OCR
Oxford Cambridge and RSA

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Monday 19 June 2017 – Morning

GCSE GATEWAY SCIENCE
CHEMISTRY B

B742/01 Chemistry modules C4, C5, C6 (Foundation Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: 1 hour 30 minutes

* B 7 4 2 0 1 *

* 6 7 5 3 0 7 9 2 6 9 *

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the barcodes.

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with a pencil (✎).
- The Periodic Table can be found on the back page.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **85**.
- This document consists of **28** pages. Any blank pages are indicated.

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Answer **all** the questions.

SECTION A – Module C4

1 Look at the formulas.

CO_2 Na Mg^{2+} F^-

(a) Which formula represents a molecule?

.....

[1]

(b) Which formula represents a metal ion?

.....

[1]

(c) Which formula represents an atom?

.....

[1]

(d) Use the formulas to write down the formula of magnesium fluoride.

.....

[1]

(e) Alex investigates the electrical conductivity of sodium chloride.

Molten (melted) sodium chloride conducts electricity.

Compare the electrical conductivities of

- solid sodium chloride
- a solution of sodium chloride in water.

.....

.....

..... **[2]**

2 Iron is a metal.

It is used to make cars and bridges.

One property of metals is that they often have a high melting point.

Write down **three other** properties of metals.

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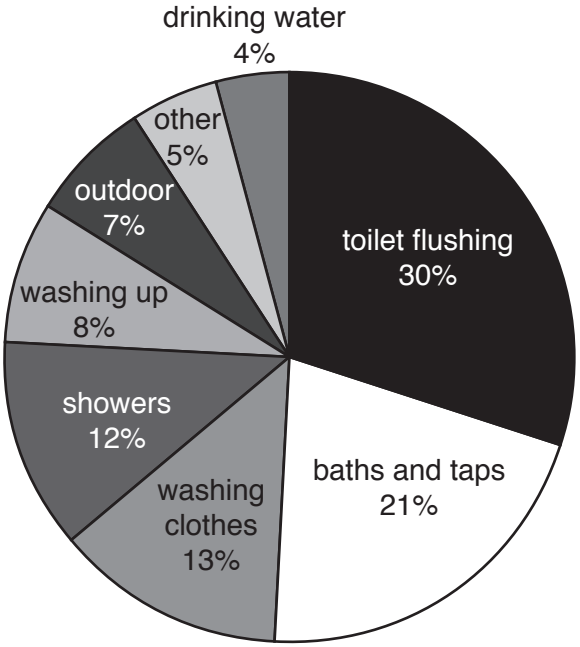
..... **[3]**

3 Look at the pie chart. It shows how water is used in a typical home in the UK.



(a) Which **two** uses, taken together, use over **half** of the water used?

..... **[1]**

(b) What percentage of water is used to wash clothes and wash dishes?

..... % **[1]**

(c) A household wants to reduce its water consumption.

Suggest the most effective way of doing this.

Explain your answer.

.....

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..... **[2]**

(d) Reservoirs and aquifers are two types of water resources found in the UK.

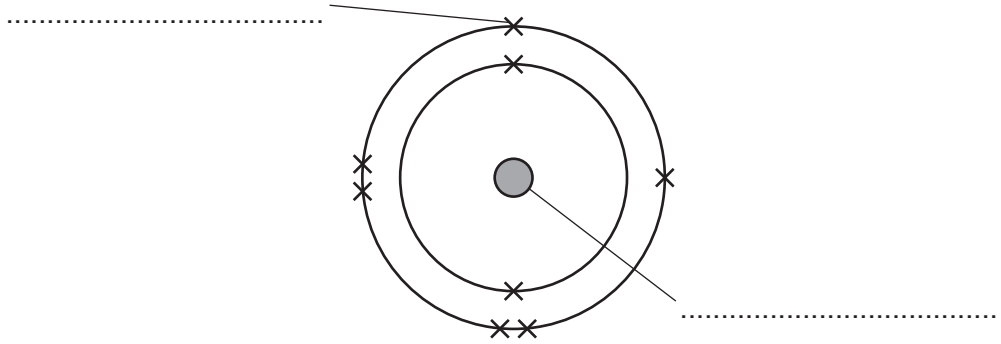
Write down **two other** water resources found in the UK.

.....

..... **[2]**

4 This question is about atoms and elements.

Look at the diagram.



(a) Label the diagram to show the main parts of an atom. **[2]**

(b) Look at the names of some elements.

aluminium

caesium

carbon

chlorine

copper

tin

Which two elements are in the same **group** of the periodic table?

Explain your answer.

Use the periodic table on the back page to help you.

.....

..... **[2]**

5 Phil is investigating the reactions of the halogens with solutions of metal halides.

Look at the table. It shows his results.

Halogen	Reaction with		
	sodium chloride	**sodium bromide**	**sodium iodide**
chlorine	no reaction	bromine and sodium chloride made	brown solution made
halogen **X**	no reaction	no reaction	no reaction
halogen **Y**	no reaction	no reaction	brown solution made

What is the order of reactivity (most reactive first) of the three halogens in the table?

Explain how you can tell.

Include a **word** equation for the reaction between chlorine and sodium bromide.

The quality of written communication will be assessed in your answer to this question.

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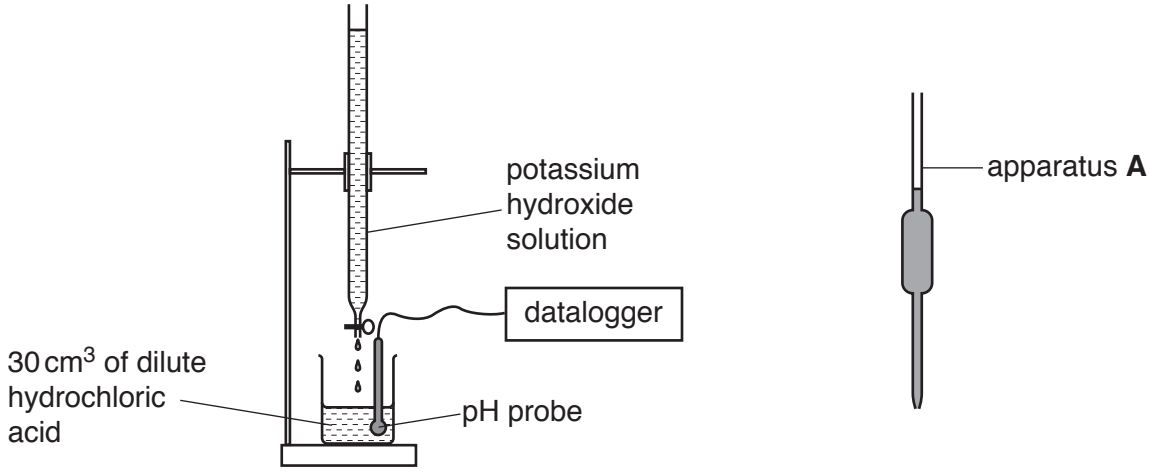
..... **[6]**

SECTION B – Module C5

6 Sara is neutralising dilute hydrochloric acid with potassium hydroxide solution.

Look at the diagram of the apparatus she uses.



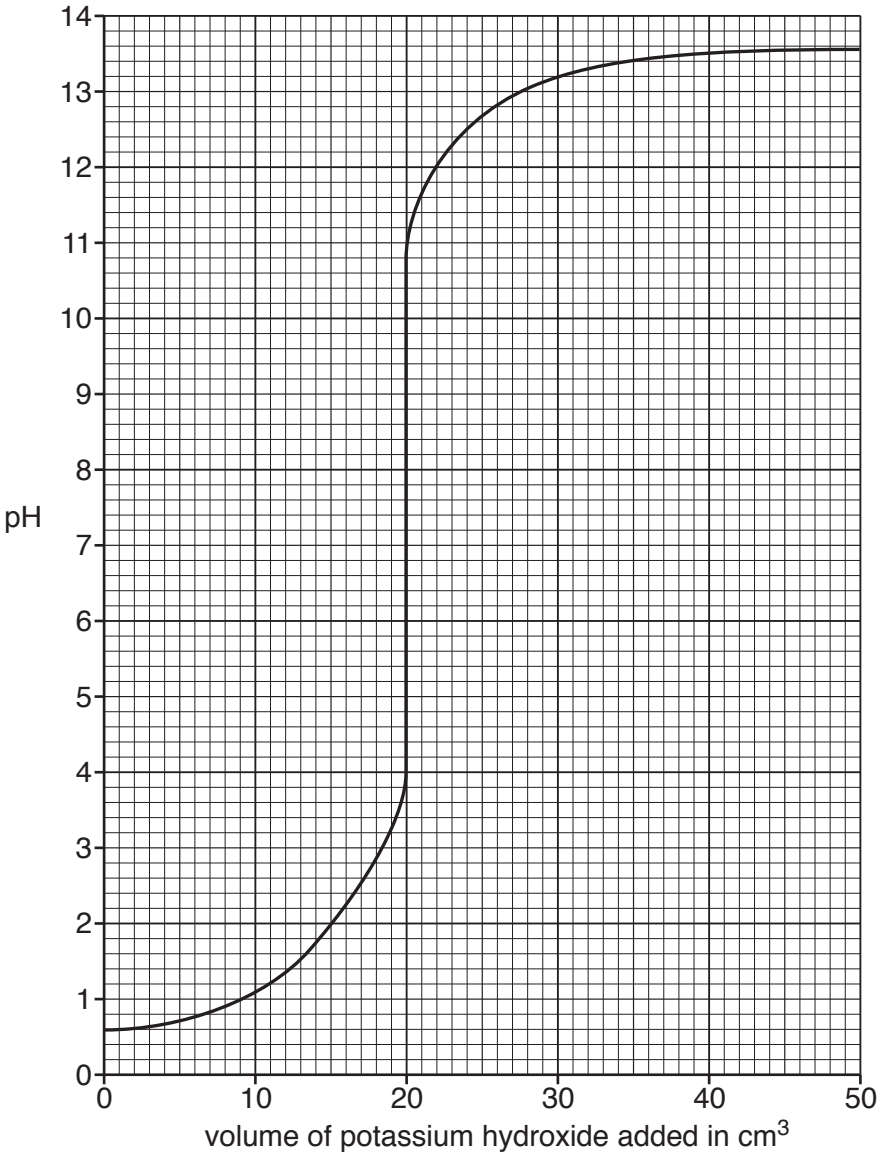
(a) What is the name of apparatus **A**?

..... **[1]**

(b) Sara slowly adds 50 cm^3 of potassium hydroxide solution to 30 cm^3 of dilute hydrochloric acid.

She measures the pH of the solution in the flask as the potassium hydroxide solution is added.

Look at the graph of her results.



(i) What volume of potassium hydroxide solution must be added to get a pH of 2?

..... cm^3 **[1]**

(ii) What volume of potassium hydroxide solution is needed to exactly neutralise the hydrochloric acid?

..... cm^3 **[1]**

(c) Sara adds litmus solution to the hydrochloric acid.

Describe the colour change that happens as the potassium hydroxide solution is added to the dilute hydrochloric acid.

.....

..... **[2]**

7 Look at the list of units.

cm^3	**dm^3**
dm^3/g	**dm^3/mol**
g	**g/dm^3**
mol	**mol/dm^3**

(a) Which **two** units are used to measure volume?

Choose from the list.

..... and ..... **[1]**

(b) Which **two** units are used to measure the concentration of a solution?

Choose from the list.

..... and ..... **[1]**

(c) Lesley has a concentrated sugar solution.

She wants to dilute it to make a sugar solution which is a **quarter** of the original concentration.

Describe how she can do this.

.....

.....

..... **[2]**

8 Mark is heating different masses of magnesium in oxygen.

Magnesium oxide is made.

Look at Mark's results.

Experiment	Mass of magnesium heated in g	Mass of oxygen used in g	Mass of magnesium oxide made in g
1	0.20	0.13	0.33
2	0.40	0.27	0.67
3	0.60	0.40	1.00
4	1.00	.....	1.67

(a) Complete the table. **[1]**

(b) What do Mark's results tell you about the relationships between the mass of magnesium, mass of oxygen and the mass of magnesium oxide?

.....

.....

..... **[2]**

(c) Look at the results.

Calculate the percentage by mass of magnesium in magnesium oxide.

percentage by mass of magnesium = ... % **[2]**

9 Pete and Sue investigate the reaction between zinc and hydrochloric acid.

$$\text{zinc} + \text{hydrochloric acid} \rightarrow \text{zinc chloride} + \text{hydrogen}$$

They do the experiment four times.

Each time they use 1.0 g of zinc.

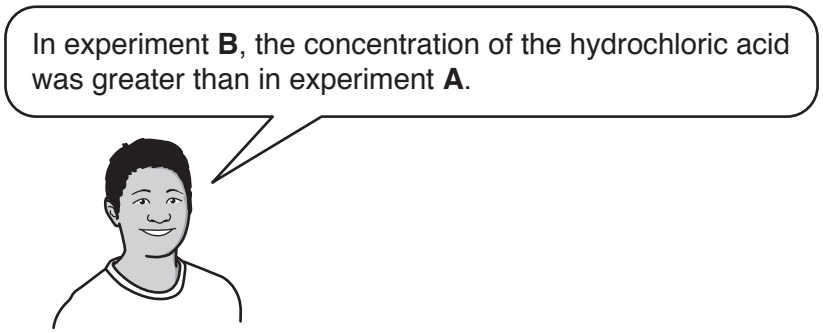
They use the same volume of different concentrations of hydrochloric acid.

They measure the total volume of hydrogen made every minute.

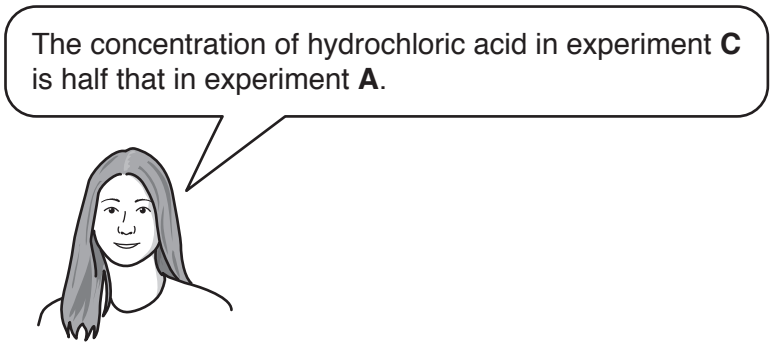
Look at the table of their results.

Experiment	Total volume of hydrogen in cm^3 made after					
	1 min	2 min	3 min	4 min	5 min	6 min
A	10	20	27	29	30	30
B	15	25	32	39	40	40
C	5	10	12	15	15	15
D	18	27	35	40	44	48

(a) Pete concludes



Sue concludes



Are each of the conclusions correct?

Explain your answers.

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..... **[2]**

(b) Look at experiment **A**.

After what time does the reaction finish?

..... minutes **[1]**

(c) Which experiment has the **fastest** reaction at the start?

Explain your answer.

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..... **[2]**

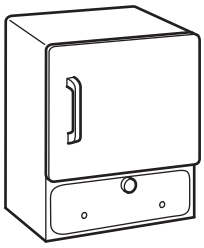
10 Jenna wants to make a pure, dry sample of the insoluble salt lead iodide, PbI_2.

She uses **precipitation**.

Jenna has solutions of lead nitrate, $Pb(NO_3)_2$, and sodium iodide, NaI.

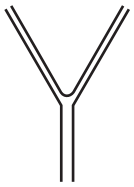
A solution of sodium nitrate, $NaNO_3$, is also made.

She also has these pieces of apparatus.

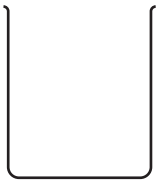


oven

test tube



filter paper and funnel



beaker

Describe the stages that Jenna uses to prepare a **pure**, **dry** sample of lead iodide.

Include a **balanced symbol** equation for the precipitation reaction.

You may wish to draw a **labelled** diagram.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

SECTION C – Module C6

11 Sophie investigates the hardness of water.

She finds out how many drops of soap solution are needed to produce a lather.

She does this with four samples of water.

Look at her results.

Water sample	Number of drops of soap solution needed to produce a lather	
	before boiling water sample	after boiling water sample
A	30	1
B	25	23
C	1	1
distilled water	1	1

(a) (i) Which water sample contains **permanent** hardness?

Choose from **A**, **B** or **C**.

answer ..... **[1]**

(ii) Which sample of water contains **only temporary** hardness?

Choose from **A**, **B** or **C**.

answer ..... **[1]**

(b) Hardness in water is caused by dissolved ions.

Which ion causes hardness in water?

Choose from the list.

chloride, Cl^-

hydrogen, H^+

hydroxide, OH^-

magnesium, Mg^{2+}

sodium, Na^+

answer ..... **[1]**

12 This question is about CFCs.

The use of CFCs was banned in the UK in 1989 because they deplete the ozone layer.

(a) Freon 112 was a CFC that was used in aerosol containers before 1989.

The formula for Freon 112 is CCl_2FCCl_2F.

How many **atoms** are in the formula CCl_2FCCl_2F?

..... **[1]**

(b) Since 1989 safer alternatives to CFCs have been used.

Write down **two** types of compounds that CFCs have been replaced with.

Choose from the list.

alcohols

alkanes

detergents

dibromo compounds

enzymes

hydrocarbons

..... and ..... **[2]**

(c) Depletion of the ozone layer allows more ultraviolet light to reach the surface of the Earth.

Write about **two** medical problems caused by increased levels of ultraviolet light.

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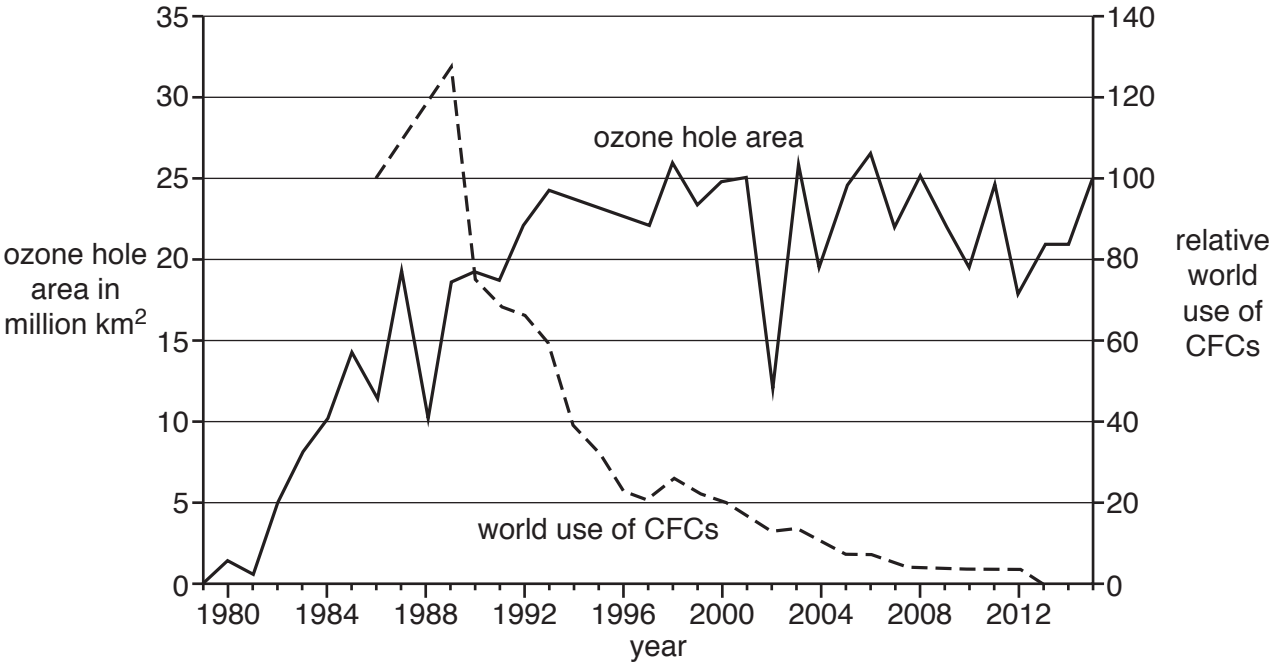
..... **[2]**

(d) Look at the graph.

It shows how the size of the hole in the ozone layer has changed between 1979 and 2015.

It also shows how the use of CFCs has changed.



Phil and Julie are scientists.

Julie thinks that CFCs will continue to deplete the ozone layer for a long time after they have stopped being used.

Phil thinks that the hole in the ozone layer in 2015 was much smaller than it was in 1989 when the use of CFCs was banned.

Write about whether Julie's opinion and Phil's opinion are correct.

Use information from the graph to help you.

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..... **[2]**

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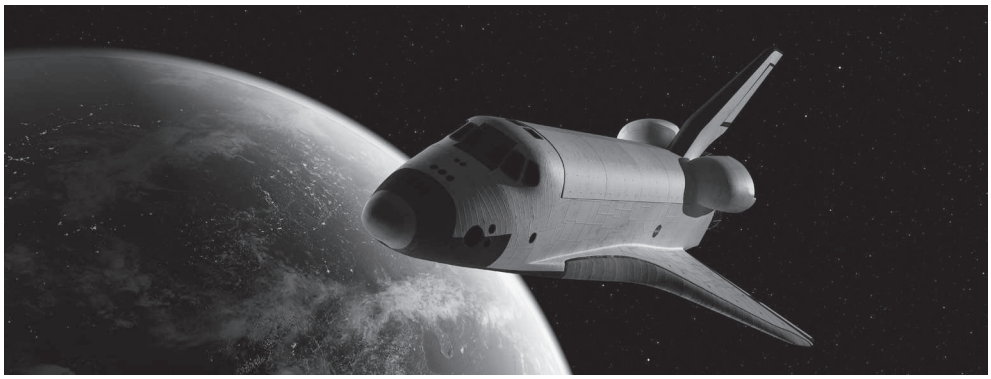
13 This question is about fuel cells.

Fuel cells are used in spacecraft.



(a) Write down one important use of fuel cells in spacecraft.

..... **[1]**

(b) In a fuel cell zinc, Zn, reacts with oxygen gas, O_2.

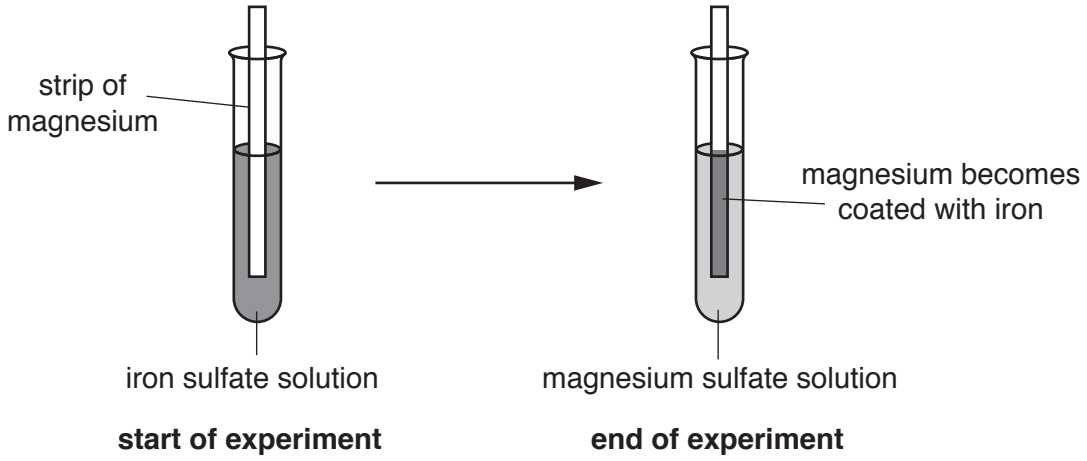
Zinc oxide, ZnO, is made.

Construct the **balanced symbol** equation for the reaction in this fuel cell.

..... **[2]**

14 Chris investigates the reactivity of some metals.

Look at the diagram. It shows the experiment Chris does.



Chris repeats the experiment with other metals and solutions.

Look at his results.

	Metal added			
Solution used	**Magnesium**	**Zinc**	**Iron**	**Tin**
Iron sulfate	✓	✓		✗
Magnesium sulfate		✗	✗	✗
Tin sulfate	✓	✓	✓	
Zinc sulfate	✓		✗	✗

✓ = metal reacts

✗ = no reaction

(a) Write down the four metals, iron, magnesium, tin and zinc, in order of reactivity.

Use the table of results to help you.

The least reactive metal has been completed for you.

Most reactive metal .....

.....

.....

Least reactive metal ..... tin **[1]**

(b) Chris reads in a textbook that magnesium reacts with copper sulfate solution.

Predict what will happen if Chris puts a strip of magnesium into copper sulfate solution.

Explain your answer.

.....

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..... **[2]**

(c) Chris finds out that iron rusts.

Two substances are needed for iron to rust.

Write down the names of these **two** substances.

..... and ..... **[1]**

15 Pete is investigating four different washing powders.

He tests the washing powders by washing dirty clothes at 40 °C.

Look at the table. It shows his results.

Washing powder	Cost per wash in pence	Overall stain removal (5 = excellent, 1 = poor)	Whiteness (5 = excellent, 1 = poor)	Prevents colour fading (5 = excellent, 1 = poor)
A	16	5	4	3
B	10	5	5	3
C	12	5	5	4
D	10	3	2	4

(a) Pete thinks that washing powder **C** is the best to use to wash his clothes.

Is he correct? Explain your answer using information from the table.

Explain the advantages of washing clothes at low temperatures.

The quality of written communication will be assessed in your answer to this question.

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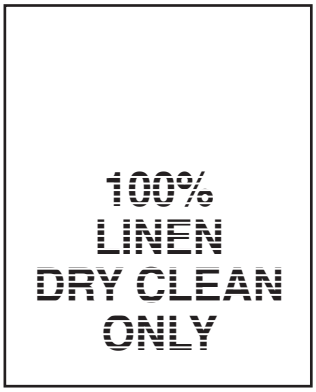
..... **[6]**

(b) Pete looks at the washing label on his jacket.



Describe what is meant by dry cleaning and suggest why Pete's jacket must be dry cleaned.

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..... **[2]**

SECTION D

16 The acidity of sea water is increasing.

Scientists think that increased levels of carbon dioxide and sulfur dioxide in the air cause this increase.

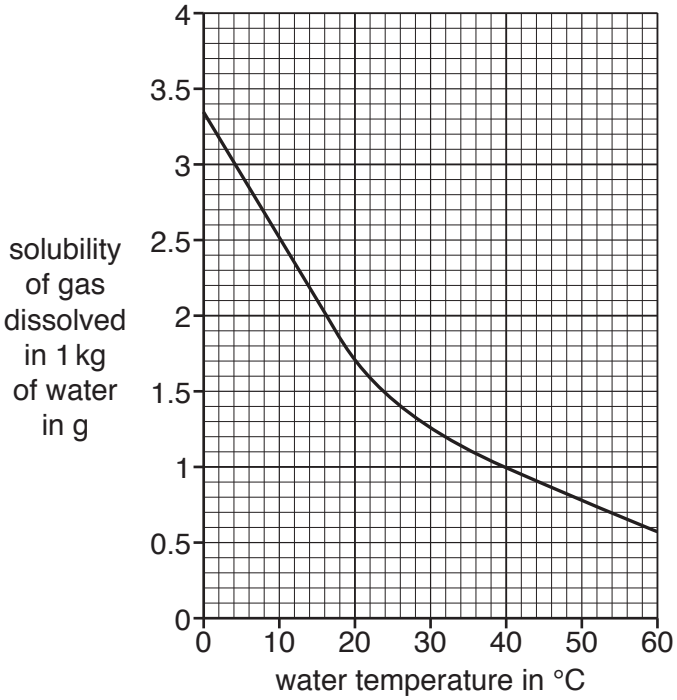
Both these gases dissolve in water to make acidic solutions.

The solubility of these gases in water changes with temperature.

(a) Look at graph **1**.

It shows the solubility of carbon dioxide in water at different temperatures.

Graph 1 – solubility of carbon dioxide



(i) At what temperature is the solubility of carbon dioxide 1 g dissolved in 1 kg of water?

..... °C **[1]**

(ii) Describe what happens to the solubility of carbon dioxide as the temperature increases.

.....

..... **[1]**

(iii) Julie has 3.0 kg of water at 10 °C.

She predicts she can dissolve 7.5 g of carbon dioxide in this water.

Is she correct?

Explain your answer using information from the graph.

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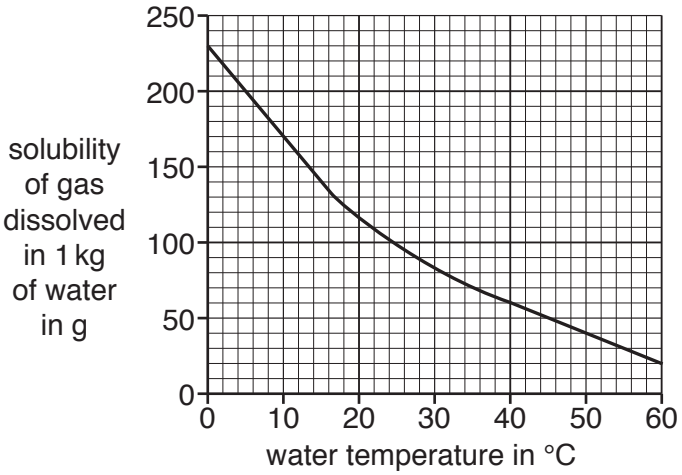
..... **[2]**

(b) Look at graph **2**.

It shows the solubility of sulfur dioxide in water at different temperatures.

Graph 2 – solubility of sulfur dioxide



Sulfur dioxide is **more soluble** in water than carbon dioxide.

Explain how you can tell from graphs **1** and **2**.

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..... **[2]**

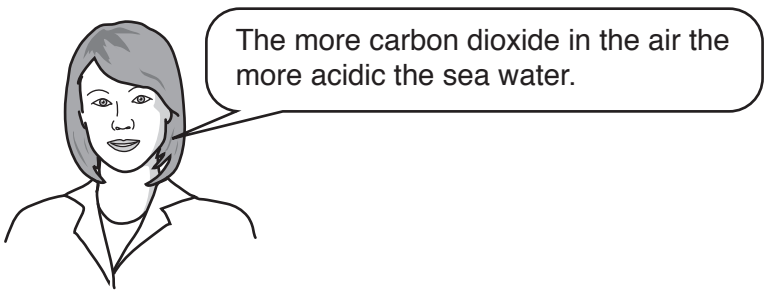
(c) Look at the table.

It shows information on sea water near a remote island in the Atlantic Ocean.

Year	pH of sea water	Percentage (%) by volume of carbon dioxide in the air	Mass of carbon dioxide in 1 kg of sea water in g
1990	8.00	0.035	1.50
1995	7.98	0.036	1.51
2000	7.95	0.037	1.52
2005	7.93	0.038	1.53
2010	7.90	0.039	1.55

The lower the pH of the ocean the more acidic it is.

Ann makes a conclusion.



(i) Which pattern in the information in the table supports this conclusion?

.....

.....

..... **[1]**

(ii) Describe **two other** patterns in the information in the table.

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..... **[2]**

(iii) Nick thinks that the data in the table is not reliable or valid.

He thinks that the temperature of the ocean should have been recorded in the table.

Suggest why Nick is correct.

.....

..... **[1]**

END OF QUESTION PAPER

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 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
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
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
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **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
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **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	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.