Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2017

GCSE Chemistry

Unit 2

Foundation Tier

GCH21

[GCH21]

WEDNESDAY 21 JUNE, MORNING

TIME

1 hour 30 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 black ink only. **Do not write with a gel pen.**
Answer **all six** questions.

INFORMATION FOR CANDIDATES

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

1 Chemistry involves the study of materials.

(a) Materials may be classified as natural or synthetic. Complete the table below by placing a tick (✔) in the correct column for each material.

Material	Natural	Synthetic
Wool		
Glass		
PVC		

[3]

(b) Materials are obtained from a range of sources. Complete the table giving the source of each material. Choose the source from the list below.

Earth Sea Air Living things Crude oil

Material	Source
Nitrogen	
Sodium chloride	
Polythene	

[3]

(c) Iron ore is an important raw material. Iron ore is mainly iron(III) oxide. Iron is extracted from its ore using carbon monoxide.

(i) State the common name for the ore from which iron is extracted.

_____ [1]

(ii) Write a balanced symbol equation for the reaction of iron(III) oxide with carbon monoxide to produce iron.

_____ [3]

(iii) State the type of reaction which is occurring between iron(III) oxide and carbon monoxide.

_____ [1]

(d) Complete the following passage.

Aluminium metal is extracted from its ore which is called _____ using electrolysis. The ore is first purified and then dissolved in molten cryolite. This lowers the melting point and also increases its _____. The electrodes are made of _____. During the electrolysis the positive ions are attracted to the _____ where they gain _____ to form aluminium atoms. [5]

[Turn over

2 Crude oil is a very valuable resource. When it is extracted from the Earth's crust, it is taken to an oil refinery where it is separated into useful components using fractional distillation. The separated components are hydrocarbons.

(a) (i) Explain, in detail, how crude oil is separated by fractional distillation.

_____

_____

_____

_____

_____ [3]

(ii) Explain the meaning of the term hydrocarbon.

_____

_____ [1]

(b) Many of the hydrocarbons obtained from crude oil are used as fuels.

(i) Write a balanced symbol equation for the complete combustion of propane.

_____ [3]

(ii) Name one other hydrocarbon which is used as a fuel.

_____ [1]

(c) Organic compounds are grouped into homologous series. Alkenes are a homologous series of hydrocarbons.

(i) What is meant by the term homologous series?

_____

_____

_____

_____

_____ [3]

(ii) Complete the table.

Name	Molecular formula	Physical state at room temperature
ethene		gas
	C_3H_6	

[3]

[Turn over

3 The rate of a chemical reaction is affected by several factors including the concentration of the reactants.

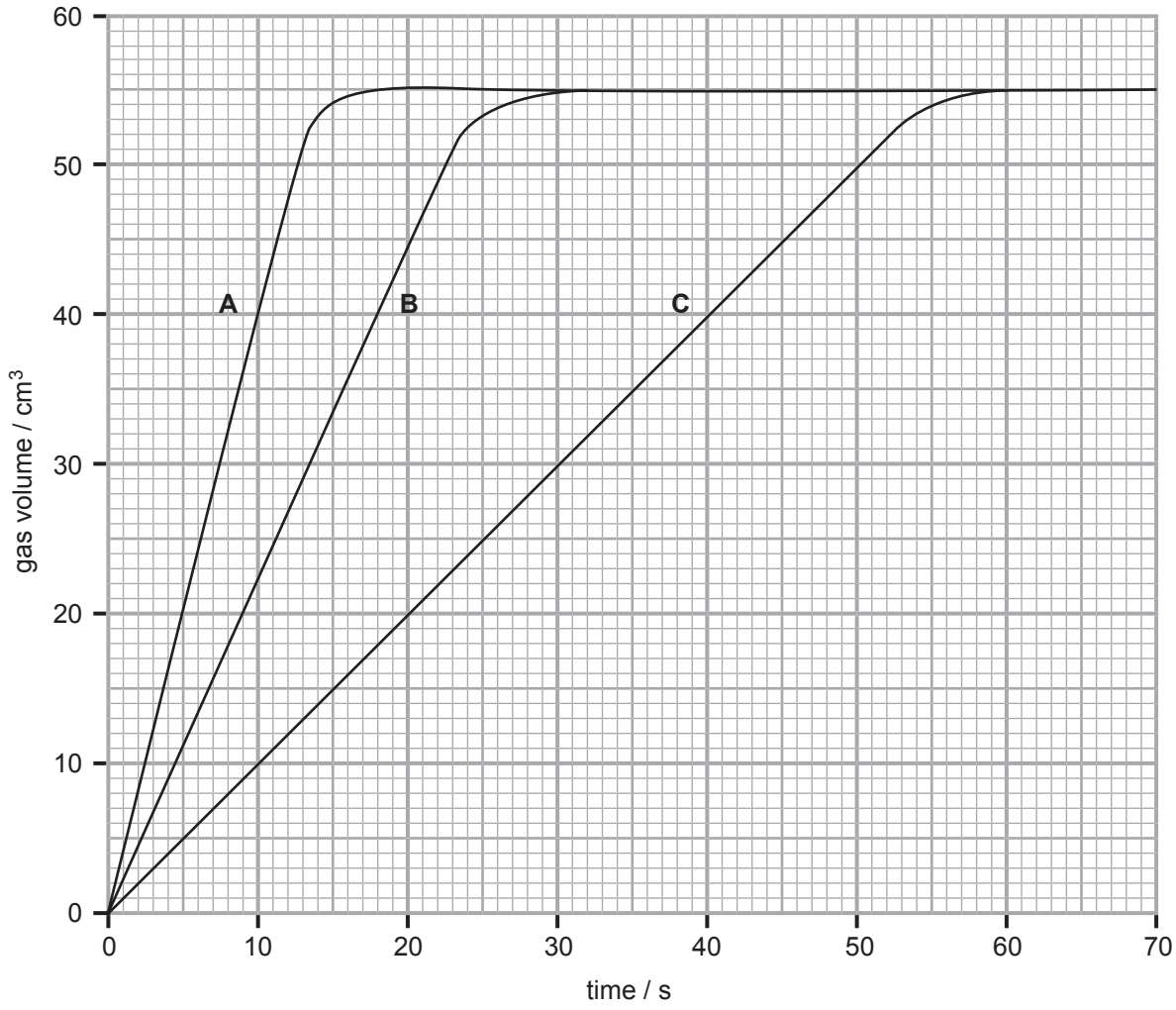
(a) State three **other** factors which affect the rate of a chemical reaction.

1. _____

2. _____

3. _____ [3]

(b) To investigate the effect of concentration of acid on the rate of reaction, a student reacted a 0.055 g strip of magnesium ribbon with solutions of hydrochloric acid of three different concentrations (0.5, 1.0 and 1.5 mol/dm^3). All reactions were carried out at room temperature. The results obtained are shown on the graph below.



10555

(i) Write a balanced symbol equation for the reaction of magnesium with hydrochloric acid.

_____ [3]

(ii) State and explain which line (A, B or C) was obtained using 1.5 mol/dm^3 hydrochloric acid.

Line _____

_____

_____

_____

_____ [3]

(iii) The student repeated the experiment using hydrochloric acid of concentration 2.0 mol/dm^3. **Sketch** a line on the same axes to represent the results obtained and label this curve D. [3]

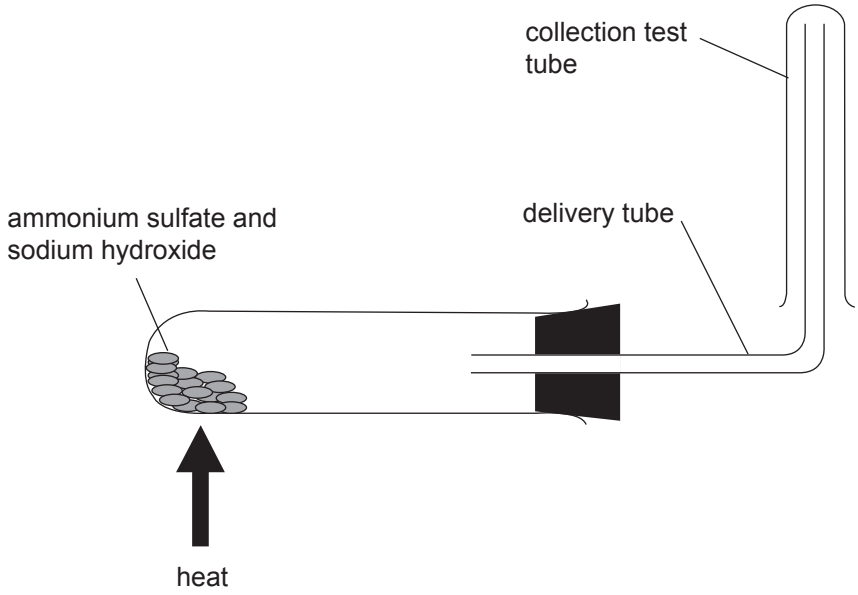
(iv) At what time did the reaction finish when 0.5 mol/dm^3 hydrochloric acid was used?

_____ [1]

[Turn over

4 Ammonia is an important chemical in the production of explosives and fertilisers. The Haber process is used to produce ammonia industrially.

(a) Ammonia can be prepared in the laboratory by the reaction of an ammonium compound with an alkali using the apparatus shown below.



State two physical properties of ammonia gas.

1. _____

2. _____ [2]

(b) Nitrogen reacts with hydrogen in the Haber process according to the equation:

$$N_2 + 3H_2 \rightarrow 2NH_3$$

(i) Explain why nitrogen is described as being reduced in this reaction.

_____

_____

_____ [2]

(ii) Describe the test for hydrogen gas.

_____

_____ [2]

(iii) Describe the test used to identify ammonia gas.

_____

_____

_____

_____

_____

_____ [3]

[Turn over

(c) Ammonia reacts with oxygen producing nitrogen and water.

(i) The unbalanced equation is given below. Balance this equation.

$$NH_3 \quad + \quad O_2 \quad \rightarrow \quad N_2 \quad + \quad H_2O$$

[1]

(ii) Explain why nitrogen gas is used in food packaging.

_____

_____ [1]

(iii) State one other use of nitrogen gas.

_____ [1]

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(Questions continue overleaf)

[Turn over

5 Copper is a transition metal and it forms many coloured compounds.

(a) Copper reacts when heated in air.

(i) Write a balanced symbol equation for the reaction which occurs when copper is heated in air.

_____ [3]

(ii) Name two pieces of apparatus used to heat a piece of copper foil in the laboratory.

1. _____

2. _____ [2]

(iii) What is the percentage of oxygen present in the air?

_____ [1]

(b) Copper(II) carbonate decomposes when heated.

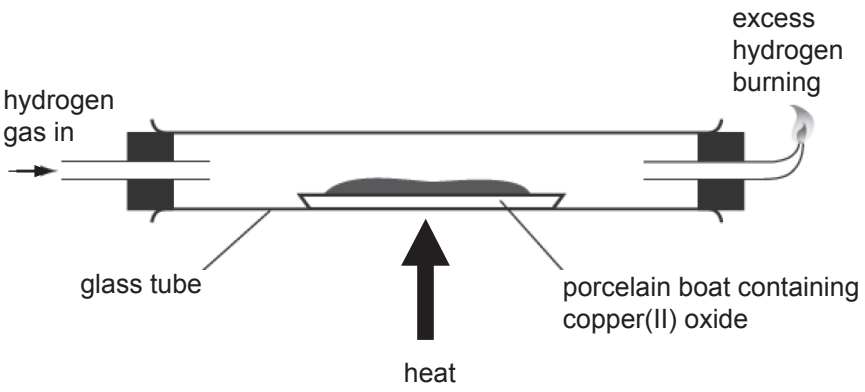
(i) What colour change is observed in this reaction?

From _____ to _____ [2]

(ii) Write a balanced symbol equation for the decomposition of copper(II) carbonate on heating.

_____ [2]

(c) Copper(II) oxide is heated in a stream of hydrogen using the apparatus shown in the diagram below.



(i) Complete the paragraph below, using the words in the box. Each word may be used once, more than once or not at all.

reduced	carbon dioxide	hydrogen	copper(II) carbonate
oxidised	copper	water	oxygen

Copper(II) oxide is _____ using hydrogen gas. The products of the reaction are _____ and _____. [3]

(ii) Write a word equation for the burning of the excess hydrogen gas.

_____ [1]

[Turn over

(d) Carbon can reduce hot copper(II) oxide to copper. The equation for the reaction is:

$$2CuO + C \rightarrow CO_2 + 2Cu$$

Explain, in terms of oxygen content, why this reaction is described as a redox reaction. State the colour change which occurs during this reaction.

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

[6]

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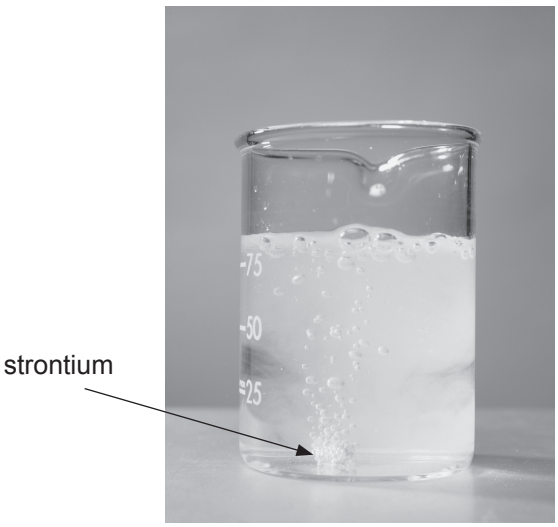
(Questions continue overleaf)

[Turn over

6 Strontium is a typical Group 2 metal. It is toxic to humans in low doses.

(a) The photograph below shows the vigorous reaction of strontium with water.



© Andrew Lambert Photography / Science Photo Library

(i) Write a balanced symbol equation for the reaction of strontium with water.

_____ [3]

(ii) **Compare** the observations made when strontium reacts with water with the observations made when potassium reacts with water.

_____

_____

_____

_____

_____

_____ [3]

(b) The table below shows if a displacement occurs (✓) when a metal is added to a solution of a metal ion.

metal ion solution / metal	Strontium nitrate	Calcium nitrate	Cadmium(II) nitrate	Copper(II) nitrate	Iron(II) nitrate	Silver nitrate
Strontium		✓	✓	✓	✓	✓
Calcium	×		✓	✓	✓	✓
Cadmium	×	×		✓	×	✓
Copper	×	×	×		×	✓
Iron	×	×	✓	✓		✓
Silver	×	×	×	×	×	

(i) Write a balanced symbol equation for the reaction between strontium and silver nitrate.

_____ [3]

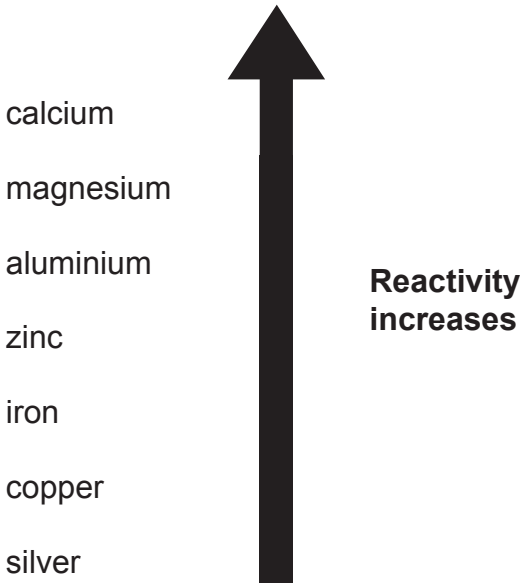
(ii) Name the products when calcium reacts with cadmium(II) nitrate solution.

_____

_____ [2]

[Turn over

(iii) On the reactivity series below indicate the position of strontium and cadmium clearly using the information from the reactions in **(b)**.



[2]

(c) A barium meal medical test uses a compound of another Group 2 metal, barium. This compound allows soft tissues like the stomach and upper intestine to be X-rayed.

(i) Name the barium compound used.

_____ [1]

(ii) State why this compound is used despite the toxicity of barium compounds.

_____

_____ [1]

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

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