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IGCSE

Chemistry

Sample Assessment Materials (SAMs)

Edexcel IGCSE in Chemistry (4CH0)

First examination 2011

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We will inform centres of any changes to this issue. The latest issue can be found on the Edexcel website: www.edexcel.org.uk.

Acknowledgements

This document has been produced by Edexcel on the basis of consultation with teachers, examiners, consultants and other interested parties. Edexcel acknowledges its indebtedness to all those who contributed their time and expertise to its development.

Authorised by Roger Beard
Prepared by Phil Myers

Contents

Introduction

These sample assessment materials have been prepared to support the specification.

The aim of these materials is to provide students and centres with a general impression and flavour of the actual question papers and mark schemes in advance of the first operational examinations.

Sample question papers

Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						4	C	H	0	/	1	C	Signature	

Paper Reference(s)

4CH0/1C

Edexcel IGCSE

Chemistry

Chemistry Paper 1

Sample Assessment Material

Time: 2 hours

Materials required for examination
Nil

Items included with question papers
Nil

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
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10	
11	
12	
13	
14	
Total	

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
Show all the steps in any calculations and state the units. Calculators may be used.
Indicate your answer to multiple choice items by marking the chosen box with a cross in the box (☒).
If you change your mind, put a line through the box (~~☒~~) and then indicate your new answer with a cross (☒).

Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 14 questions in this question paper. The total mark for this paper is 120.
There are 28 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

Write your answers neatly and in good English.

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N 3 5 0 8 4 A 0 1 2 8

Turn over

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THE PERIODIC TABLE

Period	Group 1	2											3	4	5	6	7	0
1	1 H Hydrogen 1																	4 He Helium 2
2	7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
3	23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
4	39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	63.5 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
5	86 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
6	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	179 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
7	223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

Key

Relative atomic mass
Symbol
Name
Atomic number

Leave blank

Answer ALL questions

1. Use the Periodic Table on page 2 to help you answer this question.

(a) State the symbol of the element that has the atomic number of 12.

.....

(1)

(b) State the symbol of the element that has a relative atomic mass of 12.

.....

(1)

(c) State the number of the group that contains the noble gases.

.....

(1)

(d) Which group contains elements whose atoms form ions with a 2+ charge?

.....

(1)

(e) Which group contains elements whose atoms form ions with a 1– charge?

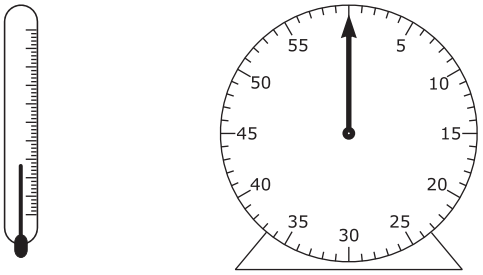
.....

(1) **Q1**

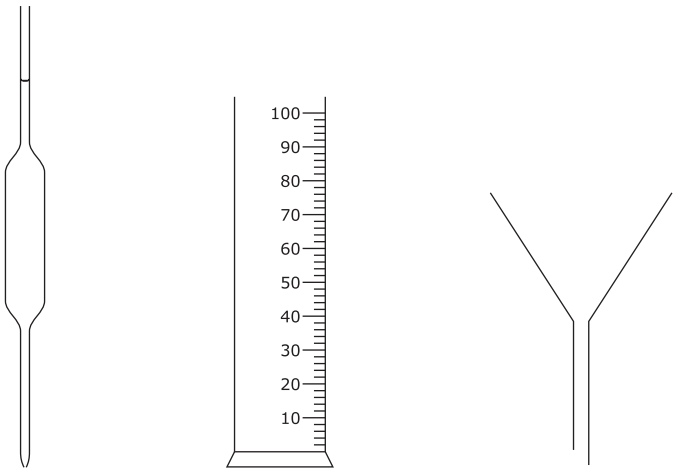
(Total 5 marks)

Leave blank

2. The diagrams show some pieces of apparatus you can find in a chemistry laboratory.



A **B**



C **D** **E**

(a) Name the pieces of apparatus, **B** and **E**. Use only names from the box.

funnel	measuring cylinder	thermometer
pipette	stop clock	

B .....

E .....

(2)

(b) **Two** of the pieces shown can be used to measure the volume of a liquid. State the letters of these two pieces.

..... and .....

(2)

(c) **One** of the pieces shown cannot be used to make a measurement. State the letter of this piece.

.....

(1) **Q2**

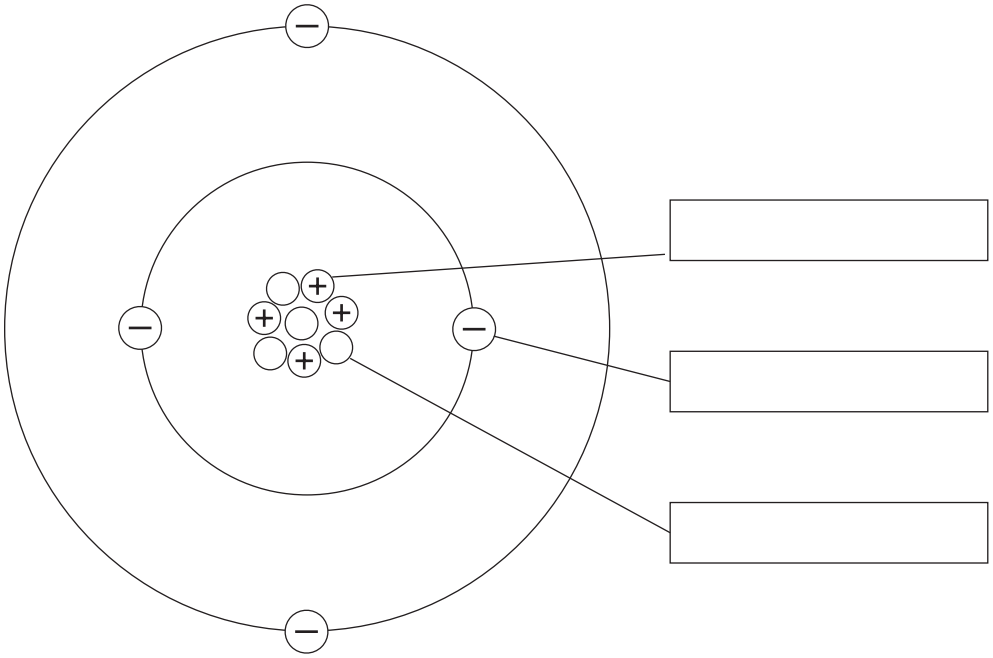
(Total 5 marks)

Leave blank

3. This question is about atoms.

(a) (i) Choose words from the box to label the diagram of an atom.

electron	**ion**
neutron	**proton**



(3)

(ii) State the mass number of this atom.

.....

(1)

(iii) The diagram above represents the atom of an element. State the name of the element. Use the Periodic Table on page 2 to help you.

.....

(1)

(b) Chlorine has two isotopes. State one way in which atoms of the two isotopes are

the same .....

.....

different .....

.....

(2) **Q3**

(Total 7 marks)

Leave blank

4. A piece of iron is left in damp air for some time.
A brown layer forms on the iron.

(a) Name the **two** substances in damp air that are needed for the iron to react.

1 .....

2 .....

(2)

(b) Name the substance in the brown layer.

.....

(1)

(c) The reaction between iron and damp air can be prevented by covering the iron with another material. Name **two** materials that can be used.

1 .....

2 .....

(2)

Q4

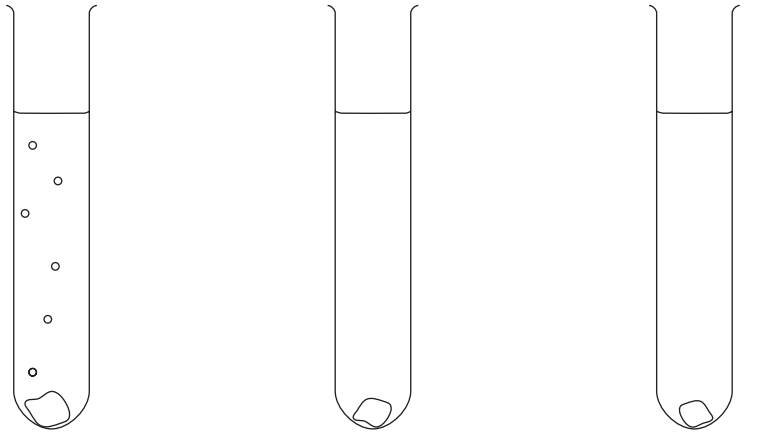
(Total 5 marks)

Leave blank

5. The reactivity of metals can be compared by comparing their reactions with dilute hydrochloric acid.
Three different metals of identical size are added to separate test tubes containing this acid.

The diagram already shows bubbles of hydrogen gas forming when a piece of zinc is added to dilute hydrochloric acid.

(a) Complete the diagram to show the bubbles forming in the other two test tubes.



(2)

(b) Write a word equation to show the reaction between zinc and dilute hydrochloric acid.

.....

(1)

(c) Name **one** metal that does not react when it is added to dilute hydrochloric acid.

.....

(1)

(d) Suggest **two** substances, other than acids, that can be used in reactions to compare the reactivity of metals.

1 .....

2 .....

(2)

Q5

(Total 6 marks)

Leave blank

6. (a) A molecule of hydrogen contains a covalent bond.

(i) What is a covalent bond?

.....

(1)

(ii) Draw a dot and cross diagram to show the covalent bond in a hydrogen molecule.

(1)

(b) State a test for hydrogen gas and the result.

Test .....

Result .....

(2)

(c) State **one** industrial use of hydrogen.

.....

(1)

(d) The only product of the combustion of hydrogen is water. Write a word equation for the combustion of hydrogen.

.....

(1)

Leave blank

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

(i) Use words from the box to complete the sentence.

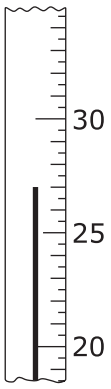
blue	**brown**	**colourless**
green	**pink**	**white**

Water is a ..... liquid which changes the colour of the copper(II) sulphate from ..... to ..... .

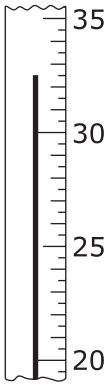
(3)

(ii) The diagrams show the thermometer readings of some water before and after the addition of anhydrous copper(II) sulfate. Write the temperature shown on each thermometer in the space below each diagram.

Before



After



Temperature before ..... °C Temperature after ..... °C

(2)

(iii) Calculate the temperature change that occurred.

(1)

Leave blank

(iv) What type of reaction occurs in this test? Put a cross (☒) in the correct box.

A endothermic ☒

B exothermic ☒

C neutralisation ☒

(1) **Q6**

(Total 13 marks)

Leave blank

7. The equation below shows the decomposition of ammonium chloride. It is a reversible reaction.

$$NH_4Cl(s) \rightleftharpoons NH_3(g) + HCl(g)$$

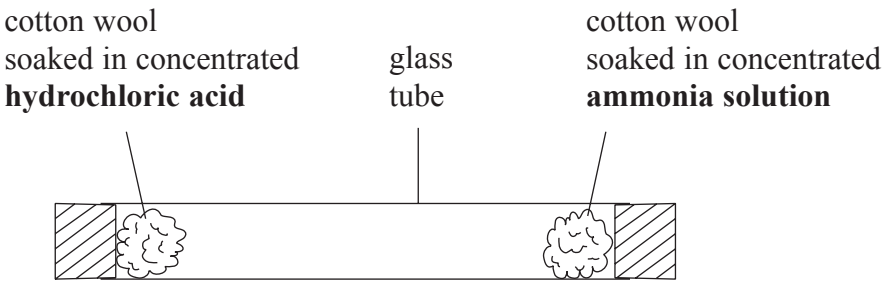
(a) How is this reaction made to go in the **forward** direction?

.....

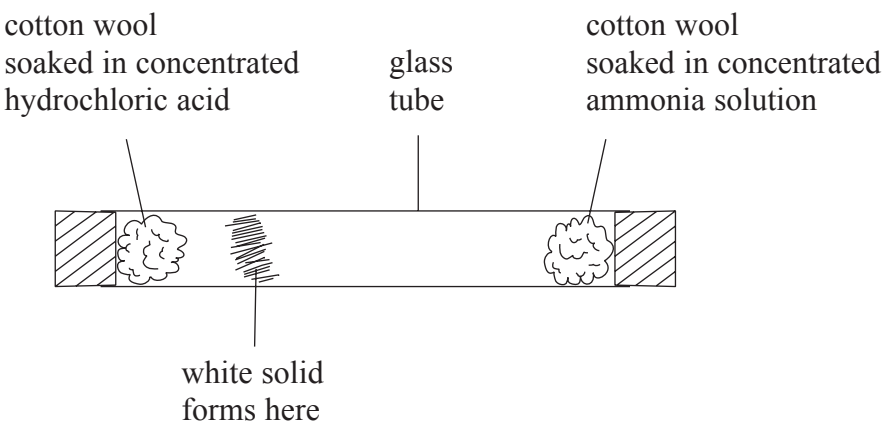
(1)

(b) Concentrated hydrochloric acid gives off hydrogen chloride gas.
Concentrated ammonia solution gives off ammonia gas.

An experiment is set up.



After a few minutes a white solid forms inside the tube. The solid forms when ammonia gas reacts with hydrogen chloride gas.



(i) Name the process by which the ammonia and hydrogen chloride particles move inside the tube.

.....

(1)

(ii) Name the white solid that forms inside the tube.

.....

(1)

Leave blank

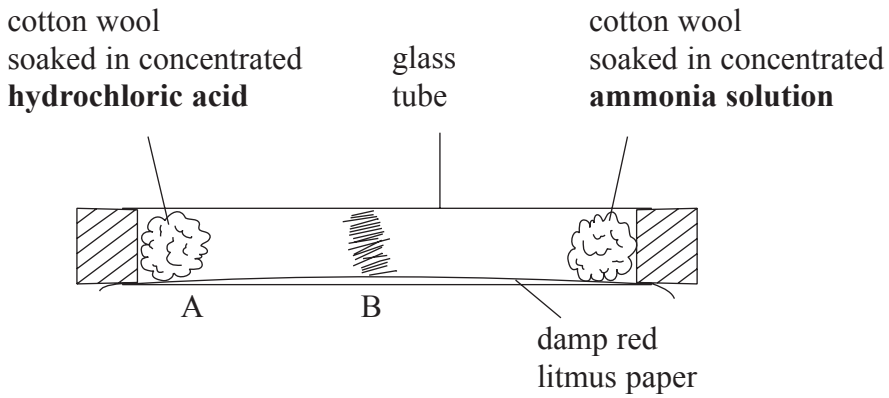
(iii) Suggest what the position of the white solid tells you about the relative speeds at which the ammonia and hydrogen chloride particles move.

.....

.....

(1)

(iv) The experiment is repeated with a strip of damp red litmus paper placed along the inside of the tube.



State the colour of the litmus paper at A and B when the white solid forms.

A .....

B .....

(2)

(Total 6 marks)

Q7

Leave blank

8. The alkenes are a **homologous series** of **unsaturated** hydrocarbons.

(a) (i) Place a cross (☒) in the **two** boxes that indicate which statements about members of a homologous series are correct.

A They have similar chemical properties ☒

B They have the same displayed formula ☒

C They have the same general formula ☒

D They have the same physical properties ☒

E They have the same relative formula masses ☒

(2)

(ii) State the meaning of the term **unsaturated**.

.....

.....

(1)

(b) Alkenes react with bromine water. Ethene is the simplest alkene.

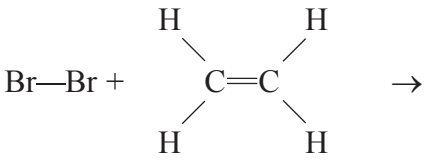
(i) Bromine water is added to ethene. State the colours of the reaction mixture at the start and the finish.

Colour at start .....

Colour at finish .....

(2)

(ii) Complete the equation by drawing the displayed formula of the product.



(1)

Leave blank

(c) Isomers are compounds that have the same molecular formula but different displayed formulae.

Draw the displayed formulae of **two** isomers that have the molecular formula C_4H_8.

(2) **Q8**

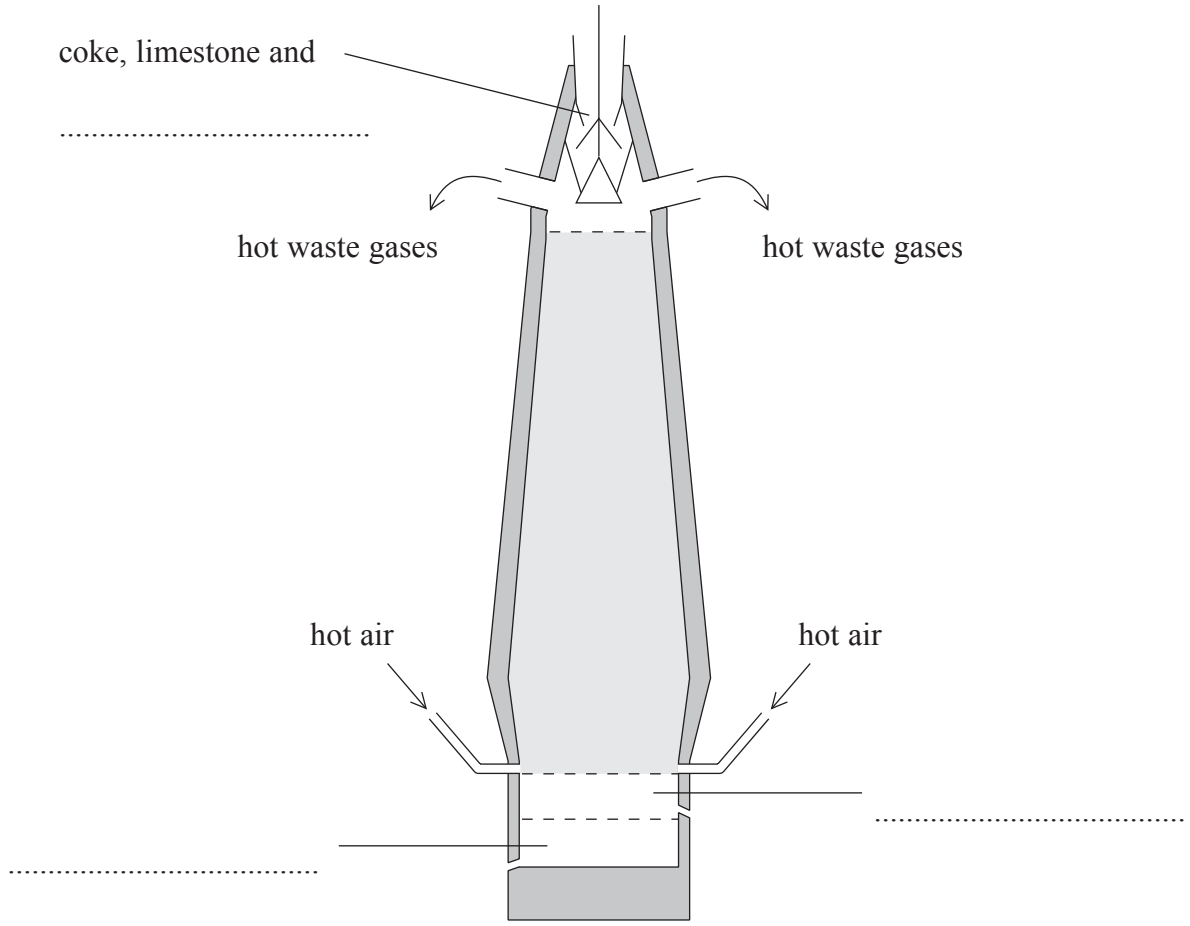
(Total 8 marks)

Leave blank

9. Iron is extracted from iron ore in a blast furnace.

(a) Label the diagram of the blast furnace. Use only words from the box. Each word may be used once, more than once or not at all.

bauxite	**cryolite**	**haematite**
molten iron	**sand**	**slag**



(3)

(b) Coke is composed mainly of carbon. Coke burns in the oxygen in the hot air.

(i) Write a chemical equation for the reaction which occurs when carbon burns completely in oxygen.

.....

(1)

(ii) State why this reaction is important in the blast furnace.

.....

.....

(1)

Leave blank

(c) Limestone is mainly calcium carbonate. In the blast furnace limestone decomposes to give carbon dioxide and calcium oxide.

Write a chemical equation for this reaction.

.....

(1)

(d) Iron is produced by the reduction of iron(III) oxide. An equation for the reaction is

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

Suggest why this reaction is described as the reduction of iron(III) oxide.

.....

(1)

(e) Aluminium is another important metal.

(i) Unlike iron, aluminium cannot be extracted from its ore using a blast furnace. Explain why.

.....

(1)

(ii) State **one** large-scale use of aluminium, and a property of aluminium on which this use depends.

Use .....

Property .....

(2)

Q9

(Total 10 marks)

Leave blank

10. Sodium is a very reactive metal. When a small piece of sodium is added to a trough of water it floats and reacts rapidly, giving off hydrogen gas.

A small piece of sodium is placed in a trough of water. A reaction takes place and hydrogen gas is given off.

(a) (i) State **two** observations, other than the sodium floating, that you could make during the reaction.

1 .....

2 .....

(2)

(ii) Write a word equation for the reaction.

.....

(1)

(b) A piece of platinum wire is dipped into the solution in the trough and then held in a roaring Bunsen flame. The Bunsen flame becomes coloured.

(i) State the colour that the flame becomes.

.....

(1)

(ii) Name the method of identification.

.....

(1)

(c) After the reaction with sodium, universal indicator is added to the solution remaining in the trough. State what colour it turns and explain why.

Colour .....

Explanation .....

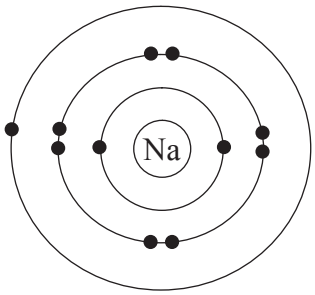
.....

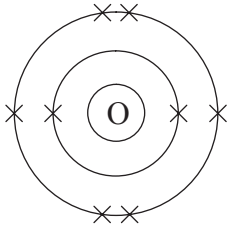
(2)

Leave blank

(d) A piece of sodium is heated in a Bunsen flame. The sodium catches fire and reacts with the oxygen in the air. The product is sodium oxide.

The diagrams show the electron arrangement in an atom of sodium and an atom of oxygen.





Sodium oxide contains ionic bonds. Describe what happens, in terms of electrons, when sodium reacts with oxygen.

.....

.....

.....

.....

.....

.....

(3) **Q10**

(Total 10 marks)

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11. Dilute hydrochloric acid reacts with solid calcium carbonate. The equation below shows this equation.

$$2HCl(aq) + CaCO_3(s) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

Some students investigate the effect on the rate of the reaction of changing the temperature of the hydrochloric acid. The method is:

- use a measuring cylinder to pour 50 cm^3 of dilute hydrochloric acid into a conical flask
- heat the acid to the required temperature
- place the flask on a balance
- add 10 g (an excess) of calcium carbonate chips to the flask
- time how long it takes for the mass to decrease by 1.00 g
- the experiment is repeated at different temperatures.

The table shows the students' results.

Temperature of acid (°C)	Time to lose 1.00 g (s)
22	93
35	68
46	65
57	40
65	33
78	26

(a) (i) On the grid opposite, draw a graph of these results. The axes and scales have been provided for you.

(3)

(ii) One of the points is anomalous. Circle this point on your graph.

(1)

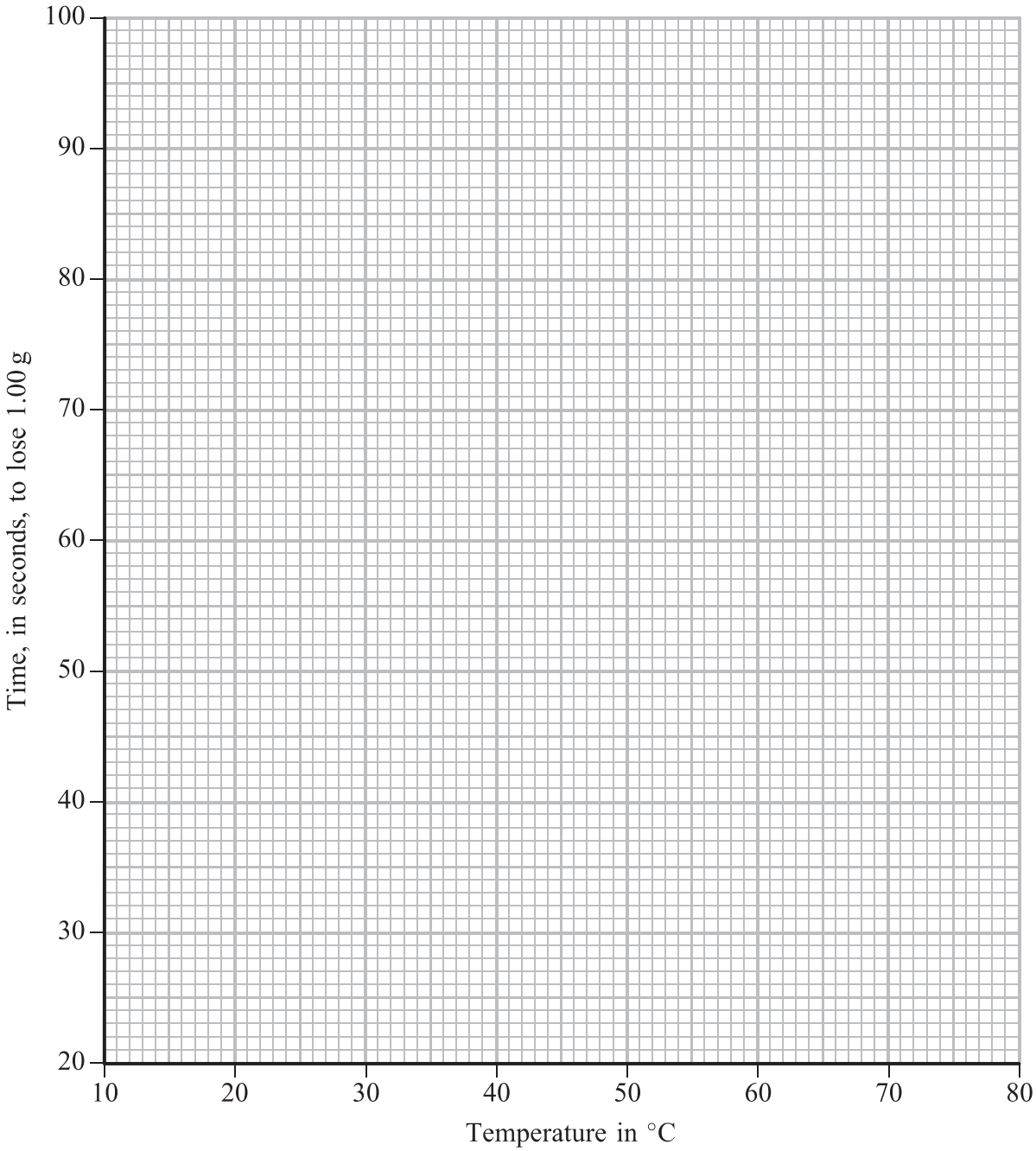
(iii) The students did not make an error in reading the stopwatch. Suggest a possible cause of this anomalous result.

.....

.....

(1)

Leave blank



QUESTION 11 CONTINUES OVERLEAF

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(b) (i) Use your graph to find the time taken to lose 1.00 g at 30 °C and at 52 °C.

Time at 30 °C ..... s

Time at 52 °C ..... s

(2)

(ii) The rate of the reaction can be found using the equation:

$$\textbf{rate of reaction} = \frac{\textbf{mass lost}}{\textbf{time taken to lose this mass}}$$

Use this equation and your results from (b)(i) to calculate the rate of reaction at 30 °C and at 52 °C.

Rate at 30 °C ..... g/s

Rate at 52 °C ..... g/s

(2)

(iii) State how the rate of reaction changes when the temperature increases.

.....

.....

(1)

(iv) Explain, in terms of particles and collisions, why the rate of reaction changes.

.....

.....

.....

.....

.....

(3)

(c) The students did **not** obtain any results at temperatures below room temperature, 22 °C. Describe how the method could be changed to obtain results below room temperature.

.....

.....

.....

(1)

Q11

(Total 14 marks)

Leave blank

12. Many useful substances are produced by the fractional distillation of crude oil.

(a) Bitumen, fuel oil and gasoline are three fractions obtained from crude oil. There are several differences between these fractions.

Name the fraction that has the following property.

the highest boiling point range .....

molecules with the fewest carbon atoms .....

the darkest colour .....

(3)

(b) Some long-chain hydrocarbons are converted into more useful products by a chemical process. Name this process and describe how it is carried out.

.....

.....

.....

.....

.....

(3)

(c) Some hydrocarbons, such as methane, are used as fuels. When methane undergoes incomplete combustion, carbon monoxide is formed.

(i) Write a balanced chemical equation for this reaction.

.....

(2)

(ii) Explain why it is dangerous to breathe air containing carbon monoxide.

.....

.....

.....

.....

(2)

Q12

(Total 10 marks)

Leave blank

13. Three of the elements in Group 7 of the Periodic Table are chlorine, bromine and iodine.

(a) State the electronic configuration of chlorine.

.....

(1)

(b) State the number of electrons present in the outer shell of an atom of iodine.

.....

(1)

(c) Bromine reacts with hydrogen to form hydrogen bromide. The chemical equation for the reaction is

$$Br_2(g) + H_2(g) \rightarrow 2HBr(g)$$

Describe the colour change occurring during the reaction.

Colour change .....

(2)

(d) Hydrogen bromide and hydrogen chloride have similar chemical properties.

(i) A sample of hydrogen bromide is dissolved in water.

A piece of blue litmus paper is placed in the solution. State, with a reason, the final colour of the litmus paper.

Colour .....

Reason .....

.....

(2)

(ii) A sample of hydrogen bromide is dissolved in methylbenzene.

A piece of blue litmus paper is placed in the solution. State, with a reason, the final colour of the litmus paper.

Colour .....

Reason .....

.....

(2) **Q13**

(Total 8 marks)

Leave blank

14. (a) A solution was made by dissolving 1.62 g of hydrogen bromide, HBr, in 250 cm^3 of water.

(i) Calculate the relative formula mass of hydrogen bromide. Use data from the Periodic Table on page 2.

.....

.....

(1)

(ii) Calculate the amount, in moles, of hydrogen bromide in a 1.62 g sample.

.....

.....

.....

.....

(2)

(iii) Calculate the concentration, in mol dm^{-3}, of the hydrogen bromide solution.

.....

.....

.....

.....

(2)

(iv) Calculate the concentration, in g dm^{-3}, of the hydrogen bromide solution.

.....

.....

.....

.....

(2)

Leave blank

(b) Hydrogen bromide solution can be neutralised by adding sodium hydroxide solution.

(i) Write a chemical equation for this neutralisation reaction.

.....

(1)

(ii) Explain, with reference to ions, why this reaction is described as a neutralisation reaction.

.....

.....

.....

.....

(1)

(c) A 20.0 cm^3 sample of a solution of hydrogen bromide had a concentration of 0.200 mol dm^{-3}.

(i) Calculate the amount, in moles, of hydrogen bromide in 20.0 cm^3 of 0.200 mol dm^{-3} solution.

.....

.....

(2)

(ii) Calculate the volume of 0.100 mol dm^{-3} sodium hydroxide solution needed to neutralise this sample of hydrogen bromide solution.

.....

.....

(2)

Q14

(Total 13 marks)

TOTAL FOR PAPER: 120 MARKS

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Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						4	C	H	0	/	2	C	Signature	

Paper Reference(s)

4CH0/2C

Edexcel IGCSE

Chemistry

Chemistry Paper 2

Sample Assessment Material

Time: 1 hour

Materials required for examination
Nil

Items included with question papers
Nil

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
Total	

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
Show all the steps in any calculations and state the units. Calculators may be used.

Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 6 questions in this question paper. The total mark for this paper is 60.
There are 16 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

Write your answers neatly and in good English.

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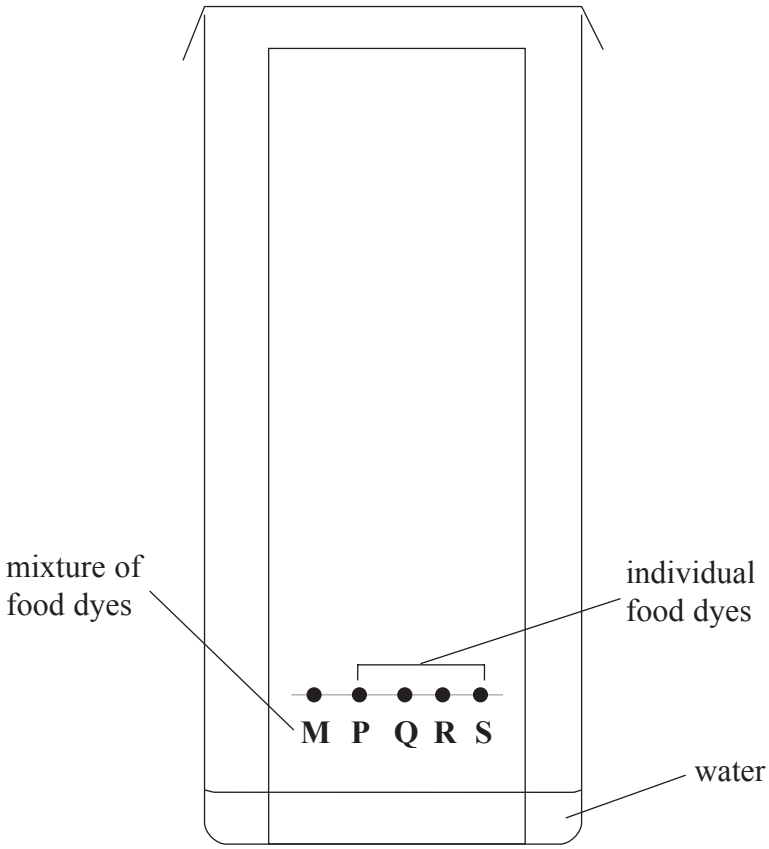
Answer ALL questions

1. Paper chromatography can be used to separate a mixture of food dyes (**M**), and identify which dyes are present. The diagram shows the apparatus used.



(a) The food dyes are placed on the paper about 2 cm up from the bottom edge. Why is it important **not** to place them at the bottom of the paper?

.....

.....

(1)

(b) State **two** observations you would make during the experiment.

1 .....

.....

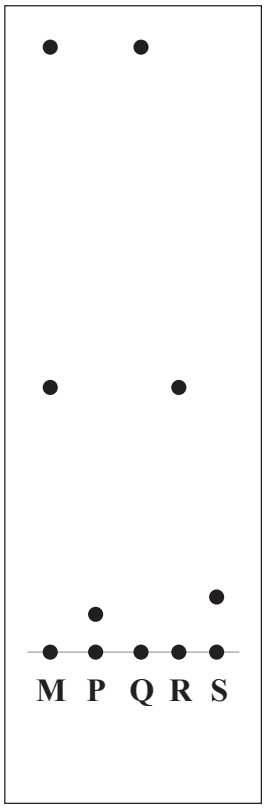
2 .....

.....

(2)

Leave blank

(c) At the end of the experiment the paper is removed and dried. The diagram shows the paper.



(i) Measure the distance moved, in centimetres, by food dye **R** during the experiment.

.....

(1)

(ii) Which of the food dyes **P**, **Q**, **R** and **S** are present in **M**?

.....

(1)

(iii) Food dyes **P** and **S** did not move very far. Suggest **one** change you could make to this experiment to help them move further.

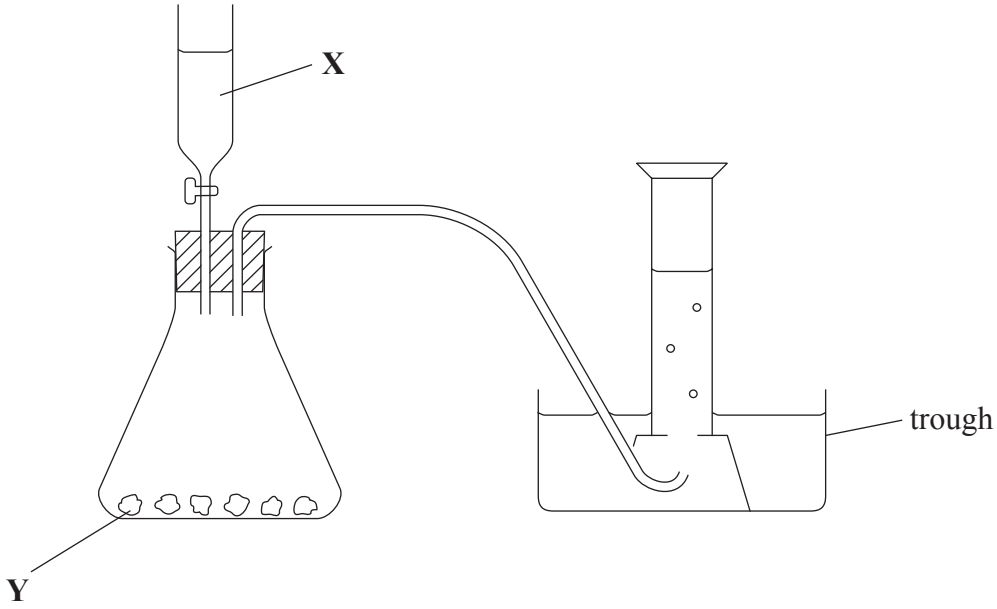
.....

(1) **Q1**

(Total 6 marks)

Leave blank

2. The diagram shows apparatus for preparing carbon dioxide gas in the laboratory.



(a) Calcium chloride and water are also products of this reaction.
Identify the reactants **X** and **Y**.

X .....

Y .....

(2)

(b) The diagram shows carbon dioxide gas being collected over water. Suggest one other way to collect the gas.

.....

(1)

Leave blank

(c) By the end of the experiment the water in the trough is acidic. A sample is tested with universal indicator.

(i) State the colour of universal indicator at the end of the test.

.....

(1)

(ii) Name the acid formed in the water and give its formula.

Name .....

Formula .....

(2)

(d) The melting point of calcium chloride is very much higher than that of water. State the type of bonding in

calcium chloride .....

water .....

(2)

(e) State one industrial use of carbon dioxide.

.....

(1)

(f) Suggest why carbon dioxide used in industry is **not** obtained from air.

.....

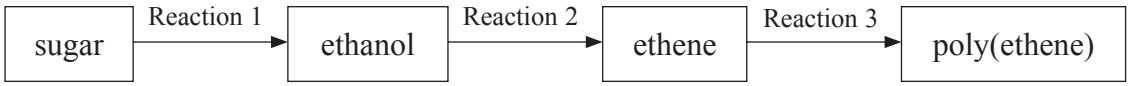
(1)

Q2

(Total 10 marks)

Leave blank

3. Sugar can be converted into poly(ethene) as follows:



(a) (i) State the type of reaction occurring in

Reaction 1 .....

Reaction 2 .....

(2)

(ii) What type of polymerisation occurs in Reaction 3?

.....

(1)

(b) State **two** conditions used in the conversion of sugar to ethanol in Reaction 1.

1 .....

2 .....

(2)

(c) Write a chemical equation for Reaction 2.

.....

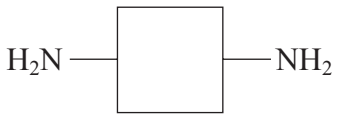
(2)

(d) Draw the displayed formula of ethanol.

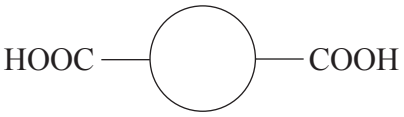
(1)

Leave blank

(e) Nylon can be made using the monomers **A** and **B** represented in the diagrams.



monomer **A**



monomer **B**

(i) What type of compound is monomer **A**?

.....

(1)

(ii) Draw a diagram to show the structure of the polymer formed from **A** and **B**. You must draw enough of the structure to make the repeat unit clear.

(3)

(f) Nylon has a simple molecular structure. Use words from the box to complete the sentences below.

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

ions	**high**	**low**
molecules	**strong**	**weak**

Nylon has a ..... melting point. This is because there are

..... forces between the ..... that make up

the structure.

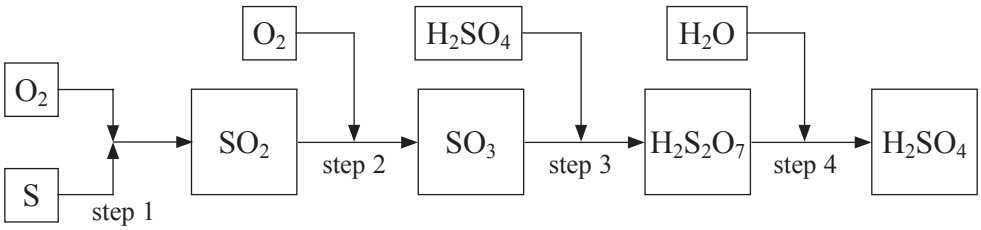
(3)

Q3

(Total 15 marks)

Leave blank

4. The flow chart shows the steps in the manufacture of sulfuric acid.



(a) Balance the equation to give the overall reaction that occurs.

..... S + ... O_2 + ... H_2O → ..... H_2SO_4

(1)

(b) The following equation represents what happens in step 2.

$$2\ O{=}S{=}O + O{=}O \rightarrow 2\ O{=}\overset{\overset{O}{\|}}{S}{=}O$$

The table shows some average bond energies.

Bond	Average bond energy (kJ/mol)
O═O	496
S═O	493

(i) Calculate the energy change, ΔH, for the reaction in step 2.

Energy taken in to break bonds	Energy given out from making bonds

ΔH = ...

(3)

Leave blank

(ii) Draw a fully labelled energy level diagram for the reaction in step 2.

(3)

(c) The following equation shows the reaction between sodium hydroxide solution and dilute sulfuric acid:

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

A 10.0 cm^3 sample of dilute sulfuric acid was titrated with 0.100 mol dm^{-3} sodium hydroxide solution. It was found that 16.70 cm^3 of the sodium hydroxide solution were needed to neutralise the acid.

Outline how, in this titration, you would

- measure the volumes of the solutions used
- accurately determine the end-point.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

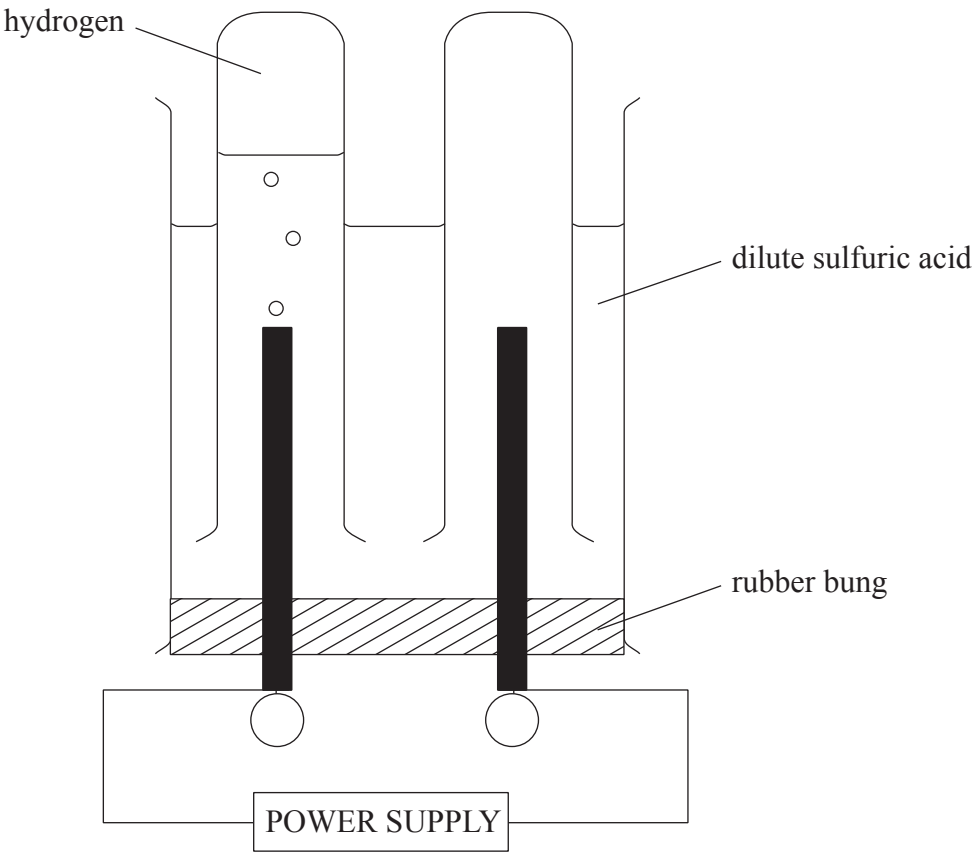
(4)

Q4

(Total 11 marks)

Leave blank

5. The diagram shows apparatus that can be used to electrolyse dilute sulfuric acid.



(a) (i) Label the electrodes in the diagram by writing the symbols + and – in the circles.

(1)

(ii) The equations for the reactions occurring at the electrodes are

Equation **1** $2H^+(aq) + 2e^- \rightarrow H_2(g)$

Equation **2** $4OH^-(aq) \rightarrow 2H_2O(l) + O_2(g) + 4e^-$

Give the formula of the ion being reduced.
Give a reason for your choice.

Ion .....

Reason .....

.....

(2)

Leave blank

(iii) The volume of hydrogen gas collected after a few minutes is shown on the diagram.

Draw another line on the diagram to show the volume of oxygen gas collected after the same length of time.
Explain your choice with reference to Equations **1** and **2**.

.....

.....

.....

(3)

(b) In one experiment, the amount of charge passed was 0.40 faraday.

(i) Calculate the amount, in moles, of hydrogen gas formed.

(1)

(ii) Calculate the volume, in dm^3, of this amount of hydrogen gas at room temperature and pressure (rtp).
(Molar volume of any gas = 24 dm^3 at rtp)

(2)

(c) In a second experiment, the amount of charge passed was 0.80 faraday.

(i) Calculate the amount, in moles, of oxygen formed.

(1)

(ii) Calculate the mass, in g, of oxygen formed.

(2) **Q5**

(Total 12 marks)

Leave blank

6. The ions present in ionic compounds can be identified using simple tests.

The first table shows the flame test colours for three cations.

Cation	Flame test colour
lithium	red
sodium	yellow-orange
strontium	red

The next table shows three tests that may be used to identify anions in solution.

Anion	Result of tests when		
	nitric acid is added	**magnesium sulphate solution is added**	**universal indicator is added**
carbonate	effervescence	precipitate forms	blue
hydrogencarbonate	effervescence	no precipitate forms	dark green
hydrogensulfate	no effervescence	no precipitate forms	red
hydroxide	no effervescence	precipitate forms	blue
sulfate	no effervescence	no precipitate forms	green

Two ionic compounds, **P** and **Q**, are known to contain only anions and cations listed in the tables. They were analysed using some of the tests in the tables.

(a) Compound **P** gave a yellow-orange flame test and produced effervescence when nitric acid was added.

Suggest **two** possible identities for compound **P**.

1 .....

2 .....

(3)

Leave blank

(b) Compound **Q** gave a red flame test and caused universal indicator to turn blue.
A student concluded that compound **Q** was strontium hydroxide.

(i) Give **two** reasons why we cannot be certain this conclusion is correct.

1 .....

.....

2 .....

.....

(2)

(ii) Using the information in the tables, give one further test that could be done to show that compound **Q** is a hydroxide. Give the expected result of the test.

.....

.....

.....

.....

.....

.....

(1) **Q6**

(Total 6 marks)

TOTAL FOR PAPER: 60 MARKS

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Sample mark schemes

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Chemistry Paper 1

Question Number	Answer	Mark
1(a)	Mg	1

Question Number	Answer	Mark
1(b)	C	1

Question Number	Answer	Mark
1(c)	O (accept 8)	1

Question Number	Answer	Mark
1(d)	2 / alkaline earth	1

Question Number	Answer	Mark
1(e)	7 / halogen	1

Question Number	Answer	Mark
2(a)	B - Stop clock E - funnel	2

Question Number	Answer	Mark
2(b)	C / pipette D / measuring cylinder (answers in either order)	2

Question Number	Answer	Mark
2(c)	E / funnel	1

Question Number	Answer	Mark
3(a)(i)	From top to bottom Proton Electron Neutron	3

Question Number	Answer	Mark
3(a)(ii)	8	1

Question Number	Answer	Mark
3(a)(iii)	Be / Beryllium	1

Question Number	Answer	Mark
3(b)	• Same number of protons / atomic number • Different number of neutrons / mass number / nucleon number	2

Question Number	Answer	Mark
4(a)	1 Oxygen 2 Water	2

Question Number	Answer	Mark
4(b)	Iron oxide / rust	1

Question Number	Answer	Mark
4(c)	1 mark for each, maximum 2 • Oil • grease / polish • paint • plastic • zinc • Accept chrome / chromium Reject copper / magnesium	2

Question Number	Answer	Mark
5(a)	Iron tube diagram completed with 5 or fewer bubbles Magnesium diagram completed with 7 or more bubbles	2

Question Number	Answer	Mark
5(b)	Zinc + hydrochloric acid → zinc chloride + hydrogen	1

Question Number	Answer	Mark
5(c)	Copper / silver / gold / platinum	1

Question Number	Answer	Mark
5(d)	1 mark for each, maximum 2, eg • Water / H_2O / steam • Oxygen / O_2 / air • Metal salt (solutions) • Allow metal oxides Allow suitable alternatives	2

Question Number	Answer	Mark
6(a)(i)	Shared pair of electrons	1

Question Number	Answer	Mark
6(a)(ii)	H × H (accept two × or two ·)	1

Question Number	Answer	Mark
6(b)	Test – lighted / lit splint Result – (squeaky) pop / explosion	2

Question Number	Answer	Mark
6(c)	(manufacture of) ammonia / margarine / HCl	1

Question Number	Answer	Mark
6(d)	Hydrogen + oxygen → water	1

Question Number	Answer	Mark
6(e)(i)	Colourless White Blue	3

Question Number	Answer	Mark
6(e)(ii)	Before – 27 After – 32.5	2

Question Number	Answer	Mark
6(e)(iii)	5.5 (ecf)	1

Question Number	Answer	Mark
6(e)(iv)	B	1

Question Number	Answer	Mark
7(a)	Heat	1

Question Number	Answer	Mark
7(b)(i)	Diffusion	1

Question Number	Answer	Mark
7(b)(ii)	Ammonium chloride / NH_4Cl	1

Question Number	Answer	Mark
7(b)(iii)	Ammonia faster / hydrogen chloride slower	1

Question Number	Answer	Mark
7(b)(iv)	A: Red B: Blue	2

Question Number	Answer	Mark
8(a)(i)	A and C	2

Question Number	Answer	Mark
8(a)(ii)	Contains a (carbon to carbon) double / multiple bond / can undergo addition reactions	1

Question Number	Answer	Mark
8(b)(i)	Orange / yellow (1) – colourless (1)	2

Question Number	Answer	Mark
8(b)(ii)	Correct structure of 1,2 – dibromoethane	1

Question Number	Answer	Mark
8(c)	Correct structures for two isomers of C_4H_8 But - 1 - ene, but – 2 - ene (cis + trans) Cyclobutane, cyclomethylpropane, methylpropene	2

Question Number	Answer	Mark
9(a)	Anticlockwise from top: Haematite Molten iron Slag	3

Question Number	Answer	Mark
9(b)(i)	$C + O_2 \rightarrow CO_2$, ignore state symbols	1

Question Number	Answer	Mark
9(b)(ii)	Heats it up / raises temperature / exothermic	1

Question Number	Answer	Mark
9(c)	$CaCO_3 \rightarrow CaO + CO_2$	1

Question Number	Answer	Mark
9(d)	Loss of oxygen / Fe^{3+} gains electrons / Fe ions gains electrons / Fe (III) gains oxygen (reject- Fe gains electrons)	1

Question Number	Answer	Mark
9(e)(i)	Aluminium too reactive / more reactive than carbon / accept Al very high in the reactivity series	1

Question Number	Answer	Mark
9(e)(ii)	Any suitable use, eg airplanes PLUS Property must be related, eg low density eg Specified transport - low density (not light) Cooking foil/drink cans - easily moulded / malleable Power cables - good conductor of electricity Window frames / cars - does not corrode Credit any other suitable Answers	2

Question Number	Answer	Mark
10(a)(i)	Any two from: Fizz / bubble Move / darts around Melts / forms a ball / Gets smaller / disappears (reject dissolves)	2

Question Number	Answer	Mark
10(a)(ii)	Sodium + water → sodium hydroxide + hydrogen (accept correct formulae equation)	1

Question Number	Answer	Mark
10(b)(i)	Orange / yellow	1

Question Number	Answer	Mark
10(b)(ii)	Flame test	1

Question Number	Answer	Mark
10(c)	Blue / purple (solution made is) alkaline / (contains) hydroxide ions OH^- / not just 'alkali metal' pH 11→14 (any in range)	2

Question Number	Answer	Mark
10(d)	• Electrons being transferred between oxygen and sodium (can be wrong way round) • Idea of sodium losing electron(s) and oxygen gaining electron(s) • Correct number of electrons involved (sodium lose 1, oxygen gain 2) (sharing = 0 marks)	3

Question Number	Answer	Mark
11(a)(i)	All points plotted correctly (-1 per error) -2 marks Smooth curve – 1 mark	3

Question Number	Answer	Mark
11(a)(ii)	Point at (46,65) circled	1

Question Number	Answer	Mark
11(a)(iii)	Any one from: • Marble chips bigger / surface less • Acid too cool • Volume of acid too small • Mass of chips too small • Acid more dilute – or reason that could cause this	1

Question Number	Answer	Mark
11(b)(i)	Read values from graph: 76±1 cq 45±1	2

Question Number	Answer	Mark
11(b)(ii)	cq on (i): 0.013 0.022 min 2 significant figures	2

Question Number	Answer	Mark
11(b)(iii)	(the higher the temperature the) faster (the reaction) cq on (ii)	1

Question Number	Answer	Mark
11(b)(iv)	• Particles have more energy • Move faster / more have energy greater than activation energy • More collisions per second / more frequent collisions greater proportions of collisions are successful	3

Question Number	Answer	Mark
11(c)	Any suitable way of cooling flask / contents, eg an ice bath Do not accept ideas based on doing the reaction somewhere else.	1

Question Number	Answer	Mark
12(a)	Bitumen Gasoline Bitumen	3

Question Number	Answer	Mark
12(b)	Cracking Heat / 400-1000 °C / high temperature (reject boil) Steam / catalyst / (high) pressure / 5-100 atm	3

Question Number	Answer	Mark
12(c)(i)	$2CH_4 + 3O_2 \rightarrow 2CO + 4H_2O$ All formula correct (1 mark) Formula balances (1 mark)	2

Question Number	Answer	Mark
12(c)(ii)	Toxic / poisonous / death / fatal (reject suffocate) Correct reference to blood or haemoglobin	2

Question Number	Answer	Mark
13(a)	2.8.7	1

Question Number	Answer	Mark
13(b)	7	1

Question Number	Answer	Mark
13(c)	Brown / orange (to) colourless	2

Question Number	Answer	Mark
13(d)(i)	Red / pink (hydrobromic acid formed / H^+ ions present	2

Question Number	Answer	Mark
13(d)(ii)	Blue No acid formed / no reaction / no H^+ ions	2

Question Number	Answer	Mark
14(a)(i)	(1 + 80 +) 81	1

Question Number	Answer	Mark
14(a)(ii)	1.62 ÷ 81 = 0.02 (ALLOW ecf)	2

Question Number	Answer	Mark
14(a)(iii)	0.02 ÷ 0.25 = 0.08 (ALLOW ecf)	2

Question Number	Answer	Mark
14(a)(iv)	0.08 × 81 = 6.5 / 6.48 OR 1.62 × 4= 6.5 / 6.48 (ALLOW ecf)	2

Question Number	Answer	Mark
14(b)(i)	$HBr + NaOH \rightarrow NaBr + H_2O$	1

Question Number	Answer	Mark
14(b)(ii)	Any from: H^+ (ions) react with OH^- (ions) OH^- (ions) gain protons	1

Question Number	Answer	Mark
14(c)(i)	0.02 × 0.2 = 0.004 (20 × 0.2 = 4 (=1 ecf)	2

Question Number	Answer	Mark
14(c)(ii)	0.004 ÷ 0.1 OR 20 × (0.2 ÷ 0.1) = 0.04 dm^3 OR = 40 cm^3 Units needed ALLOW ecf	2

Chemistry Paper 2

Question Number	Answer	Mark
1(a)	They would dissolve (in the water) (or words to that effect)	1

Question Number	Answer	Mark
1(b)	Two from: • Water rises up paper • Colours separate • new colours appear • dyes move up paper	2

Question Number	Answer	Mark
1(c)(i)	3.5cm	1

Question Number	Answer	Mark
1(c)(ii)	Q and R	1

Question Number	Answer	Mark
1(c)(iii)	Use another liquid / organic solvent / use longer paper	1

Question Number	Answer	Mark
2(a)	X - dilute hydrochloric acid / HCl Y - limestone / calcium carbonate / marble / $CaCO_3$	2

Question Number	Answer	Mark
2(b)	In a syringe / by downward delivery or ecognizable diagram / by upward displacement of air	1

Question Number	Answer	Mark
2(c)(i)	Yellow / orange - not red	1

Question Number	Answer	Mark
2(c)(ii)	Carbonic (acid) H_2CO_3	2

Question Number	Answer	Mark
2(d)	Ionic covalent	2

Question Number	Answer	Mark
2(e)	Carbonating drinks / fizzy drinks / fire extinguishers / dry ice	1

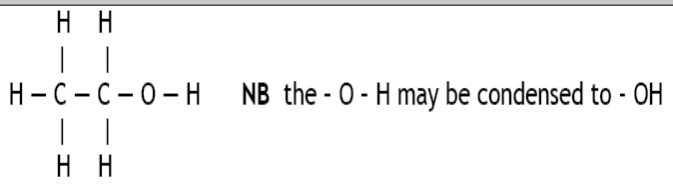
Question Number	Answer	Mark
2(f)	Amount / percentage too small (any stated % under 1 %)	1

Question Number	Answer	Mark
3(a)(i)	Fermentation Dehydration / Elimination of water	2

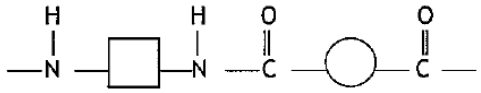
Question Number	Answer	Mark
3(a)(ii)	Addition	1

Question Number	Answer	Mark
3(b)	Any two for 1 mark each: (dissolved in) water yeast warm / stated temperature in range 20-35 °C	2

Question Number	Answer	Mark
3(c)	$C_2H_5OH \rightarrow C_2H_4 + H_2O$ Award 1 for correct formulae of ethanol and ethane and 1 for H_2O and no coefficients	2

Question Number	Answer	Mark
3(d)	 **NB** the - O - H may be condensed to - OH	1

Question Number	Answer	Mark
3(e)(i)	(di) amine (Allow animo)	1

Question Number	Answer	Mark
3(e)(ii)	alternating circle and square correct linkage between blocks (NH-CO- is minimum) two NH and CO groups in correct positions is minimum  must have 'continuation bonds' for 3rd mark **ALLOW** terminal COOH or NH_2 if brackets used round repeat unit	1 1 1

Question Number	Answer	Mark
3(f)	Low Weak molecules	3

Question Number	Answer	Mark
4(a)	2:3:2:2	1

Question Number	Answer	Mark
4(b)(i)	• Energy in = 2468 / correct working • Energy out = 2958 / or correct working • Energy change = - 490 (kJ/mol) (cq on above)	3

Question Number	Answer	Mark
4(b)(ii)	• Exo / endothermic diagram (cq on above) • ΔH AND vertical energy axis abeled • Reagents / products abeled (names or formulae)	3

Question Number	Answer	Mark
4(c)	• Pipette / burette to measure sulfuric acid • Sodium hydroxide in burette • Indicator used and colour change (NOT universal indicator) • Add sodium hydroxide gradually near end point (and swirl)	4

Question Number	Answer	Mark
5(a)(i)	(on diagram) – in left and + in right	1

Question Number	Answer	Mark
5(a)(ii)	H^+ Gains electrons (reject OH^- =0/2)	2

Question Number	Answer	Mark
5(a)(iii)	(on diagram) horizontal line in right-hand tube about halfway between hydrogen gas level and top of tube (explanation)(1) for same number of electrons in (i) and (ii) 2 moles / molecules of hydrogen formed for 1 mole / molecule of oxygen (2)	3

Question Number	Answer	Mark
5(b)(i)	0.2(0)	1

Question Number	Answer	Mark
5(b)(ii)	0.2 × 24 = 4.8 (dm^3)	2

Question Number	Answer	Mark
5(c)(i)	0.2(0)	1

Question Number	Answer	Mark
5(c)(ii)	0.2 × 32 =6.4 (g)	2

Question Number	Answer	Mark
6(a)	Both are sodium One carbonate One hydrogen carbonate	3

Question Number	Answer	Mark
6(b)(i)	Both Li and Sr give red flames Both carbonate and hydroxide turn UI blue	2

Question Number	Answer	Mark
6(b)(ii)	Add (nitric) acid - does not fizz	1

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