OCR
RECOGNISING ACHIEVEMENT

F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

CHEMISTRY B

B642/01

Unit 2 Modules C4 C5 C6 (Foundation Tier)

B621901111

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)

Wednesday 26 January 2011
Afternoon

Duration: 1 hour

B642201

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. Pencil may be used for graphs and diagrams only.
- 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).
- Answer **all** the questions.
- 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 **20** pages. Any blank pages are indicated.

Answer **all** the questions.

Section A – Module C4

1 Ethanoic acid is an important industrial chemical.

Large amounts of ethanoic acid are needed every day.

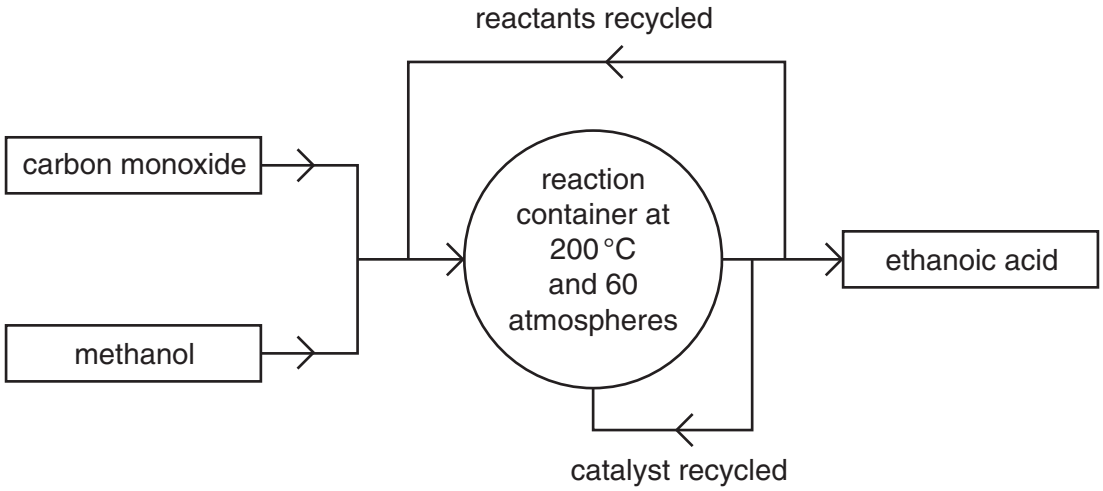
Ethanoic acid is made by a **continuous** process.

(a) What is meant by a continuous process?

.....

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

(b) Look at the flow chart. It shows how ethanoic acid is manufactured.



(i) Write down the **word** equation for the manufacture of ethanoic acid.

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

(ii) Write about the costs of manufacturing ethanoic acid.

.....

.....

.....

.....

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

(c) Kritica is a research chemist.

She investigates the percentage yield of ethanoic acid as the conditions change.

The conditions she changes are the **temperature** and the **pressure**.

Look at the table. It shows the results of her investigation.

pressure in atmospheres	**percentage yield at 100 °C**	**percentage yield at 300 °C**	**percentage yield at 500 °C**	**percentage yield at 700 °C**
20	50	43	32	19
40	80	76	68	56
60	94	92	89	85
80	98	97	95	92
100	99	99	98	97

(i) Look at the column for **100 °C**.

How does increasing the **pressure** change the percentage yield?

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

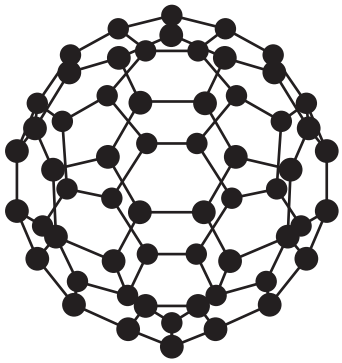
(ii) How does increasing the **temperature** change the percentage yield?

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

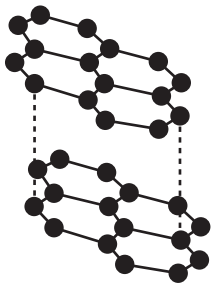
[Total: 7]

2 Three forms of carbon are buckminster fullerene, graphite and diamond.

Look at the diagrams. They show the structures of these three forms of carbon.



buckminster fullerene



graphite

diamond

(a) Which form of carbon is used to make the lead in pencils?

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

(b) Which form of carbon is used to make nanotubes?

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

(c) Match each **form of carbon** with its correct **properties**.

Draw three straight lines only.

form of carbon	**properties**
buckminster fullerene	grey-black solid, conducts electricity and has a high melting point
diamond	transparent solid, does not conduct electricity and has a high melting point
graphite	black solid, dissolves in petrol to make a red solution

[2]

[Total: 4]

3 Luke uses the internet to find information about some salts.

Look at the table. It shows the information Luke finds.

name of salt	formula of salt	ions present in salt
ammonium sulfate	$(NH_4)_2SO_4$	ammonium and sulfate
barium sulfate	$BaSO_4$	barium and sulfate
lead(II) nitrate	$Pb(NO_3)_2$	lead and nitrate
potassium iodide	KI	potassium and iodide
potassium nitrate	KNO_3	potassium and nitrate

(a) How many **atoms** are there in the formula for lead(II) nitrate?

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

(b) One substance reacts with silver nitrate solution to give a pale **yellow** precipitate.

Which substance?

Choose from the table.

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

(c) The three essential elements for plant growth are:

- nitrogen
- phosphorus
- potassium.

Write down which of these **essential** elements are in potassium nitrate.

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

(d) What is the relative formula mass, M_r, of potassium nitrate?

The relative atomic mass, A_r, of K = 39, of N = 14 and of O = 16.

.....

.....

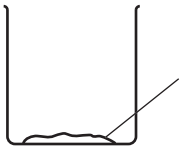
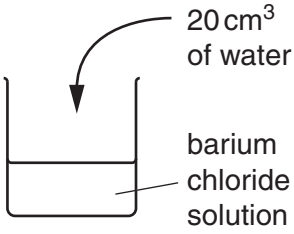
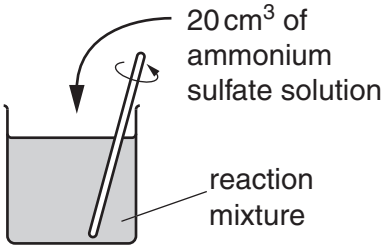
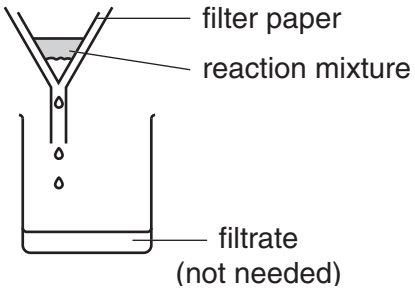
.....

relative formula mass, M_r, = ... **[1]**

Turn over for the remainder of question 3

(e) Luke decides to make barium sulfate.

Look at the diagrams. They show how Luke makes barium sulfate.

Step 1  	Luke puts 2.00 g of barium chloride into a beaker.
Step 2  	Luke adds water to the barium chloride to make a solution.
Step 3  	Luke puts ammonium sulfate solution into the beaker. He stirs the mixture with a glass rod.
Step 4  	Luke filters the reaction mixture.
Step 5  	Luke dries the filter paper containing barium sulfate.

(i) Luke mixes barium chloride solution with ammonium sulfate solution.

A precipitate is made.

What is the colour of the precipitate?

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

(ii) Luke starts with 2.00 g of barium chloride.

He does not get a 100 % yield of barium sulfate.

He predicts he should make 2.24 g of barium sulfate.

He actually makes 1.68 g of barium sulfate.

What is his percentage yield of barium sulfate?

.....

.....

.....

percentage yield = ... % **[2]**

(iii) Suggest **two** reasons why Luke does not get a 100 % yield.

1 .....

.....

2 .....

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

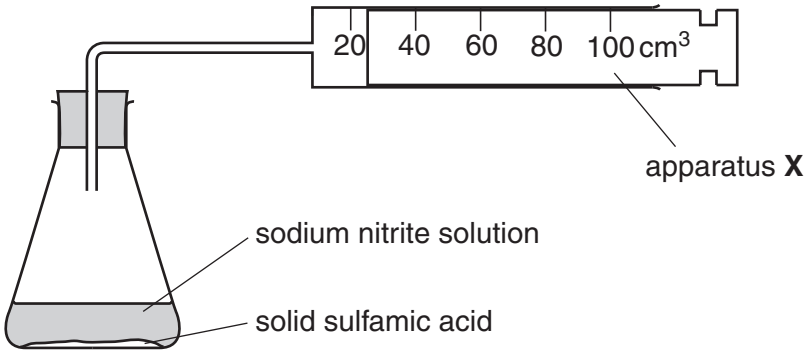
[Total: 9]

Section B – Module C5

4 Jenny investigates the reaction between sulfamic acid and sodium nitrite solution.

Solid sulfamic acid reacts with sodium nitrite solution to make nitrogen.

Look at the apparatus she uses.

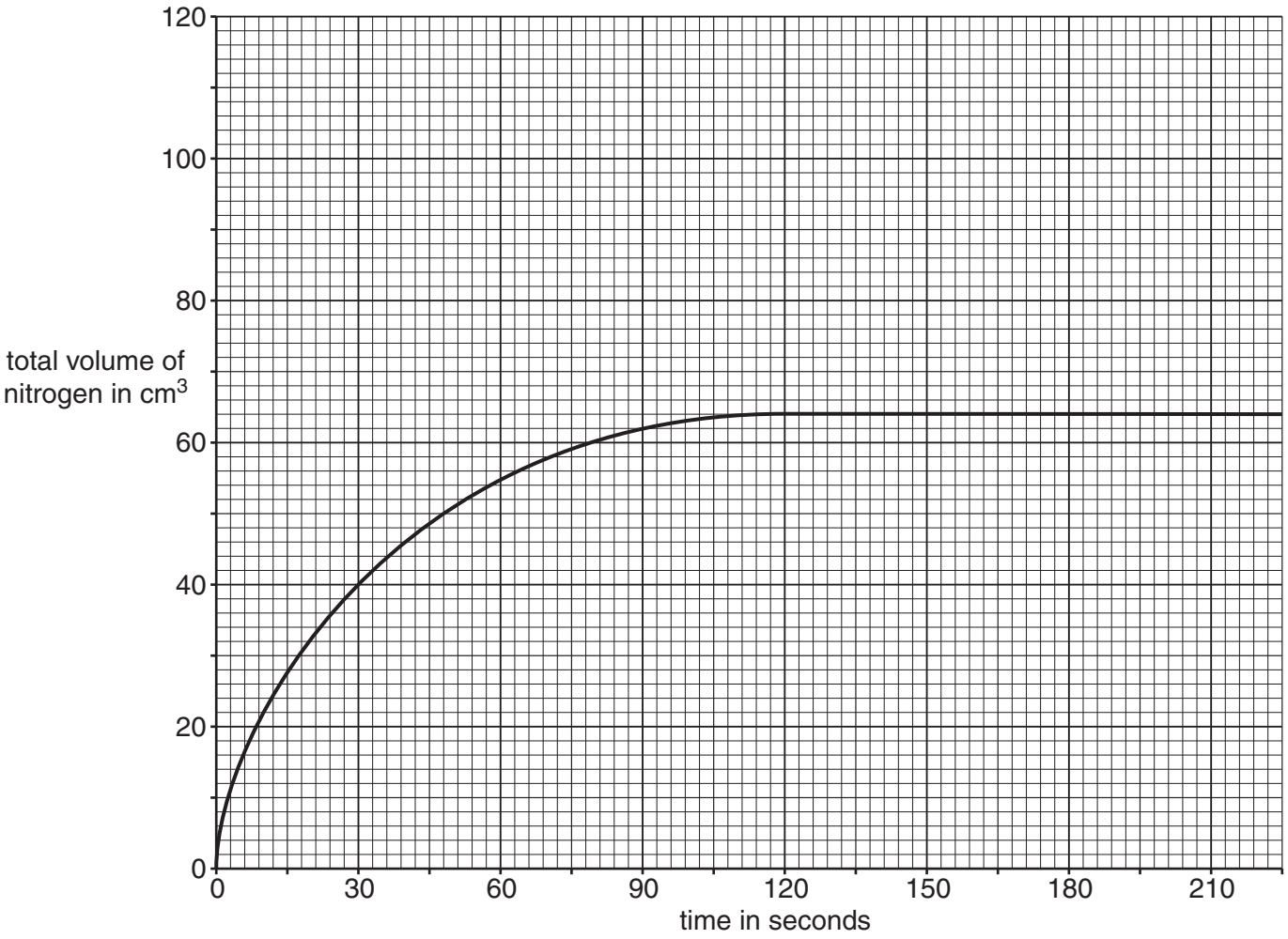


Jenny measures the total volume of gas in apparatus **X** every 30 seconds.

(a) Write down the name of apparatus **X**.

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

She plots the results on a graph.



(b) Look at the graph.

(i) How long does it take to collect a total volume of 40 cm^3 of nitrogen?

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

(ii) What is the total volume of nitrogen formed at the end of the reaction?

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

(iii) In which time interval was the reaction fastest?

Choose from the list.

0 to 3 seconds

30 to 33 seconds

60 to 63 seconds

90 to 93 seconds

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

Turn over for the remainder of question 4

(c) Suggest why the reaction eventually stops.

.....

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

(d) Sulfamic acid is a **weak acid**.

What is a weak acid?

.....

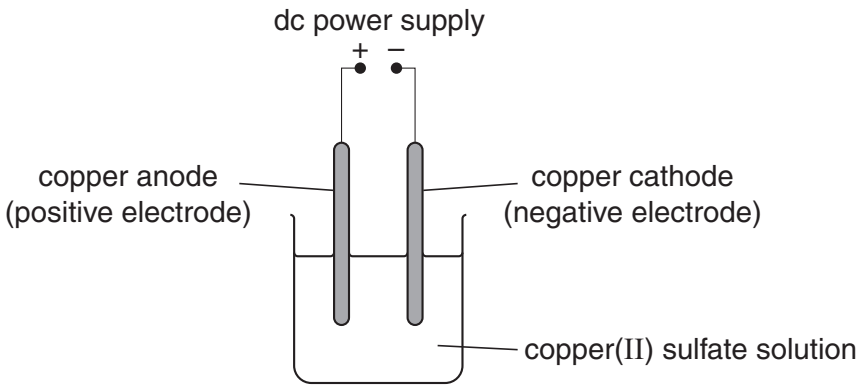
.....

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

[Total: 7]

5 Aimee investigates the electrolysis of copper(II) sulfate solution.

Look at the apparatus she uses.



Aimee finds the mass of the copper anode and of the copper cathode.

Aimee then passes an electric current through the copper sulfate solution for 5 minutes.

She dries the anode and cathode and finds their masses again.

Look at her results table.

	anode	**cathode**
mass before in g	1.24	1.54
mass after in g	1.01	1.77

(a) What is the change in mass of the cathode?

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

(b) Write down what happens to each electrode during the electrolysis.

anode .....

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

(c) Look at the list of the particles found in copper(II) sulfate solution.

Cu^{2+} H_2O H^+

OH^- SO_4^{2-}

Some particles are attracted to the **anode**. Write down the formula of one of these particles.

Choose from the list.

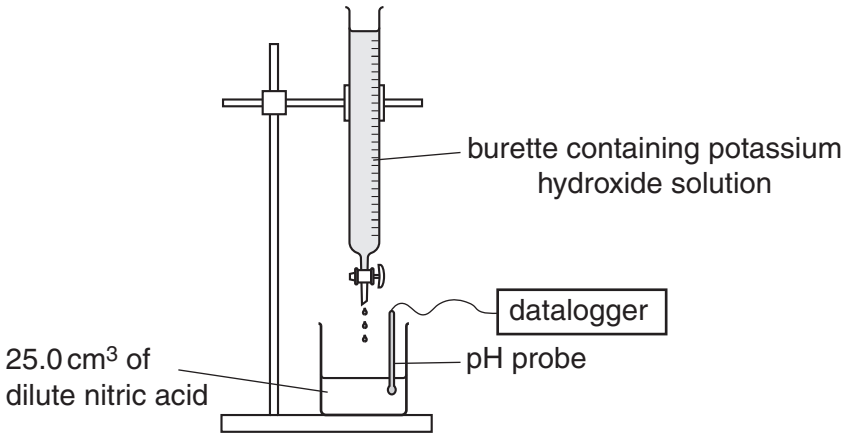
answer ..... **[1]**

[Total: 4]

6 Zak investigates the neutralisation of dilute nitric acid.

Zak reacts the dilute nitric acid with an alkali, potassium hydroxide solution.

Look at the diagram. It shows the apparatus he uses.



(a) Zak measures 25.0 cm^3 of dilute nitric acid into a beaker.

What apparatus should he use to measure out this volume of acid?

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

(b) Zak slowly adds the alkali to the dilute nitric acid.

Describe what happens to the pH of the solution in the beaker as the alkali is slowly added.

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

(c) Zak uses a pH probe (pH meter) to find the pH of the solution in the beaker.

Write about **another** method Zak could use to find the pH of a solution.

.....

.....

.....

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

[Total: 4]

7 Sodium peroxide has the formula Na_2O_2.

(a) What is the **empirical** formula of sodium peroxide?

Choose from the list.

Na_2O

NaO_2

NaO

Na_2O_2

Na_4O_4

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

(b) Sodium peroxide reacts with water to make oxygen.

Look at the equation for this reaction.

$$2Na_2O_2(s) + 2H_2O(l) \rightarrow 4NaOH(aq) + O_2(g)$$

Match each **compound** to its **physical state**. Use the state symbols in the equation to help.

Draw only **three** straight lines.

compound	physical state
$Na_2O_2(s)$	liquid
$H_2O(l)$	solid
NaOH(aq)	solution in water

[2]

(c) Chloe finds that 7.80 g of sodium peroxide makes 1.60 g of oxygen.

What mass of oxygen can be made from 1.95 g of sodium peroxide?

.....

.....

.....

mass of oxygen = ... g **[2]**

[Total: 5]

Section C – Module C6

8 This question is about hardness in water.

Hardness of water is caused by chemicals dissolved in the water.

There are two types of hardness, temporary and permanent.

(a) Write down the name of a chemical which causes **temporary** hardness.

Choose from the list.

calcium hydrogencarbonate

calcium sulfate

sodium carbonate

sodium chloride

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

(b) Terry buys a new kettle.

She uses the kettle to boil water.

Boiling removes temporary hardness in water.

After a few days the inside of the kettle is coated with a white solid, called limescale.

Write down the **chemical** name of limescale.

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

[Total: 2]

9 This question is about ethanol.

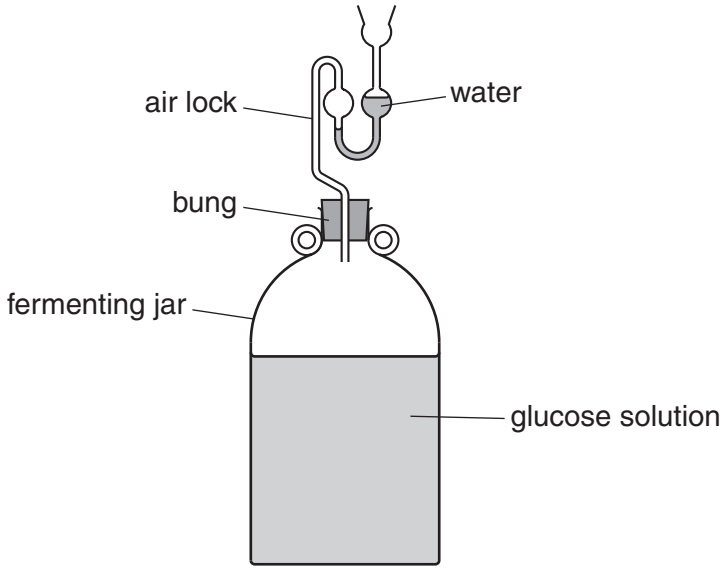
(a) Ethanol is used in alcoholic drinks.

Write down **one** other use for ethanol.

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

(b) Look at the diagram.

It shows how ethanol can be made by fermentation.



Which three of the following conditions are suitable for fermentation?

Put ticks (✓) next to the **three** correct conditions.

oxygen present	☐
oxygen absent	☐
temperature of 0 °C	☐
temperature of 35 °C	☐
dry conditions	☐
enzyme found in yeast present	☐

[2]

Turn over for the remainder of question 9

(c) Ethanol can also be made by reacting ethene with water (steam).

(i) Write down the **word** equation for this reaction.

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

(ii) Write down the name given to this **type** of reaction.

Choose from the list.

dehydration

displacement

fermentation

hydration

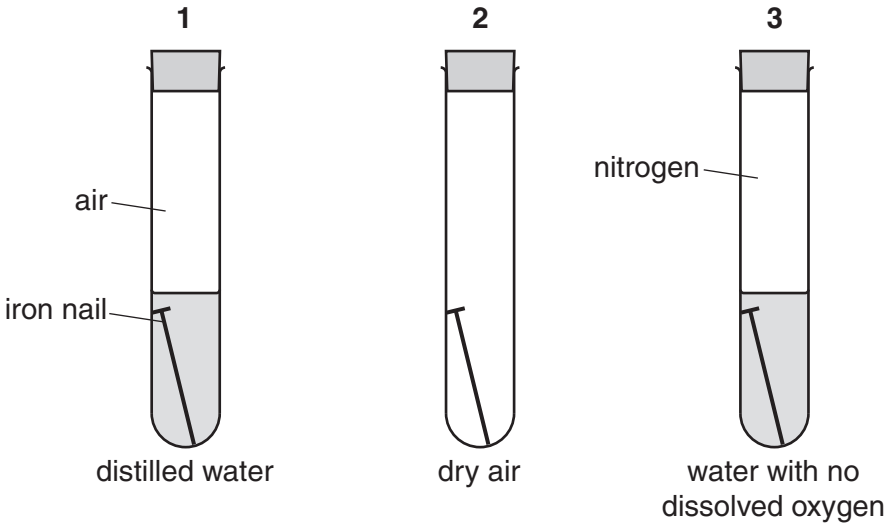
answer ..... **[1]**

[Total: 5]

10 This question is about rusting.

Gemma investigates the rusting of iron.

Look at the diagram. It shows how she sets up her experiment.



After 2 weeks the nail in tube **1** was rusty.

The nails in tubes **2** and **3** were not rusty.

(a) Explain why the nails in tubes **2** and **3** were not rusty.

tube 2 .....

.....

tube 3 .....

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

(b) Gemma leaves a piece of iron outside.

She paints it to stop it rusting.

Write about **two other** ways she could stop iron rusting.

.....

.....

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

(c) The rusting of iron involves both oxidation and reduction.

Write down the name of this type of reaction.

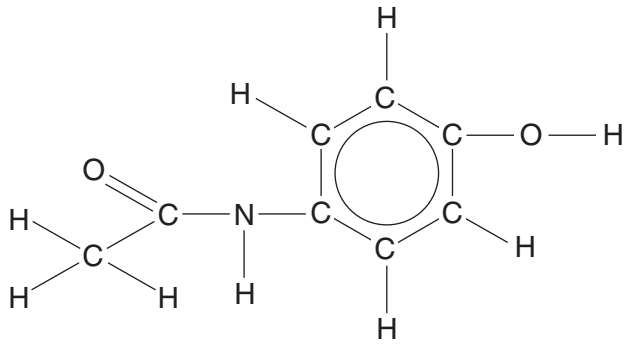
..... **[1]**

[Total: 5]

11 This question is about analgesics.

(a) Look at the table. It shows some displayed and molecular formulas.

Complete the table.

name of compound	molecular formula of compound	displayed formula of compound
ethanol	C_2H_6O	
paracetamol		

[3]

(b) **(i)** Paracetamol is an example of an **analgesic** drug.

What effect does an analgesic drug have on the body?

Choose from the list.

reduces pain

lowers body temperature

thins the blood

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

(ii) Write down the name of **another** analgesic drug.

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

[Total: 5]

12 This question is about chlorofluorocarbons, CFCs.

Most CFCs are banned in the UK.

This is because CFCs damage the ozone layer.

(a) Chlorofluorocarbons contain **three** different elements.

Two of these elements are fluorine and carbon.

Write down the **name** of the **other** element.

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

(b) An oxygen molecule has the formula O_2.

This means an oxygen molecule contains two atoms.

How many atoms are there in a molecule of ozone, O_3?

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

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

An increase in ultraviolet light can cause some medical problems.

Write about one of these medical problems.

.....

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

[Total: 3]

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.