Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015

GCSE Chemistry

Unit 1

Foundation Tier

GCH11

[GCH11]
TUESDAY 9 JUNE, AFTERNOON

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in blue or black ink only. **Do not write with a gel pen.**
Answer **all five** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 80.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **2(c)**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

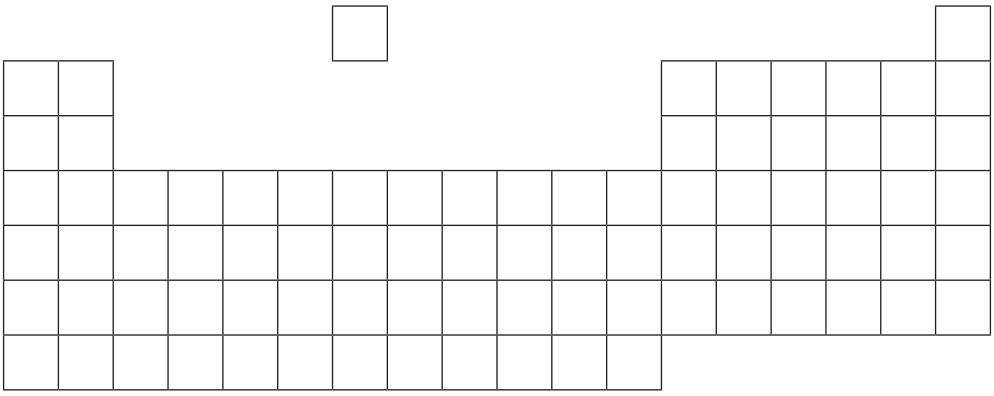
1 The Periodic Table has been developed over many years by several scientists. Each scientist produced a Periodic Table with different characteristics and this eventually led to the Periodic Table we use today.

(a) Complete the table below by adding the name of the scientist.

Characteristic of the Periodic Table	Name of Scientist
Law of octaves	
Spaces for undiscovered elements	

[2]

(b) The diagram below is an outline of the modern Periodic Table.



Using the letters **A–D** show the position of the following elements on the outline of the Periodic Table above. Place each letter in the appropriate box on the outline.

A a gas which burns with a pop

B the least reactive alkali metal

C the element in Period 3 and Group 2

D a metal which is a liquid at room temperature

[4]

(c) The table below shows six elements and the electronic configuration of their atoms. The elements are represented by the letters **P–U** (these are not the symbols of the elements).

Element	Electronic configuration
P	2,6
Q	2,8,1
R	2,8,2
S	2,8,7
T	2,8,8
U	2,8,8,1

Using the letters **P–U**, identify the following elements. Each letter may be used once, more than once or not at all.

(i) two elements in the same Group _____ and _____

(ii) an element in Period 2 _____

(iii) a noble gas _____

(iv) an alkaline earth metal _____

[4]

[Turn over

(d) Iron and sulfur are two elements found in the Periodic Table.

(i) Describe the appearance of sulfur.

_____

_____ [2]

(ii) Describe how you would practically separate a mixture of iron and sulfur.

_____

_____

_____

_____

_____ [2]

(iii) **Name** the compound formed when iron reacts with sulfur.

_____ [1]

2 **(a)** The following balanced symbol equations show reactions of some acids:

Reaction A $Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$

Reaction B $CuO + 2HCl \rightarrow CuCl_2 + H_2O$

Reaction C $Na_2CO_3 + 2HNO_3 \rightarrow 2NaNO_3 + CO_2 + H_2O$

Reaction D $KOH + HCl \rightarrow KCl + H_2O$

In the following questions where a **name** is required, a chemical formula will not be accepted.

(i) **Name** a base from the equations above.

_____ [1]

(ii) **Name** a salt of a transition metal from the equations above.

_____ [1]

(iii) Write a word equation for **Reaction A**.

_____ [2]

(iv) Describe a chemical test for the gas produced in **Reaction C**. Include observations for a positive result.

_____

_____

_____ [3]

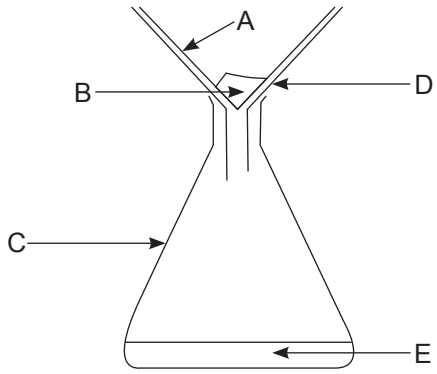
[Turn over

(b) Excess copper(II) carbonate is added to dilute nitric acid to form copper(II) nitrate solution.

(i) Write a balanced symbol equation for the reaction of copper(II) carbonate with nitric acid.

_____ [3]

(ii) Excess copper(II) carbonate is removed using the following apparatus.



Use the labels in the box below to identify A to E from the diagram.

beaker	condenser	conical flask
distillate	filter funnel	filter paper
filtrate	residue	separating funnel

A _____

B _____

C _____

D _____

E _____ [5]

(c) Many cation and anion tests rely on the formation of a precipitate.

Describe the chemical tests used to positively identify:

- the cation
- the anion

present in a sample of **solid** magnesium iodide.

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

[6]

[Turn over

3 **(a)** Whitening toothpastes contain hydrogen peroxide which bleaches teeth.

(i) During the bleaching process the hydrogen peroxide decomposes to produce water and oxygen. Balance the equation for this reaction below.

$$H_2O_2 \rightarrow \quad H_2O + \quad O_2$$

[1]

(ii) The molecular formula of hydrogen peroxide is H_2O_2. What is its empirical formula?

_____ [1]

(b) The table below shows the chemical formula and relative formula mass of other chemicals which can be present in whitening toothpastes.

Substance	Chemical Formula	Relative Formula Mass
Sodium fluoride		
Sodium hydrogen carbonate		84
Hydrated silica	$SiO_2.2H_2O$	
Sodium lauryl sulfate	$CH_3(CH_2)_{11}SO_4Na$	

(i) Complete the table. [5]

(ii) Hydrated silica contains water of crystallisation. What is meant by the term water of crystallisation?

_____

_____

_____ [2]

(iii) Calculate the percentage of water of crystallisation present in hydrated silica.
(Relative atomic masses: H = 1; O = 16; Si = 28).

Percentage of water = _____ % [2]

(iv) How many different types of atoms are present in sodium lauryl sulfate?

_____ [1]

[Turn over

(c) Hydrated aluminium oxide may also be present in whitening toothpastes. In an experiment, hydrated aluminium oxide was heated to remove all of the water of crystallisation.

When 3.12 g of hydrated aluminium oxide were heated, 2.04 g of anhydrous aluminium oxide (Al_2O_3) remained.

(Relative atomic masses: H = 1; O = 16; Al = 27)

(i) Calculate the mass of water in 3.12 g of hydrated aluminium oxide.

_____ g [1]

(ii) Calculate the number of moles of water in 3.12 g of hydrated aluminium oxide.

_____ mol [2]

(iii) Calculate the number of moles of anhydrous aluminium oxide.

_____ mol [2]

4 Many substances are very soluble in water and are said to have high solubility.

(a) What is meant by the term solubility?

_____

_____

_____

_____

_____ [4]

(b) Use your Data Leaflet to determine if the substances given in the table below are soluble or insoluble in water. Place one tick (✓) in each row. The first substance has been completed for you.

Substance	Soluble	Insoluble
Sodium chloride	✓	
Lead sulfate		
Potassium carbonate		
Ammonium nitrate		
Calcium carbonate		

[4]

[Turn over

(c) The table below shows how the solubility of some solids and some gases varies with temperature.

Temperature (°C) / Substance	20	30	40	50	60
Sodium chloride	35.9	36.1	36.4	36.7	37.0
Potassium iodide	144	153	162	169	176
Oxygen	0.0043	0.0036	0.0031	0.0027	0.0023
Carbon dioxide	0.150	0.125	0.059	0.055	0.052

Use the information in the table to answer the following questions.

(i) Name the gases from the table above.

_____ [1]

(ii) State the effect of increasing temperature on the solubility of a gas.

_____ [1]

(iii) State the effect of increasing temperature on the solubility of a solid.

_____ [1]

(iv) Which substance has the lowest solubility at 40 °C?

_____ [1]

(v) Which substance is most soluble at 20 °C?

_____ [1]

5 The symbol for the element magnesium as it appears in the Periodic Table is shown below:

$$^{24}_{12}\mathrm{Mg}$$

(a) (i) The atomic number of magnesium is 12. Explain what you understand by the term atomic number.

_____

_____ [1]

(ii) The mass number of magnesium is 24. Explain what you understand by the term mass number.

_____

_____

_____ [1]

(iii) Complete the table below to give information about the particles present in the nucleus of a magnesium atom.

Name of particle	Relative Mass	Relative Charge
	1	0
		+1

[2]

[Turn over

(b) Magnesium and chlorine react together to form the ionic compound magnesium chloride.

(i) Write the formula for magnesium chloride.

_____ [1]

(ii) Using **dot and cross** diagrams explain how magnesium chloride is formed from atoms of magnesium and chlorine.
Include the charge on each ion.

_____

_____ [6]

(iii) Magnesium chloride is a white crystalline solid at room temperature with a melting point of 714 °C. State two other physical properties of magnesium chloride.

1. _____

_____

2. _____

_____ [2]

(iv) Name one other compound with similar bonding and physical properties to magnesium chloride.

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

DO NOT WRITE ON THIS PAGE

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

Examiner Number