Rewarding Learning

Centre Number

71

Candidate Number

General Certificate of Secondary Education
2013

Double Award Science: Chemistry

Unit C2

Higher Tier

[GSD52]

MV18

MONDAY 10 JUNE 2013, AFTERNOON

TIME

1 hour 15 minutes, plus your additional time allowance.

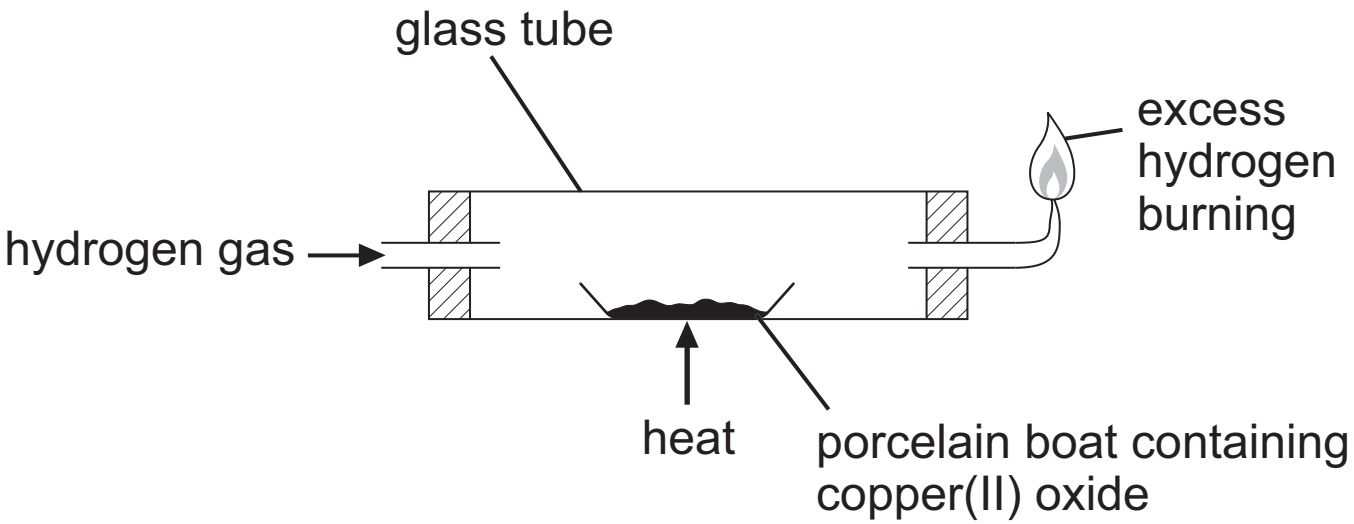
INSTRUCTIONS TO CANDIDATES

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 Questions **2** and **5(a)**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

1 The reaction between hydrogen gas and copper(II) oxide can be carried out using the apparatus shown below.



(i) What colour change takes place during this reaction? [2]

from _____ to _____

(ii) Complete the word equation for the reaction. [2]

copper(II) oxide + hydrogen → +

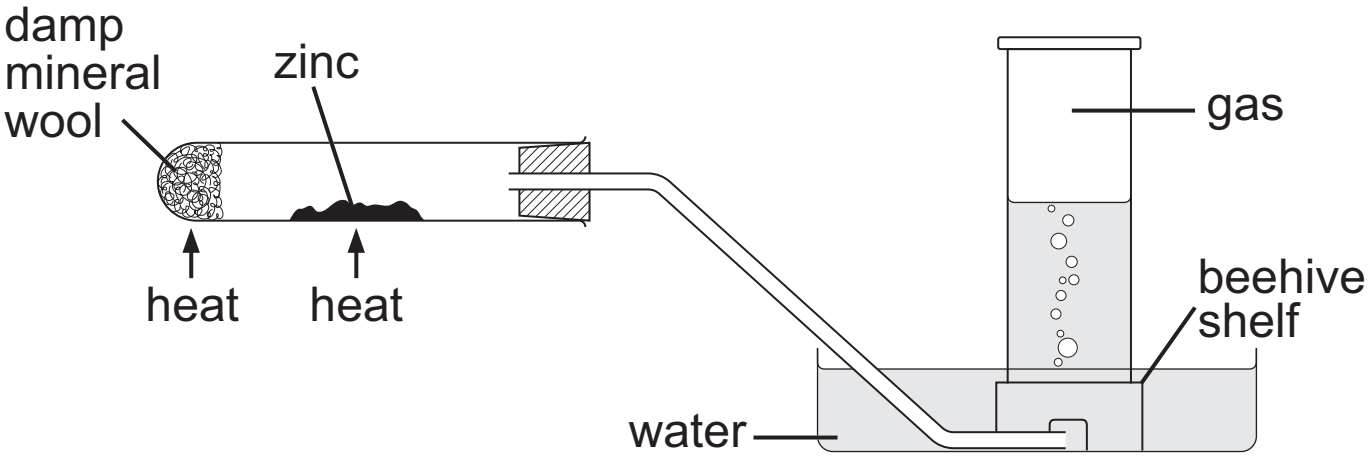
2 Limestone is mined from a quarry near Larne, Co. Antrim. The limestone is blasted from the quarry rock and it is then taken by dumper truck and fed into a crushing plant. Heavy lorries then carry the crushed limestone to the port of Larne and various parts of Northern Ireland.

Describe the advantages and disadvantages to the people of Larne of having a limestone quarry near their town. [6]

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

3 **(a)** Zinc does not react with cold water, but does react with steam.

The diagram below shows the apparatus used to react zinc with steam and to collect the gas produced.



(i) What gas is produced when zinc reacts with steam? [1]

_____

(ii) Why is the damp mineral wool heated? [1]

_____

(iii) What colour is the solid product formed from zinc in this reaction? [1]

_____

(iv) Name a metal, other than zinc, which will react with steam but not with cold water. [1]

_____

(b) Magnesium is a Group 2 metal.

(i) Give two observations made when magnesium is burned in air. [2]

1. _____

_____

2. _____

_____

(ii) Complete and balance the symbol equation for the reaction of magnesium with air. [2]

$Mg + O_2 \longrightarrow$

4 This question is about carbon dioxide and the gases in the Earth's atmosphere.

(a) The atmosphere contains about 0.04% carbon dioxide gas. Complete the table below by adding the two most abundant gases in the atmosphere and their approximate proportions. [4]

Gas	**Approximate proportion in the atmosphere**
carbon dioxide	about 0.04%

(b) The table below shows how the level of carbon dioxide in the Earth's atmosphere has changed over the last 150 years. The table also shows the change in average global temperature in the same time span.

Year	**1750**	**1800**	**1850**	**1900**	**1950**	**2000**
concentration of CO_2 in atmosphere/ % by volume	0.027	0.028	0.029	0.030	0.032	0.037
average global temperature/°C	13.3	13.4	13.5	13.6	13.8	14.4

(i) Use the information in the table to describe the pattern of change in carbon dioxide levels in the atmosphere between 1750 and 2000. [2]

(ii) What is the relationship between the level of carbon dioxide in the atmosphere and average global temperature? [1]

_____

_____

(iii) Give one reason for the changing amounts of carbon dioxide in the atmosphere. [1]

_____

_____

(iv) Give one way in which our planet is affected by global warming. [1]

_____

_____

(c) Carbon dioxide is used to make fizzy drinks and can be tested for in the laboratory using limewater solution.

(i) Give one physical property which makes carbon dioxide suitable for use in fizzy drinks. [1]

_____

(ii) What is the name of the substance formed when carbon dioxide dissolves in water? [1]

_____

(iii) What would be observed when carbon dioxide gas is bubbled through limewater solution? [2]

_____

_____

_____

(iv) What would be observed if you continued to bubble carbon dioxide gas through limewater solution? [1]

_____

_____

5 Town A has a hard water supply and town B has a soft water supply.
You are provided with two samples of water, one from town A and the other from town B.

(a) Explain what is meant by hard water and describe a **fair** test you could carry out to find which is the hard water sample. [6]

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

(b) The water in town A is hard water.

(i) Name an ion which causes water to be hard. [1]

_____

(ii) Why is hard water thought to be good for your health? [1]

_____

_____

(iii) Name one industry which benefits from hard water. [1]

_____

(iv) Why could it be less expensive to live in town B, where the water is soft, rather than town A? [2]

_____

_____

_____

_____

_____

_____

(c) The water in town C is temporary hard water

(i) Name a compound that causes temporary hard water. [1]

_____

(ii) Explain, **in terms of ions present**, how temporary hard water can be softened by boiling. [4]

_____

_____

_____

_____

_____

_____

_____

_____

_____

6 The Haber Process is used in the manufacture of ammonia and it involves a reversible reaction.

(a) What do you understand by the term **reversible reaction**? [2]

(b) Write a balanced symbol equation to show the important reversible reaction in the Haber Process. [4]

(c) Name the catalyst used in the Haber Process. [1]

7 When zinc metal reacts with hydrochloric acid the mixture fizzes as hydrogen gas is given off. The reaction can be speeded up by increasing the concentration of the hydrochloric acid or by heating the reaction mixture.

(a) Use the collision theory to explain how increasing the concentration of the hydrochloric acid increases the rate of the reaction. [2]

(b) Use the collision theory to explain how increasing the temperature of the reaction mixture increases the rate of reaction. [3]

8 This question is about relative atomic mass, relative formula masses and using mole calculations.

(a) What do you understand by the relative atomic mass of an atom? [3]

_____

_____

_____

_____

(b) Barium sulfate can be produced by reacting barium nitrate with excess sodium sulfate.

$Ba(NO_3)_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaNO_3$

(i) Calculate the relative formula mass of barium sulfate. [1]
(Ba = 137; S = 32; O = 16)

Answer _____

(ii) Calculate the relative formula mass of barium nitrate. [1]
(Ba = 137; N = 14; O = 16)

Answer _____

(iii) Calculate the number of moles of barium nitrate in 13.05 g of the compound. [1]

Answer _____ mole

(iv) Use your answer to **(b)(i)** and **(b)(iii)** and the equation:

$$Ba(NO_3)_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaNO_3$$

to calculate the maximum mass of barium sulfate that can be obtained from 13.05 g of barium nitrate. [1]

Answer _____ g

(c) A solution of dilute sodium hydroxide is described as 2.0 mol/dm^3.

(i) What does 2.0 mol/dm^3 mean? [2]

_____

_____

(ii) How much water must be added to 100 cm^3 of 2.0 mol/dm^3 sodium hydroxide to make a 1.0 mol/dm^3 solution? [1]

_____

9 **(a)** Natural gas is an important fossil fuel that is found in refinery gases. It is described as a non-renewable fuel.

(i) What is a **fossil fuel**? [1]

_____

_____

(ii) What element is present in all fossil fuels? [1]

_____

(iii) Natural gas is described as **non-renewable**. What does this mean? [1]

_____

_____

(b) Ethanol is a renewable fuel. It is produced from food crops. Distillation is needed in the manufacture of ethanol. Burning ethanol produces less carbon dioxide than burning natural gas but ethanol is more expensive to produce than natural gas.

(i) Suggest one reason why ethanol is used as a fuel. [1]

_____

_____

(ii) Suggest one reason why there could be concerns about replacing natural gas with ethanol as a fuel. [1]

_____

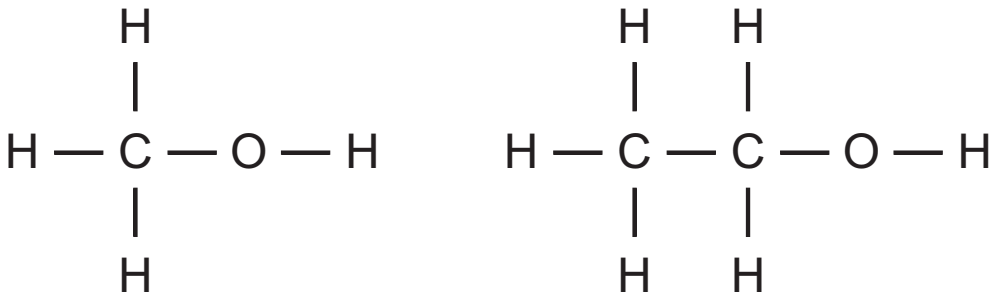
_____

(iii) Why is hydrogen considered to be a “cleaner” fuel than either ethanol or natural gas? [1]

_____

_____

(c) The structural formula for the first two members of the alcohol homologous series are given below:



(i) Give the general formula of the alcohol homologous series. [1]

_____

(ii) What is the functional group of the alcohol homologous series? [1]

_____

(iii) Write out the molecular formula of ethanol. [1]

_____

(d) Ethanol can be prepared from the reaction of ethene with steam.
Write a balanced symbol equation for this reaction. [2]

_____

(e) (i) Methanol and ethanol can be used as fuels.
Write a balanced symbol equation for the combustion of methanol in a plentiful supply of air. [3]

(ii) When alcohols are burned in a limited supply of air another product is formed. Name this product. [1]

(f) The alkane hexane and the alkene hexene are both colourless liquids.
Describe a chemical test you could carry out on each of these liquids to determine which one is the alkene.
[2]/[2]/[1]

Test

Expected result with hexene:

Expected result with hexane:

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	