CCEA GCSE CHEMISTRY (2003 SPECIFICATION)

CHEMISTRY



EXAM QUESTION PACK

PAPER 2 FOUNDATION TIER G1402 PAPERS

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2012

Science: Chemistry

Paper 2
Foundation Tier

[G1402]

FRIDAY 22 JUNE, AFTERNOON

G1402

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.
Write your answers in the spaces provided in this question paper.
Answer **all six** questions.

INFORMATION FOR CANDIDATES

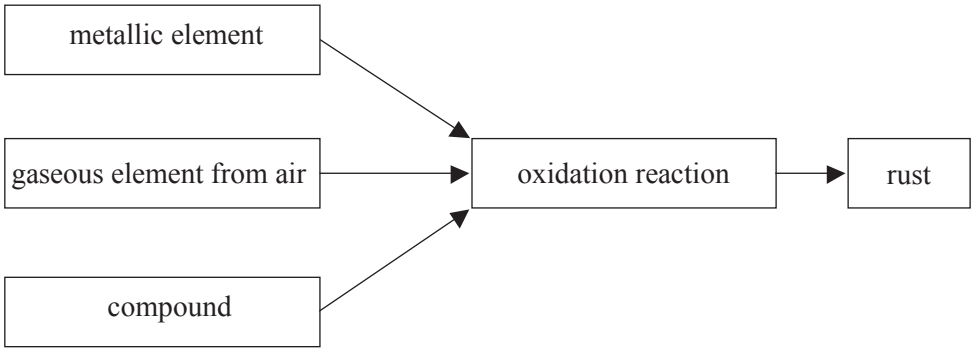
The total mark for this paper is 120.
Quality of written communication will be assessed in question **5(d)(iii)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Data Leaflet which includes a Periodic Table of the Elements is provided.

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

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Examiner Only	
Marks	Remark

1 **(a)** The formation of rust is described as an oxidation reaction. The flow chart below shows the formation of rust during which a metallic element reacts with a gaseous element from the air and a compound.



(i) Name the metallic element which reacts to form rust.

_____ [1]

(ii) Name the gaseous element from the air which is required for the formation of rust.

_____ [1]

(iii) Name the compound which is required for the formation of rust.

_____ [1]

(iv) Explain what is meant by oxidation.

_____

_____ [1]

(v) Describe the appearance of rust.

_____

_____ [2]

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Examiner Only	
Marks	Remark

(b) The reaction of chlorine with hydrogen may be described as both an exothermic reaction and as a reduction.

chlorine + hydrogen → hydrogen chloride

(i) Write a balanced symbol equation for the reaction of chlorine with hydrogen.

_____ [3]

(ii) Explain why chlorine is described as being reduced in this reaction.

_____

_____

_____ [2]

(iii) Describe the colour of the reactants in this reaction.

chlorine _____

hydrogen _____ [2]

(iv) What is meant by the term exothermic?

_____

_____ [1]

(c) Copper(II) carbonate breaks down on heating in an endothermic reaction.

(i) What term is used to describe a reaction in which a substance breaks down on heating?

_____ [2]

(ii) Write a balanced symbol equation for the reaction which occurs when copper(II) carbonate is heated.

_____ [2]

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(iii) State the colour change observed when copper(II) carbonate is heated.

_____

_____ [2]

Examiner Only	
Marks	Remark

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2 Many pharmaceutical drugs contain carbon along with other elements.

Examiner Only

Marks	Remark



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(a) Complete the paragraph below about carbon using the words and numbers in the box. Each word or number may be used once, more than once or not at all.

6	**electrons**	**shells**	**12**
nucleus	**protons**	**neutrons**	**4**

Carbon is an element which is found in Group _____ of the Periodic Table. The relative atomic mass of all other atoms is based on an atom of carbon with a mass of _____.

The mass of any atom is mainly in the _____ because _____ have a very low mass compared to other subatomic particles. [4]

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Examiner Only	
Marks	Remark

(b) Amyl nitrite is a drug commonly used to treat patients with heart disease. Its chemical formula is $C_5H_{11}NO_2$.

(i) How many different elements are present in amyl nitrite?

_____ [1]

(ii) Calculate the relative formula mass of amyl nitrite.
(Relative atomic masses: H = 1; C = 12; N = 14; O = 16)

Relative formula mass _____ [1]

(iii) Calculate the percentage of carbon in amyl nitrite using the expression below.

$$\text{Percentage of carbon} = \frac{\text{total mass of all carbon atoms}}{\text{relative formula mass}} \times 100$$

Percentage of carbon _____ [1]

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(c) Another pharmaceutical drug, Eskalith, contains a carbonate compound. The formula of this compound may be written as X_2CO_3. The relative formula mass of X_2CO_3 is 74.

(Relative atomic masses: C = 12; O = 16)

(i) Calculate the mass of carbonate in X_2CO_3.

_____ [1]

(ii) Calculate the mass of the two atoms of X in X_2CO_3.

_____ [1]

(iii) Calculate the mass of one atom of X.

_____ [1]

(iv) Use your Data Leaflet to find the identity of X.

_____ [1]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

3 **(a)** Acids, bases, alkalis and salts are used in many commonly available household products such as those shown below. One substance found in each is stated.

'The following images have been removed from this page due to copyright issues:

- A bag of Bath Crystals containing magnesium chloride.
- A bottle of Milk of Magnesia liquid containing magnesium hydroxide.
- A can of Mr Muscle Oven Cleaner containing sodium hydroxide.
- A bag of Mosskiller & Lawn Tonic containing zinc sulphate.'

(i) Classify each substance as an acid, base, alkali or salt by placing a tick (✔) in the correct column in the table below. Choose the most common classification for each substance. You may find your Data Leaflet useful in answering this question.

Substance	acid	base	alkali	salt
magnesium chloride				
magnesium hydroxide				
sodium hydroxide				
zinc sulphate				

[4]

(ii) Sodium hydroxide reacts with sulphuric acid. Write a balanced symbol equation for this reaction.

_____ [3]

(iii) Name the salt produced when magnesium hydroxide reacts with nitric acid.

_____ [1]

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(iv) Hydrated zinc sulphate has the formula $ZnSO_4.7H_2O$. What is meant by the term hydrated?

_____

_____ [2]

(b) Aqueous ammonia is a weak alkali and it is used in hair dyes.

(i) Write the chemical formula for ammonia.

_____ [1]

(ii) Suggest a value for the pH of aqueous ammonia.

_____ [1]

(iii) Ammonia reacts with acids producing ammonium compounds. Write a balanced symbol equation for the reaction of ammonia with nitric acid.

_____ [2]

(iv) Name the ion which is present in all alkalis.

_____ [1]

Examiner Only

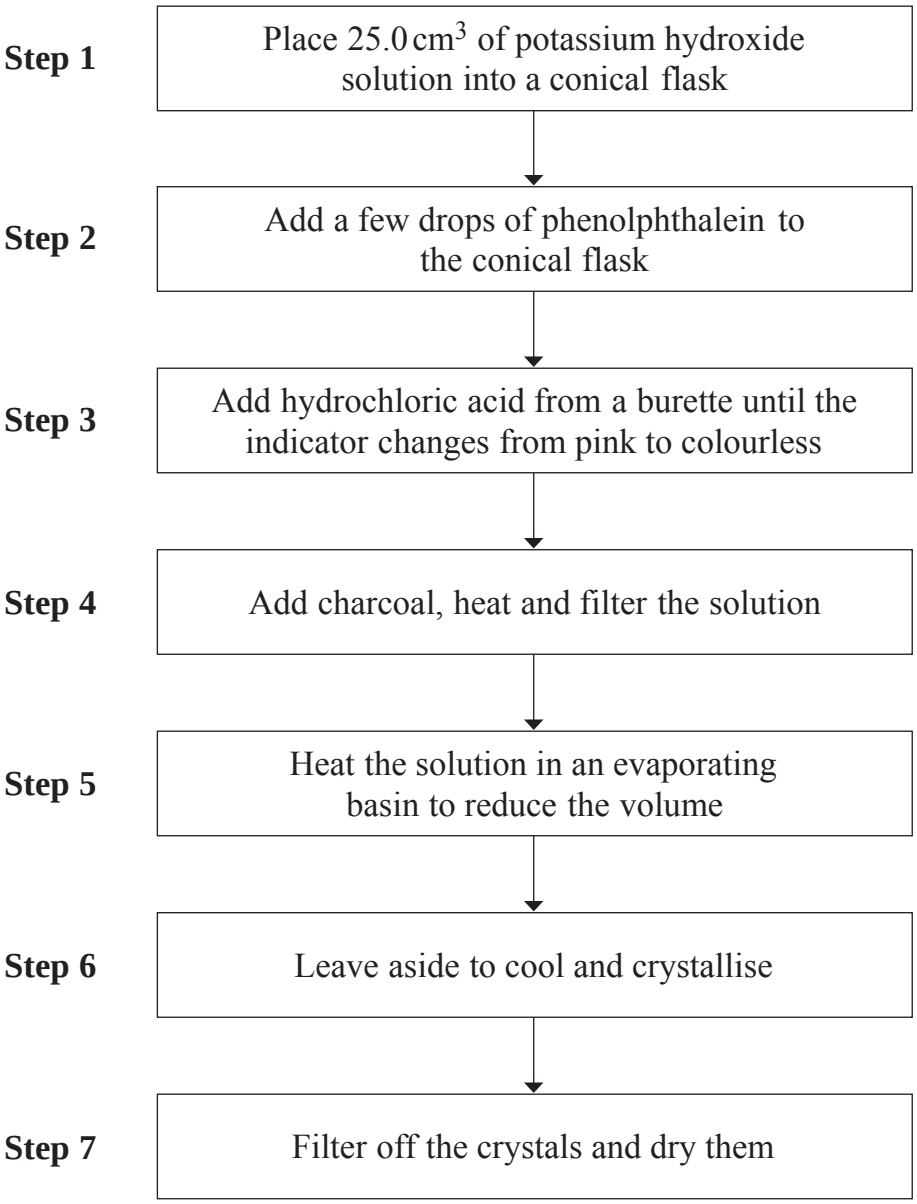
Marks	Remark

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Examiner Only	
Marks	Remark

(c) A pure, dry sample of potassium chloride can be prepared by the reaction of potassium hydroxide solution with hydrochloric acid.

The flow chart below explains how this is carried out.



(i) Name the piece of apparatus required to place 25.0 cm^3 of potassium hydroxide solution into the conical flask in **Step 1**.

_____ [1]

(ii) What is the purpose of the charcoal in **Step 4**?

_____ [1]

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(iii) Draw a labelled diagram of the assembled apparatus used to heat the solution in **Step 5**.

[3]

(iv) Explain why crystals form on cooling in **Step 6**.

_____

_____ [1]

(v) State **two** methods which may be used to dry the crystals in **Step 7**.

1. _____

_____

2. _____

_____ [2]

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Marks	Remark

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Examiner Only	
Marks	Remark

4 Aluminium is the most abundant metal in the Earth's crust. Aluminium ore is first purified to give aluminium oxide and the metal is then extracted from the aluminium oxide by electrolysis.

(a) What is meant by the term electrolysis?

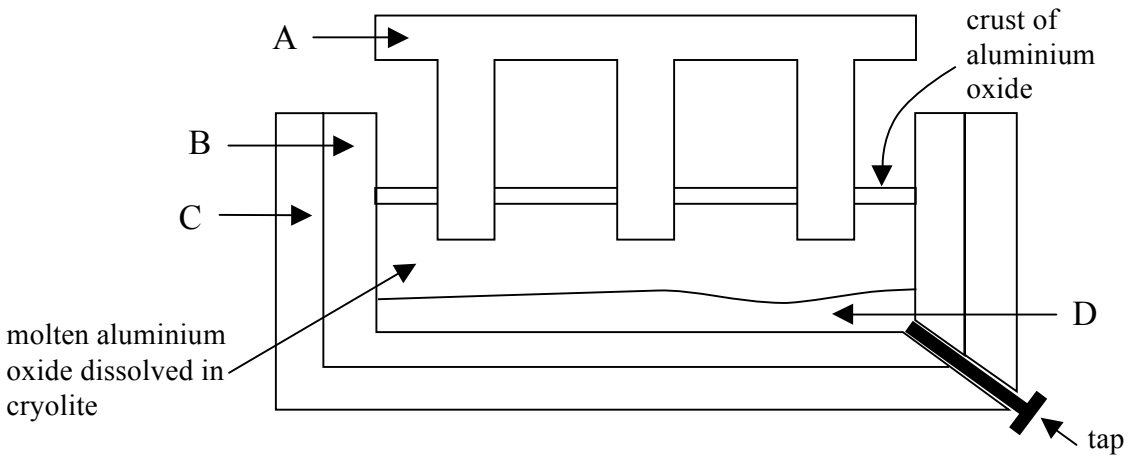
_____

_____ [2]

(b) Name the ore from which aluminium is extracted.

_____ [1]

(c) The electrolysis of the purified ore is carried out in the Hall-Héroult cell. The diagram below shows the cell used.



(i) Name parts A, B and C, and substance D.

A _____

B _____

C _____

D _____ [4]

(ii) Explain why the aluminium oxide will only conduct electricity when molten.

_____

_____ [2]

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(iii) At what temperature does the electrolysis take place?

_____ [1]

(iv) Suggest **one** reason why the aluminium oxide is dissolved in cryolite.

_____ [1]

(v) Name the ions which are discharged at each electrode.

Positive electrode: _____

Negative electrode: _____ [2]

(vi) Which electrode must be replaced regularly? Explain your answer using a balanced symbol equation.

Electrode: _____ [1]

Equation: _____ [2]

(vii) Explain how the aluminium produced in the process is removed from the cell.

_____

_____ [1]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

5 On 14th April 2010 the volcano Eyjafjallajökull erupted in Iceland, creating an ash cloud which was dangerous for aircraft and led to the closure of many airports for about ten days.



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A large number of gases were released into the atmosphere from the volcano. These volcanic gases included carbon dioxide, hydrogen, hydrogen chloride and water vapour.

(a) Complete the table below to give the formula, one use and two physical properties of carbon dioxide and hydrogen gas.

Gas	Formula	Use	Physical properties
carbon dioxide			1. 2.
hydrogen			1. 2.

[4]

[4]

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(b) Complete the table below to describe the tests used to identify carbon dioxide, hydrogen, hydrogen chloride and water in the laboratory and state the result of a positive test.

Gas	Test	Result of positive test	
carbon dioxide			[2]
hydrogen			[2]
hydrogen chloride			[4]
water			[3]

Examiner Only	
Marks	Remark

(c) Sulphur dioxide is also emitted when a volcano erupts. It is a pollutant gas which reacts with water in the air to form aci d rain.

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

_____ [2]

(ii) State **two** harmful effects of acid rain on the environment.

1. _____

_____

2. _____

_____ [2]

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(d) Sulphur dioxide can be produced in the laboratory by burning sulphur.

Examiner Only	
Marks	Remark

(i) Describe the appearance of sulphur.

_____ [2]

(ii) Write a balanced symbol equation for the burning of sulphur in air.

_____ [2]

(iii) What is observed when sulphur burns in air?

_____

_____

_____

_____

_____

_____ [3]

Quality of written communication [2]

(iv) State **one** use of sulphur dioxide.

_____ [1]

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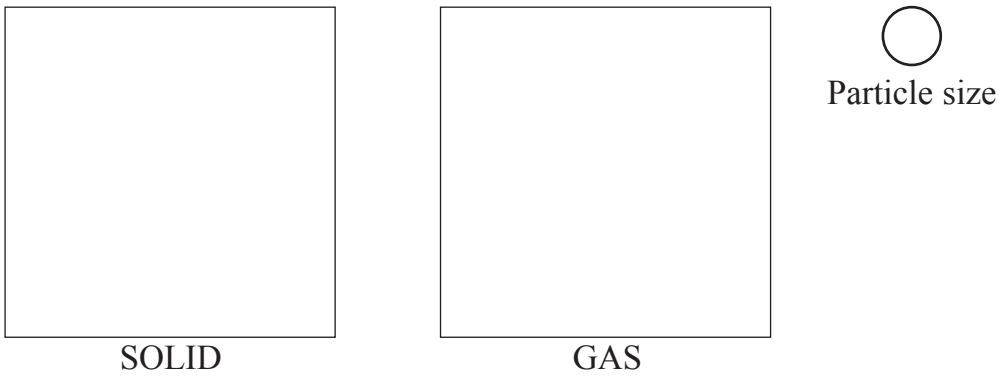
(Questions continue overleaf)

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Examiner Only	
Marks	Remark

6 Substances may be classified according to their physical state.

(a) In the boxes below draw the arrangement of particles in a solid and in a gas.
The particles should have the approximate size shown on the right.



SOLID GAS

[2]

(b) The table below shows the melting points and boiling points of a range of substances found in the laboratory.

Substance	Melting point (°C)	Boiling point (°C)
sodium chloride	808	1465
oxygen	−218	−182
sulphur	114	444
carbon	3550	4827
water	0	100
carbon dioxide	−78	−57

Questions (b)(i)–(b)(vi) refer to the substances in the table above.

(i) Name the substance which melts at the lowest temperature.

_____ [1]

(ii) Name the **element** which is a solid at room temperature (20 °C) but a liquid at 400 °C.

_____ [1]

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(iii) Write the formula of the substance which is a liquid at room temperature (20 °C).

_____ [1]

(iv) Which substance is a liquid over the greatest temperature range?

_____ [1]

(v) What is the physical state of oxygen at −200 °C?

_____ [1]

(vi) At what temperature does sulphur change from a liquid into a solid?

_____ [1]

(c) Solid carbon dioxide undergoes sublimation.

(i) What name is given to solid carbon dioxide?

_____ [1]

(ii) Explain fully what is meant by sublimation.

_____

_____ [2]

(iii) Name one **element** which undergoes sublimation.

_____ [1]

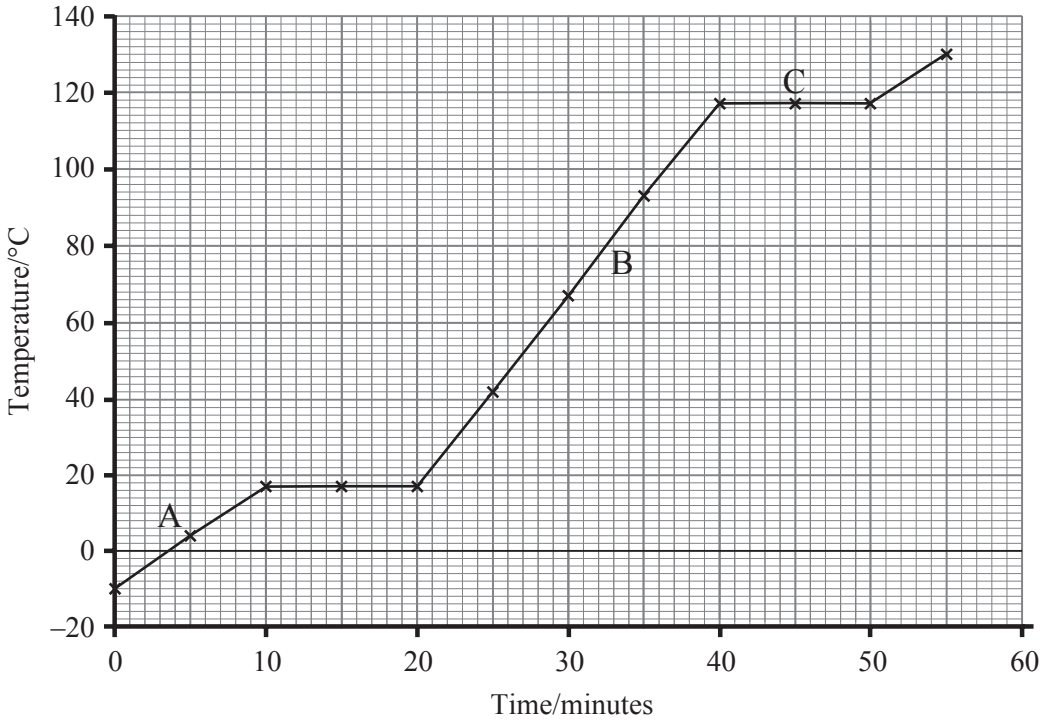
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

(d) Ethanoic acid is an organic acid present in vinegar. In an experiment some crystals of ethanoic acid, at a temperature of −10 °C, were heated and their temperature recorded every five minutes. The results are plotted on the graph below.



(i) What is the melting point of ethanoic acid?

_____ [1]

(ii) Which physical state will be observed at A and B on the graph?

A _____

B _____ [2]

(iii) Name the process occurring at C on the graph.

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

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Rewarding Learning

General Certificate of Secondary Education
2012

Science: Chemistry

Paper 2
Foundation Tier

[G1402]

FRIDAY 22 JUNE, AFTERNOON

MARK SCHEME

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					AVAILABLE MARKS
1	**(a)**	**(i)**	iron	[1]	
		(ii)	oxygen	[1]	
		(iii)	water	[1]	
		(iv)	gain of oxygen	[1]	
		(v)	red-brown [1] flaky [1] solid [1]	maximum [2]	
	(b)	**(i)**	$H_2 + Cl_2 \rightarrow 2HCl$	[3]	
		(ii)	chlorine gains hydrogen [1] gain of hydrogen is reduction [1]	[2]	
		(iii)	chlorine: yellow-green [1] hydrogen: colourless [1]	[2]	
		(iv)	gives out heat	[1]	
	(c)	**(i)**	thermal [1] decomposition [1]	[2]	
		(ii)	$CuCO_3 \rightarrow CuO + CO_2$	[2]	
		(iii)	green [1] to black [1]	[2]	20

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2 **(a)** [1] for each of the following in the order given:
4
12
nucleus
electrons [4]

(b) **(i)** four/4 [1]

(ii) 117 [1]

(iii) $\frac{60}{117} \times 100 = 51.28$ (allow 51) [1]

(c) **(i)** $12 + 3 \times 16 = 60$ [1]

(ii) $74 - 60 = 14$ [1]

(iii) $\frac{14}{2} = 7$ [1]

(iv) lithium/Li/Li_2CO_3 [1]

AVAILABLE MARKS

11

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AVAILABLE MARKS

3 **(a)** **(i)**

Substance	acid	base	alkali	salt
magnesium chloride				✓ [1]
magnesium hydroxide		✓ [1]		
sodium hydroxide		✓	✓	
	accept either tick for sodium hydroxide [1]			
zinc sulphate				✓ [1]

[4]

(ii) $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$ [3]

(iii) magnesium nitrate [1]

(iv) contains water [1]
contains water of crystallisation [2] [2]

(b) **(i)** NH_3 [1]

(ii) 9–11 [1]

(iii) $NH_3 + HNO_3 \rightarrow NH_4NO_3$ [2]

(iv) hydroxide [1]

(c) **(i)** pipette [1]

(ii) remove the indicator [1]

(iii) Individual marks are awarded for correctly labelled and recognisable drawings of assembled apparatus.
No labels = no marks.

evaporating basin [1]
tripod and gauze [1]
heat/Bunsen burner [1] [3]

(iv) solubility decreases/solution becomes saturated [1]

(v) Any **two** from:
dry between two sheets of filter paper [1]
dry in a low temperature oven [1]
dry in a desiccator [1] [2]

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			AVAILABLE MARKS
4	**(a)**	decomposition/breaking down [1] of a substance using electricity [1] [2]	
	(b)	bauxite [1]	
	(c) **(i)**	A is anode [1] B is cathode [1] C is casing [1] D is (molten) aluminium [1] [4]	
	(ii)	ions are free to move [1] idea that ions are the charge carriers [1] [2]	
	(iii)	900–1000 °C [1]	
	(iv)	lower melting point of aluminium oxide/increase conductivity [1]	
	(v)	Positive electrode: oxide [1] Negative electrode: aluminium [1] [2]	
	(vi)	electrode: anode [1] equation: $C + O_2 \rightarrow CO_2$ [2]	
	(vii)	aluminium is tapped off [1] at the bottom of the cell [1]	17

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AVAILABLE MARKS

5 (a)

Gas	Formula	Use	Physical properties	
carbon dioxide	CO_2 [1]	dry ice/carbonated drinks/fire extinguishers [1]	Any **two** from: colourless odourless acidic denser than air slightly soluble in water	[4]
hydrogen	H_2 [1]	weather balloons/ rocket fuel [1]	Any **two** from: colourless odourless neutral less dense than air insoluble in water	[4]

(b)

Gas	Test	Result of positive test	
carbon dioxide	bubble into **limewater** [1]	milky [1]	[2]
hydrogen	apply a lit splint [1]	pop [1]	[2]
hydrogen chloride	glass rod dipped in **concentrated** [1] **ammonia** [1]	white [1] smoke [1]	[4]
water	**anhydrous copper sulphate** [1] **or** cobalt chloride paper [1]	white [1] to blue [1] **or** pale blue [1] to pink [1]	[3]

(c) (i) $SO_2 + H_2O \rightarrow H_2SO_3$ [2]

(ii) Any **two** from:
corrodes statues/buildings [1]
kills fish [1]
kills trees/vegetation [1] [2]

(d) (i) brittle [1]
yellow [1]
solid [1] maximum [2]

(ii) $S + O_2 \rightarrow SO_2$ [2]

(iii) melts/forms a liquid [1]
dark red/brown [1]
blue flame [1]
colourless/misty [1]
pungent/bad smell [1] gas [1] maximum [3]

Quality of written communication [2]

(iv) fungicide/bleach/preservative [1]

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				AVAILABLE MARKS
6	**(a)**	solid – regular close packed arrangement [1] gas – few particles well spaced out [1]	[2]	
	(b)	**(i)** oxygen	[1]	
		(ii) sulphur	[1]	
		(iii) H_2O	[1]	
		(iv) carbon	[1]	
		(v) liquid	[1]	
		(vi) 114 (°C)	[1]	
	(c)	**(i)** dry ice	[1]	
		(ii) from solid to gas [1] on heating [1] **or** from gas to solid [1] on cooling [1]	[2]	
		(iii) iodine	[1]	
	(d)	**(i)** 17 (°C) ± 1	[1]	
		(ii) A – solid [1] B – liquid [1]	[2]	
		(iii) boiling	[1]	16
			Total	**120**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2011

Science: Chemistry

Paper 2
Foundation Tier

G1402

[G1402]

TUESDAY 7 JUNE, AFTERNOON

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

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Write your answers in the spaces provided in this question paper.
Answer **all six** questions.

INFORMATION FOR CANDIDATES

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A Data Leaflet which includes a Periodic Table of the Elements is provided.

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

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Examiner Only	
Marks	Remark

1 **(a)** Nitrogen is diatomic like several other non-metallic elements. It is one of the most abundant non-metallic elements on the Earth, making up 79% of the atmosphere.

(i) What is meant by the term diatomic?

_____ [1]

(ii) Name one other diatomic element.

_____ [1]

(iii) Name one other **element** present in the Earth's atmosphere.

_____ [1]

(iv) Complete the table below giving the physical properties of nitrogen.

Name	Nitrogen
State at room temperature and pressure	
Colour	
Odour	

[3]

(v) Nitrogen is used in food packaging. Suggest one **chemical** property of nitrogen which makes it suitable for this use.

_____ [1]

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(b) One of the most important compounds of nitrogen is ammonia.
A solution of ammonia in water is called aqueous ammonia.

Complete the table below giving the physical properties of ammonia.

Name	Ammonia
State at room temperature and pressure	
Colour	
Odour	
pH of aqueous ammonia	

[4]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

(c) The presence of ammonia can be detected chemically by reacting it with hydrogen chloride gas. The hydrogen chloride gas is released from concentrated hydrochloric acid.

The information given below describes how the test is carried out.

1. Wear safety glasses.

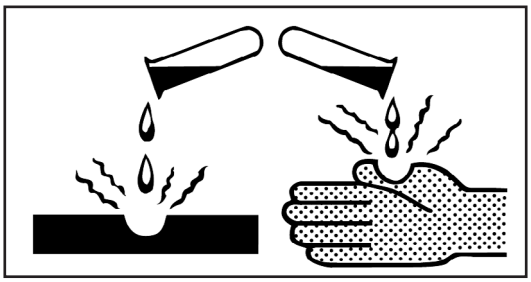
2. Dip a glass rod into concentrated hydrochloric acid.

3. Apply the glass rod to ammonia.

(i) What observations would you make for a positive test?

_____ [2]

(ii) The hazard symbol below is found on the bottle of concentrated hydrochloric acid.



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Name this hazard symbol.

_____ [1]

(iii) Apart from wearing safety glasses, state one safety precaution you should take when carrying out this test.

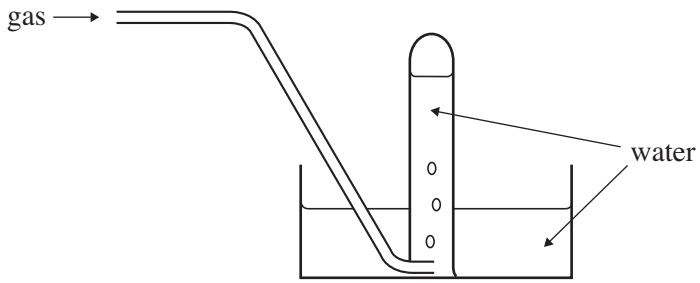
_____ [1]

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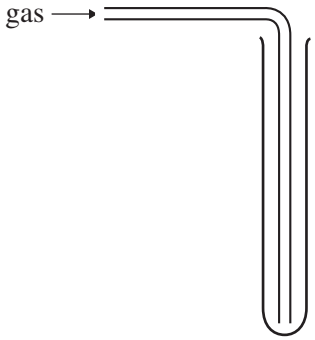
(d) The collection of gases prepared in the laboratory depends on their solubility in water and their density compared to air.

Examiner Only	
Marks	Remark

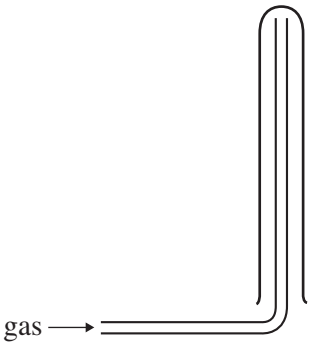
METHOD 1



METHOD 2



METHOD 3



The table below shows the solubility in water and density compared to air for three different gases.

Gas	Solubility in water	Density compared to air
Nitrogen	low	same
Ammonia	high	less dense
Hydrogen chloride	high	more dense

State which method (1, 2 or 3) could be used to collect each gas.

Nitrogen _____

Ammonia _____

Hydrogen chloride _____ [3]

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Examiner Only	
Marks	Remark

2 Deodorants, body sprays and air fresheners are often supplied as an aerosol. Aerosol cans contain a solution of the substance to be sprayed and a propellant gas.

Dut to copyright an image of an aerosol can has been removed which is not essential to answer this question.

(a) (i) What is the meaning of the term solution?

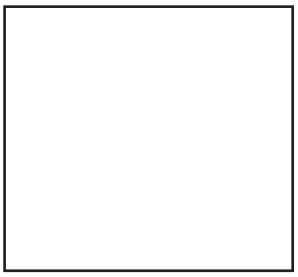
_____

_____ [2]

(ii) In the box below show the arrangement of the particles of a gas at room temperature and pressure. The particle should be approximately the size shown on the left.



gas particle



[1]

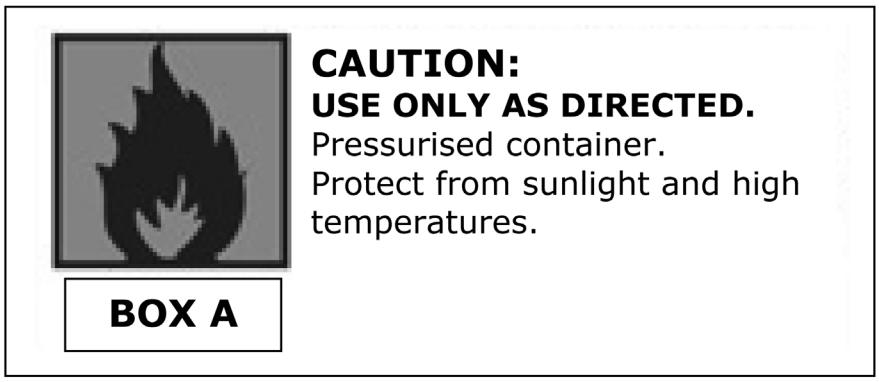
(iii) How does the volume of a gas change if the pressure is increased?

_____ [1]

(iv) How does the volume of a gas change if the temperature is increased?

_____ [1]

(b) The label shown below was found on an aerosol can.



© Crown copyright

(i) What term is missing from box A on the label to describe the hazard associated with the aerosol?

_____ [1]

(ii) Explain why an aerosol can should not be exposed to sunlight or high temperatures.

_____

_____ [1]

(c) An aerosol deodorant is made of many compounds which contain different elements. Some of these elements are listed in the table below.

Element	Melting point (°C)	Boiling point (°C)	State at room temperature (20 °C)
Silicon	1410	2355	
Oxygen	–219	–183	
Sodium	98	890	
Bromine	–7	59	

(i) Use the data given to help you complete the table by deducing the state of each element at room temperature (20 °C). [4]

Examiner Only

Marks	Remark

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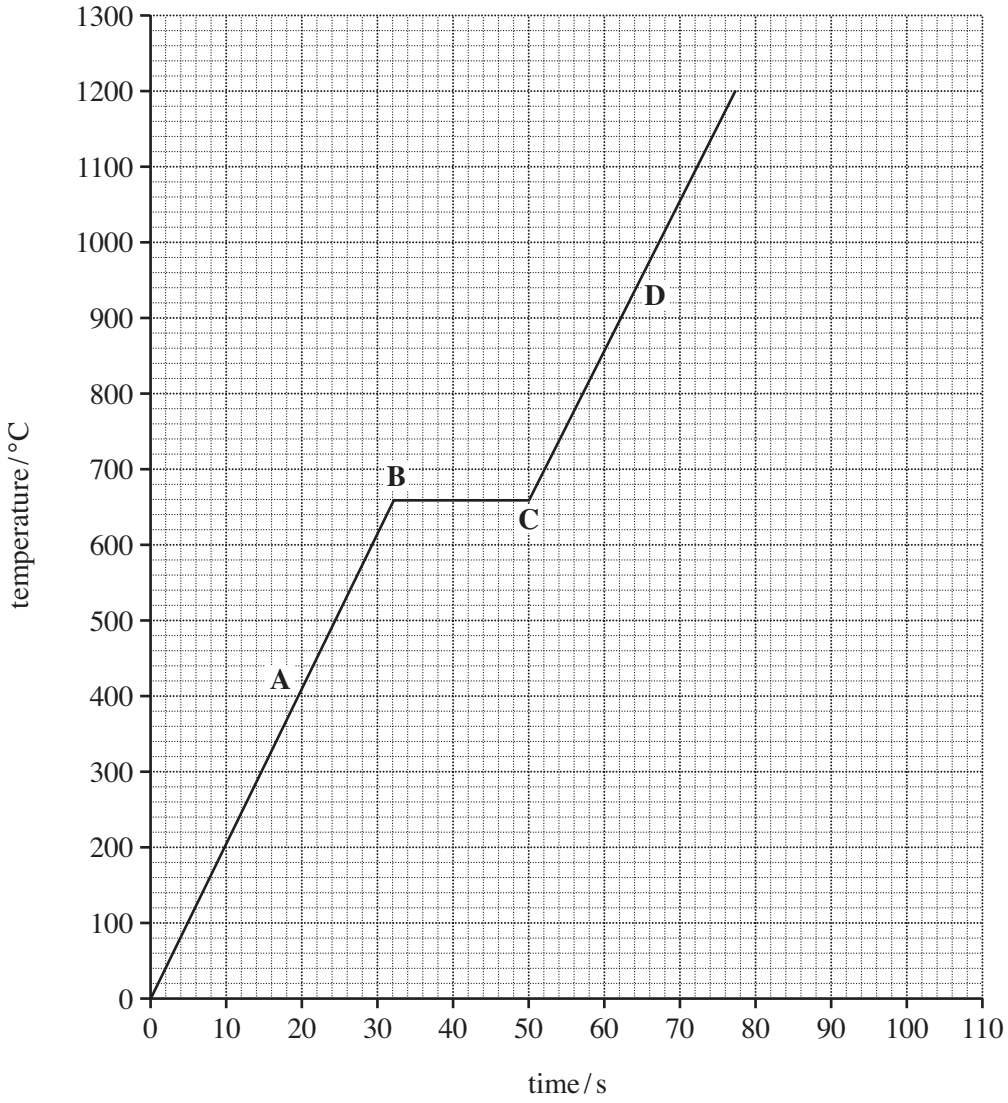
(ii) What is meant by the term element?

_____

_____ [2]

(d) Some aerosol cans are made of aluminium metal. Aluminium metal can be recycled and during this process the aluminium is heated.

The graph below shows the change in temperature against time when aluminium is heated.



Examiner Only

Marks	Remark

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(i) Which letter, A, B, C or D shows when aluminium is beginning to melt?

_____ [1]

(ii) What is the melting point of aluminium?

_____ [1]

(iii) Complete the passage below about changes of state using only the words given in the box

solid	**liquid**	**gas**

Each word may be used once, more than once or not at all.

Evaporation is the change of state from _____ to _____

Sublimation is the change of state from _____

to _____ on heating.

Condensation is the change of state from _____

to _____ [6]

Examiner Only

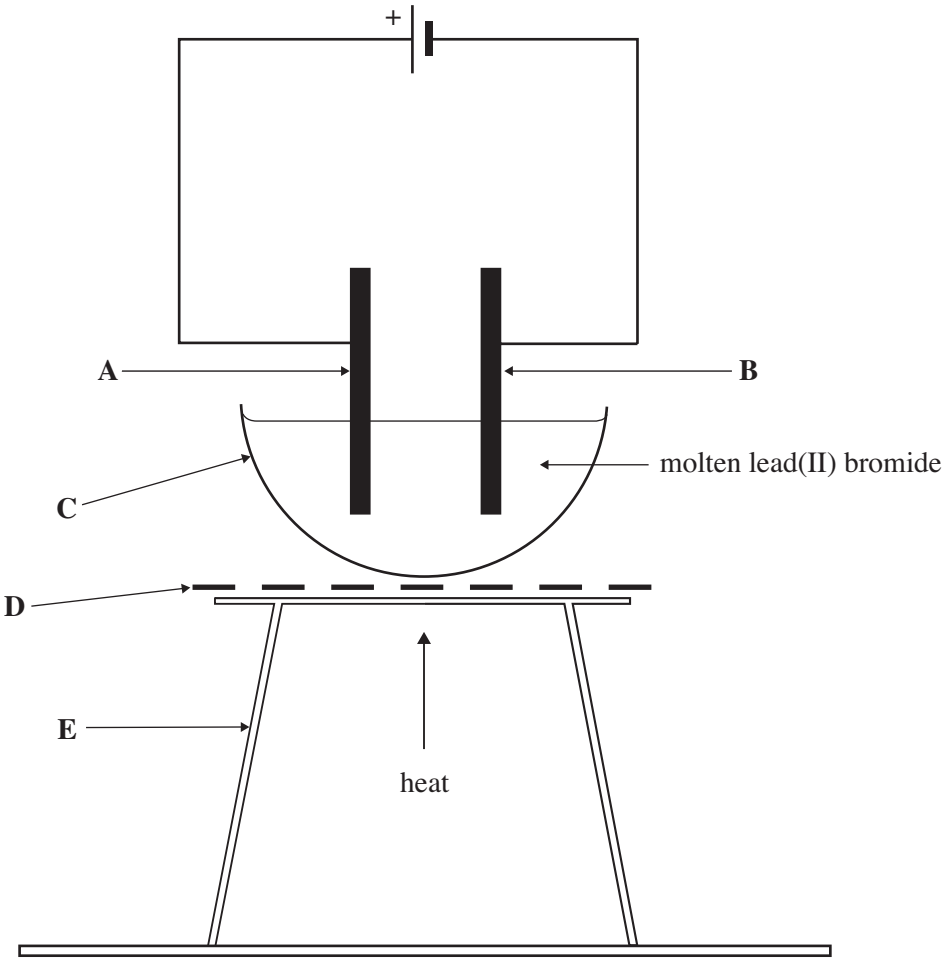
Marks	Remark

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Examiner Only	
Marks	Remark

3 Some substances, for example molten lead(II) bromide and molten sodium chloride, are electrolytes. Other substances, for example copper metal, are conductors.

(a) An experiment to investigate the electrolysis of molten lead(II) bromide was set up as shown in the diagram below.



(i) Some pieces of apparatus in the diagram are labelled A–E. Complete the table by stating the correct name for each piece of apparatus.

Label	Name of apparatus
A	
B	
C	
D	
E	

[5]

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(ii) Name a piece of apparatus which could be connected in the circuit to show that an electric current is flowing through the molten lead(II) bromide.

_____ [1]

(iii) What is meant by the term electrolysis?

_____

_____ [2]

(iv) State the name of the charged particles that allow the electric current to flow in molten lead(II) bromide.

_____ [1]

(v) Complete the table to state the observations at electrode A, and the name of the product at each electrode.

Electrode	Observations	Name of Product
A		
B	silvery grey bead	

[4]

(vi) Why does this electrolysis need to be carried out in a fume cupboard?

_____

_____ [1]

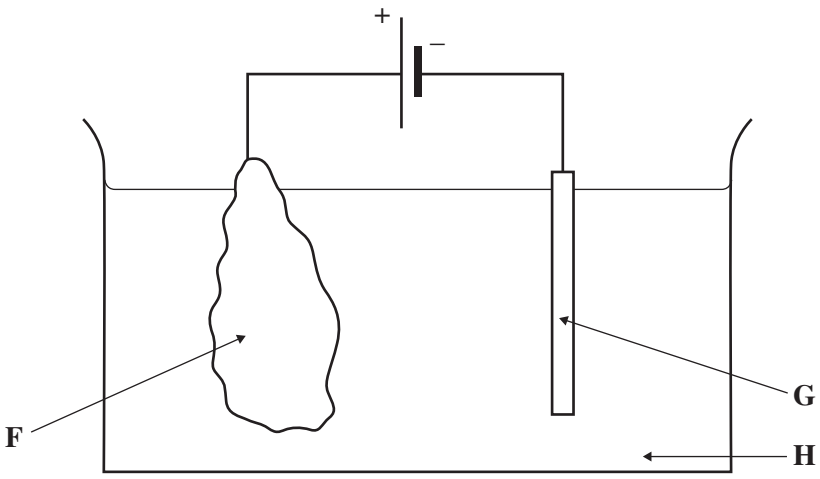
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

(b) Copper metal is a good conductor of electricity and is often used in electrical wires. Impure copper is not used to make wires because the impurities greatly reduce the conductivity. Impure copper is refined by electrolysis as shown in the diagram below.



(i) State the name of the materials which are used to make electrodes **F** and **G**.

F _____

G _____ [2]

(ii) Name the electrolyte **H** which is used in this electrolysis.

_____ [1]

(iii) Apart from electrical conductivity, state one other physical property of copper which makes it suitable for use in electrical wiring.

_____ [1]

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Examiner Only	
Marks	Remark

4 **(a)** Five solutions were tested to find their pH. The results are recorded in the table below.

Solution	pH value
Soap solution	10
Sulphuric acid	1
Water	7
Sodium hydroxide	14
Lemon juice	5

(i) Describe the method the student should use to determine the pH of each solution.

_____

_____

_____ [2]

(ii) Using only the solutions given in the table above, state an example of each of the following:

A weak acid _____

A strong alkali _____

Neutral _____ [3]

(iii) Hydrogen ions are found in all acidic solutions. Write the symbol for a hydrogen ion including its charge.

_____ [1]

(iv) The ion found in all alkalis is OH^-. Name this ion.

_____ [1]

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Examiner Only	
Marks	Remark

(v) **Name** the salt produced when sulphuric acid reacts with sodium hydroxide solution.

_____ [1]

(vi) Write a balanced symbol equation for the reaction between sulphuric acid and sodium hydroxide solution.

_____ [3]

(b) Lead(II) iodide, PbI_2, is a toxic yellow solid used as a pigment by painters in the nineteenth century. It is insoluble in water.

(i) Name two solutions which would react together to form insoluble lead(II) iodide.

Solution 1: _____

Solution 2: _____ [2]

(ii) Draw a labelled diagram of the assembled apparatus used to recover the lead(II) iodide when the reaction is finished.

[3]

(iii) Suggest how the solid lead(II) iodide should be dried.

_____

_____ [1]

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(iv) The bonding in lead(II) iodide is ionic. Write the symbols for the lead(II) ion and the iodide ion. You may use your Data Leaflet to help answer this answer.

Lead(II) ion _____

Iodide ion _____ [2]

(v) Using your Data Leaflet, write the formula of another insoluble lead compound.

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

5 **(a)** Coal is a fossil fuel. It consists mainly of the element carbon but with some hydrogen, nitrogen and sulphur.



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When coal burns, the elements it contains undergo combustion. The scheme below gives some details of this combustion.

Reactants	**Name**		Sulphur	
	Formula	N_2	S	C
Combustion		↓	↓	↓
Products	**Name**	Nitrogen dioxide		Carbon dioxide
	Formula		SO_2	

(i) Complete the scheme above, filling in the missing names and formulae. [5]

(ii) What is meant by the term combustion?

_____

_____

_____ [3]

(iii) Which element in coal is responsible for its distinctive colour?

_____ [1]

(iv) What is the common name for the oxide of hydrogen?

_____ [1]

(v) Describe how fossil fuels are formed.

_____

_____

_____

_____

_____ [3]

Quality of Written Communication [2]

(b) The objects listed below are all made from materials which are hydrocarbons. Hydrocarbons can be solids, liquids or gases.

Polystyrene **Petrol** **Polythene** **Methane** **Candle wax**

(i) What is a hydrocarbon?

_____

_____ [2]

Examiner Only

Marks	Remark

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(ii) Complete the table below indicating whether the hydrocarbon materials shown are solid, liquid or gas. Place **one** tick (✓) in each row.

Material	Solid	Liquid	Gas
Polystyrene			
Petrol			
Polythene			
Methane			
Candle wax			

[5]

(iii) Write a balanced symbol equation for the complete combustion of methane, CH_4.

_____ [3]

(iv) When hydrocarbons burn in a limited supply of air a toxic gas is produced. Name this toxic gas.

_____ [1]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

6 Chemical reactions are either exothermic or endothermic.

(a) What do you understand by the term exothermic?

_____

_____ [1]

(b) The table below gives the word equations for several exothermic reactions.

Reaction	Word Equation
A	hydrogen + oxygen → water
B	sodium hydroxide + hydrochloric acid → sodium chloride + water
C	magnesium + carbon dioxide → magnesium oxide + carbon
D	copper(II) oxide + magnesium → magnesium oxide + copper

(i) Name the type of reaction represented by **A** and **B**.

A _____ [1]

B _____ [1]

(ii) Write a balanced symbol equation for Reaction **A**.

_____ [3]

Examiner Only	
Marks	Remark

(c) In reaction **C**, a piece of burning magnesium metal is lowered into a gas jar of carbon dioxide gas.

(i) Write a balanced symbol equation for the reaction between magnesium and carbon dioxide.

_____ [3]

(ii) Describe what would be observed during this reaction.

_____

_____

_____ [3]

(d) Reaction **D** is described as a redox reaction as both oxidation and reduction are occurring at the same time. The balanced symbol equation for the reaction is given below.

$$Mg + CuO \rightarrow MgO + Cu$$

(i) Explain why magnesium is described as being oxidised in this reaction.

_____

_____

_____ [2]

(ii) Explain why copper is described as being reduced in this reaction.

_____

_____

_____ [2]

(iii) What colour is copper(II) oxide?

_____ [1]

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THIS IS THE END OF THE QUESTION PAPER

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111006

Rewarding Learning

General Certificate of Secondary Education
2011

Science: Chemistry

Paper 2
Foundation Tier

[G1402]

TUESDAY 7 JUNE, AFTERNOON

MARK SCHEME

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Guidelines for marking equations

Equations where the stoichiometry is 1 gain [2] maximum

[1] for correct formula of reactant/s
[1] for correct formula of product/s

e.g. $CaO + H_2O \rightarrow Ca(OH)_2$ [2]
[1] [1]

$CaO + \mathbf{2}H_2O \rightarrow Ca(OH)_2$ [1]
[0] [1]

However:
$2CaO + 2H_2O \rightarrow 2Ca(OH)_2$ [2]
[1] [1]

Equations where the stoichiometry is more than 1 gain [3]

[1] for correct formula of reactant/s
[1] for correct formula of product/s
[1] for correct balancing

e.g. $2Na + 2H_2O \rightarrow 2NaOH + H_2$
[1] [1]

+ [1] for balancing = [3]

$2Na + H_2O \rightarrow 2NaOH + H_2$
[1] [1]

No balancing mark = [2]

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AVAILABLE MARKS

1 **(a)** **(i)** two atoms. [1]

(ii) hydrogen/oxygen/any halogen. [1]

(iii) oxygen/any noble gas. [1]

(iv)

Name	nitrogen
State at room temperature and pressure	gas [1]
Colour	colourless [1]
Odour	odourless/no odour [1]

[3]

(v) unreactive/inert [1]

(b)

Name	Ammonia
State at room temperature and pressure	gas [1]
Colour	colourless [1]
Odour	pungent/smelly [1]
pH of aqueous ammonia	9–11 [1]

[4]

(c) **(i)** white [1] smoke/fumes/solid/cloud [1] [2]

(ii) corrosive [1]

(iii) gloves/lab coat/fume cupboard/apron [1]

(d) nitrogen = method 1 [1]
ammonia = method 3 [1]
hydrogen chloride = method 2 [1] [3]

18

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AVAILABLE MARKS

2 **(a)** **(i)** solid dissolved/solute [1]
in a liquid/solvent [1] [2]

(ii) a few well spaced particles [1]

(iii) decreases [1]

(iv) increases [1]

(b) **(i)** flammable [1]

(ii) explosion risk [1]

(c) **(i)**

Element	Melting point (°C)	Boiling point (°C)	State at room temperature (20°C)
silicon	1410	2355	solid [1]
oxygen	–219	–183	gas [1]
sodium	98	890	solid [1]
bromine	–7	59	liquid [1]

[4]

(ii) substance which cannot be broken down into anything simpler [1]
by chemical means [1]
(substance made up of only one type of atom [2]) [2]

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(d) (i) B [1]

(ii) 660 [1] °C [1]

(iii) liquid [1] to gas [1]
solid [1] to gas [1]
gas [1] to liquid [1] [6]

AVAILABLE MARKS

21

3 (a) (i) A = anode [1]
B = cathode [1]
C = evaporating basin/crucible [1]
D = gauze/pipeclay triangle [1]
E = tripod [1] [5]

(ii) bulb/ammeter [1]

(iii) decomposition [1]
using (a direct current of) electricity [1] [2]

(iv) ions [1]

(v)

Electrode	Observations	Name of Product
A	red-brown [1] pungent [1] gas [1] **max [2]**	bromine [1]
B	silvery grey bead	lead [1]

[4]

(vi) bromine/lead fumes are toxic [1]

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	(b)	**(i)**	**F** impure copper [1] **G** pure copper [1]	[2]	AVAILABLE MARKS
		(ii)	copper sulphate/copper chloride/copper nitrate	[1]	
		(iii)	ductile	[1]	18
4	**(a)**	**(i)**	add universal indicator/pH paper [1] compare to colour chart [1] **or** use pH meter [1] read off value [1]	[2]	
		(ii)	weak acid lemon juice [1] strong alkali sodium hydroxide [1] neutral water [1]	[3]	
		(iii)	H^+	[1]	
		(iv)	hydroxide	[1]	
		(v)	sodium sulphate	[1]	
		(vi)	$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$	[3]	
	(b)	**(i)**	lead nitrate [1] any soluble iodide, e.g. sodium iodide, potassium iodide etc. [1]	[2]	
		(ii)	marks are awarded for labelled and *recognisable* pieces of *assembled* apparatus labels: filter funnel [1] filter paper [1] conical flask/suitable container [1]	[3]	
		(iii)	low temperature oven/desiccator	[1]	
		(iv)	lead(II) ion Pb^{2+} [1] iodide ion I^- [1]	[2]	
		(v)	$PbCl_2/PbSO_4/PbO/PbBr_2$	[1]	20

AVAILABLE MARKS

5 **(a)** **(i)**

Reactants	**Name**	**Nitrogen** [1]	Sulphur	**Carbon** [1]
	Formula	N_2	S	C

Combustion

Products	**Name**	Nitrogen dioxide	**Sulphur dioxide** [1]	Carbon dioxide
	Formula	**NO_2** [1]	SO_2	**CO_2** [1]

[5]

(ii) fuels and oxygen [1]
reacting [1]
releasing heat [1]
forming oxides [1] max [3]

(iii) carbon [1]

(iv) water [1]

(v) dead plants/animals [1]
millions of years [1]
heat (and) pressure [1] [3]

Quality of written communication [2]

(b) **(i)** substance containing only [1] carbon and hydrogen [1] [2]

(ii)

Material	solid	liquid	gas
Polystyrene	✓ [1]		
Petrol		✓ [1]	
Polythene	✓ [1]		
Methane			✓ [1]
Candle wax	✓ [1]		

[5]

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				AVAILABLE MARKS
	(iii) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$		[3]	
	(iv) carbon monoxide		[1]	26
6	**(a)** gives out heat		[1]	
	(b) **(i)** A	combustion	[1]	
	B	neutralisation	[1]	
	(ii) $2H_2 + O_2 \rightarrow 2H_2O$		[3]	
	(c) **(i)** $2Mg + CO_2 \rightarrow 2MgO + C$		[3]	
	(ii) Mg continues to burn [1] white light [1] white [1] solid [1] black specks [1]		max [3]	
	(d) **(i)** magnesium gains oxygen [1] gain of oxygen is oxidation [1]		[2]	
	(ii) copper oxide loses oxygen [1] loss of oxygen is reduction [1]		[2]	
	(iii) black		[1]	17
		Total		**120**

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2010

Science: Chemistry

Paper 2
Foundation Tier

[G1402]

WEDNESDAY 9 JUNE, AFTERNOON

G1402

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.
Write your answers in the spaces provided in this question paper.
Answer **all six** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 120.
Quality of written communication will be assessed in question **1(c)(iv)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Data Leaflet which includes a Periodic Table of the Elements is provided.

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

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Examiner Only	
Marks	Remark

1 Neutralisation occurs when an acid and an alkali react to form a salt and water.

(a) (i) Complete the table below to give the names and formulae of the ions present in all acids and alkalis.

	Name	**Formula**
Ion present in all acids		
Ion present in all alkalis		

[4]

(ii) Different acids produce different salts. Complete the table below. One has been done for you.

Name of acid	**Name of salt**
Sulphuric acid	sulphate
Nitric acid	
Hydrochloric acid	

[2]

(b) Sulphuric acid can be neutralised using an alkali such as sodium hydroxide or by adding an insoluble base such as copper(II) oxide.

(i) Write a word equation for the reaction between sodium hydroxide and sulphuric acid.

_____ [1]

(ii) Write a balanced symbol equation for the reaction between copper(II) oxide and sulphuric acid.

_____ [2]

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Examiner Only	
Marks	Remark

(c) In the preparation of copper(II) sulphate crystals, an excess of copper(II) oxide is added to warm dilute sulphuric acid.

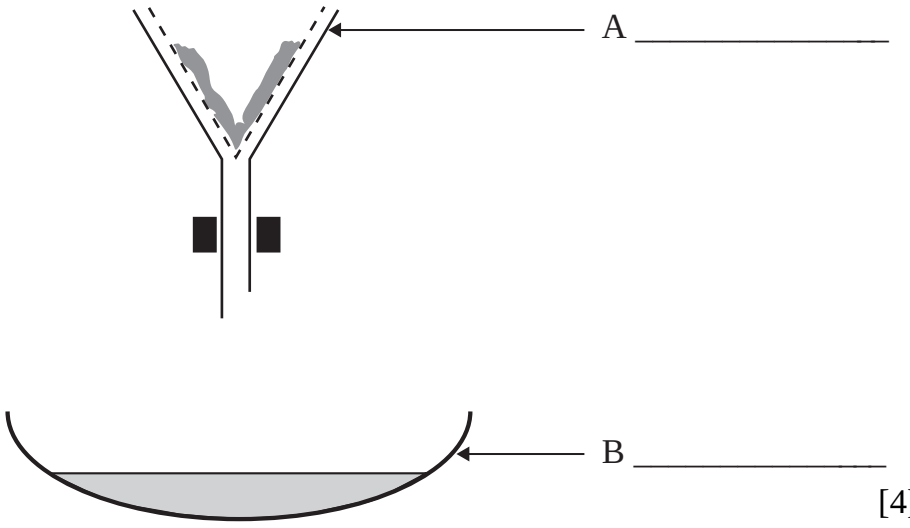
(i) Why is the copper(II) oxide added in excess?

_____[1]

(ii) What colour is the solution when the reaction is complete?

_____[1]

(iii) The apparatus shown in the diagram below is used to separate the excess copper(II) oxide from the solution.
Identify the apparatus A and B.
Label the filtrate and the residue clearly using an arrow.



[4]

(iv) Describe how you would obtain pure dry crystals of copper(II) sulphate from the solution collected in part **(iii)**.

_____

_____

_____

_____

_____

_____[3]

Quality of written communication [2]

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(v) Copper(II) sulphate can also be prepared by adding an excess of copper carbonate to sulphuric acid. Write a word equation for this reaction.

_____[1]

(vi) Copper(II) sulphate cannot be prepared by adding copper metal to sulphuric acid. Explain why not.

_____[1]

Examiner Only	
Marks	Remark

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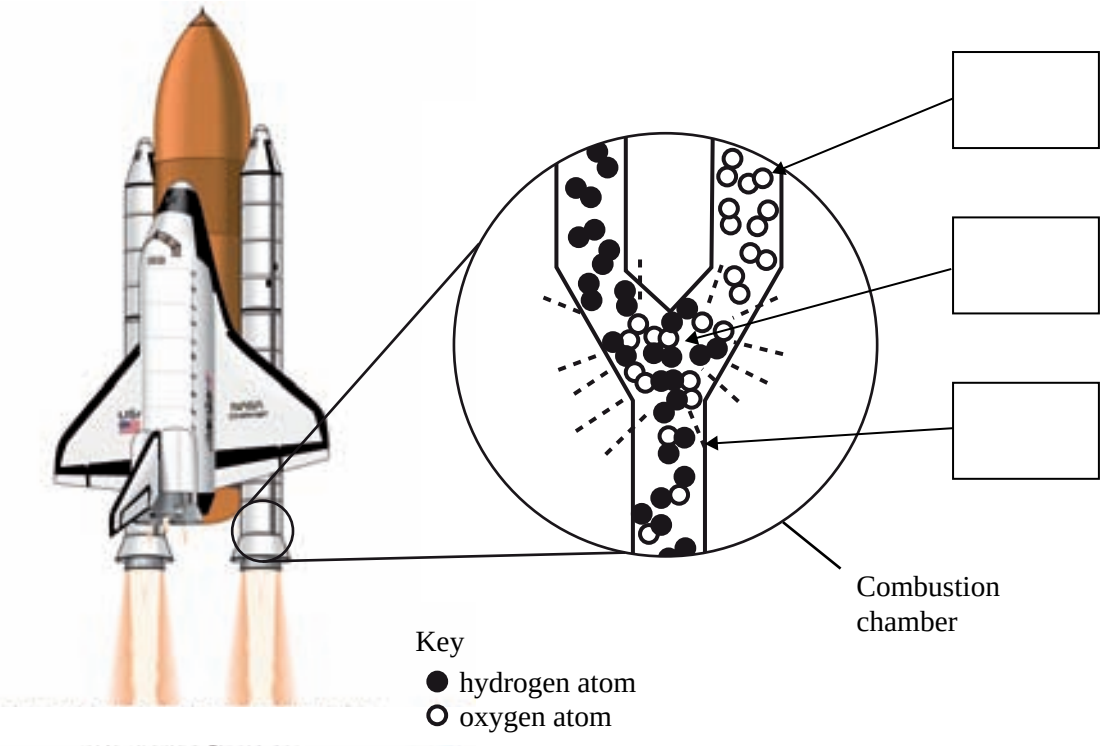
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(Questions continue overleaf)

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Examiner Only	
Marks	Remark

2 Hydrogen is a powerful rocket fuel. The diagram shows the reaction which occurs in the combustion chamber of a rocket.



© NASA http://www1.dfrc.nasa.gov/Gallery/Graphics/STS/Large/EG-0076-04.gif

(a) (i) Using the description for the letters **A**, **B** and **C** below, complete the diagram above by placing a letter to label each arrow in the boxes on the right of the diagram above.

A oxygen molecules

B mixture of hydrogen and oxygen gas

C compound of hydrogen and oxygen

[3]

(ii) Write a balanced symbol equation for the reaction which occurs in the combustion chamber.

_____ [3]

(iii) Explain why hydrogen is considered to be a 'clean' fuel.

_____

_____ [1]

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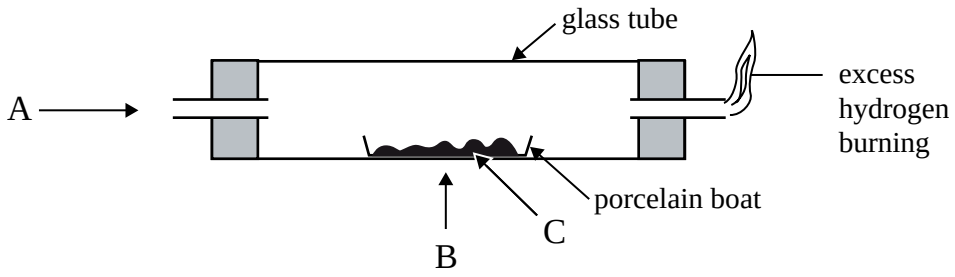
(iv) Explain why the reaction in the combustion chamber is considered to be oxidation.

_____

_____

_____ [2]

(b) Hydrogen is also a powerful reducing agent. The diagram shows the apparatus which could be used in the laboratory to reduce **copper(II) oxide** using **hydrogen.**



(i) What labels should be placed on the diagram at A, B and C?

A _____

B _____

C _____ [3]

(ii) State two observations made during this reaction.

1. _____

2. _____ [2]

(iii) Write a balanced symbol equation for the reduction of copper(II) oxide using hydrogen.

_____ [2]

(iv) Explain why this reaction is described as reduction.

_____

_____

_____ [2]

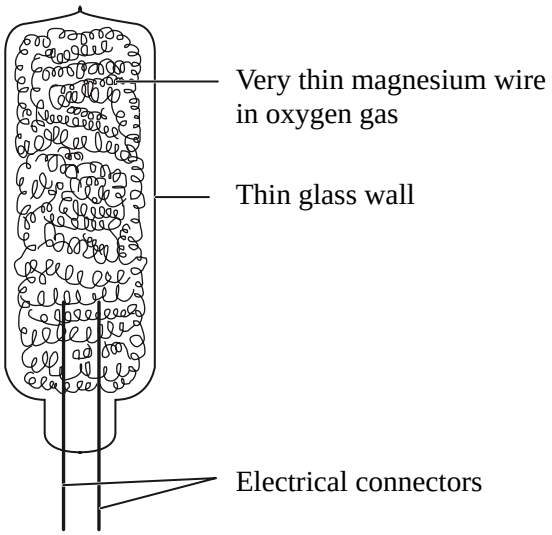
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

(c) Before the use of electronic built-in flashes, most cameras needed flash bulbs to create a flash of artificial light. The diagram below represents a flash bulb which works by the reaction of very thin magnesium wires with oxygen.



(i) Write a balanced symbol equation for the reaction which occurs inside the flash bulb.

_____ [3]

(ii) State one observation made during this reaction.

_____ [1]

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3 All swimming pools must be correctly treated with different chemicals to ensure that the water is free from bacteria and other microbes.



© Ambassador Pools Ltd http://1st-direct.com/panel-and-liner-pool-with-automatic-cover_photos.htm

(a) The table below gives information about some of the chemicals used to treat water in swimming pools.

Complete the table.

Name	Formula	Relative formula mass
sodium hypochlorite	NaClO	
chlorine dioxide	ClO_2	
ozone	O_3	

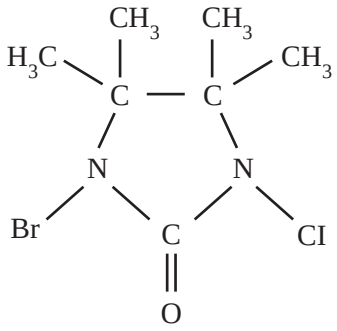
[3]

Examiner Only

Marks	Remark

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(b) The diagram below shows a molecule of a compound which is used in the USA to kill bacteria in swimming pools.



Use the formula of the molecule to help you answer the following questions.

(i) Complete the table to give the name, relative atomic mass and number of atoms present for all the elements in this compound.
The first one has been done for you. You may find your Data Leaflet useful in answering this question.

Symbol	Name of element	Relative atomic mass	Number of atoms of this element present in the molecule
H	hydrogen	1	12
C	carbon	12	
N	nitrogen		2
Cl		35.5	1
O	oxygen	16	
Br	bromine		1

[5]

(ii) Name the **two** elements in this compound which are in the same group of the Periodic Table.

_____ and _____ [1]

Examiner Only	
Marks	Remark

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(iii) Use the information in the table to calculate the relative molecular mass of this molecule.

Relative molecular mass = _____ [1]

(iv) Find the percentage by mass of Br in this compound using the formula:

$$\text{percentage of Br by mass} = \frac{\text{relative atomic mass of Br}}{\text{relative molecular mass of compound}} \times 100$$

percentage of Br by mass = _____ [2]

(c) Another chemical added to swimming pool water is chloramine. The formula mass of chloramine is 51.5 and its formula can be represented by NX_2Cl where X represents a non-metal.

Calculate the relative atomic mass of element X and use your Data Leaflet to identify the element represented by X.

Relative atomic mass of X _____

Identity of X _____ [4]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

4 **(a)** Calcium carbonate thermally decomposes to form calcium oxide. Calcium oxide (lime) has a high melting point and can be heated to a high temperature without melting so that it emits white light, called limelight.



© Adam Hart-Davis/Science Photo Library

(i) Explain what is meant by the term thermal decomposition.

_____

_____[2]

(ii) Write a balanced symbol equation for the thermal decomposition of calcium carbonate.

_____[2]

(iii) The thermal decomposition of calcium carbonate is an endothermic reaction. What is meant by the term endothermic?

_____[1]

(iv) Explain why calcium oxide has a high melting point.

_____

_____

_____[2]

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Marks	Remark

(v) Calcium oxide must be kept dry because when it comes into contact with even the slightest amount of moisture, it rapidly becomes hot and hisses, releasing a large amount of steam.

Write a balanced symbol equation for the reaction of calcium oxide with water.

_____[2]

(b) Calcium carbonate reacts with acids and is used in many antacid tablets, where it reacts with excess acid in the stomach, reducing acidity and relieving 'heartburn'.



© drflet/istockphoto

(i) Write a balanced symbol equation for the reaction between calcium carbonate and hydrochloric acid.

_____[3]

(ii) State two observations made during this reaction.

1. _____

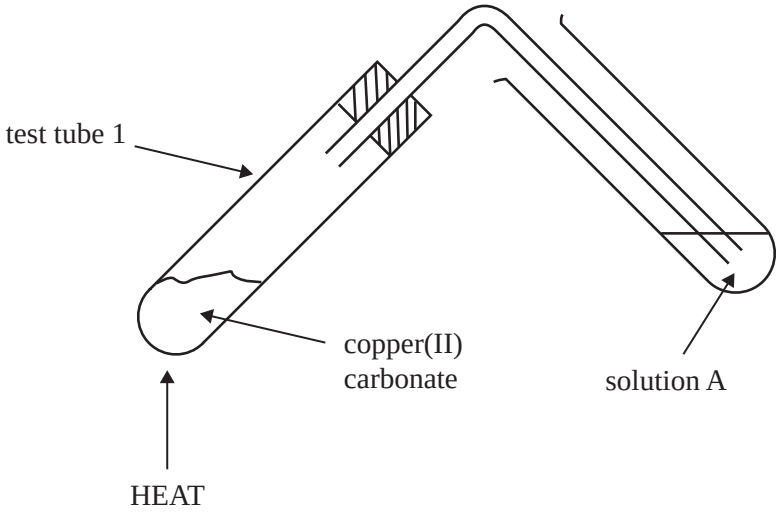
2. _____[2]

(iii) State one safety precaution which is necessary when carrying out this reaction in a test tube in the laboratory.

_____[1]

Examiner Only	
Marks	Remark

(c) Copper(II) carbonate, which is used in paints, thermally decomposes. The diagram below shows the apparatus used to thermally decompose a sample of copper(II) carbonate and test the carbon dioxide gas produced.



(i) What would you observe in test tube 1 as the copper(II) carbonate was heated?

_____

_____ [2]

(ii) Solution A is used to test for presence of carbon dioxide.
State the name of solution A, and the observations you would make for a positive test.

Solution A _____

Observations _____

_____ [3]

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(d) Metal compounds have important uses. For each of the uses listed in the table below, select the metal compound which is used for this purpose.
Each metal compound may be used once, more than once, or not at all.

sodium chloride **silver nitrate** **copper sulphate**

calcium sulphate **calcium hydroxide** **calcium nitrate**

aluminium hydroxide **sodium hydrogen carbonate**

Use	Metal compound
De-icing roads	
White line road markings	
Neutralising acidic soil	
Baking soda	

[4]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

5 During the nineteenth and twentieth centuries many scientists contributed to the development of atomic theory.

(a) Name one scientist whose work led to the structure of the atom as we know it today.

_____

_____ [1]

(b) The table below shows information about an aluminium **atom** and a fluoride **ion**.

(i) Complete the table.

	Symbol	**Number of electrons**	**Electronic configuration**
Aluminium **atom**		13	
Fluoride **ion**	F^-		

[4]

(ii) Write the formula for aluminium fluoride.

_____ [1]

(iii) Explain why an aluminium atom has no charge.

_____

_____

_____ [2]

(c) Compounds are formed when two or more different elements chemically bond together.

(i) Explain what you understand by the term element.

_____

_____

_____ [2]

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(ii) Using **full** electronic configurations, **draw diagrams** to show how atoms of magnesium combine with atoms of oxygen to form magnesium oxide.

[6]

(iii) State the type of bonding which is present in magnesium oxide.

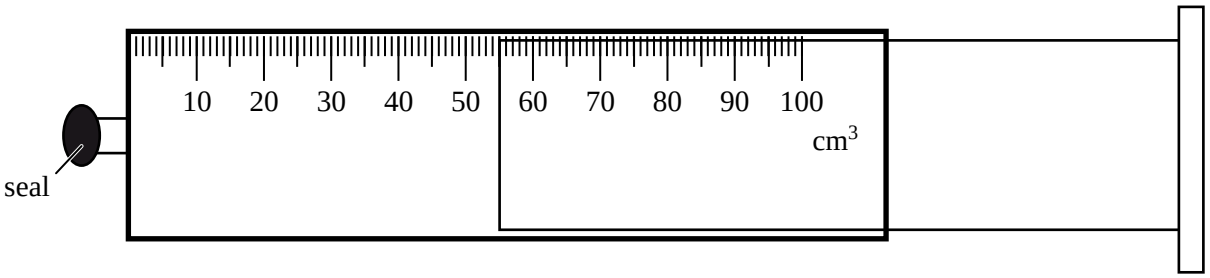
_____ [1]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

6 **(a)** The diagram below shows a gas syringe containing a sample of air. The syringe is sealed. The units on the syringe are cm^3.



(i) What volume of air is in the gas syringe?

_____ cm^3 [1]

(ii) Indicate whether the volume of air in the sealed gas syringe would increase or decrease by placing a tick in the correct column in the following table.

External factor	Volume increases	Volume decreases
Increase pressure		
Increase temperature		

[2]

(b) Air is a mixture of gases, some of which are listed in the table below. Complete the table giving the name or formula of the gas.

Name of gas	Formula of gas
	N_2
Oxygen	
Carbon dioxide	
	He
	Ar

[5]

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(c) Air contains only non-metallic elements. The table below lists the melting and boiling points of some non-metallic elements which are found in common pollutants in air.

Element	Melting point (°C)	Boiling point (°C)
carbon	3500	4827
fluorine	–220	–188
sulphur	114	444
chlorine	–101	–35
phosphorus	44	280
bromine	–7	59

(i) What is meant by the term melting point?

_____

_____[2]

(ii) At room temperature (20 °C), name the elements from the table above which are:

Gases _____

Liquids _____

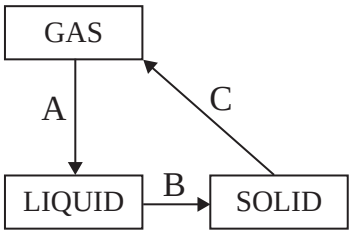
Solids _____[6]

Examiner Only

Marks	Remark

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(d) Some other changes of state are labelled in the diagram below.



Name the changes of state represented by the letters A, B and C.

A _____

B _____

C _____ [3]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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1847-028-1

GCSE

Science: Chemistry

Summer 2010

Mark Schemes

Issued: October 2010

Rewarding Learning

General Certificate of Secondary Education
2010

Science: Chemistry

Paper 2
Foundation Tier

[G1402]

WEDNESDAY 9 JUNE, AFTERNOON

MARK SCHEME

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AVAILABLE MARKS

1 (a) (i)

	Name	Formula
Ion present in all acids.	hydrogen [1]	H^+ [1]
Ion present in all alkalis.	hydroxide [1]	OH^- [1]

[4]

(ii)

Name of acid	Name of salt
Sulphuric acid	sulphate
Nitric acid	nitrate [1]
Hydrochloric acid	chloride [1]

[2]

(b) (i) sodium hydroxide + sulphuric acid → sodium sulphate + water [1]

(ii) $CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$ [2]

(c) (i) to ensure the acid is used up [1]

(ii) blue [1]

(iii) A = filter funnel [1]
B = evaporating basin [1]
Label residue [1]
Label filtrate [1] [4]

(iv) evaporate off half/$\frac{2}{3}$ of the water/heat to concentrate/idea of reduced volume [1] using heat
allow to cool [1] and crystallise [1]
filter [1]
idea of drying (crystals) between sheets of filter paper/in a low temperature oven/in a desiccator [1] max [3]

Quality of written communication [2]–[3] max [1]
[1] max [1] [2]

(v) copper carbonate + sulphuric acid → copper sulphate + water + carbon dioxide [1]

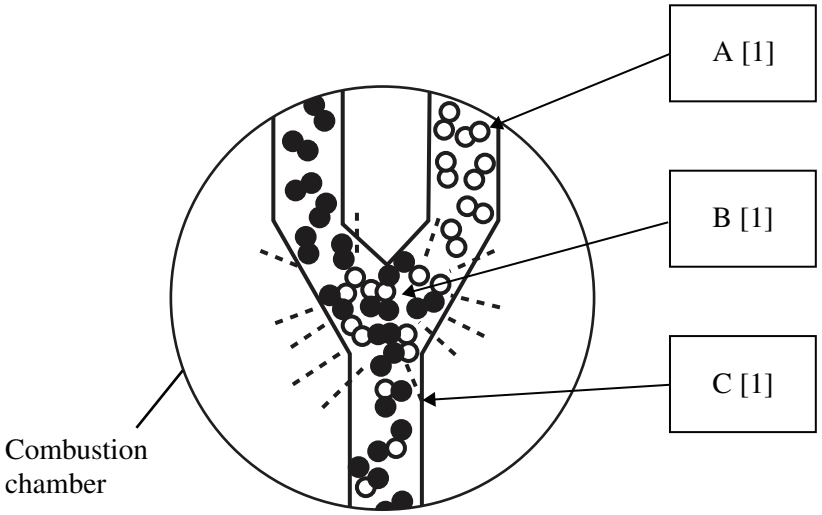
(vi) copper does not react (with sulphuric acid)/unreactive/low down in reactivity series [1]

22

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AVAILABLE MARKS

2 (a) (i)



© NASA http://www1.dfrc.nasa.gov/Gallery/Graphics/STS/Large/EG-0076-04.gif

Key
● hydrogen atom
○ oxygen atom [3]

(ii) $2H_2 + O_2 \rightarrow 2H_2O$ [3]

(iii) (combustion) product is water
or
(combustion) product(s) does not cause pollution
or
no solid residue in (combustion) product(s) e.g. no soot produced [1]

(iv) hydrogen gains oxygen [1]
oxidation is gain of oxygen [1] [2]

(b) (i) A = hydrogen/H_2 **not** H
B = heat
C = copper(II) oxide/copper oxide/CuO [3]

(ii) black [1] copper oxide
red-brown [1] copper
condensation/droplets/a colourless liquid [1] max [2]

(iii) $CuO + H_2 \rightarrow Cu + H_2O$ [2]

(iv) copper oxide loses oxygen [1]
reduction is loss of oxygen [1]
or
copper ions gain electrons [1]
reduction is gain of electrons [1] [2]

(c) (i) $2Mg + O_2 \rightarrow 2MgO$ [3]

(ii) white light/bright light
heat (given off) [1] max [1]

22

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AVAILABLE MARKS

3 **(a)**

Name	Formula	Relative formula mass
sodium hypochlorite	NaClO	74.5 [1]
chlorine dioxide	ClO_2	67.5 [1]
ozone	O_3	48 [1]

[3]

(b) **(i)**

Symbol	Name of element	Relative atomic mass	Number of atoms of this element present in the molecule
H	hydrogen	1	12
C	carbon	12	**7**
N	nitrogen	**14**	2
Cl	**chlorine**	35.5	1
O	oxygen	16	**1**
Br	bromine	**80**	1

[5]

(ii) bromine and chlorine/Br_2 and Cl_2/Br and Cl any order [1]

(iii) 255.5 CM from table [1]

(iv) $\frac{80}{255.5}$ [1] × 100 = 31.3% [1] apply CM from **(iii)** above and table [2]

(c) $NX_2Cl = 14 + 2X + 35.5 = 51.5$ [1]

$2X = 51.5 – 49.5 = 2$ [1]

division by 2 R.A.M. of X = 1 [1]

Give 3 directly for R.A.M of X = 1 with no working

Identity of X = hydrogen [1] [4] 16

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					AVAILABLE MARKS
4	(a)	(i)	break down [1] using heat [1]	[2]	
		(ii)	$CaCO_3 \rightarrow CaO + CO_2$	[2]	
		(iii)	heat taken in/energy taken in	[1]	
		(iv)	breaking strong/ionic bonds [1] requires a lot of energy [1]	[2]	
		(v)	$CaO + H_2O \rightarrow Ca(OH)_2$	[2]	
	(b)	(i)	$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$	[3]	
		(ii)	bubbles/effervescence/gas produced/fizzing [1] idea of solid/calcium carbonate disappears [1] **not** dissolves idea of heat (released) [1] idea of solution remaining colourless [1]	max [2]	
		(iii)	safety goggles	[1]	
	(c)	(i)	green [1] to black [1]	[2]	
		(ii)	limewater/calcium hydroxide [1] colourless [1] solution to milky/white (ppte) [1]	[3]	
	(d)		sodium chloride NaCl [1] calcium sulphate $CaSO_4$ [1] calcium hydroxide $Ca(OH)_2$ [1] sodium hydrogen carbonate $NaHCO_3$ [1]	[4]	24

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AVAILABLE MARKS

5 **(a)** John Dalton/J Chadwick/Rutherford/Thompson/Bohr [1]

(b) **(i)**

	Symbol	Number of electrons	Electronic configuration
Aluminium atom	Al [1]	13	2,8,3 [1]
Fluoride ion	F^-	10 [1]	2,8 [1]

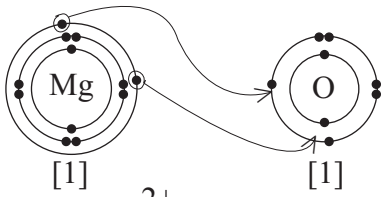
[4]

(ii) AlF_3 [1]

(ii) idea of same <u>number</u> [1] of protons and electrons [1] [2]

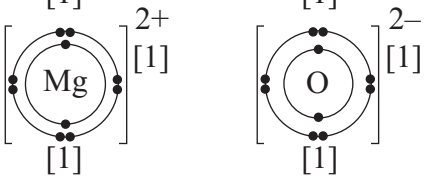
(c) **(i)** A substance made up of only one type of atom [2]
substance made of only one atom [1]
or substance which cannot be broken down (into anything simpler) [1]
by chemical means [1] [2]

(ii) Using full diagrams
magnesium atom 2,8,2 [1]
oxygen atom 2,6 [1]
transfer of 2 electrons from Mg to O [1]



[1] [1]

magnesium ion 2,8 [1]
oxide ion 2,8 [1]



[1] [1] [1] [1]

charge on magnesium ion 2^+ [1]
charge on oxide ion 2^- [1]

attraction between oppositely charged ions/electrostatic attraction [1]
max [6]

(iii) ionic [1]

17

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6 (a) (i) 55 [1]

(ii)

External factor	Volume increases	Volume decreases
Increase pressure		✓ [1]
Increase temperature	✓ [1]	

[2]

(b)

Name of gas	Formula of gas
Nitrogen [1]	N_2
Oxygen	O_2 [1]
Carbon dioxide	CO_2 [1]
Helium [1]	He
Argon [1]	Ar

[5]

(c) (i) temperature [1]
at which a solid changes to a liquid [1] [2]

(ii) Gases: fluorine [1] chlorine [1]
Liquids: bromine [1]
Solids: carbon [1] sulphur [1] phosphorus [1] [6]

(d) A = condensing [1]
B = freezing/solidifying [1]
C = subliming [1] [3]

Total

AVAILABLE MARKS

19

120

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Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2009

Science: Chemistry

Paper 2
Foundation Tier

G1402

[G1402]

WEDNESDAY 17 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.
Write your answers in the spaces provided in this question paper.
Answer **all six** questions.

INFORMATION FOR CANDIDATES

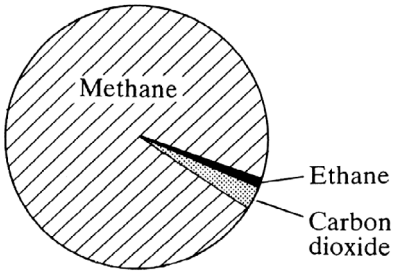
The total mark for this paper is 120.
Quality of written communication will be assessed in question **6(a)(iv)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Data Leaflet which includes a Periodic Table of the Elements is provided.

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

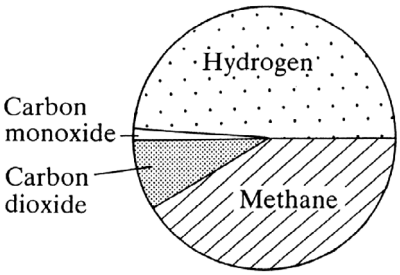
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Examiner Only	
Marks	Remark

1 Before large amounts of natural gas were discovered under the North Sea the main gas used in the UK was coal gas. The diagrams below show the composition of natural gas and coal gas.



Natural gas



Coal gas

(a) (i) Describe a chemical test that you could use to show that both gases contained carbon dioxide. State the result for a positive test.

_____

_____

_____ [3]

(ii) Name the substance in coal gas which is toxic.

_____ [1]

(iii) Name the substances formed when natural gas burns in a plentiful supply of air.

_____

_____ [2]

(iv) When both natural gas and coal gas burn, heat energy is given out. State the name used to describe a reaction which gives out heat.

_____ [1]

(v) Natural gas contains two **hydrocarbons**, ethane and methane. What is meant by the term hydrocarbon?

_____

_____ [2]

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(vi) Coal gas contains hydrogen. Write a balanced symbol equation for hydrogen burning in oxygen.

_____ [3]

(b) The table shows the percentage of different energy sources used in the UK in 2004.

Energy Source	Percentage (%)
coal	26
crude oil	46
natural gas	18
nuclear power	3
hydroelectric power	6
others (wood, alcohol etc.)	0.5
solar power	0.5

(i) Name **two** energy sources from the table which are renewable.

_____

_____ [2]

(ii) Explain the difference between renewable and non-renewable sources of energy.

_____

_____

_____ [2]

(iii) One of the energy sources is also used to make many organic chemicals, for example, plastics. Name this energy source.

_____ [1]

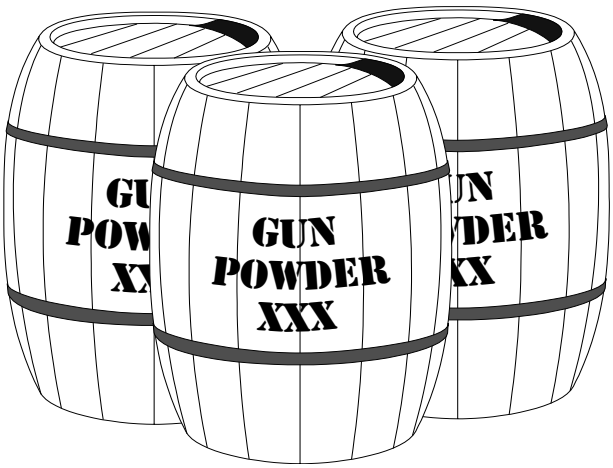
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

2 **(a)** Gunpowder is an explosive material which contains the salt potassium nitrate. In the 15th and 16th centuries potassium nitrate was obtained from urine. Nowadays potassium nitrate can be manufactured by neutralisation.



(i) What do you understand by the term **salt**?

_____

_____ [2]

(ii) Write the formula for potassium nitrate.

_____ [1]

(iii) Name **two compounds** which would react together to form potassium nitrate.

1. _____

2. _____ [2]

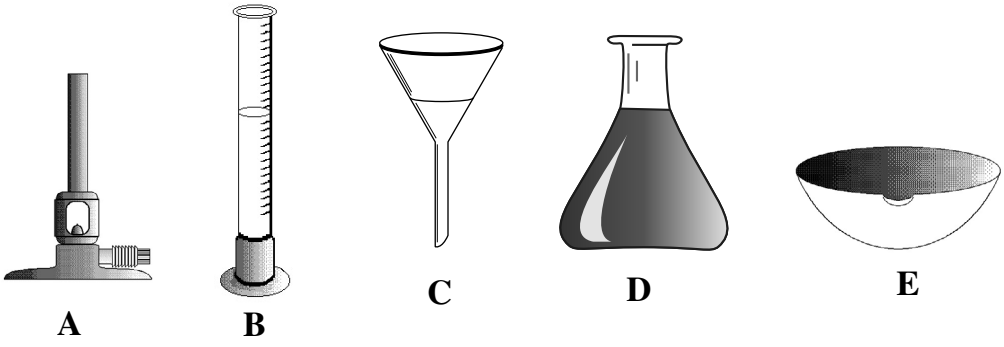
(b) Complete the following word equations for the reactions of acids.

(i) + → zinc sulphate + hydrogen [2]

(ii) + → potassium chloride + water [2]

Examiner Only	
Marks	Remark

(c) Sodium chloride is another salt and it may be prepared from the reaction between sodium hydroxide solution and hydrochloric acid. Some of the apparatus needed for this preparation is shown below.



A **B** **C** **D** **E**

(i) Name the pieces of apparatus labelled **A**, **B**, **C**, **D** and **E** in the diagrams above.

A _____

B _____

C _____

D _____

E _____ [5]

Using only the letters **A** to **E** answer the following questions.

(ii) Which piece of apparatus could be used to measure out 25 cm^3 of sodium hydroxide solution?

_____ [1]

(iii) In which piece of apparatus would you place the 25 cm^3 of sodium hydroxide solution before adding the acid?

_____ [1]

(iv) Which **two** pieces of apparatus would you need to evaporate some of the water from the salt solution?

_____ [2]

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(d) Zinc chloride is a soluble salt which may be prepared by adding excess zinc carbonate to hydrochloric acid.

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Marks	Remark

(i) State one way you would know that the zinc carbonate was in excess.

_____

_____ [1]

(ii) Write a balanced symbol equation for the reaction of zinc carbonate with hydrochloric acid.

_____ [3]

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Examiner Only	
Marks	Remark

3 Bordeaux mixture is a combination of copper(II) sulphate and calcium hydroxide invented in the vineyards of the Bordeaux region of France, and used mainly to control fungus on grapes, apples and peaches.



Source: http://www.organiccatalog.com/catalog/product_info.php?cPath=61_:181&products_id=517

(a) Bordeaux mixture is prepared by making a solution of copper(II) sulphate and a solution of calcium hydroxide, and the two solutions are then poured together through a strainer.

(i) What colour is copper(II) sulphate solution?

_____ [1]

(ii) What colour is calcium hydroxide solution?

_____ [1]

(iii) What is the common name for a solution of calcium hydroxide?

_____ [1]

(iv) Write the formula for calcium hydroxide.

_____ [1]

(v) What is meant by the term solution?

_____

_____ [2]

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Examiner Only	
Marks	Remark

(b) To prepare a solution of copper(II) sulphate for use in Bordeaux mixture, 6.8 g of hydrated copper(II) sulphate crystals were crushed and added to 20 cm^3 of water in a boiling tube.

The mixture was stirred with a thermometer and heated very gently in a water bath. All the crystals dissolved and a **saturated solution** was obtained at 50 °C.

(i) State the **three** procedures in this experiment which helped to increase the speed of dissolving.

1. _____

2. _____

3. _____ [3]

(ii) Draw a **labelled diagram** of the assembled apparatus used to heat and dissolve the copper(II) sulphate crystals.

[4]

(iii) Explain what is meant by the term **saturated solution**.

_____

_____

_____ [2]

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(c) Bordeaux mixture sometimes finds its way into lakes and rivers where it is dangerous for aquatic life.

State **two other** causes of pollution in water.

1. _____

2. _____ [2]

(d) Like Bordeaux mixture, sulphur dioxide gas is used to control fungus on grapes.

(i) How does the solubility of sulphur dioxide gas change as the temperature increases?

_____ [1]

(ii) State one other use for sulphur dioxide.

_____ [1]

(e) Anhydrous copper sulphate can be used to test for water.

(i) What is meant by the term anhydrous?

_____ [1]

(ii) What colour is anhydrous copper sulphate?

_____ [1]

(iii) Name one other chemical which could be used to test for water.

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

4 The Periodic Table contains all known elements. It evolved from the study of the trends and patterns in the physical and chemical properties of the elements.

(a) (i) Name the Russian chemist who devised a Periodic Table very similar to the modern Periodic Table used today.

_____ [1]

(ii) Fill in the blanks in the following passage.

The modern Periodic Table arranges the elements in order of increasing atomic _____ whereas early versions of the Periodic Table arranged them in order of increasing atomic _____. [2]

(iii) Name the English chemist who devised "a law of octaves" for the elements.

_____ [1]

(b) The Periodic Table groups together elements with similar properties.

(i) How many groups are there in the Periodic Table?

_____ [1]

(ii) In which group would you find the most reactive metals?

_____ [1]

(iii) Name the group which contains only non-metals which are unreactive.

_____ [1]

(iv) How does the reactivity of the elements in Group II change on descending the group?

_____ [1]

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(c) There are many patterns and trends in the Periodic Table.

Examiner Only	
Marks	Remark

(i) What is the name given to the horizontal rows in the Periodic Table?

_____ [1]

(ii) What is the relationship between the position of an element in the Periodic Table and the number of electrons in the outer shell of an atom of the element?

_____

_____ [1]

(iii) Atoms of Group II elements form simple ions. What is the charge on these ions?

_____ [1]

Examiner Only	
Marks	Remark

(d) Samples of oxides of elements were tested for their solubility in water. The pH of any resulting solution was recorded. The reaction of the oxides with dilute hydrochloric acid was also noted. The results are summarised in the table below.

Unknown oxide	Soluble in water	pH of solution	Reaction with dilute hydrochloric acid
A	YES	14	YES
B	NO	—	YES
C	YES	2	NO

(i) Which letter, **A**, **B or C**, represents an oxide of a non-metal?

_____ [1]

(ii) Which letter, **A**, **B or C**, represents an oxide which is a base, but is not an alkali?

_____ [1]

(iii) Which letter, **A**, **B or C**, represents an alkali?

_____ [1]

(iv) Write a balanced symbol equation for the reaction of the base magnesium oxide with dilute hydrochloric acid.

_____ [3]

(e) Some **elements** form neutral oxides.

Name one **element** which forms a neutral oxide and write the formula of this oxide.

Element: _____

Formula of oxide: _____ [2]

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Examiner Only	
Marks	Remark

5 Metals show a variety of physical and chemical properties. Some metals react with cold water and others, which do not react with cold water, will react with steam.

(a) Some of the physical properties of metals and their meanings are given in the table below. Complete the table.

Physical Property	Meaning
malleable	
	can be drawn out into wires
lustrous	

[3]

(b) Both potassium and calcium react with cold water. Complete both of the tables below stating the observations and writing a balanced symbol equation for each reaction.

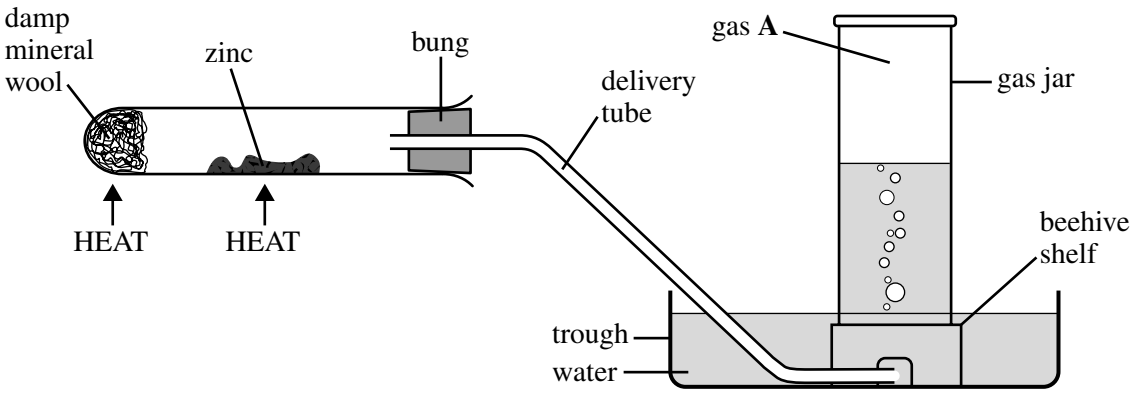
potassium and water	
observations	[4]
balanced symbol equation	[3]

calcium and water	
observations	[3]
balanced symbol equation	[3]

Examiner Only	
Marks	Remark

(c) 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 gaseous product.



(i) Explain why the damp mineral wool is heated.

_____

_____ [1]

(ii) What is the name of gas **A**?

_____ [1]

(iii) Write a balanced symbol equation for the reaction of zinc with steam.

_____ [2]

(iv) Name **one other** metal which does not react with cold water but does react with steam.

_____ [1]

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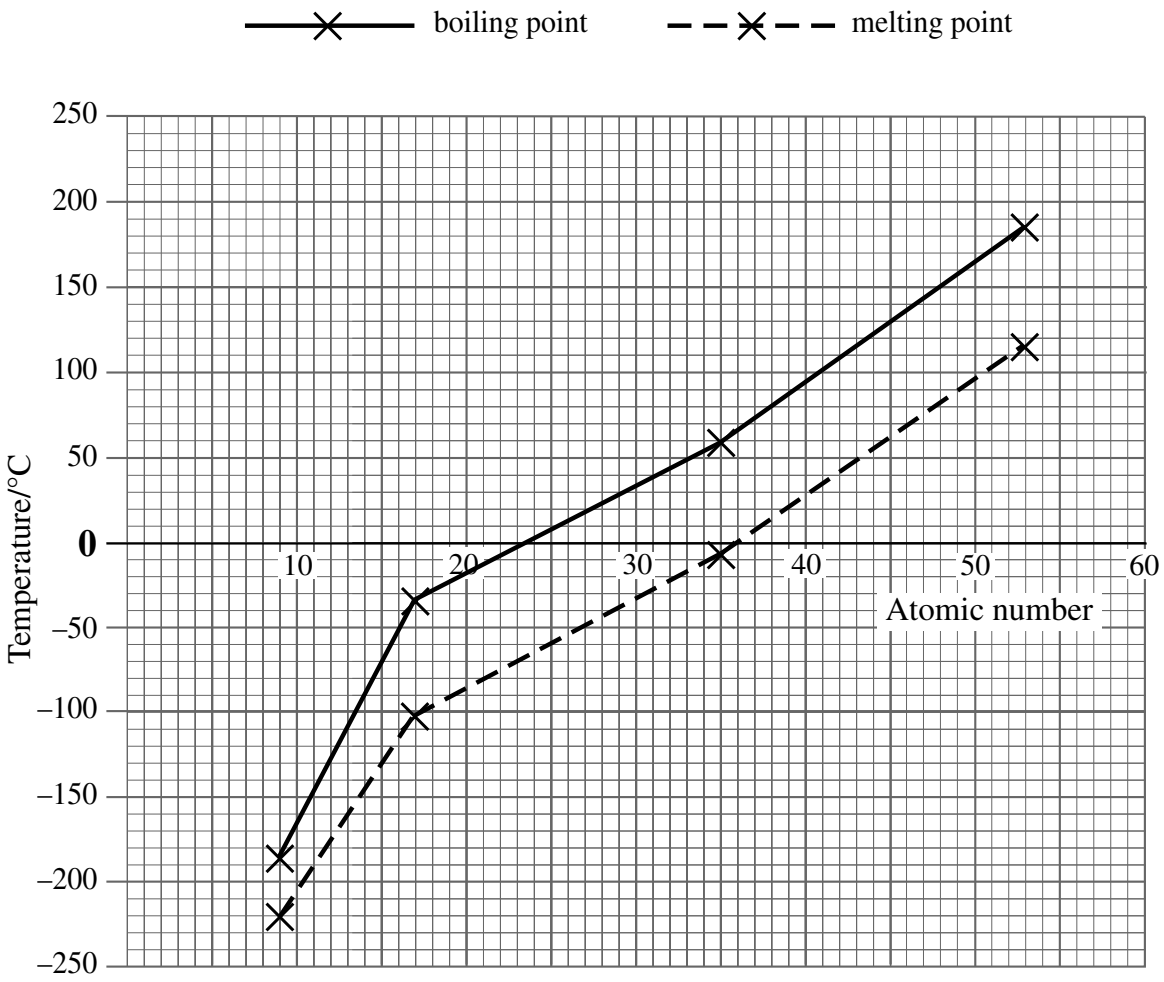
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Marks	Remark

6 **(a)** The graph shows the melting points and the boiling points of the first four elements in the same group of the Periodic Table, against their atomic number.



(i) State the electronic configuration of the element with the **lowest** melting point.

_____ [1]

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(ii) Use the graph to find the melting point and boiling point of the elements with atomic number 17 and 35 and use this information to work out the states of these elements at room temperature and pressure (20 °C).

	Element with atomic number 17	**Element with atomic number 35**
Melting point (°C)		
Boiling point (°C)		
Physical state at room temperature		

[6]

(iii) Draw a diagram to show how the particles are arranged at 20 °C in the element with atomic number 17.

Element
(atomic number 17) [1]

(iv) The graph shows data for the first four elements in this group. The fifth element in this group is a solid at room temperature and pressure. Explain what happens, in terms of particles, when this solid is heated and changes to a liquid.

_____

_____

_____

_____

_____

_____ [3]

Quality of written communication [2]

(v) One of the elements in this group sublimes when heated. What is meant by the term sublimation?

_____ [1]

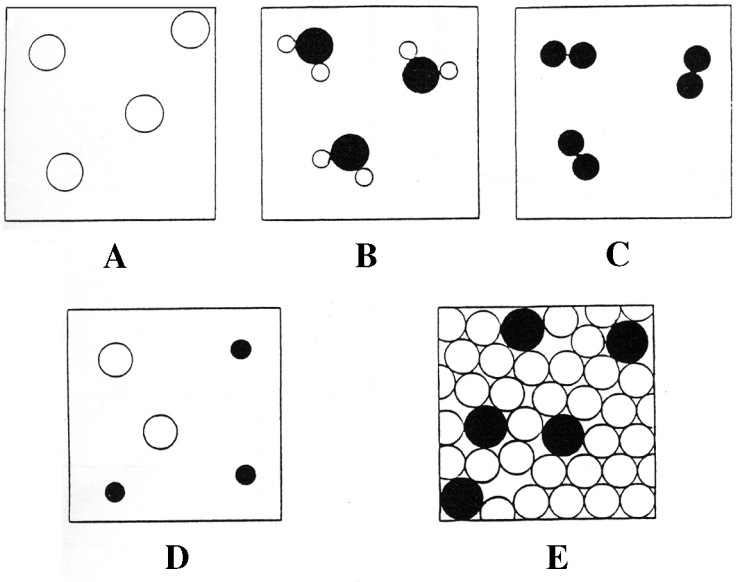
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

(b) The diagrams below represent elements, compounds and mixtures.



Use the letters **A**, **B**, **C**, **D** or **E** to answer the questions below. Each letter may be used once, more than once, or not at all.

State which of the diagrams could represent:

(i) a gaseous mixture of argon and neon _____

(ii) a mixture of two solids _____

(iii) oxygen gas O_2 _____

(iv) a gas such as helium _____

(v) a compound which is a gas _____ [5]

THIS IS THE END OF THE QUESTION PAPER

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GCSE

Science: Chemistry

Summer 2009

Mark Schemes

Issued: October 2009

Rewarding Learning

General Certificate of Secondary Education
2009

Science: Chemistry

Paper 2
Foundation Tier

[G1402]

WEDNESDAY 17 JUNE, MORNING

MARK SCHEME

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					AVAILABLE MARKS
1	(a)	(i)	limewater [1] colourless [1] to milky [1]	[3]	
		(ii)	carbon monoxide	[1]	
		(iii)	carbon dioxide [1] water [1]	[2]	
		(iv)	exothermic	[1]	
		(v)	substance which contains **carbon and hydrogen** [1] only [1]	[2]	
		(vi)	$2H_2 + O_2 \rightarrow 2H_2O$	[3]	
	(b)	(i)	hydroelectric/solar/others maximum [2]	[2]	
		(ii)	non-renewable – idea of will eventually run out [1] renewable – idea of can be replaced [1]	[2]	
		(iii)	crude oil	[1]	17

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				AVAILABLE MARKS
2	**(a)**	**(i)**	a compound [1] formed when an acid reacts with/neutralises **or** when acid hydrogen replaced [1] a base/alkali/metal/carbonate [1] **or** with a metal [1] maximum [2] [2]	
		(ii)	KNO_3 [1]	
		(iii)	potassium oxide/hydroxide/carbonate/hydrogen carbonate [1] nitric acid [1] [2]	
	(b)	**(i)**	zinc [1] + sulphuric acid [1] → zinc sulphate + hydrogen [2]	
		(ii)	potassium hydroxide/oxide [1] + hydrochloric acid [1] → potassium chloride + water [2]	
	(c)	**(i)**	**A** = Bunsen burner [1] **B** = measuring cylinder [1] **C** = filter funnel [1] **D** = conical flask [1] **E** = evaporating basin/dish [1] [5]	
		(ii)	**B** [1]	
		(iii)	**D** [1]	
		(iv)	**A** and **E** [2]	
	(d)	**(i)**	no more gas produced/gas production stops/idea of solid remaining at bottom of beaker [1]	
		(ii)	$ZnCO_3 + 2HCl \rightarrow ZnCl_2 + CO_2 + H_2O$ [3]	22

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					AVAILABLE MARKS
3	**(a)**	**(i)**	blue	[1]	
		(ii)	colourless	[1]	
		(iii)	limewater	[1]	
		(iv)	$Ca(OH)_2$	[1]	
		(v)	A solute [1] (dissolved) in a solvent [1]	[2]	
	(b)	**(i)**	increased temperature/heat [1] stir [1] crystals crushed [1]	[3]	
		(ii)	individual marks are given for correctly labelled and recognisable drawing No labels = no marks water and copper sulphate in boiling tube [1] boiling tube in water bath [1] thermometer in boiling tube [1] tripod [1] gauze [1] Bunsen burner/heat [1] maximum [4]	[4]	
		(iii)	no more solid will dissolve/maximum mass dissolved [1] at a particular temperature [1]	[2]	
	(c)		oil/litter/hot water from factories/excess fertilisers/detergents/sewage Any **two**	[2]	
	(d)	**(i)**	decreases	[1]	
		(ii)	preservative/bleach	[1]	
	(e)	**(i)**	without water	[1]	
		(ii)	white	[1]	
		(iii)	(anhydrous) cobalt chloride	[1]	22

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					AVAILABLE MARKS
4	(a)	(i)	Mendeleev	[1]	
		(ii)	number [1] mass [1]	[2]	
		(iii)	Newlands	[1]	
	(b)	(i)	8	[1]	
		(ii)	Group I/alkali metals	[1]	
		(iii)	noble gases/Group VIII or 0 **Not** inert gases	[1]	
		(iv)	more reactive/increased reactivity	[1]	
	(c)	(i)	Periods	[1]	
		(ii)	number of electrons in outer shell equals group number/as the Periodic Table is crossed from left to right the number of electrons increases	[1]	
		(iii)	2 +	[1]	
	(d)	(i)	**C**	[1]	
		(ii)	**B**	[1]	
		(iii)	**A**	[1]	
		(iv)	$MgO + 2HCl \rightarrow MgCl_2 + H_2O$	[3]	
	(e)		Hydrogen [1] H_2O [1] **or** Carbon [1] CO[1] **or** Nitrogen [1] NO [1]	[2]	19

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AVAILABLE MARKS

5 **(a)**

Physical Property	Meaning
malleable	can be hammered into shape/ beaten into sheets [1]
ductile [1]	can be drawn out into wires
lustrous	shiny [1]

[3]

(b)

potassium and water	
observations	floats/on surface [1] moves [1] hisses/gas produced/bubbles/fizzes [1] heat released [1] lilac [1] flame [1] eventually disappears [1] **not** dissolves colourless solution [1] cracks/explodes/sparks/vigorous reaction [1] melts/forms a (silvery) ball [1] maximum [4]
balanced symbol equation	$2K + 2H_2O \rightarrow 2KOH + H_2$

[4]

[3]

calcium and water	
observations	bubbles/gas produced/fizzes [1] heat released [1] eventually disappears [1] **not** dissolves colourless solution [1] Ca sinks/Ca sinks and rises [1] maximum [3]
balanced symbol equation	$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$

[3]

[3]

(c) **(i)** to generate/produce steam [1]

(ii) hydrogen [1]

(iii) $Zn + H_2O \rightarrow ZnO + H_2$ [2]

(iv) aluminium/iron [1]

21

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AVAILABLE MARKS

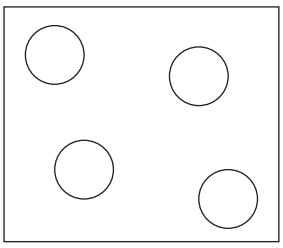
6 **(a)** **(i)** 2, 7 [1]

(ii)

	Element with atomic number 17	**Element with atomic number 35**
Melting point (°C)	–101 [1] (**accept** –100)	–7 [1] (**accept** –5 → –10)
Boiling point (°C)	–35 [1] (**accept** –34 → –36)	59 [1] (**accept** 60)
Physical state at room temperature	gas [1]	liquid [1]

[6]

(iii) allow c.m. from **(ii)** [1]



(iv) particles gain energy [1]
vibrate more [1]
idea of overcome attractive forces [1]
idea of move apart [1]
maximum [3] [3]

Quality of written communication [2]

(v) solid to gas [1]

(b) **(i)** **D** [1]

(ii) **E** [1]

(iii) **C** [1]

(iv) **A** [1]

(v) **B** [1] [5] 19

Total **120**

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