GCSE
SCIENCE A
CHEMISTRY
Foundation Tier  Unit Chemistry C1

Thursday 18 May 2017  Morning  Time allowed: 1 hour

Materials
For this paper you must have:
  • a ruler
  • the Chemistry Data Sheet (enclosed).
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 7 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.
This question is about gases in the Earth’s atmosphere.

**Figure 1** shows the atmospheres of the early Earth and of the Earth today.

![Figure 1](diagram.png)

**Figure 1**

The early Earth

Most of the atmosphere was carbon dioxide and water vapour

The Earth today

Most of the atmosphere is nitrogen and oxygen

**1 (a) (i)** Use the correct answers from the box to complete the sentence. [2 marks]

- dissolved
- evaporated
- locked up
- released

The amount of carbon dioxide in the early Earth’s atmosphere decreased because carbon dioxide was ____________ in the oceans and gradually became ____________ in sedimentary rocks as carbonates.

**1 (a) (ii)** Plants and algae used carbon dioxide and water vapour in the early Earth’s atmosphere to produce oxygen.

Give the name of this process. [1 mark]
1 (b) The Earth’s atmosphere today contains about 0.04% carbon dioxide.

1 (b) (i) Draw one line from each gas to the approximate percentage of gas in the Earth’s atmosphere today.

[3 marks]

<table>
<thead>
<tr>
<th>Gas</th>
<th>Approximate percentage of gas in the Earth’s atmosphere today</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argon</td>
<td>10</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>50</td>
</tr>
<tr>
<td>Oxygen</td>
<td>80</td>
</tr>
</tbody>
</table>

1 (b) (ii) Give one reason why the amount of carbon dioxide in the Earth’s atmosphere has increased in the last 50 years.

[1 mark]

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

Figure 2 shows part of the periodic table.

**Figure 2**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li</td>
<td>Be</td>
<td></td>
<td></td>
<td>F</td>
<td>Ne</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Na</td>
<td>Mg</td>
<td></td>
<td></td>
<td>Cl</td>
<td>Ar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>Ca</td>
<td></td>
<td></td>
<td>Br</td>
<td>Kr</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2 (a) Give the name of the element that should be in the shaded box.  

_____________________________________________________________________________________[1 mark]

2 (b) How many different elements are there in the complete periodic table?  

Tick (✓) one box.  

About 36

About 100

About 500
2 (c) What are two reasons why lithium, sodium and potassium are in the same group of the periodic table? [2 marks]

Tick (✓) two boxes.

- Low melting points
- Same number of electrons in the outer shell
- Similar atomic (proton) numbers
- Similar chemical reactions
- Two electrons in the innermost shell

2 (d) Complete each sentence. [2 marks]

The elements in Group 0 are called ________________ gases.
The elements in the central block are known as ____________________ metals.

2 (e) Use the correct word from the box to complete each sentence. [2 marks]

Atoms of fluorine gain electrons to form fluoride ________________ .
Atoms of fluorine share electrons to form fluorine ________________ .
3 This question is about metals.

3 (a) Complete the word equation for the reaction of magnesium with oxygen.  

\[ \text{magnesium} + \text{oxygen} \rightarrow \text{______________________________} \]  

[1 mark]

3 (b) Iron oxide is reduced to iron in a blast furnace.

The chemical equation for the reaction is:

\[ 2 \text{Fe}_2\text{O}_3 + 3 \text{C} \rightarrow 4 \text{Fe} + 3 \text{CO}_2 \]

3 (b) (i) Give the name of the element used for the reduction of iron oxide.  

_____________________________________________________________________________________

[1 mark]

3 (b) (ii) How can you tell that iron oxide is reduced?  

_____________________________________________________________________________________

_____________________________________________________________________________________

[1 mark]

3 (b) (iii) Complete the sentences.  

[3 marks]

For many uses, iron from the blast furnace is too ________________________ .

For many uses, pure iron is too ________________________ .

Mixtures of iron with carbon are called ________________________ .
Some plants contain oils that can be extracted.

**Figure 3** shows a process used to separate oils from plants.

**Question 4 continues on the next page**
4 (c) **Table 1** gives the melting points and boiling points of some plant oils.

<table>
<thead>
<tr>
<th>Plant oil</th>
<th>Melting point in °C</th>
<th>Boiling point in °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olive</td>
<td>−41</td>
<td>+216</td>
</tr>
<tr>
<td>Sunflower</td>
<td>−17</td>
<td>+227</td>
</tr>
<tr>
<td>Corn</td>
<td>−11</td>
<td>+232</td>
</tr>
<tr>
<td>Peanut</td>
<td>−2</td>
<td>+232</td>
</tr>
<tr>
<td>Coconut</td>
<td>+25</td>
<td>+177</td>
</tr>
</tbody>
</table>

4 (c) (i) An article stated that:

‘plant oils with lower melting points are healthier because they are high in unsaturated oils’.

Which plant oil in **Table 1** is the healthiest according to the article? [1 mark]

_____________________________________________________________________________________

4 (c) (ii) Which plant oil in **Table 1** is solid at room temperature (20 °C)? [1 mark]

_____________________________________________________________________________________

4 (c) (iii) Which plant oil in **Table 1** is liquid over the greatest temperature range? [1 mark]

_____________________________________________________________________________________

4 (d) Give two ways that food cooked in plant oils would be different from the same food cooked in water. [2 marks]

1  ___________________________________________________________________________________

2  ___________________________________________________________________________________
5 (a) **Figure 4** shows the layered structure of the Earth.

![Figure 4](image)

5 (a) (i) The radius of the Earth is 6400 km.

Calculate the distance from the surface of the crust to the surface of the core.

[2 marks]

_____________________________________________________________________________________

_____________________________________________________________________________________

Distance = _______________ km

5 (a) (ii) Use the correct answers from the box to complete the sentences.

Each word can be used only once.

[4 marks]

<table>
<thead>
<tr>
<th>currents</th>
<th>concentrations</th>
<th>distances</th>
</tr>
</thead>
<tbody>
<tr>
<td>plates</td>
<td>processes</td>
<td>speeds</td>
</tr>
</tbody>
</table>

Tectonic __________ move at __________ of a few centimetres per year.

This movement is caused by convection __________ within the Earth’s mantle

-driven by heat released by natural radioactive __________ .
5 (b) Figure 5 shows the percentage by mass of some elements in the Earth’s crust.

Figure 5

<table>
<thead>
<tr>
<th>Name of element</th>
<th>Percentage (%) by mass in Earth’s crust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>0</td>
</tr>
<tr>
<td>Silicon</td>
<td>47</td>
</tr>
<tr>
<td>Aluminium</td>
<td>8</td>
</tr>
<tr>
<td>Iron</td>
<td>5</td>
</tr>
<tr>
<td>Calcium</td>
<td>3</td>
</tr>
</tbody>
</table>

5 (b) (i) The percentage by mass of oxygen is 47%.

Draw the bar for oxygen on Figure 5.

5 (b) (ii) Look at your completed bar chart.

What is the percentage by mass of all the other elements not shown on the chart in the Earth’s crust?

Tick (✓) one box.

- 1%  
- 9%  
- 20%
5 (b) (iii) There is about 0.007% by mass of copper in the Earth’s crust.

Suggest why copper should be recycled. [1 mark]

_____________________________________________________________________________________

_____________________________________________________________________________________

Question 5 continues on the next page
Bioleaching of low-grade copper ores produces a solution of copper sulfate. Figure 6 shows apparatus used to obtain copper from copper sulfate solution.

**Figure 6**

Negative electrode  | Positive electrode
--- | ---
Cu$^{2+}$  | Cu$^{2+}$
SO$_4^{2-}$  | SO$_4^{2-}$
Copper sulfate solution

d.c. power supply

What is the name of the process shown in **Figure 6**? [1 mark]

Tick (√) one box.

- Combustion
- Cracking
- Electrolysis
- Hydration

**5 (b) (v)** Explain why copper ions move towards the negative electrode in **Figure 6**. [2 marks]

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
6 This question is about compounds of carbon.

6 (a) Figure 7 shows an atom with two energy levels (shells).

![Figure 7](image)

6 (a) (i) A carbon atom has six electrons.

Complete Figure 7 to show the electronic structure of a carbon atom.

Use x to represent an electron.

[1 mark]

6 (a) (ii) Complete the following description about the central part of this carbon atom.

The central part is made up of six neutrons that have no electrical charge and ________

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

[3 marks]

6 (b) Crude oil is a mixture of compounds. These compounds are mainly hydrocarbons.

What does the term hydrocarbon mean?

[1 mark]

_____________________________________________________________________________________
6 (c) Alkanes and alkenes are hydrocarbons.

Table 2 shows the boiling points of some alkanes and alkenes.

<table>
<thead>
<tr>
<th>Alkanes</th>
<th>Boiling point in °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Formula</td>
</tr>
<tr>
<td>Ethane</td>
<td>C₂H₆</td>
</tr>
<tr>
<td>Propane</td>
<td>C₃H₈</td>
</tr>
<tr>
<td>Butane</td>
<td>C₄H₁₀</td>
</tr>
<tr>
<td>Pentane</td>
<td>C₅H₁₂</td>
</tr>
<tr>
<td>Hexane</td>
<td>C₆H₁₄</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alkenes</th>
<th>Boiling point in °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Formula</td>
</tr>
<tr>
<td>Ethene</td>
<td>C₂H₄</td>
</tr>
<tr>
<td>Propene</td>
<td>C₃H₆</td>
</tr>
<tr>
<td>Butene</td>
<td>C₄H₈</td>
</tr>
<tr>
<td>Pentene</td>
<td>C₅H₁₀</td>
</tr>
<tr>
<td>Hexene</td>
<td>C₆H₁₂</td>
</tr>
</tbody>
</table>

6 (c) (i) Complete the displayed structure of ethane and the displayed structure of ethene.

![Ethane Structure](image)

![Ethene Structure](image)

6 (c) (ii) Describe the relationship between the number of carbon atoms in an alkane molecule and the boiling point of the alkane molecule.

_____________________________________________________________________________________

_____________________________________________________________________________________
6 (c) (iii) Use the information in Table 2 to compare the boiling points of alkanes with the boiling points of alkenes. [2 marks]

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

6 (d) A student used the apparatus in Figure 8 to investigate what happens when liquid paraffin is heated to a high temperature.

**Figure 8**

Liquid paraffin contains alkanes.

Describe what happens to the alkane molecules in this investigation. [3 marks]

_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

Turn over ▶
In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Limestone is heated in a lime kiln to produce calcium oxide.

**Figure 9** shows the reactants used and the products made in a lime kiln.

Use information from **Figure 9** to explain the potential environmental impacts of quarrying, drilling and the thermal decomposition of limestone used in the production of calcium oxide. 

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