Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2014

Double Award Science: Chemistry

Unit C2

Foundation Tier

[GSD51]

MV18

TUESDAY 10 JUNE 2014, AFTERNOON

TIME

1 hour 15 minutes, 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 nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 90.
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 **4(b)**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

1 **(a)** This part of the question is about oxidation. Complete the sentences below by choosing from the words in the list.

hydrogen	**nitrogen**	**oxygen**
rusting	**neutralisation**	**reduction**

(i) Oxidation is the addition of _____ to a substance, or the removal of _____ from a substance. [2 marks]

(ii) The reverse of oxidation is called _____ [1 mark]

(b) Below are 5 chemical equations. Tick (✓) the **three** equations which represent oxidation reactions. [3 marks]

$NaOH + HCl \rightarrow NaCl + H_2O$ ☐

$2Cu + O_2 \rightarrow 2CuO$ ☐

$CuCO_3 \rightarrow CuO + CO_2$ ☐

$2HI \rightarrow H_2 + I_2$ ☐

$CuS + O_2 \rightarrow Cu + SO_2$ ☐

2 **(a)** The element oxygen is a gas.

Give two **other** physical properties of oxygen. [2 marks]

1. _____

2. _____

(b) Give two uses of oxygen gas. [2 marks]

1. _____

2. _____

(c) Oxygen is a reactive element which reacts with both metals and non-metals such as magnesium and sulfur. [8 marks]

Complete the table below.

Element	Colour of element	Colour of flame during heating with oxygen	Description of product
sulfur	[1]	[1]	[2]
magnesium	[1]	[1]	[2]

3 **(a)** This part of the question is about the burning of coal or carbon.

When coal burns in an efficient fire, carbon dioxide gas is produced. Sometimes a faulty fire can produce a lot of carbon monoxide gas.

(i) Why is carbon monoxide gas very dangerous? [2 marks]

_____

_____

(ii) What causes carbon monoxide to be formed in a faulty fire? [1 mark]

_____

(b) This part of the question is about the properties and uses of carbon dioxide.

(i) Listed below are some properties of gases. Circle **two** of those properties which apply to carbon dioxide gas. [2 marks]

colourless **pungent smell** **denser than air**

burns **insoluble in water**

(ii) Give a reason why carbon dioxide is used in fizzy drinks. [1 mark]

_____

(iii) Give two **other** uses of carbon dioxide. [2 marks]

1. _____

2. _____

(c) Burning coal and other fossil fuels has led to increased levels of carbon dioxide in the atmosphere.

(i) What name is given to the effect of increased levels of carbon dioxide in the atmosphere? [1 mark]

_____ effect

(ii) Give two ways in which the increasing levels of carbon dioxide in the atmosphere are changing our planet. [2 marks]

1. _____

_____

2. _____

_____

4 **(a)** A teacher demonstrated the reaction of zinc with dilute sulfuric acid. The acid was in a beaker and the teacher added some large zinc granules to the beaker. The reaction was very slow.
Give three things the teacher could do to help speed up the reaction. [3 marks]

1. _____

2. _____

3. _____

(b) The reaction between dilute hydrochloric acid and marble chips is given in the equation below:

$$CaCO_{3(s)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$$

Plan a method to study the rate of reaction between dilute hydrochloric acid and marble chips.

You should give clear details of how you would carry out your investigation, including a description of what results you will need to record. Explain how you would use your results. [6 marks]

You will be assessed on your written communication skills including the use of specialist scientific terms.

_____

_____

_____

_____

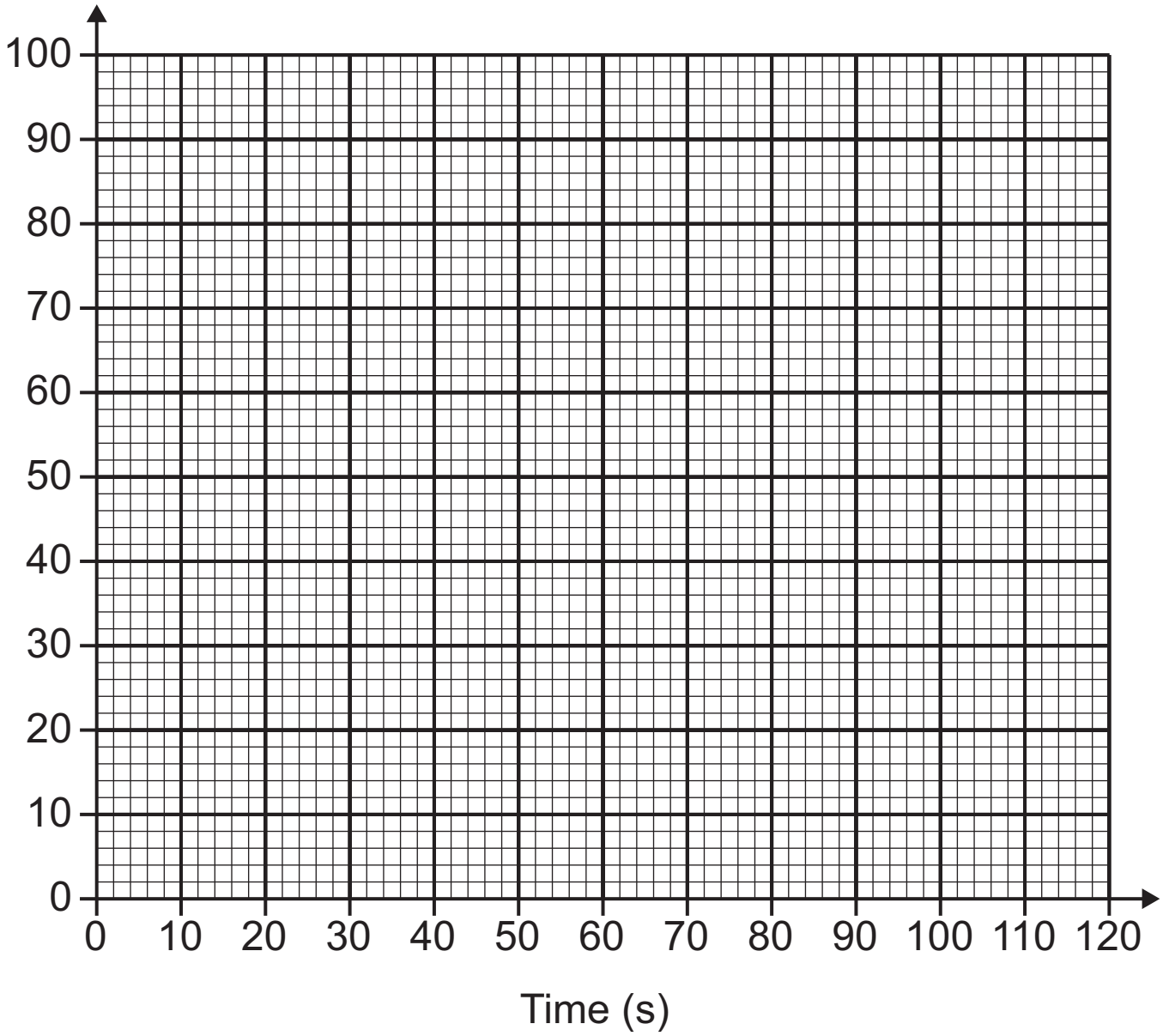
_____

(c) Magnesium ribbon reacts with dilute hydrochloric acid to produce hydrogen gas. A student measured the volume of gas produced over a period of time. The results are shown in the table below.

Volume of H_2 gas (cm^3)	0	23	40	58	71	75	78	80	80
Time (s)	0	10	20	40	60	70	80	90	100

(i) Label the y-axis on the grid opposite. [1 mark]

(ii) Use the grid opposite to plot a curve showing the results of the experiment. [3 marks]



(iii) At what time did the reaction stop? [1 mark]

_____

(iv) From your graph, how long did it take for 50 cm^3 of hydrogen to be formed? [1 mark]

_____

5 **(a)** To find the order of the reactivity of copper, nickel and zinc, a small amount of each metal was placed into a test tube containing a solution of a salt of one of the other metals. For example, when some copper was added to a test tube containing nickel nitrate solution there was no reaction.

The table below illustrates the results for the whole investigation.

metal / salt solution	copper	nickel	zinc
copper(II) sulfate		reaction	reaction
nickel nitrate	no reaction		reaction
zinc chloride	no reaction	no reaction	

(i) From the table, work out the order of reactivity of these three metals from most to least reactive. [2 marks]

Most reactive _____

_____

_____

Least reactive

(ii) Why could a similar type of investigation **not** be used to find the order of reactivity of calcium, potassium and sodium? [1 mark]

_____

(iii) Describe the colour change, in the solution, when zinc reacts with the copper sulfate solution. [2 marks]

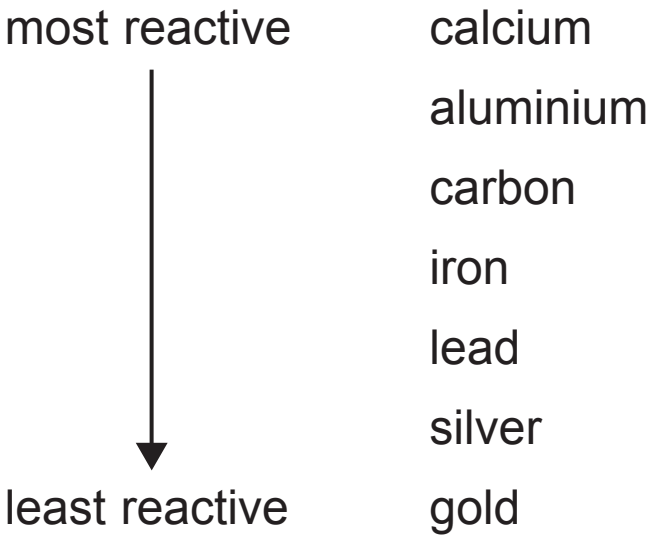
from _____ to _____

(iv) Zinc can be obtained in the laboratory from zinc chloride solution by displacement with metal X.

Name a metal which could be used as metal X. [1 mark]

_____

(b) The method of extraction of a metal from its ore depends on the position of the metal in the reactivity series. The order of reactivity of some metals and of carbon is given below. Use this order of reactivity to help you answer the question.



(i) Which one of the metals in the list above is most likely to be found in the ground as the pure metal? [1 mark]

_____

(ii) Name one of the metals in the list which will need to be extracted from its ore by electrolysis. [1 mark]

_____

(iii) Name one of the metals in the list which could be extracted from its ore by chemical reduction with carbon or carbon monoxide. [1 mark]

_____

6 **(a)** Calculate the relative formula mass of each of the following substances.

(Relative atomic masses: H = 1, N = 14, O = 16, Na = 23, S = 32, Ca = 40)

(i) sodium nitrate $NaNO_3$ [1 mark]

_____

(ii) sulfuric acid H_2SO_4 [1 mark]

_____

(iii) calcium hydroxide $Ca(OH)_2$ [1 mark]

_____

(b) What is meant by one mole of a substance? [2 marks]

_____

_____

_____

(c) The compound Fe_2O_3 has a relative formula mass of 160. [1 mark]

(i) How many moles are there in 80 g of Fe_2O_3?

Answer _____ moles

(ii) How many moles are there in 8 tonnes of Fe_2O_3? [2 marks]
(1 tonne **=** 1000 kg)

Answer _____ moles

7 **(a)** This part of the question is about the heating of solid calcium carbonate.

(i) Complete the word equation for this reaction. [2 marks]

calcium carbonate $\xrightarrow{\text{heat}}$ **+**

(ii) The reaction in part **(i)** is an example of an endothermic change. Which one of the following statements describes an endothermic reaction? Tick (✓) the correct statement. [1 mark]

Gives out heat energy to the surroundings ☐

Takes in heat energy from the surroundings ☐

No change in energy during reaction ☐

(iii) Circle the term below which best describes the type of reaction which occurs when calcium carbonate is heated. [1 mark]

thermal cracking **displacement** **neutralisation**

thermal decomposition **photosynthesis**

(b) Temporary hard water is found in limestone regions.

Explain how water in limestone regions becomes hard. [4 marks]

(c) During the first billion years of the Earth's existence, there was intense volcanic activity which released gases that formed the early atmosphere. The early atmosphere contained over 90**%** carbon dioxide, 5**%** nitrogen, 3**%** sulfur dioxide and traces of hydrogen sulfide, ammonia and methane, but no oxygen. It was hot, smelly and deadly poisonous.

(i) What is the **difference** in percentage composition of nitrogen gas found in the atmosphere today compared to its composition in the early atmosphere? [1 mark]

(ii) One theory suggests that the early atmosphere changed as living organisms evolved. State two ways that the carbon dioxide could have been removed from the early atmosphere. [2 marks]

1. _____

_____

2. _____

_____

8 **(a)** This part of the question is about the physical properties and uses of nitrogen gas.

(i) From the list below tick (✓) the **two** physical properties of nitrogen gas. [2 marks]

very soluble in water	☐
pale green coloured	☐
colourless	☐
odourless	☐
sweet smelling	☐

(ii) Nitrogen is used in the manufacture of ammonia. Give one other use of nitrogen. [1 mark]

_____

(b) Ammonia gas is manufactured in the Haber Process by reacting hydrogen with nitrogen:

$N_2 + 3H_2 \rightleftharpoons 2NH_3$

(i) Complete the table below to give the conditions needed for this reaction to occur. Include units where appropriate. [3 marks]

temperature	
catalyst	
pressure	

(ii) Give two uses of ammonia. [2 marks]

1. _____

2. _____

9 **(a)** Ethene is a member of the alkene homologous series. Its molecular formula is C_2H_4.

(i) Give the name and molecular formula of one other alkene.

Name [1 mark] _____

Molecular formula [1 mark] _____

(ii) When hydrocarbons, such as ethene are completely burnt in air (oxygen) what two compounds are always formed? [2 marks]

_____ and _____

(iii) Ethene molecules are able to join together to make a very long chain molecule, called a polymer. What is the name of the polymer formed from ethene? [1 mark]

_____

(iv) Many polymers, such as those used to make plastic bottles, are non-biodegradable. Give two disadvantages of disposing of polymers in landfill sites.

1. [1 mark] _____

2. [1 mark] _____

(b) (i) Ethanol is used in alcoholic drinks. Give one other use of ethanol. [1 mark]

_____

(ii) Drinking alcohol, in large quantities or over a long period of time, can have harmful effects. Describe two harmful effects which can arise from drinking alcohol. [2 marks]

1. _____

_____

2. _____

_____

THIS IS THE END OF THE QUESTION PAPER

For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	