Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

B642/02

GATEWAY SCIENCE
CHEMISTRY B

Unit 2 Modules C4 C5 C6
(Higher Tier)

WEDNESDAY 17 JUNE 2009: Morning
DURATION: 1 hour

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

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)

READ INSTRUCTIONS OVERLEAF

DC (SLM/SW) OV90743 10947/1

INSTRUCTIONS TO CANDIDATES

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully and make sure that you know what you have to do before starting your answer.**
- **Answer ALL the questions.**
- **Write your answer to each question in the space provided, however additional paper may be used if necessary.**

INFORMATION FOR CANDIDATES

- **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 60.**
- **The Periodic Table is printed on the back page.**

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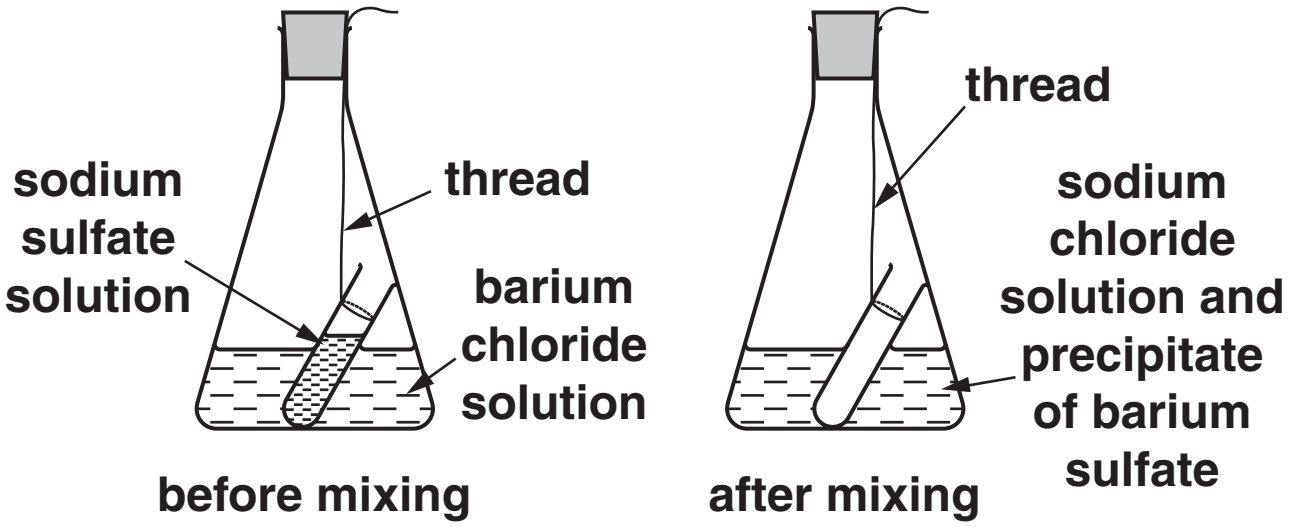
Answer <u>ALL</u> the questions.

SECTION A – MODULE C4

1 Nick and Sloane investigate precipitation reactions.

Look at the apparatus they use.



They record the total mass of the flask, test-tube and contents.

They then take the flask off the balance and tip the flask upside down.

Nick and Sloane are careful not to let any liquid leak out of the flask.

The solutions mix and react. A precipitate is made.

They put the flask back on the balance and record the mass again.

(a) Look at the results of this experiment.

	MASS IN GRAMS
mass of flask, test-tube and contents before mixing	142.6
mass of flask, test-tube and contents after mixing	142.6

Look at the balanced symbol equation for the reaction taking place.

$$BaCl_2 + Na_2SO_4 \rightarrow 2NaCl + BaSO_4$$

Use the balanced symbol equation to help explain why the mass does not change during the reaction.

_____

_____ **[1]**

(b) Nick and Sloane do another experiment.

This time they use barium chloride solution and ammonium sulfate solution.

Complete the <u>WORD</u> equation opposite for this reaction. [1]

barium chloride + **ammonium sulfate** → _____ + _____

_____ _____

(c) Look at the table.

It shows the formula of some of the compounds used by Nick and Sloane.

COMPOUND	FORMULA
ammonium sulfate	$(NH_4)_2SO_4$
barium chloride	$BaCl_2$
iron(III) sulfate	$Fe_2(SO_4)_3$
sodium sulfate	Na_2SO_4

(i) How many ATOMS are there in the formula for ammonium sulfate?

_____ **[1]**

(ii) The relative formula mass (M_r) of barium chloride is 208.

What is the relative formula mass of iron(III) sulfate, $Fe_2(SO_4)_3$?

The relative atomic mass (A_r) of O is 16, of S is 32, of Cl is 35.5 of Fe is 56 and of Ba is 137.

_____

_____

_____

_____

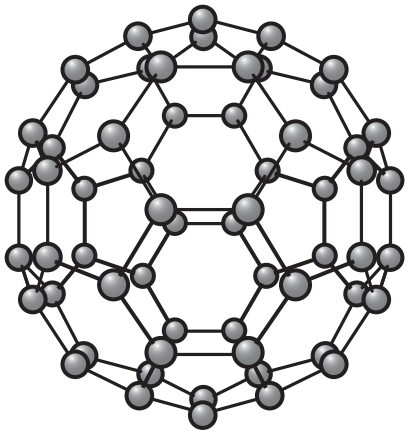
relative formula mass _____ **[1]**

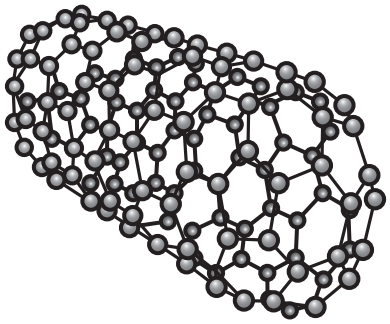
[Total: 4]

2 Buckminster fullerene and nanotubes are recently discovered substances.

Look at the diagrams.

They show the structures of Buckminster fullerene and of a nanotube.





BUCKMINSTER FULLERENE **A NANOTUBE**

(a) (i) What is the formula for a molecule of Buckminster fullerene?

_____ **[1]**

(ii) Buckminster fullerene can 'cage' other molecules.

Describe ONE use of caged molecules.

_____

_____ **[1]**

(b) (i) Write down <u>TWO</u> reasons why nanotubes are used as catalysts.

1 _____

_____

2 _____

_____ **[2]**

(ii) Nanotubes are very strong and conduct electricity.

One use for nanotubes is as industrial catalysts.

Describe <u>ONE OTHER</u> use of nanotubes.

_____

_____ **[1]**

[Total: 5]

3 Dirty clothes can be cleaned using a solvent.

(a) One way of using a solvent to clean clothes is called dry cleaning.

Suggest why it is called <u>DRY</u> cleaning.

_____ **[1]**

(b) Grease will dissolve in dry cleaning solvents.

Explain why.

Use ideas about

- **solvent molecules**
- **intermolecular forces**
- **molecules of grease.**

A labelled diagram may help you answer the question.

_____

_____

_____

_____ **[2]**

(c) Dry cleaning solvents are often harmful.

Eric decides to use solid carbon dioxide to dry clean some clothes.

Small lumps of solid carbon dioxide are fired at the clothing.

These dislodge the dirt.

Solid carbon dioxide quickly changes into a gas.

Suggest one <u>ADVANTAGE</u> of using solid carbon dioxide rather than a dry cleaning solvent.

_____

_____ **[1]**

[Total: 4]

4 A continuous process is used to make ammonia.

A batch process is used to make speciality chemicals such as medicines.

(a) Ammonia is made by a continuous process rather than a batch process. Suggest why.

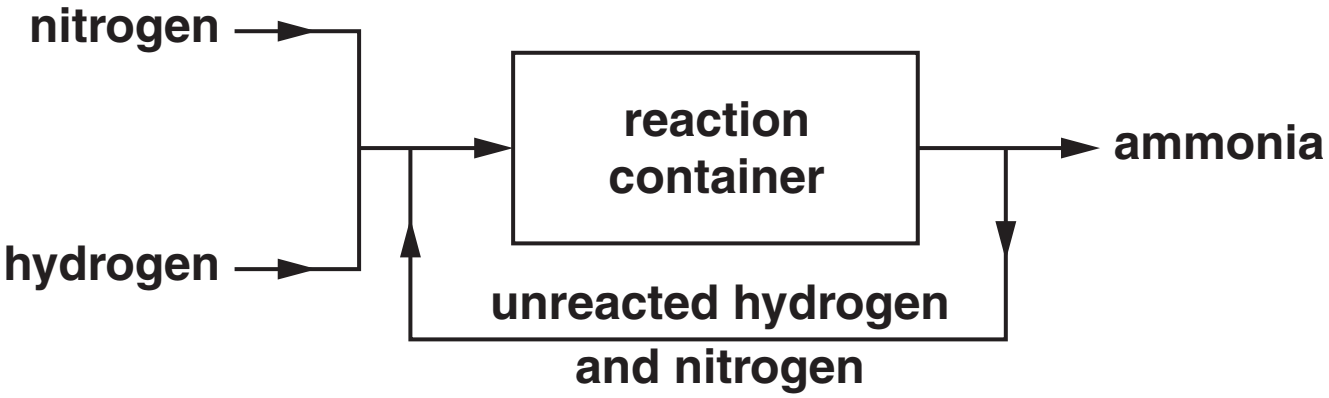
_____

_____ **[1]**

(b) Ammonia is made in the Haber process.

Look at the diagram.

It shows a flowchart of the Haber process.



Write about how ammonia is made in the Haber process.

Include in your answer

- **the word equation for the reaction taking place in the Haber process**
- **the conditions used in the Haber process.**

_____

_____

_____

_____

_____ **[3]**

(c) Ammonium phosphate is made by reacting ammonia with an acid.

Which acid?

_____ **[1]**

(d) Ammonia is used to make fertilisers.

Fertilisers increase crop yield.

Explain why fertilisers increase crop yield.

Use ideas about

- **essential elements**
- **plant protein.**

_____

_____

_____ **[2]**

[Total: 7]

SECTION B – MODULE C5

5 Josh looks at this label on his packet of cornflakes.

It shows some information about 100 g of cornflakes.

NUTRIENT	MASS OF INGREDIENT IN MILLIGRAMS	PERCENTAGE OF RECOMMENDED DAILY ALLOWANCE (RDA)
folic acid	0.2	85
iron	7.9	55
niacin	13.2	75
vitamin B1	0.7	50

(a) What mass of cornflakes will contain the RDA for vitamin B1?

_____

_____

mass of cornflakes = _____ g [1]

(b) Look at the table.

It gives information about the amount of sodium and of salt in 100 g of cornflakes.

	MASS IN GRAMS
sodium	0.7
salt	1.8

The RDA for salt is 6.0 g.

(i) What is the percentage of the RDA of <u>SALT</u> in 100 g of cornflakes?

_____

_____

percentage = _____ [1]

(ii) Show by calculation that all of the sodium in cornflakes comes from salt, NaC*l*.

The relative atomic mass of Na is 23 and of C*l* is 35.5.

_____

_____

_____

_____ **[2]**

[Total: 4]

6 Insoluble compounds can be prepared by using a precipitation reaction.

(a) Emma wants to prepare a pure, dry sample of lead iodide.

She mixes potassium iodide solution and lead nitrate solution in a beaker.

An insoluble precipitate of lead iodide is made.

Describe the next steps Emma must do to get a PURE, DRY sample of lead iodide.

A labelled diagram may help you answer this question.

_____

_____

_____

_____ **[3]**

(b) Potassium iodide solution, KI, reacts with lead nitrate solution, $Pb(NO_3)_2$.

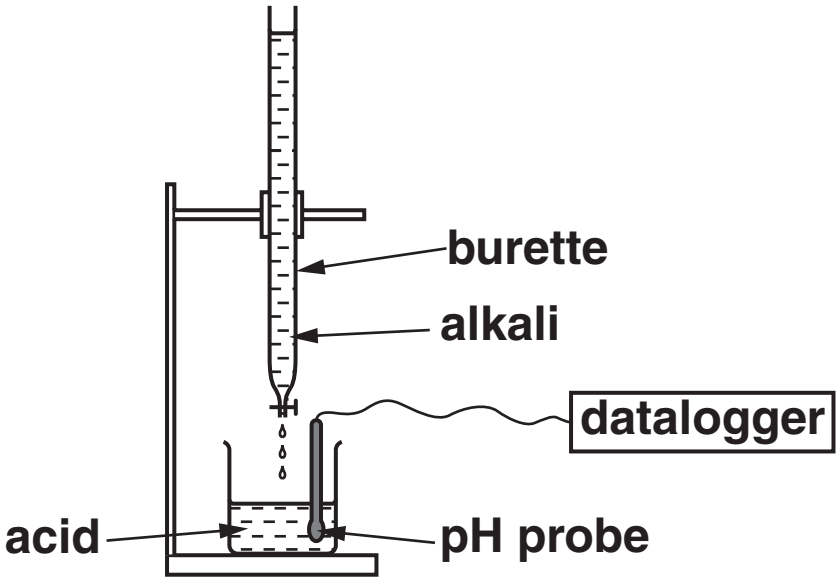
Lead iodide, PbI_2, and potassium nitrate, KNO_3, are made.

Write down the <u>BALANCED SYMBOL</u> equation for this reaction.

_____ **[2]**

[Total: 5]

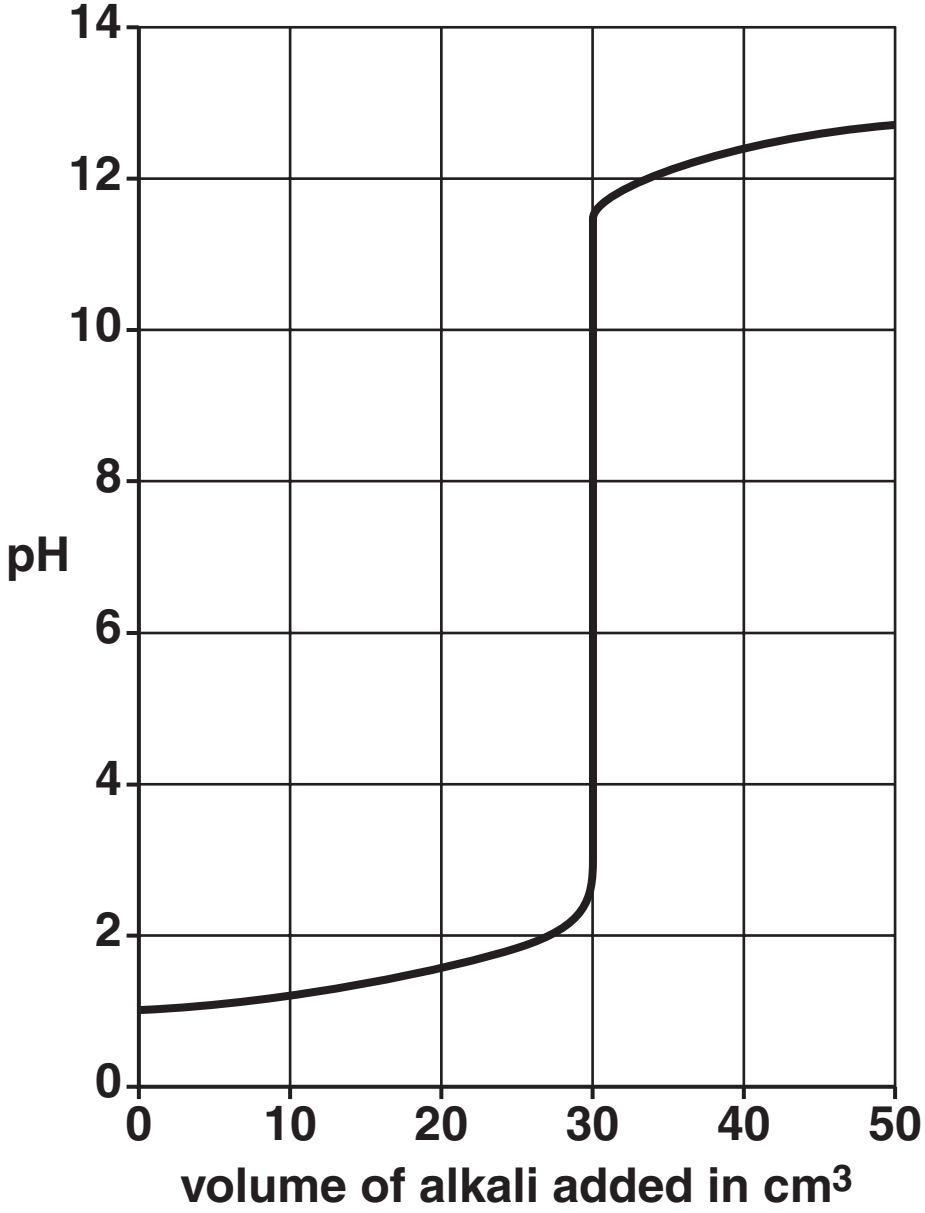
7 Tina investigates how the pH value changes as an acid is neutralised by an alkali.
Look at the apparatus she uses.



Sodium hydroxide solution is added slowly into the beaker of dilute sulfuric acid.

The pH probe is connected to a datalogger.

Look at the display opposite from the datalogger.



(a) (i) What is the pH value when 15.0 cm^3 of sodium hydroxide has been added?

_____ **[1]**

(ii) What volume of alkali is needed to exactly neutralise the sulfuric acid?

_____ **cm^3** **[1]**

(b) Tina does another experiment.

This time she uses

- **25.0 cm^3 of dilute hydrochloric acid in the beaker**
- **sodium hydroxide solution of concentration 0.100 mol/dm^3 in the burette.**

The hydrochloric acid is exactly neutralised by 20.0 cm^3 of this sodium hydroxide solution.

Look at the balanced symbol equation for the reaction.

$$NaOH + HCl \rightarrow NaCl + H_2O$$

Calculate

- **the number of moles of sodium hydroxide in 20.0 cm^3 of a 0.100 mol/dm^3 solution**
- **the number of moles of hydrochloric acid that reacted with this amount of sodium hydroxide**
- **the concentration, in mol/dm^3, of the hydrochloric acid.**

_____

_____

_____

_____

_____

_____

concentration of hydrochloric acid =

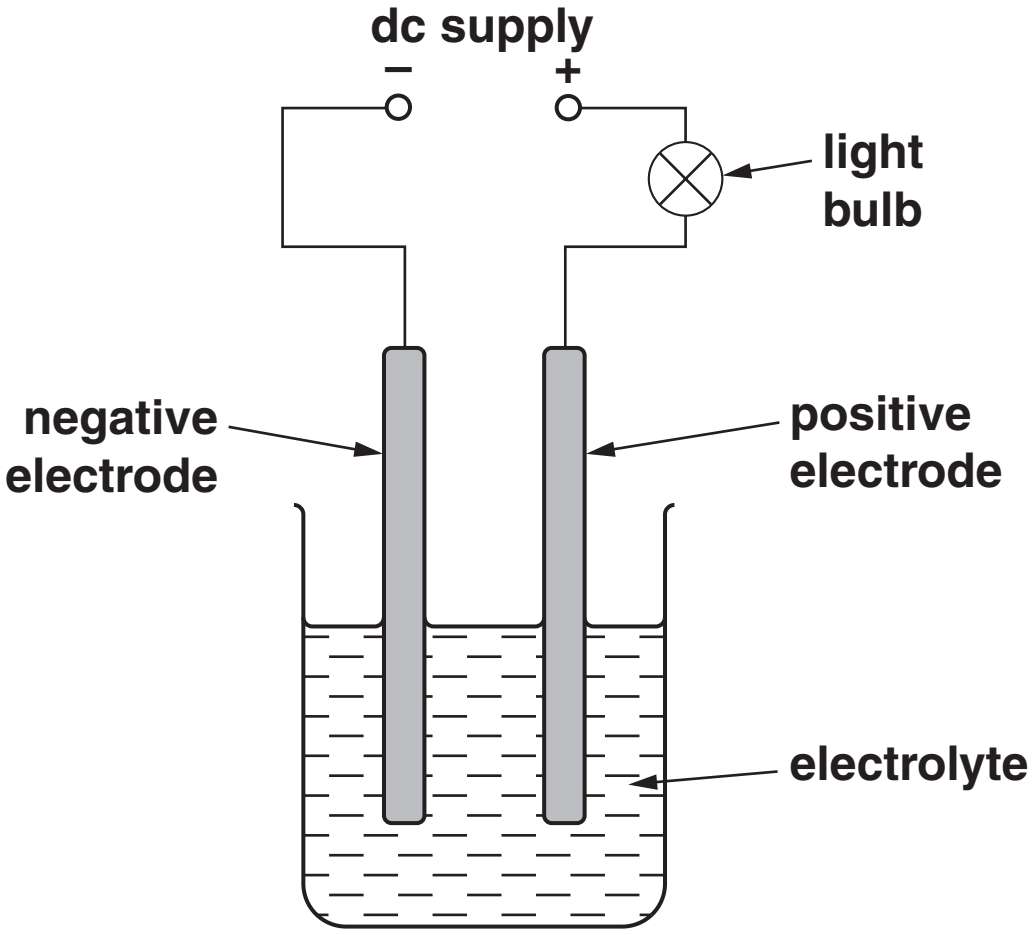
_____ **mol/dm^3** **[3]**

[Total: 5]

8 This question is about electrolysis.

Look at the diagram.

It shows the apparatus that can be used to electrolyse solutions.



When a current flows the light bulb will glow.

The more a solution conducts the brighter the bulb.

(a) Luke uses potassium nitrate solution as the electrolyte.

A gas is made at the negative electrode.

What is the name of this gas?

Choose from the list.

HYDROGEN

NITROGEN

NITROGEN DIOXIDE

OXYGEN

answer _____ [1]

(b) Dilute ethanoic acid contains particles.

Look at the list of particles found in dilute ethanoic acid.

CH_3COOH

CH_3COO^-

H_2O

H^+

OH^-

Luke uses ethanoic acid as the electrolyte.

Hydrogen is made at the negative electrode.

Explain why.

_____ **[1]**

(c) Luke uses hydrochloric acid as the electrolyte.

The light bulb glows much brighter than with dilute ethanoic acid of the same concentration.

Explain why.

Use ideas about

- **strong and weak acids**
- **ions.**

_____

_____

_____

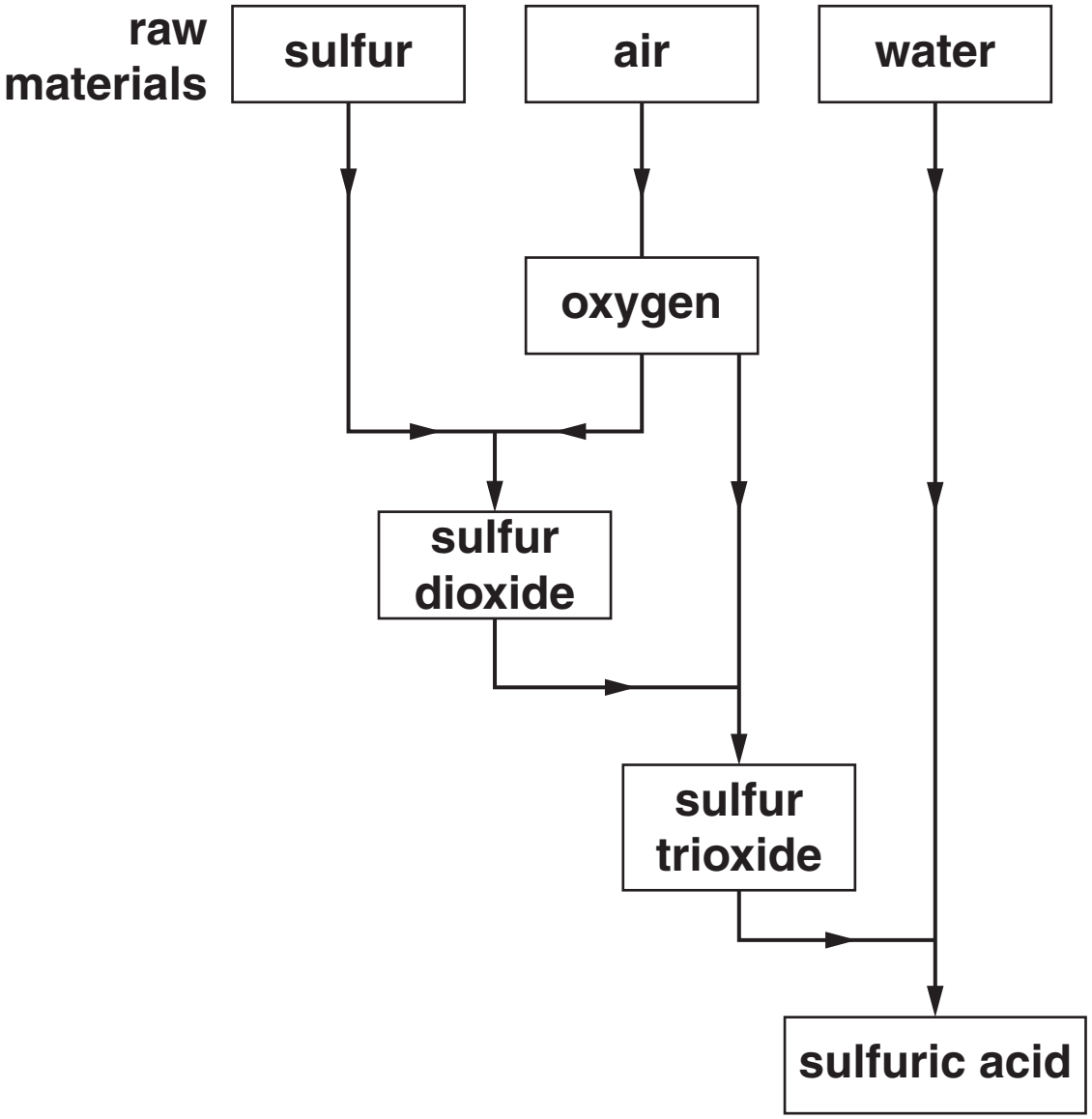
_____ **[2]**

[Total: 4]

9 Sulfuric acid is made in the Contact Process.

Look at the flow chart.

It shows all the stages in the Contact Process.



There are three stages in the Contact Process.

- **Stage 1 involves the reaction of sulfur and oxygen.**

- **Stage 2 involves the reaction of sulfur dioxide and oxygen.**

$$2SO_2 + O_2 \rightleftharpoons 2SO_3$$

- **Stage 3 involves the reaction of sulfur trioxide and water.**

Write the balanced symbol equations for stages 1 and 3.

stage 1 _____

stage 3 _____ **[2]**

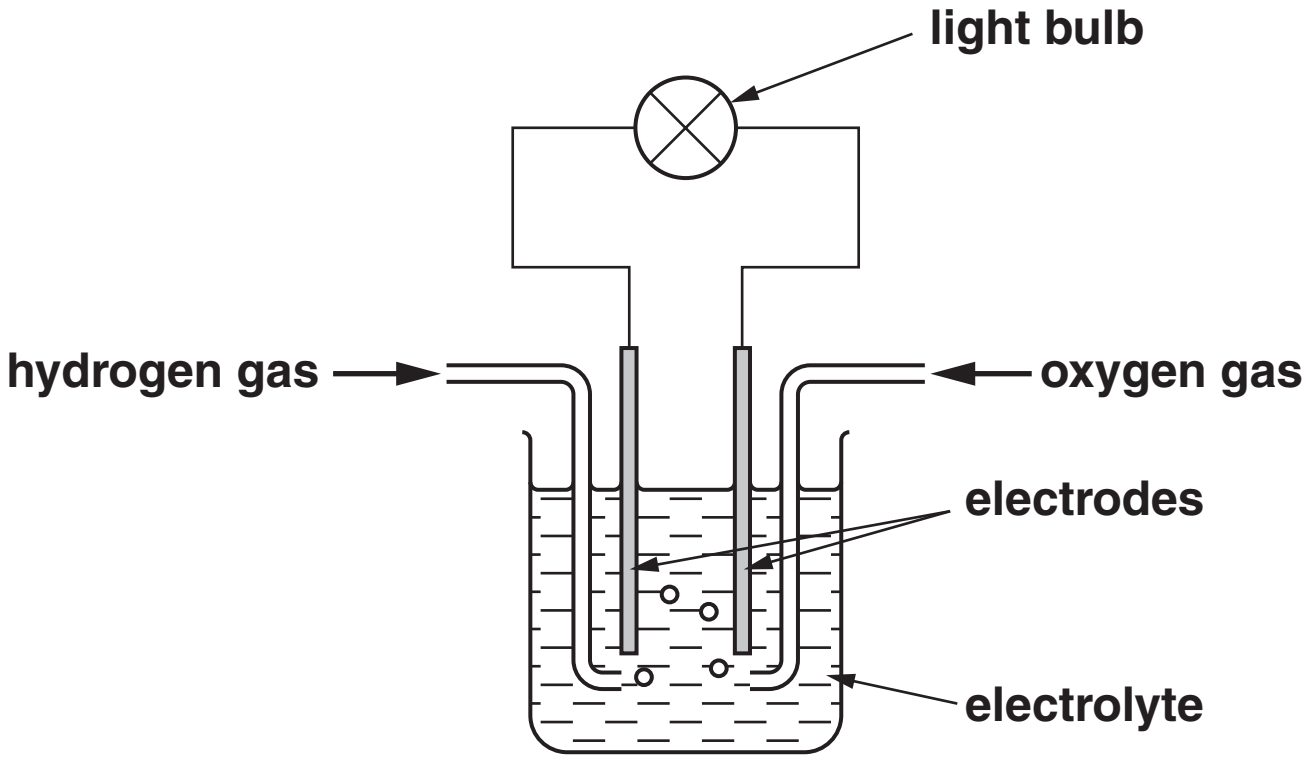
[Total: 2]

SECTION C – MODULE C6

10 This question is about fuel cells.

Look at the diagram.

It shows a fuel cell.



In a fuel cell, hydrogen and oxygen react to release energy.

(a) Hydrogen reacts with oxygen to make water.

Write a <u>WORD</u> equation for this reaction.

_____ **[1]**

(b) Car makers may replace diesel or petrol engines with fuel cells.

Other than cost, write down TWO reasons for doing this.

1 _____

2 _____ **[2]**

(c) Hydrogen gas, H_2, reacts at one electrode in a fuel cell.

The reaction makes hydrogen ions, H^+, and electrons.

Write an equation for this reaction. Use e^- to show an electron.

_____ **[2]**

(d) Hydrogen can explode when it reacts with oxygen.

Heat energy is given out.

What type of reaction gives out heat?

Choose from the list.

DEHYDRATION

ELECTROLYSIS

ENDOTHERMIC

EXOTHERMIC

answer _____ **[1]**

[Total: 6]

11 This question is about reactions of metals.

(a) This question is about a large statue made from iron. It is going rusty.

Covering iron in oil or grease stops iron rusting.

(i) Explain why.

_____ **[1]**

(ii) The statue can also be coated with zinc.

This is called galvanising.

Explain why galvanising stops iron rusting.

_____

_____ **[2]**

(b) Look at the equation.

$$Fe - 2e^- \rightarrow Fe^{2+}$$

The equation shows what happens when iron starts to rust.

What sort of reaction is this?

Choose from the list.

OXIDATION

REDUCTION

SAPONIFICATION

TINNING

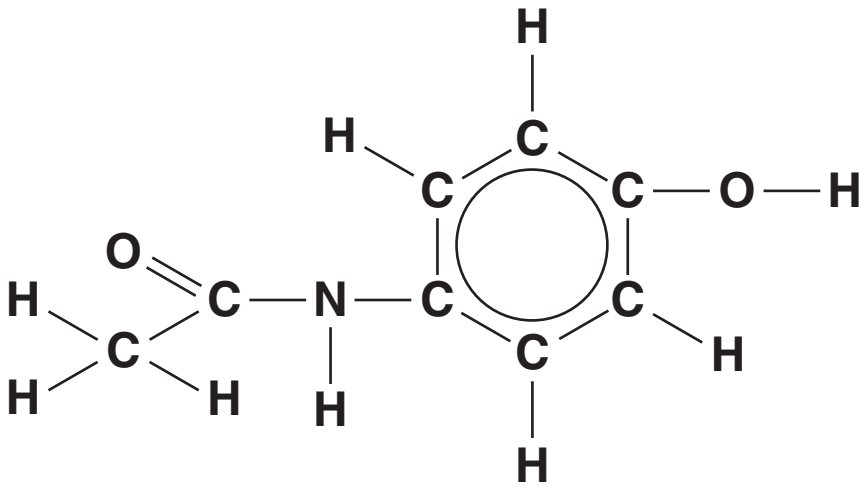
answer _____ **[1]**

[Total: 4]

12 This question is about drugs.

(a) Look at the diagram.

It shows the displayed formula of paracetamol.



Write down the <u>MOLECULAR FORMULA</u> of paracetamol.

_____ **[2]**

(b) Taking an overdose of aspirin can be dangerous.

Suggest why.

_____

_____ **[1]**

(c) Aspirin is now available in a soluble form.

What is the advantage of using soluble aspirin?

_____ **[1]**

[Total: 4]

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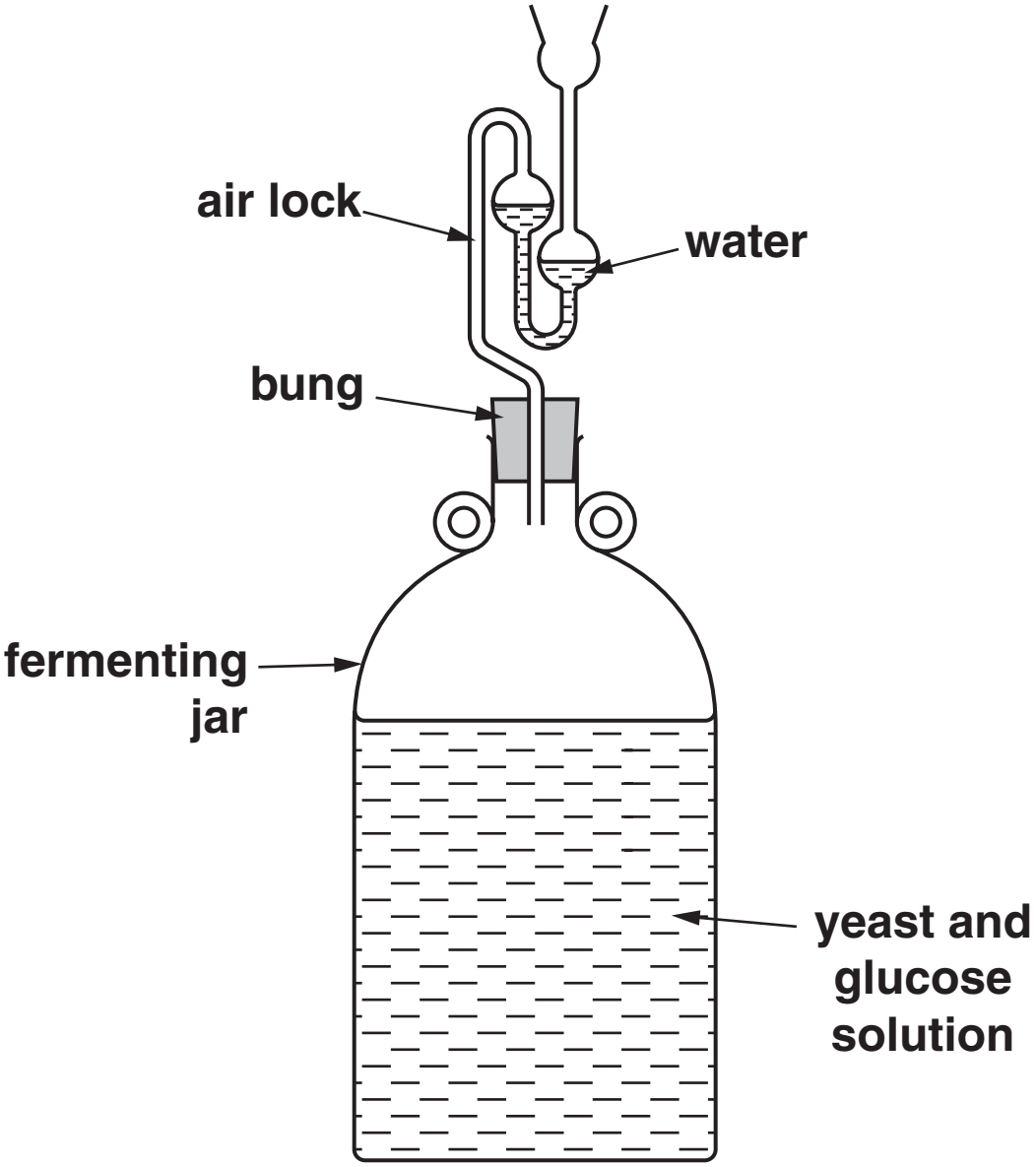
13 This question is about ethanol.

Look at the diagram.

It shows how ethanol can be made by fermentation in a school laboratory.



(a) This reaction works best at 40 °C in the absence of air.

(i) The reaction does not work at 70 °C.

Explain why.

_____

_____ **[1]**

(ii) The reaction is very slow at 10 °C.

Explain why.

_____

_____ **[1]**

(iii) Air must be kept out of the fermenting jar.

Explain why.

_____ **[1]**

(b) At the end of the process, the fermenting jar contains a mixture of ethanol and water.

How can the ethanol be separated from the water?

Choose from the list.

DISTILLATION

ELECTROLYSIS

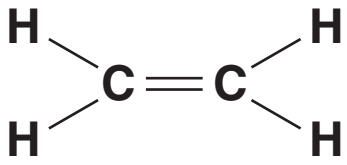
FILTRATION

SAPONIFICATION

answer _____ [1]

(c) The molecular formula of ethene is C_2H_4.

Look at the <u>DISPLAYED</u> formula of ethene.



The molecular formula of ethanol is C_2H_5OH.

Draw the <u>DISPLAYED</u> formula of ethanol.

[1]

(d) The general formula for an alcohol is $C_nH_{2n+1}OH$.

Pentanol is an alcohol.

A molecule of pentanol contains five carbon atoms.

Write down the MOLECULAR FORMULA of pentanol.

_____ **[1]**

[Total: 6]

END OF QUESTION PAPER

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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.