

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



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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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.



(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.

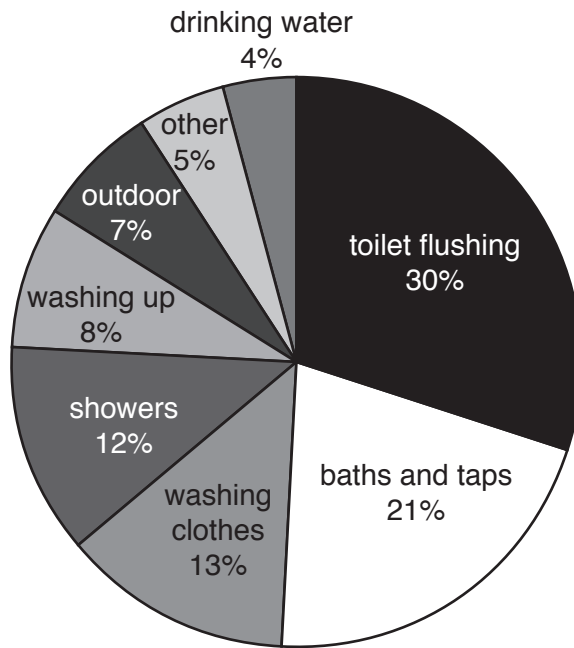
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..... [3]

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]

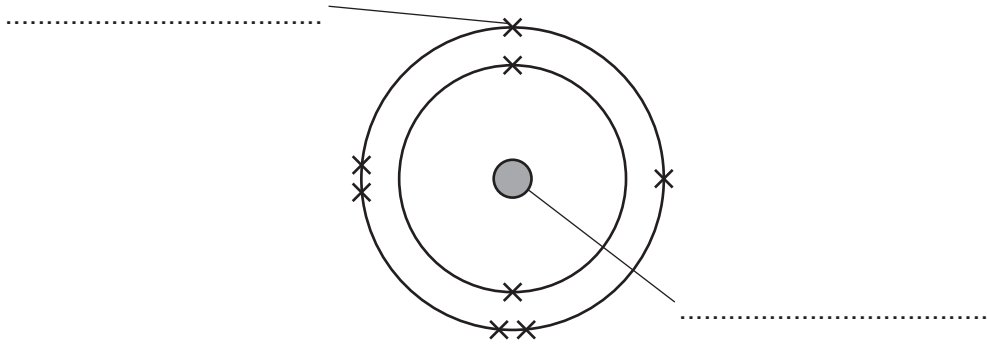
(b) What percentage of water is used to wash clothes and wash dishes?
 % [1]

(c) A household wants to reduce its water consumption.
 Suggest the most effective way of doing this.
 Explain your answer.
 [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.

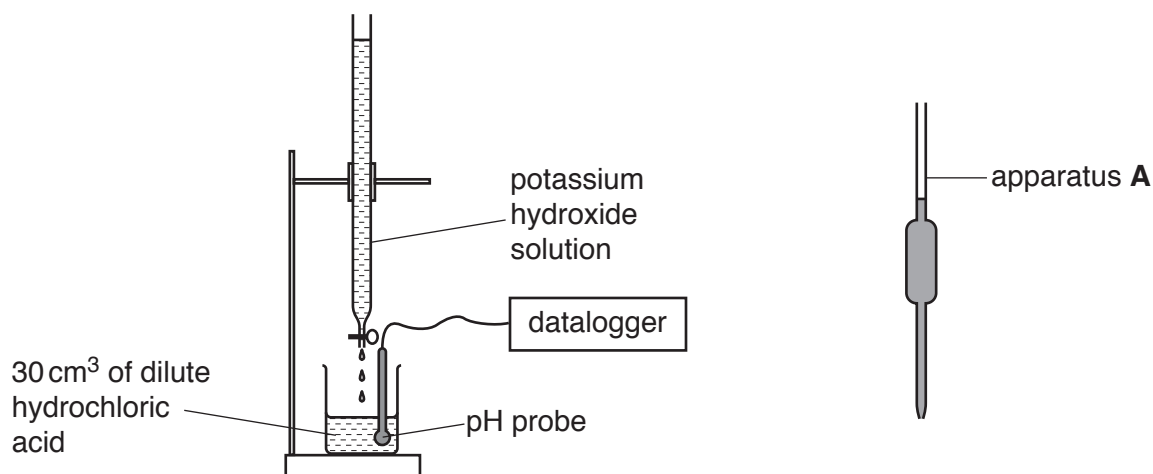
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[6]

SECTION B – Module C5

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

Look at the diagram of the apparatus she uses.



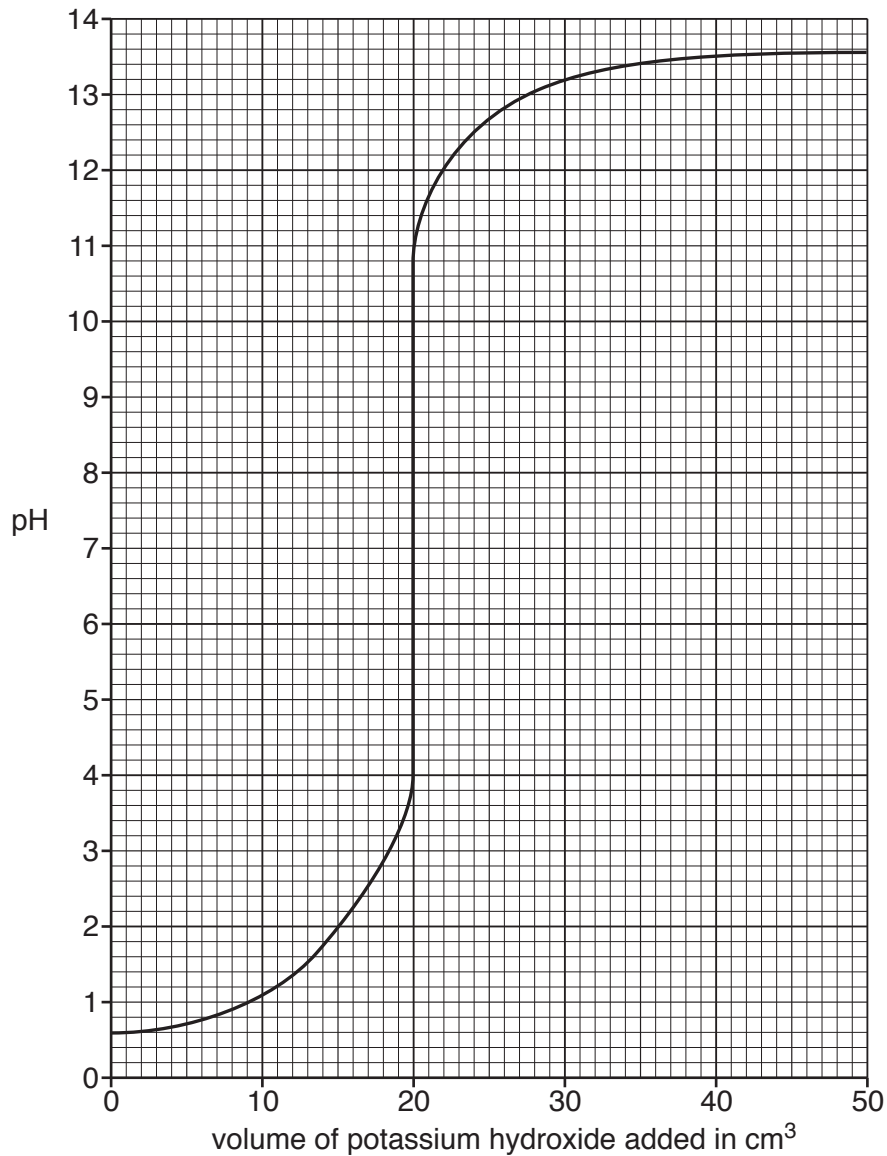
- (a) What is the name of apparatus **A**?

..... [1]

- (b) Sara slowly adds 50 cm³ of potassium hydroxide solution to 30 cm³ 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?

..... cm³ [1]

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

..... cm³ [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?

.....

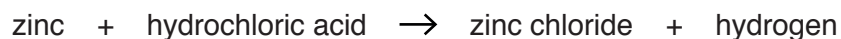
 [2]

(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.



They do the experiment four times.

Each time they use 1.0g 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

In experiment **B**, the concentration of the hydrochloric acid was greater than in experiment **A**.



Sue concludes

The concentration of hydrochloric acid in experiment **C** is half that in experiment **A**.



Are each of the conclusions correct?

Explain your answers.

.....

.....

.....

..... [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.

.....

.....

..... [2]

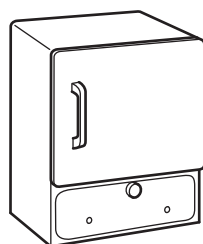
10 Jenna wants to make a pure, dry sample of the insoluble salt lead iodide, PbI_2 .

She uses **precipitation**.

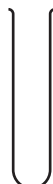
Jenna has solutions of lead nitrate, $\text{Pb}(\text{NO}_3)_2$, and sodium iodide, NaI .

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

She also has these pieces of apparatus.



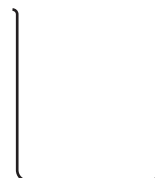
oven



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.

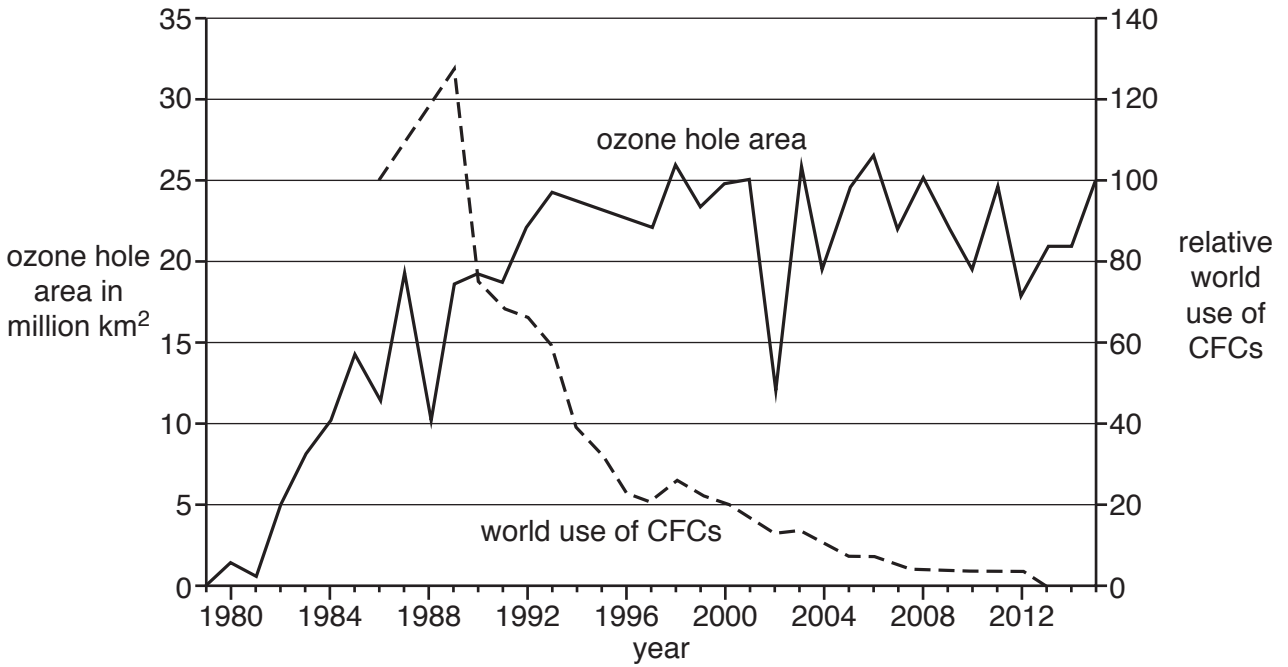
Write about **two** medical problems caused by increased levels of ultraviolet light.

.....
.....
..... [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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.....

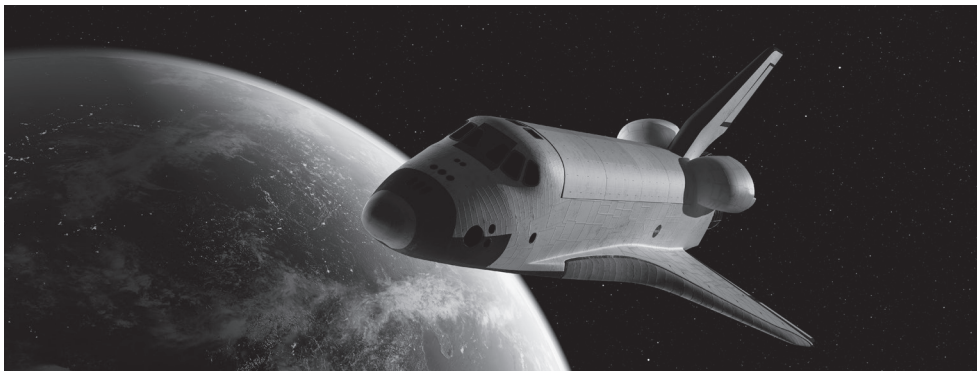
..... [2]

18
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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, O₂.

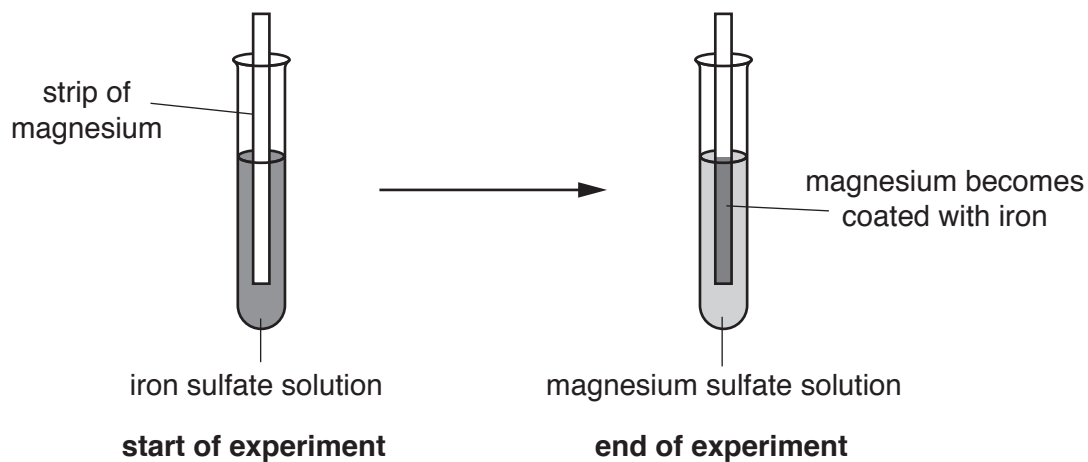
Zinc oxide, ZnO, is made.

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.

Solution used	Metal added			
	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]

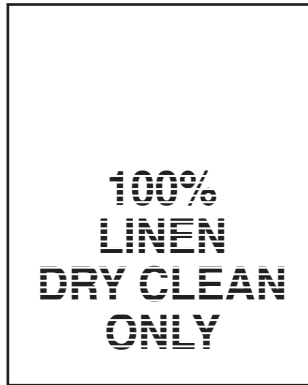
(c) Chris finds out that iron rusts.

Two substances are needed for iron to rust.

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

..... and [1]

(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.

.....

.....

..... [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.

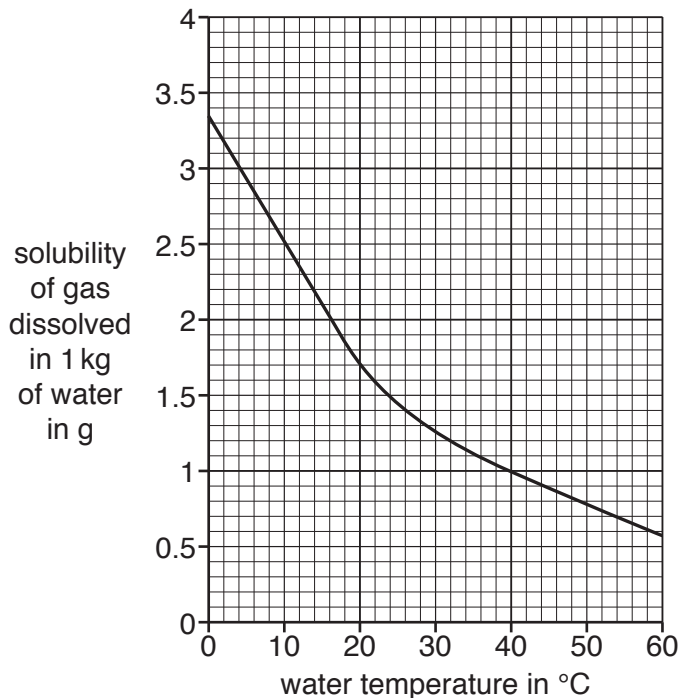
Both these gases dissolve in water to make acidic solutions.

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.

.....

.....

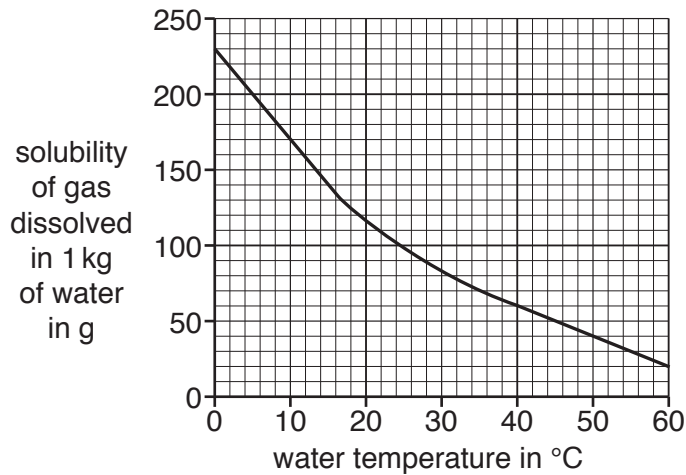
.....

..... [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.

.....

.....

.....

..... [2]

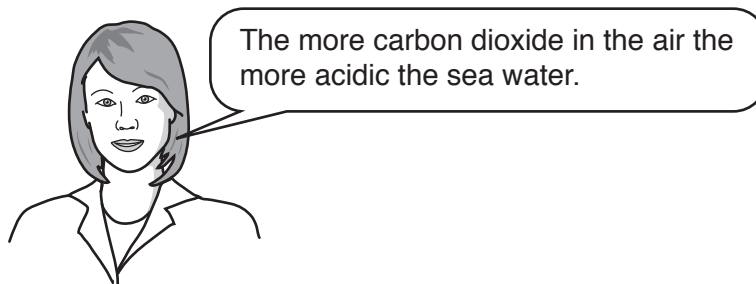
(c) Look at the table.

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.

.....

.....

.....

.....

..... [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

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The Periodic Table of the Elements

	1	2	3	4	5	6	7	0										
	7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 Mg magnesium 12	13 Al aluminium 13	14 Si silicon 14	15 P phosphorus 15	16 S sulfur 16	17 Cl chlorine 17	18 Ar argon 18								
	19 K potassium 19	20 Ca calcium 20	21 Sc scandium 21	22 Ti titanium 22	23 V vanadium 23	24 Cr chromium 24	25 Mn manganese 25	26 Fe iron 26	27 Co cobalt 27	28 Ni nickel 28	29 Cu copper 29	30 Zn zinc 30	31 Ga gallium 31	32 Ge germanium 32	33 As arsenic 33	34 Se selenium 34	35 Br bromine 35	36 Kr krypton 36
	37 Rb rubidium 37	38 Sr strontium 38	39 Y yttrium 39	40 Zr zirconium 40	41 Nb niobium 41	42 Mo molybdenum 42	43 Tc technetium 43	44 Ru ruthenium 44	45 Rh rhodium 45	46 Pd palladium 46	47 Ag silver 47	48 Cd cadmium 48	49 In indium 49	50 Sn tin 50	51 Sb antimony 51	52 Te tellurium 52	53 I iodine 53	54 Xe xenon 54
	55 Cs caesium 55	56 Ba barium 56	57 La* lanthanum 57	72 Hf hafnium 72	73 Ta tantalum 73	74 W tungsten 74	75 Re rhenium 75	76 Os osmium 76	77 Ir iridium 77	78 Pt platinum 78	79 Au gold 79	80 Hg mercury 80	81 Tl thallium 81	82 Pb lead 82	83 Bi bismuth 83	84 Po polonium 84	85 At astatine 85	86 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						

1
H
hydrogen
1

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.