

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

B642/02

CHEMISTRY B

Unit 2 Modules C4 C5 C6
(Higher 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)

Wednesday 17 June 2009
Morning

Duration: 1 hour



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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MODIFIED LANGUAGE

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- 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.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

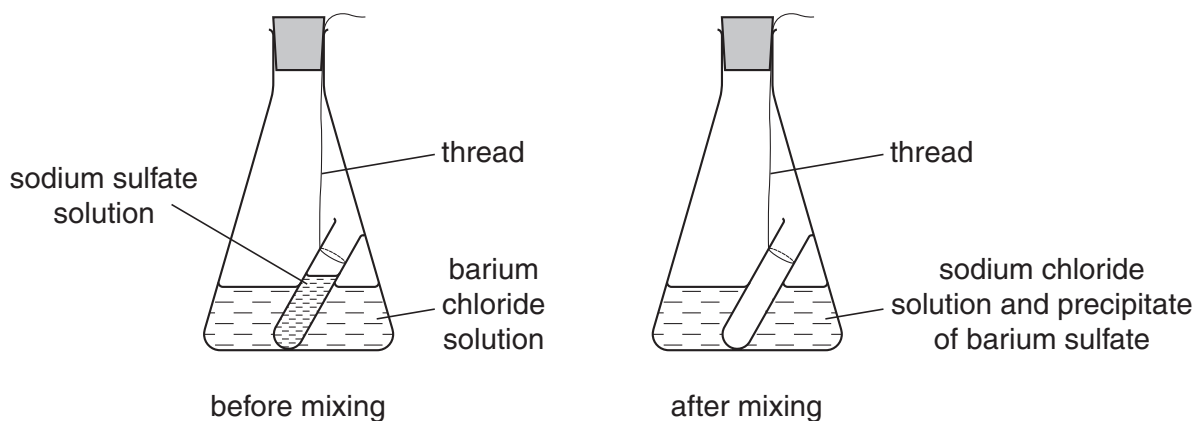
- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- The Periodic Table is printed on the back page.
- This document consists of **24** pages. Any blank pages are indicated.

Answer **all** 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.

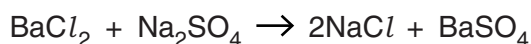
The solutions mix and react. A precipitate is made.

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.



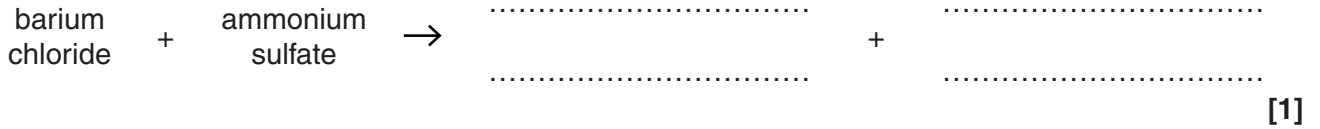
Use the balanced symbol equation to help explain why the mass does not change during the reaction.

.....
 [1]

(b) Nick and Sloane do another experiment.

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

Complete the **word** equation for this reaction.



(c) Look at the table.

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

compound	formula
ammonium sulfate	$(\text{NH}_4)_2\text{SO}_4$
barium chloride	BaCl_2
iron(III) sulfate	$\text{Fe}_2(\text{SO}_4)_3$
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, $\text{Fe}_2(\text{SO}_4)_3$?

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.

.....

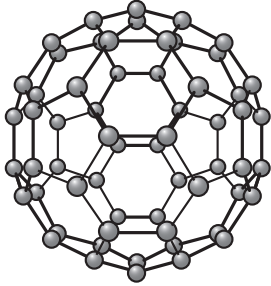
relative formula mass [1]

[Total: 4]

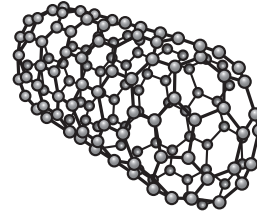
2 Buckminster fullerene and nanotubes are recently discovered substances.

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 **two** 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 **one other** 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 **dry** 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 **advantage** of using solid carbon dioxide rather than a dry cleaning solvent.

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

[Total: 4]

Turn over

4 A continuous process is used to make ammonia.

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

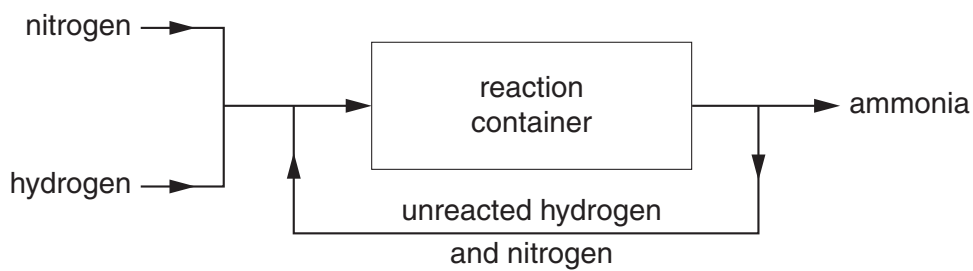
(a) Ammonia is made by a continuous process rather than a batch process. Suggest why.

.....
 [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 6.0g.

(i) What is the percentage of the RDA of **salt** in 100 g of cornflakes?

.....

percentage = [1]

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

The relative atomic mass of Na is 23 and of Cl 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, $\text{Pb}(\text{NO}_3)_2$.

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

Write down the **balanced symbol** equation for this reaction.

..... [2]

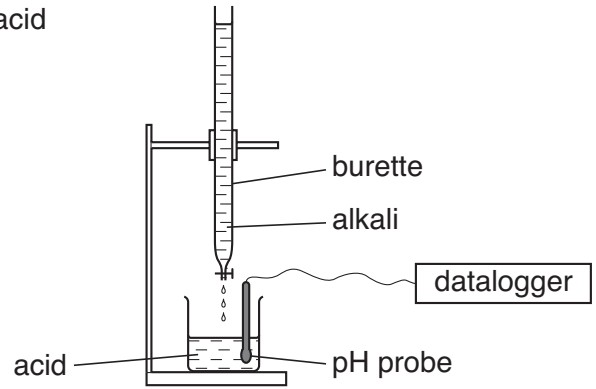
[Total: 5]

11
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Question 7 starts on page 12.

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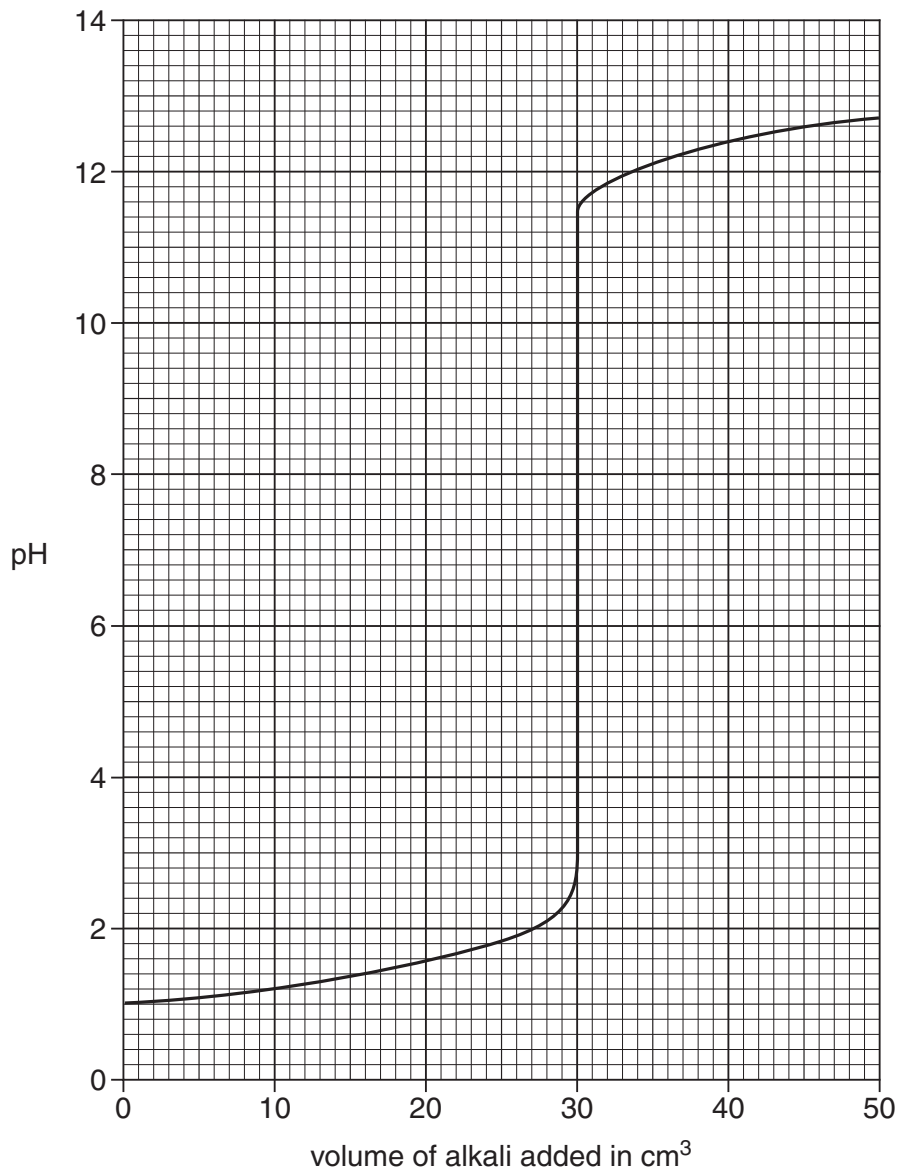
- 7 Tina investigates how the pH value changes as an acid is neutralised by an alkali.
Look at the apparatus she uses.



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 from the datalogger.



(a) (i) What is the pH value when 15.0 cm³ of sodium hydroxide has been added?

..... [1]

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

..... cm³ [1]

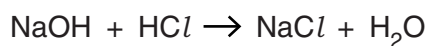
(b) Tina does another experiment.

This time she uses

- 25.0 cm³ of dilute hydrochloric acid in the beaker
- sodium hydroxide solution of concentration 0.100 mol/dm³ in the burette.

The hydrochloric acid is exactly neutralised by 20.0 cm³ of this sodium hydroxide solution.

Look at the balanced symbol equation for the reaction.



Calculate

- the number of moles of sodium hydroxide in 20.0 cm³ of a 0.100 mol/dm³ solution
- the number of moles of hydrochloric acid that reacted with this amount of sodium hydroxide
- the concentration, in mol/dm³, of the hydrochloric acid.

.....

.....

.....

.....

.....

.....

.....

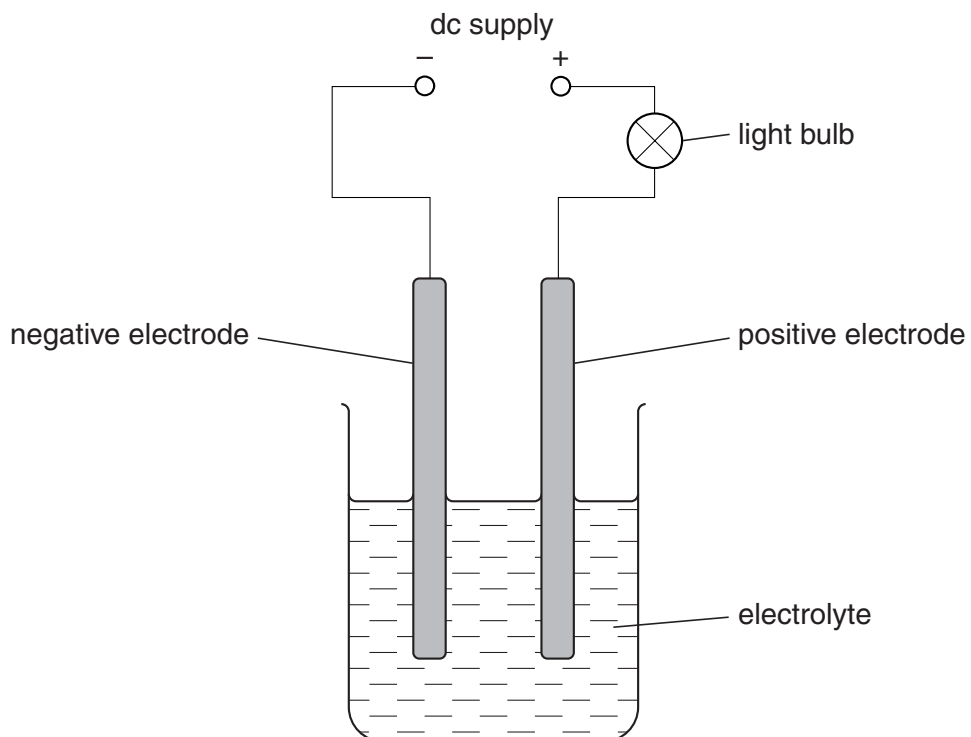
concentration of hydrochloric acid = mol/dm³ [3]

[Total: 5]

8 This question is about electrolysis.

Look at the diagram.

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



The light bulb will glow when a current flows.

The bulb glows brighter when a solution conducts more.

(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.



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.

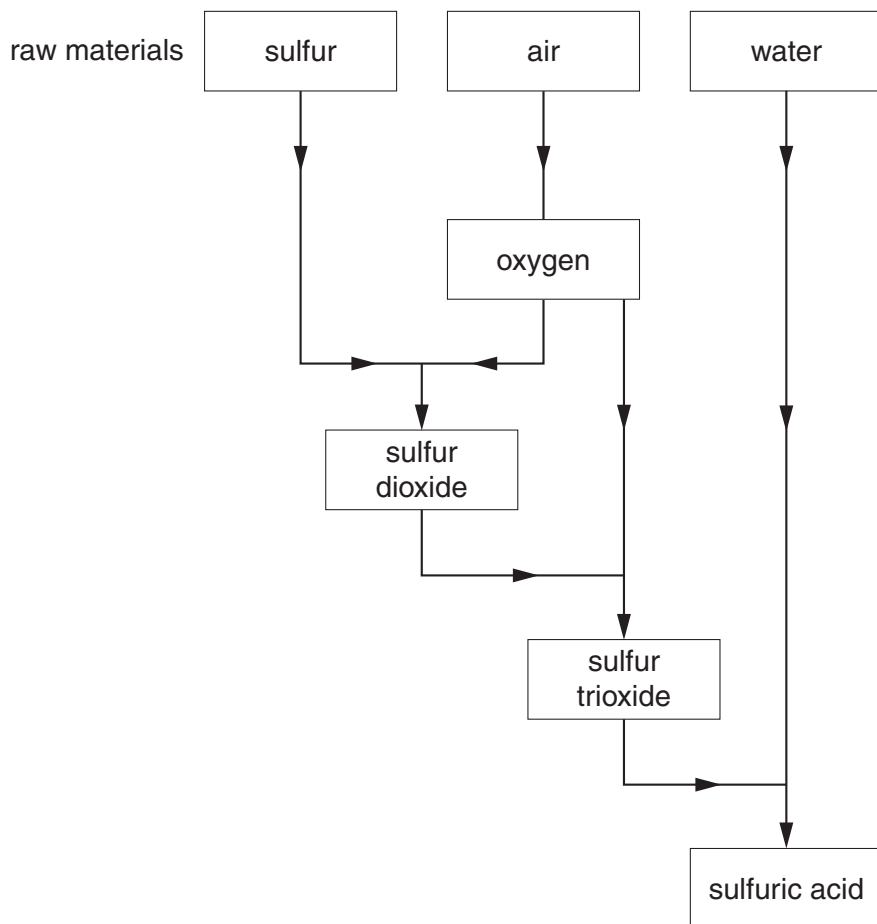
.....
.....
.....
..... [2]

[Total: 4]

9 Sulfuric acid is made in the Contact Process.

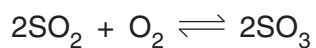
Look at the flow chart.

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.



- 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]

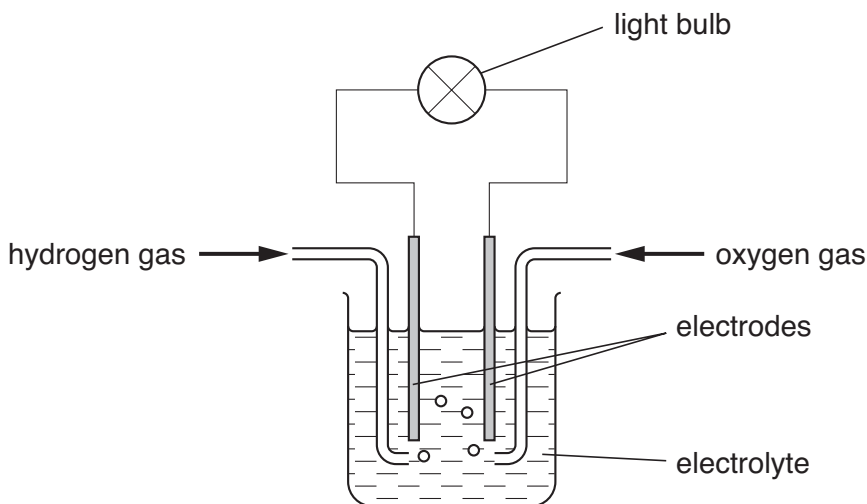
[Total: 2]

Section C – Module C6

10 This question is about fuel cells.

Look at the diagram.

It shows a fuel cell.



Hydrogen and oxygen react in a fuel cell to release energy.

(a) Hydrogen reacts with oxygen to make water.

Write a **word** equation for this reaction.

..... [1]

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

Write down **two** reasons for doing this, other than cost.

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.

This large statue is made from iron.



(a) The statue is going rusty.

Covering iron in oil or grease stops iron rusting.

(i) Explain why.

..... [1]

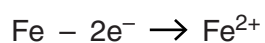
(ii) The statue can also be coated with zinc.

This is called galvanising.

Explain why galvanising stops iron rusting.

.....
 [2]

(b) Look at the equation.



The equation shows what happens when iron starts to rust.

What sort of reaction is this?

Choose from the list.

oxidation reduction saponification tinning

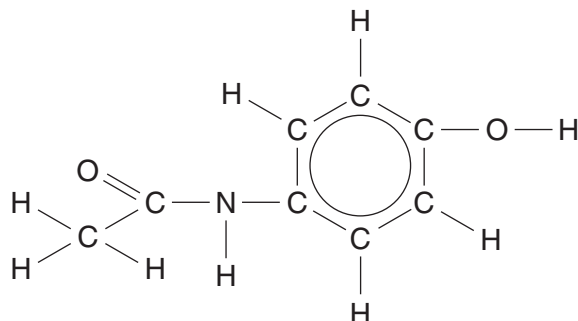
answer [1]

[Total: 4]

12 This question is about drugs.

(a) Look at the diagram.

It shows the displayed formula of paracetamol.



Write down the **molecular formula** 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?

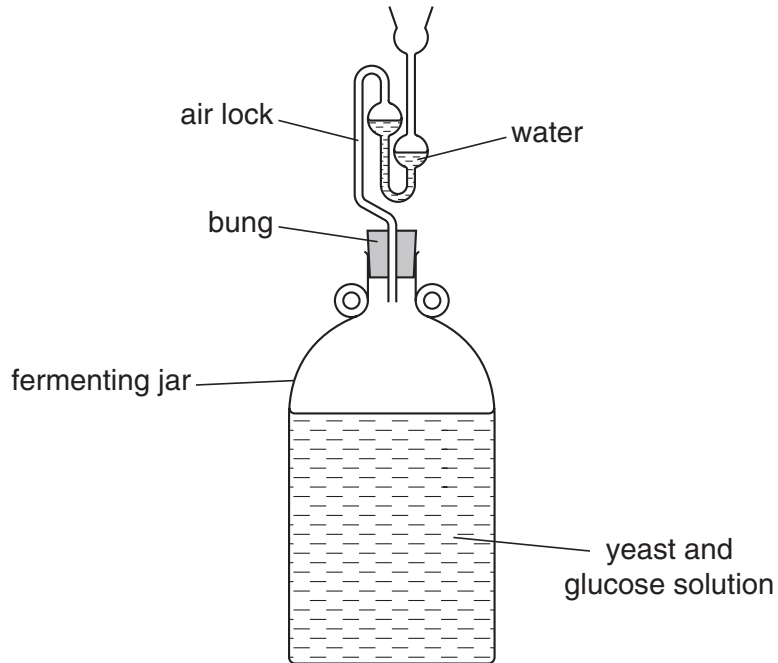
..... [1]

[Total: 4]

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) The fermenting jar contains a mixture of ethanol and water at the end of the process.

How can the ethanol be separated from the water?

Choose from the list.

distillation

electrolysis

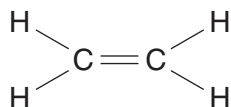
filtration

saponification

answer [1]

(c) The molecular formula of ethene is C_2H_4 .

Look at the **displayed** formula of ethene.



The molecular formula of ethanol is C_2H_5OH .

Draw the **displayed** 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										
7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 C carbon 6	13 Al aluminium 13	14 N nitrogen 7	15 P phosphorus 15	16 O oxygen 8	17 F fluorine 9	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 [98]	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	58 Hf hafnium 58	59 Ta tantalum 59	60 W tungsten 60	61 Re rhenium 61	62 Os osmium 62	63 Ir iridium 63	64 Pt platinum 64	65 Au gold 65	66 Hg mercury 66	67 Tl thallium 67	68 Pb lead 68	69 Bi bismuth 69	70 Po polonium 70	71 At astatine 71	72 Rn radon 72
[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
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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.