AQA

Level 3 Certificate/Extended Certificate
APPLIED SCIENCE

Unit 1 Key Concepts in Science
Section B – Chemistry

Tuesday 21 January 2020   Morning

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.
• Fill in the boxes at the top of this page.
• 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.
• If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
• 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 and Periodic Table.
• 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
TOTAL	

IB/M/Jan20/E7

ASC1/C

Section B – Chemistry

Answer **all** questions in this section.

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0 1 Group 1 sulfates are very soluble in water. This makes group 1 sulfates useful for many industrial applications.

0 1 . 1 What is the name given to the elements in group 1 of the Periodic Table?

[1 mark]

_____

Table 1 shows the solubility of group 1 sulfates.

Table 1

Element	Lithium sulfate	Sodium sulfate	Potassium sulfate	Rubidium sulfate	Caesium sulfate
Solubility in mol / 100 g	2.36×10^{-1}	3.03×10^{-2}	6.91×10^{-2}	1.90×10^{-1}	4.61×10^{-1}

0 1 . 2 Describe the trend in solubility of group 1 sulfates.

Use **Table 1** and the Periodic Table to help you.

[2 marks]

_____

_____

_____

_____

A laboratory technician made sodium sulfate from sulfuric acid using common laboratory reagents.

0 1 . 3 The formula of sodium sulfate is Na_2SO_4.
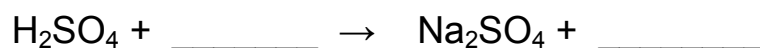
What is the charge on a sulfate ion?

[1 mark]

0 1 . 4 Suggest **one** reagent that could be used in the **safe** production of sodium sulfate from sulfuric acid.

[1 mark]

0 1 . 5 Complete and balance the symbol equation using your suggested reagent in Question **01.4**.

[1 mark]

$$H_2SO_4 + \underline{\hspace{2cm}} \rightarrow Na_2SO_4 + \underline{\hspace{2cm}}$$

0 1 . 6 Sodium, aluminium and chlorine are all elements in period 3.

Which of these elements has the largest atomic radius?

Give **two** reasons for your choice of element.

[3 marks]

Element _____

Reason 1 _____

_____

_____

Reason 2 _____

_____

_____

Question 1 continues on the next page

Turn over ▶

0 1 . 7 Compound **X** contains the elements potassium, manganese and oxygen.

Analysis of compound **X** shows that it contains, by mass:

- 24.7% potassium
- 34.8% manganese
- 40.5% oxygen

Calculate the empirical formula of compound **X**.

[3 marks]

Empirical formula = _____

12

0 2 Properties of substances are determined by the type of bonding and structure present.

0 2 . 1 Graphite is a form of carbon that has many industrial uses.

What is the type of bonding between the carbon atoms in a layer of graphite?

[1 mark]

_____

0 2 . 2 Draw a diagram showing one layer of graphite.

Show at least 10 atoms in your diagram.

[2 marks]

Question 2 continues on the next page

Turn over ►

0 2 . 3 An unknown substance **Y** has the following properties:

- does **not** conduct electricity when solid
- conducts electricity when dissolved in aqueous solution or molten
- high melting point.

Which type of structure and bonding is found in substance **Y**?

Tick (✓) **one** box.

[1 mark]

Giant covalent ☐

Giant ionic ☐

Giant metallic ☐

Simple molecular ☐

4

0 3 The enthalpy of combustion can be calculated using Hess's Law and enthalpies of formation.

0 3 . 1 What is meant by the term enthalpy of combustion?

[2 marks]

Table 2 shows enthalpy of formation data for the combustion of hexane.

Table 2

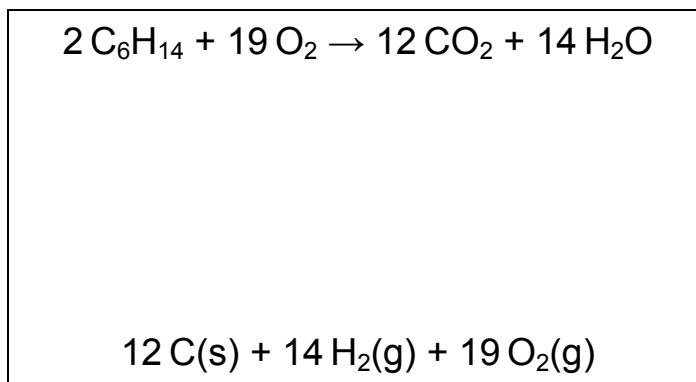|	C_6H_{14}	CO_2	H_2O
Enthalpy of formation / kJmol^{-1}	−198.6	−383.5	−228.6

0 3 . 2 **Figure 1** shows an incomplete Hess's Law cycle for the combustion of hexane.

Complete **Figure 1**.

[1 mark]

Figure 1

$$2\,C_6H_{14} + 19\,O_2 \rightarrow 12\,CO_2 + 14\,H_2O$$

$$12\,C(s) + 14\,H_2(g) + 19\,O_2(g)$$

0 3 . 3 Why is there no enthalpy of formation data for oxygen?

[1 mark]

END OF QUESTIONS

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

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