Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015–2016

Double Award Science: Chemistry

Unit C1
Higher Tier

MV18

[GSD22]

THURSDAY 25 FEBRUARY 2016, MORNING

Time

1 hour, plus your additional time allowance.

Instructions to Candidates

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all seven** questions.

Information for Candidates

The total mark for this paper is 70.
Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **2**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

1 **(a)** Give an accurate definition of the term **solubility**.
[4 marks]

Solubility is _____

_____

_____

_____

The table below gives information on whether some salts are soluble (S) or insoluble (I) in water.

anion / cation	**nitrate**	**carbonate**	**chloride**	**sulfate**
magnesium	S	I	S	S
potassium	S	S	S	S
lead	S	I	I	I
calcium	S	I	S	S
ammonium	S	S	S	S

(b) Use the information in the table to deduce rules for the solubility of salts by completing the following sentences:
[5 marks]

(i) **Cations:** All _____ and

_____ salts are soluble.

Anions: Most sulfates are _____

except for _____.

All **metal** _____ are soluble.

(ii) Predict whether each of the following salts is soluble (S) or insoluble (I) in water. [3 marks]

potassium iodide _____

lead bromide _____

copper nitrate _____

(c) The chemical formula for ammonium sulfate is **$(NH_4)_2SO_4$**.

(i) How many elements are present in ammonium sulfate? [1 mark]

_____

(ii) How many oxygen atoms are present in the formula $(NH_4)_2SO_4$? [1 mark]

_____

(iii) How many atoms are present in the formula $(NH_4)_2SO_4$? [1 mark]

_____

(iv) Give the formula of a molecular ion present in ammonium sulfate. [1 mark]

_____

2 The modern Periodic Table of the elements has been developed over many years. Newlands and Mendeleev were both involved in finding patterns between the elements and Mendeleev prepared the first Periodic Table.

Describe:

- The key feature of the pattern found by Newlands
- Key features of Mendeleev's Periodic Table
- Ways in which the modern Periodic Table differs from the one proposed by Mendeleev [6 marks]

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

3 **(a)** Draw diagrams to show the electronic arrangements for a hydrogen atom and a chlorine atom. **All** electrons should be shown. [2 marks]

hydrogen atom **chlorine atom**

(b) Explain fully, in terms of the electrons, how hydrogen and chlorine combine to form the gas hydrogen chloride. Your answer should include the type of bonding.
[3 marks]

4 Read the information given below about smart phones and then answer the questions that follow. You may find your Data Leaflet helpful.

The screen on a smart phone is made of a mixture of tin oxide and indium oxide. It is transparent and is able to conduct electricity. The glass underneath is made of aluminium oxide and silicon dioxide and is strengthened with potassium ions. The electrical components are made from copper, silver and gold. The wiring is copper.

Nickel is used in the microphone. Some rare elements including neodymium and gadolinium are used in the magnets of the microphone and in the speaker. Magnesium compounds are used to make phone cases. The batteries contain lithium compounds and carbon.

(a) Name one element, from each of the following Groups in the Periodic Table, which is mentioned in the passage: [4 marks]

Group 1 _____

Group 2 _____

Group 3 _____

Group 4 _____

(b) Copper, nickel, silver and gold are all found in the same block or section of the Periodic Table.
What name is given to this block? [1 mark]

_____

(c) Give the chemical **symbol** for an element, mentioned in the passage, which is found in the Lanthanum series of the Periodic Table. [1 mark]

_____

(d) Indium is in the same Group as aluminium. Predict the formula for indium oxide. [1 mark]

_____

(e) Explain fully, in terms of its structure, why copper is a suitable element to use for the wiring of the phone.
[3 marks]

_____

_____

_____

_____

5 Draw dot and cross diagrams to show how **all** the electrons are arranged in the bonding of:

(a) methane CH_4 [3 marks]

(b) carbon dioxide CO_2 [3 marks]

(c) Label a double bond, and a lone pair on the carbon dioxide diagram. [2 marks]

(d) Describe fully in terms of the movement of electrons how magnesium bonds with oxygen. [4 marks]

6 The table below gives information about the salts formed when four metal oxides react with acids.

metal oxide	**acid used**	**formula of cation in salt**	**formula of anion in salt**	**formula of salt produced**
magnesium oxide	sulfuric acid		SO_4^{2-}	$MgSO_4$
	hydrochloric acid	Na^+		NaCl
copper oxide		Cu^{2+}		$CuSO_4$
calcium oxide	nitric acid		NO_3^-	

(a) Complete the table. [4 marks]

(b) Each of these four reactions can be described as neutralisation. Write an ionic equation, including state symbols, for a neutralisation reaction. [3 marks]

_____

(c) **(i)** Write a balanced symbol equation for the reaction of magnesium with hydrochloric acid. [3 marks]

_____

(ii) Describe the test used to identify the gas produced in this reaction. [2 marks]

_____

_____

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(Questions continue overleaf)

7 This question is about the halogens.

An experiment was carried out to compare the reactivity of the elements of Group 7. The elements were added to aqueous solutions of three halides. The results are shown in the table below.

solution / halogen	**sodium chloride**	**sodium bromide**	**sodium iodide**
chlorine	no reaction	reaction and colour change	reaction and colour change
bromine	no reaction	no reaction	reaction and colour change
iodine	no reaction	no reaction	no reaction
X	reaction	reaction and colour change	reaction and colour change

(a) Use your knowledge and the information in the table to answer the following questions.

(i) Which of the four halogens in the table is the most reactive? [1 mark]

_____

(ii) Which halogen in the table is the least reactive? [1 mark]

_____

(iii) Describe and explain the colour changes you would observe when chlorine is added to sodium iodide solution. [3 marks]

(b) Write a balanced symbol equation for the reaction between bromine and sodium iodide. [3 marks]

(c) Predict the name of the halogen **X**. [1 mark]

THIS IS THE END OF THE QUESTION PAPER

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
Total Marks	