-point pen.
• Answer all questions in each section.
• 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
• You will be provided with a copy of the formulae sheet.
• There are three sections in this paper:
  Section A – Biology   Section B – Chemistry   Section C – Physics.
• The marks for questions are shown in brackets.
• The maximum mark for this paper is 60 and the maximum mark for this section is 20.

Advice
Read each question carefully.
There are no questions printed on this page
The Periodic Table is a valuable tool that has been developed by chemists over many years.

Complete the sentence. [1 mark]

The Periodic Table lists elements in order of ____________________________

The elements in group VII (17) all have similar chemical properties.

What is the name given to the elements in group VII (17)? [1 mark]

______________________________

State the trend shown in electronegativity in group VII (17) elements. [1 mark]

______________________________

______________________________

______________________________

______________________________

Explain why elements in the same group of the Periodic Table have similar chemical properties. [2 marks]

______________________________

______________________________

______________________________

______________________________

______________________________

______________________________
Silicon has three stable isotopes.

State what is meant by the term isotope. [2 marks]

Table 1 shows information about isotopes of silicon.

<table>
<thead>
<tr>
<th>Isotope</th>
<th>Symbol</th>
<th>Isotopic abundance / %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicon-28</td>
<td>$^{28}\text{Si}$</td>
<td>92</td>
</tr>
<tr>
<td>Silicon-29</td>
<td>$^{29}\text{Si}$</td>
<td>5</td>
</tr>
<tr>
<td>Silicon-30</td>
<td>$^{30}\text{Si}$</td>
<td>3</td>
</tr>
</tbody>
</table>

Calculate the relative atomic mass of silicon.

Give your answer to 3 significant figures. [3 marks]

Relative atomic mass = ___________________________
Silicon has a structure similar to diamond.

Explain why silicon has a high melting point.

[3 marks]
Chemical engineers often use Hess’s Law to calculate enthalpy changes.

Table 2 shows the enthalpy change of combustion of carbon, hydrogen and butane.

<table>
<thead>
<tr>
<th></th>
<th>Carbon C(s)</th>
<th>Hydrogen H₂(g)</th>
<th>Butane C₄H₁₀(g)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enthalpy change of combustion (kJmol⁻¹)</strong></td>
<td>-393.5</td>
<td>-285.8</td>
<td>-2877.5</td>
</tr>
</tbody>
</table>

Use information from Table 2 to determine the accurate value of the enthalpy change of formation of butane.

Give your answer to 1 decimal place.

\[4 \text{C(s)} + 5 \text{H}_2(\text{g}) \rightarrow \text{C}_4\text{H}_{10}(\text{l})\]

Enthalpy change of formation = ____________________________ kJ
A student wants to determine the enthalpy change of combustion of a fuel. 

**Figure 1** shows the equipment the student used.

![Diagram](image)

**Figure 1**

It is difficult to determine accurate enthalpy of combustion, as heat loss is a major error.

Give **two** ways that the design of the experiment in **Figure 1** could be improved to reduce the amount of heat loss.  

[2 marks]

1. 

2. 

Give **one** other possible source of error that would affect the enthalpy change value.  

[1 mark]

End of questions