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**Wednesday 1 February 2012 – Afternoon**

**GCSE GATEWAY SCIENCE  
CHEMISTRY B**

**B642/01** Unit 2 Modules C4 C5 C6 (Foundation Tier)

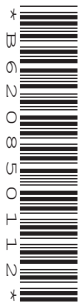
Candidates answer on the Question Paper.  
A calculator may be used for this paper.

**Duration: 1 hour**

**OCR supplied materials:**  
None

**Other materials required:**

- Pencil
- Ruler (cm/mm)



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 bar codes.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.

Answer **all** the questions.

**Section A – Module C4**

- 1 This question is about acids, bases and salts.

Look at this list of compounds.

**ammonia,  $\text{NH}_3$**

**ammonium nitrate,  $\text{NH}_4\text{NO}_3$**

**calcium carbonate,  $\text{CaCO}_3$**

**hydrochloric acid,  $\text{HCl}$**

**sodium chloride,  $\text{NaCl}$**

**sodium hydroxide,  $\text{NaOH}$**

**sulfuric acid,  $\text{H}_2\text{SO}_4$**

Choose compounds only from this list to answer the questions.

Each compound can be used **once, more than once** or **not at all**.

- (a) Which compound has a molecule that contains seven atoms?

..... [1]

- (b) Which compound is used as a fertiliser?

..... [1]

- (c) Which compound is used as car battery acid?

..... [1]

- (d) Write down the name of a compound that reacts with magnesium carbonate to make carbon dioxide.

..... [1]

- (e) Which **two** compounds react together to make sodium chloride?

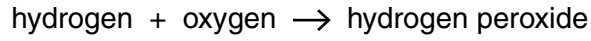
..... and ..... [1]

**[Total: 5]**

2 Hydrogen peroxide solution is used to sterilise contact lenses.

Look at the word equation.

It shows the overall process used to make hydrogen peroxide.



The process uses a catalyst and a temperature of 45 °C.

(a) The hydrogen for this process comes from the cracking of crude oil.

Suggest where the oxygen comes from.

..... [1]

(b) One of the costs of making hydrogen peroxide is the cost of hydrogen and oxygen.

Write about some of the **other** costs of making hydrogen peroxide.

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

[Total: 4]

3 Ammonium phosphate is a fertiliser.

The formula for ammonium phosphate is  $(\text{NH}_4)_3\text{PO}_4$ .



(a) Ammonium phosphate contains two **essential elements**.

Which **two** essential elements?

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

(b) Why do farmers use fertilisers?

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

(c) Fertilisers must dissolve in water before they can be absorbed by plants.

Write down the main part of a plant that absorbs fertilisers.

..... [1]

(d) Calculate the relative formula mass,  $M_r$ , for ammonium phosphate.

The relative atomic mass of H = 1, of N = 14, of O = 16 and of P = 31.

.....  
 .....  
 .....

relative formula mass = ..... [1]

(e) A factory makes ammonium phosphate.

Ian predicts the factory should make 25 tonnes of ammonium phosphate.

The factory actually makes 17.5 tonnes of ammonium phosphate.

What is the percentage yield?

.....  
.....  
.....

percentage yield = ..... %

[2]

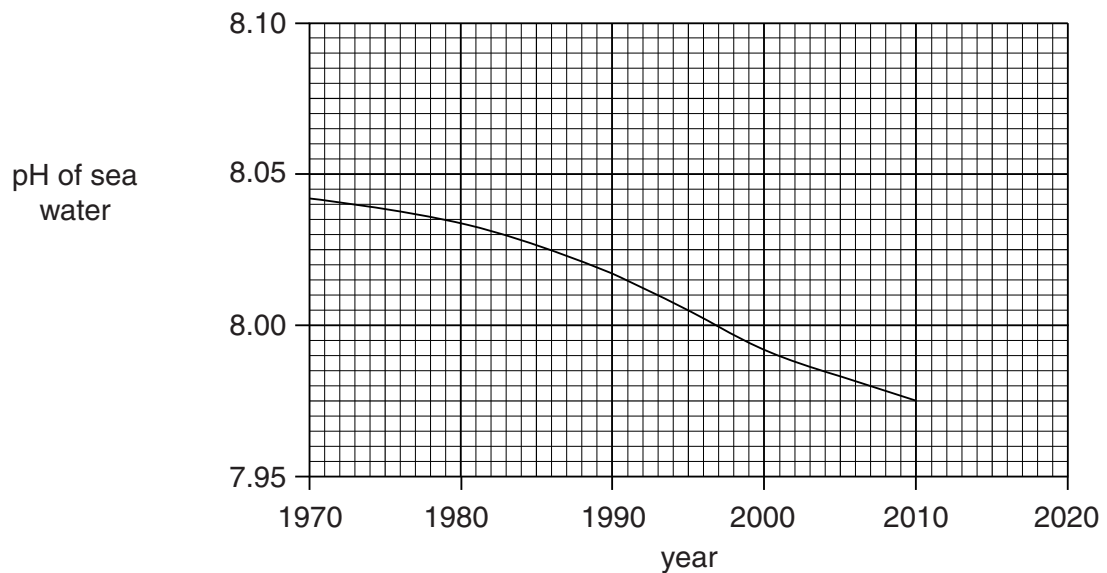
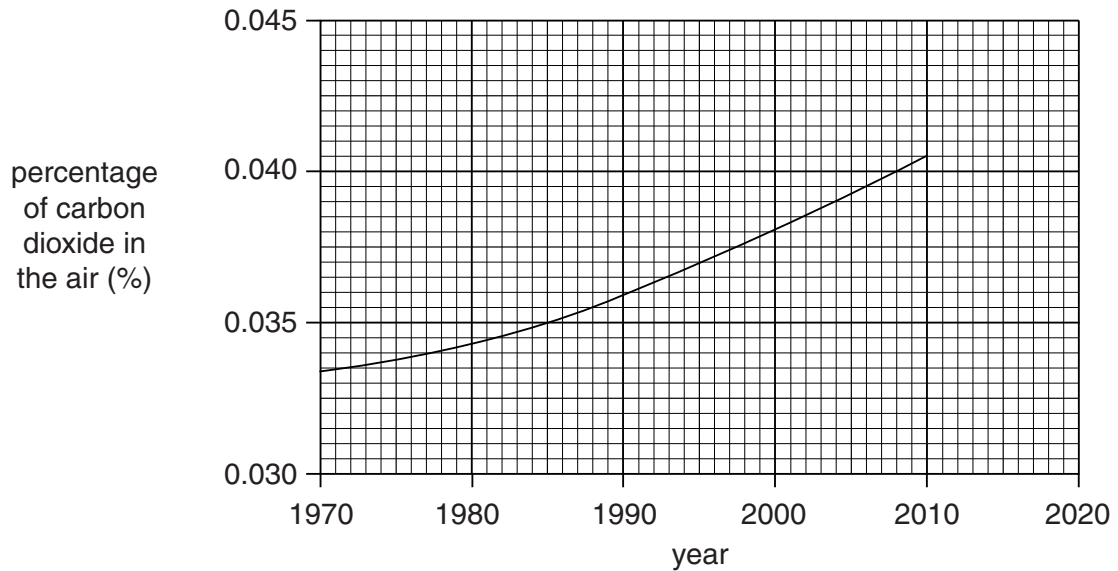
[Total: 6]

- 4 Some scientists think there is a connection between the pH of sea water and the percentage of carbon dioxide in the air.

Look at the two graphs.

One graph shows how the percentage of carbon dioxide in the air has changed since 1970.

The other graph shows how the pH of sea water has changed since 1970.



- (a) In which year was the pH of sea water 8.00?  
..... [1]
- (b) Describe how the percentage of carbon dioxide in the air has changed since 1970.  
..... [1]
- (c) Describe how the pH of sea water has changed since 1970.  
..... [1]
- (d) Scientists know that carbon dioxide,  $\text{CO}_2$ , reacts with water,  $\text{H}_2\text{O}$ , to make an acid.  
The acid is called carbonic acid,  $\text{H}_2\text{CO}_3$ .  
Construct a **balanced symbol** equation for this reaction.  
..... [1]
- (e) Sea water can be used to remove waste acidic gases.  
Suggest why.  
Use the information from the graph of the pH of sea water to help you.  
..... [1]

[Total: 5]

## Section B – Module C5

5 Ali uses the internet to find out about sea water.

Look at the table of information he finds.

It shows the concentration of ions in sea water.

name of ion	formula of ion	concentration in g/dm <sup>3</sup>
calcium	Ca <sup>2+</sup>	0.40
chloride	Cl <sup>-</sup>	19.00
hydrogencarbonate	HCO <sub>3</sub> <sup>-</sup>	0.14
magnesium	Mg <sup>2+</sup>	1.26
potassium	K <sup>+</sup>	0.38
sodium	Na <sup>+</sup>	10.56
sulfate	SO <sub>4</sub> <sup>2-</sup>	2.65

(a) One ion contains **three** elements bonded together.

Which ion?

Choose from the ions in the table.

..... [1]

(b) Ali measures out a 3 dm<sup>3</sup> sample of sea water.

What is the mass, in grams, of calcium ions in the sample?

.....  
 .....

mass = .....g [1]

(c) Ali wants to make the sample of sea water **more** concentrated.

Suggest how he could do this.

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



(d) Ali tests a sample of sea water with **barium chloride** solution.

An ion in the sea water reacts with barium chloride solution.

This ion makes a white precipitate.

Which ion reacts with the barium chloride solution?

Choose from the ions in the table.

..... [1]

(e) Ali tests another sample of sea water with **silver nitrate** solution.

Silver nitrate solution reacts with chloride ions.

What is the colour of the precipitate made?

Choose from this list.

**blue**

**cream**

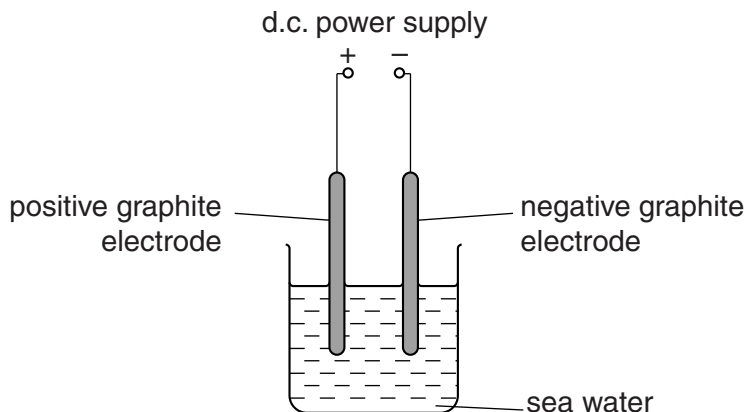
**white**

**yellow**

answer ..... [1]

(f) Ali decides to investigate the electrolysis of sea water.

Look at the apparatus he uses.



(i) The name of the positive electrode is the anode.

What is the name of the **negative** electrode?

..... [1]

(ii) Ali turns on the d.c. power supply.

Bubbles are seen at both electrodes.

This shows that electrolysis is happening.

Suggest why it is possible to electrolyse sea water.

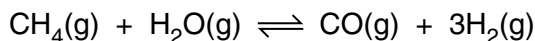
Use ideas about particles.

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

[Total: 8]

- 6 Hydrogen is manufactured from methane and water.

Look at the balanced symbol equation for this reaction.



- (a) What is the meaning of the symbol **(g)** next to each formula?

..... [1]

- (b) Kate calculates that 6 tonnes of hydrogen,  $\text{H}_2$ , can be made from 16 tonnes of methane,  $\text{CH}_4$ .

What mass of hydrogen can be made from 320 tonnes of methane?

.....  
 .....  
 .....

mass of hydrogen = ..... tonnes [1]

- (c) The reaction between methane and water is reversible.

The reaction reaches an equilibrium.

Put ticks (✓) next to the **two** sentences that are correct.

At equilibrium the forward and backward reactions have stopped.

At equilibrium the rate of the forward reaction is greater than the backward reaction.

At equilibrium the rate of the forward reaction is the same as the backward reaction.

At equilibrium the concentrations of the reactants are the same as the concentrations of the products.

At equilibrium the concentrations of the reactants and of the products do not change.

[2]

- (d) The conditions for the reaction are 700 °C and 30 atmospheres pressure.

At these conditions the **position of equilibrium is on the right**.

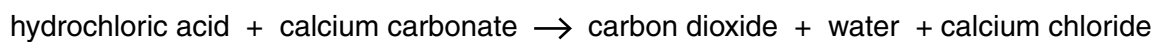
What is meant by 'the position of equilibrium is on the right'?

.....  
 .....

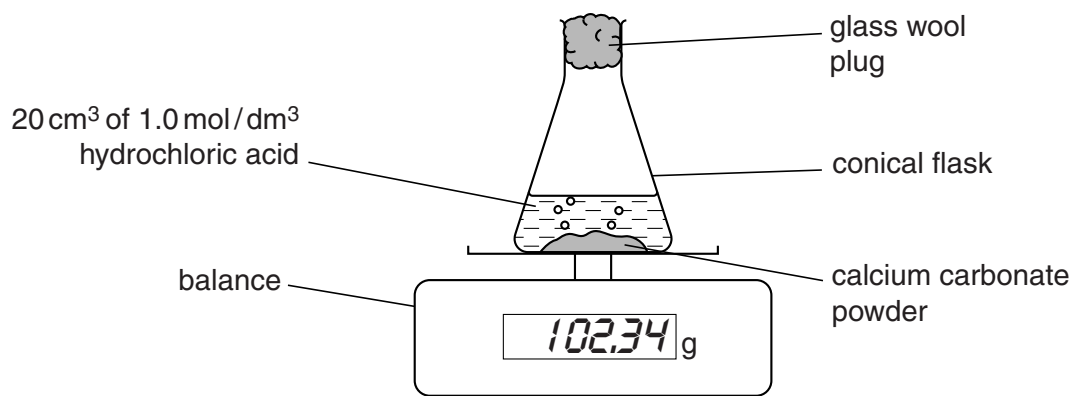
[1]

[Total: 5]

7 Hazel investigates the reaction between hydrochloric acid and calcium carbonate.



Look at the apparatus she uses.



Every minute she records the mass on the balance.

Look at the table of her results.

time in minutes	mass in grams
0	102.34
1	102.29
2	102.24
3	102.19
4	102.14
5	102.09
6	102.04
7	101.99
8	101.95
9	101.92
10	101.91
11	101.90
12	101.90
13	101.90

(a) The mass decreases during the first minute of the investigation.

(i) Suggest why the mass decreases.

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

(ii) What was the decrease in mass during the first minute?

.....  
.....

decrease in mass = .....g [1]

(b) The reaction stopped before 13 minutes.

(i) Estimate how long after the start of the experiment the reaction stopped.

time ..... minutes [1]

(ii) Suggest why the reaction stopped.

..... [1]

[Total: 4]

8 Mike wants to find the concentration of some dilute nitric acid.  
He decides to neutralise 25.0 cm<sup>3</sup> of the nitric acid with an alkali.  
He wants to find the volume of alkali that will neutralise the acid.  
Mike decides to use 0.100 mol/dm<sup>3</sup> potassium hydroxide solution.  
He knows that he must do a titration.

He also knows he must use

- a burette, pipette, pipette filler and a flask
- an indicator.

Describe how Mike does his titration.

Use a labelled diagram to help you answer the question.

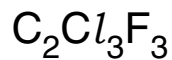
.....  
.....  
..... [3]

[Total: 3]

Section C – Module C6

9 Freon is a CFC.

The formula of freon is



(a) Write down the **names** of the **elements** in freon.

Use the Periodic Table on the back page to help you.

..... [1]

(b) CFCs can be used as refrigerants and aerosol propellants.

The use of CFCs has been banned in the UK.

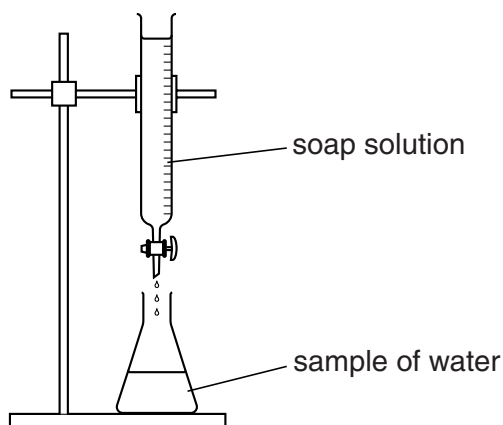
Explain why.

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

[Total: 3]

10 Judi and Phil are investigating samples of water.

Look at the diagram. It shows the apparatus they use.



They add soap solution to samples of water and shake them.

They add more soap solution until a permanent lather is made.

Look at the table of their results.

sample	burette reading at start in cm <sup>3</sup>	burette reading at end in cm <sup>3</sup>	volume of soap solution added in cm <sup>3</sup>
distilled water	0.0	1.0	1.0
tap water	1.0	11.0	10.0
boiled tap water	11.0	12.0	1.0
pond water	12.0	17.2	5.2
boiled pond water	17.2	22.4	.....

(a) (i) What volume of soap solution is needed to give a permanent lather with boiled pond water?

Write your answer in the table.

[1]

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

..... [1]

(iii) Why is distilled water used as one of the water samples?

..... [1]



(b) Write about **two** ways that **permanent** hardness can be removed from water.

.....

.....

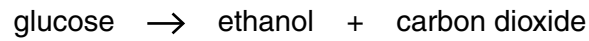
.....

.....

..... [2]

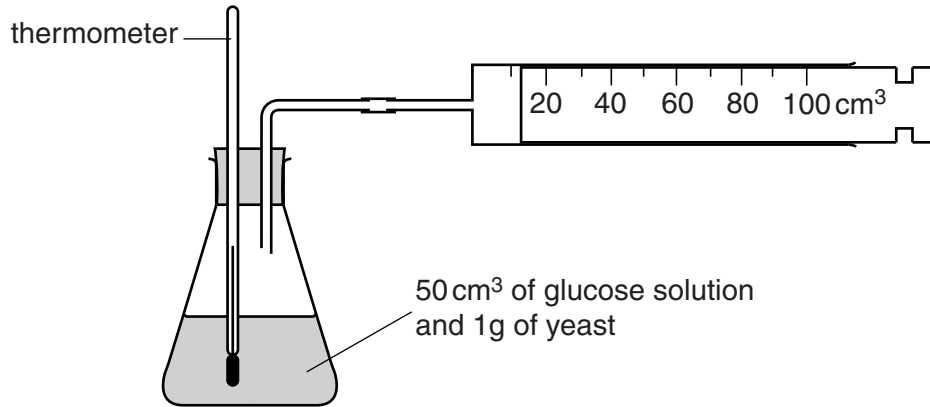
[Total: 5]

11 Ethanol is made by fermentation.



Clive and Gill investigate the fermentation of glucose.

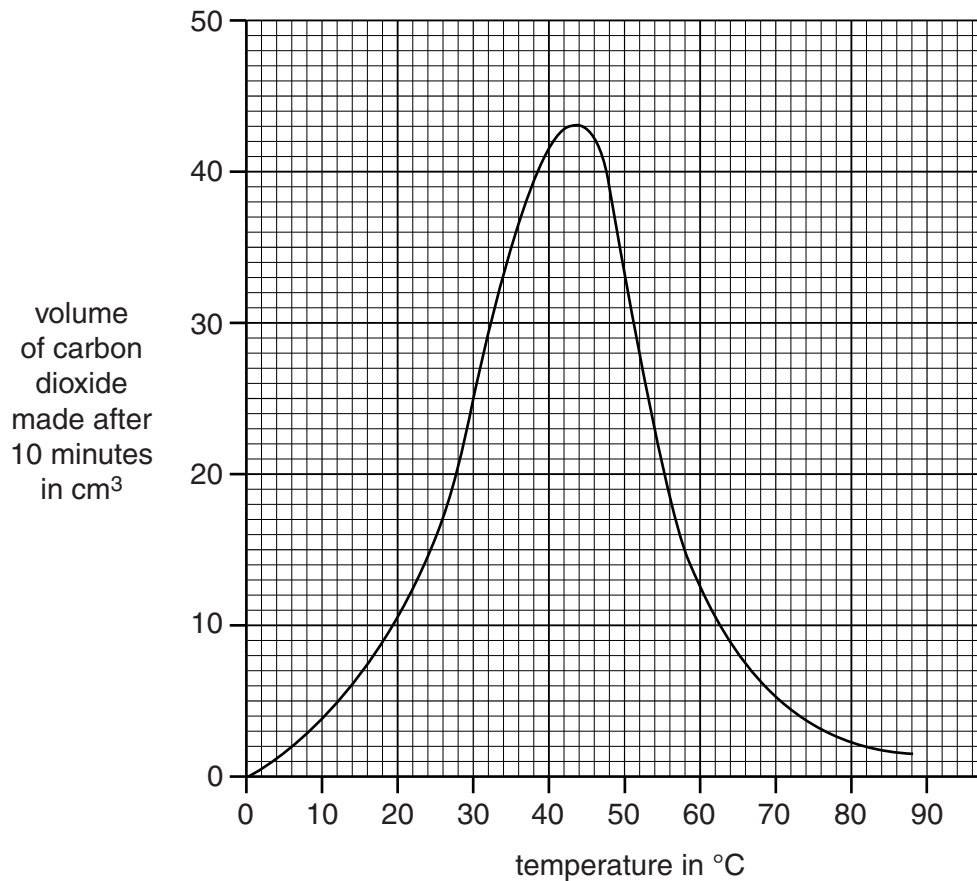
Look at the diagram. It shows the apparatus they use.



Clive and Gill measure the volume of carbon dioxide made after 10 minutes.

They do the investigation 8 times at different temperatures.

Look at the graph. It shows their results.



(a) (i) What is the volume of carbon dioxide made at 30 °C?

answer .....cm<sup>3</sup> [1]

(ii) What is the **optimum temperature** for fermentation in their investigation?

answer .....°C [1]

(b) Yeast is needed for fermentation to happen.

Explain why.

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

(c) Ethanol can also be made from ethene.



What is the name of this process?

Choose from this list.

**dehydration**

**emulsification**

**hydration**

**saponification**

answer ..... [1]

[Total: 4]

12 This question is about chemicals and their uses.

Link each **chemical** to its **use**.

Draw only three straight lines.

**chemical**

chlorine

ethanol

vegetable oils

**use**

making bio-diesel

making plastics

as a solvent

[2]

[Total: 2]

13 This question is about medicines.

One type of medicine is an **analgesic**.

(a) (i) What is the purpose of an analgesic in the body?

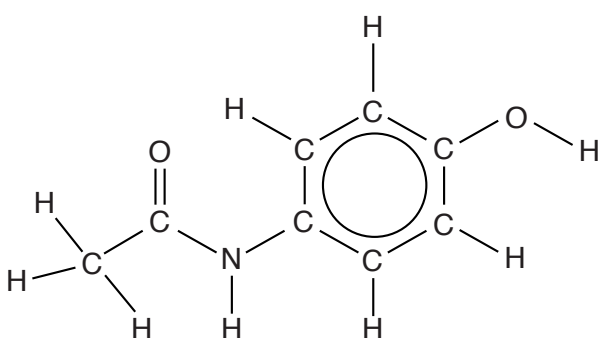
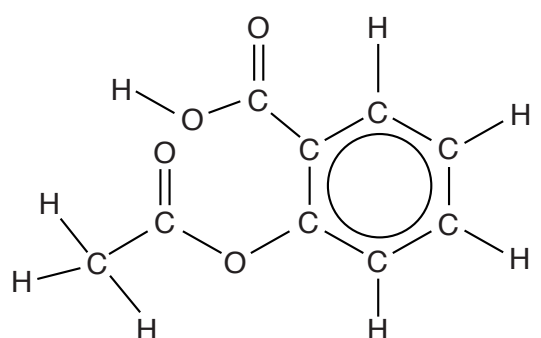
..... [1]

(ii) Aspirin and paracetamol are analgesics.

Write down the name of **one other** analgesic.

..... [1]

(b) Look at the displayed formulas of paracetamol and aspirin.

name	displayed formula
paracetamol	
aspirin	

The molecular formula of paracetamol is  $C_8H_9O_2N$ .

Write down the molecular formula of aspirin.

..... [1]

[Total: 3]

14 This question is about rusting.

John wants to stop his bicycle chain rusting.



(a) John puts oil onto his bicycle chain.

Explain why this stops the chain rusting.

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

(b) Write down two **other** ways of stopping iron rusting.

1 .....  
2 ..... [2]

[Total: 3]

**END OF QUESTION PAPER**

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# The Periodic Table of the Elements

	1	2	3	4	5	6	7	0										
	7 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4	11 <b>Na</b> sodium 11	12 <b>Mg</b> magnesium 12	13 <b>Al</b> aluminium 13	14 <b>N</b> nitrogen 7	15 <b>P</b> phosphorus 15	16 <b>O</b> oxygen 8	17 <b>Cl</b> chlorine 17	18 <b>Ar</b> argon 18								
	19 <b>K</b> potassium 19	20 <b>Ca</b> calcium 20	21 <b>Sc</b> scandium 21	22 <b>Ti</b> titanium 22	23 <b>V</b> vanadium 23	24 <b>Cr</b> chromium 24	25 <b>Mn</b> manganese 25	26 <b>Fe</b> iron 26	27 <b>Co</b> cobalt 27	28 <b>Ni</b> nickel 28	29 <b>Cu</b> copper 29	30 <b>Zn</b> zinc 30	31 <b>Ga</b> gallium 31	32 <b>Ge</b> germanium 32	33 <b>As</b> arsenic 33	34 <b>Se</b> selenium 34	35 <b>Br</b> bromine 35	36 <b>Kr</b> krypton 36
	37 <b>Rb</b> rubidium 37	38 <b>Sr</b> strontium 38	39 <b>Y</b> yttrium 39	40 <b>Zr</b> zirconium 40	41 <b>Nb</b> niobium 41	42 <b>Mo</b> molybdenum 42	43 <b>Tc</b> technetium [98]	44 <b>Ru</b> ruthenium 44	45 <b>Rh</b> rhodium 45	46 <b>Pd</b> palladium 46	47 <b>Ag</b> silver 47	48 <b>Cd</b> cadmium 48	49 <b>In</b> indium 49	50 <b>Sn</b> tin 50	51 <b>Sb</b> antimony 51	52 <b>Te</b> tellurium 52	53 <b>I</b> iodine 53	54 <b>Xe</b> xenon 54
	55 <b>Cs</b> caesium 55	56 <b>Ba</b> barium 56	57 <b>La*</b> lanthanum 57	72 <b>Hf</b> hafnium 72	73 <b>Ta</b> tantalum 73	74 <b>W</b> tungsten 74	75 <b>Re</b> rhenium 75	76 <b>Os</b> osmium 76	77 <b>Ir</b> iridium 77	78 <b>Pt</b> platinum 78	79 <b>Au</b> gold 79	80 <b>Hg</b> mercury 80	81 <b>Tl</b> thallium 81	82 <b>Pb</b> lead 82	83 <b>Bi</b> bismuth 83	84 <b>Po</b> polonium 84	85 <b>At</b> astatine 85	86 <b>Rn</b> radon 86
	[223] <b>Fr</b> francium 87	[226] <b>Ra</b> radium 88	[227] <b>Ac*</b> actinium 89	[261] <b>Rf</b> rutherfordium 104	[262] <b>Db</b> dubnium 105	[266] <b>Sg</b> seaborgium 106	[264] <b>Bh</b> bohrium 107	[277] <b>Hs</b> hassium 108	[268] <b>Mt</b> meitnerium 109	[271] <b>Ds</b> darmstadtium 110	[272] <b>Rg</b> roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

1	<b>H</b> 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.