WJEC GCSE CHEMISTRY

CHEMISTRY



EXAM QUESTION PACK

UNIT C3 FOUNDATION TIER 0245 PAPERS

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

0245/01

SCIENCE
FOUNDATION TIER
CHEMISTRY 3

A.M. TUESDAY, 29 January 2013

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**5**	
3.	**5**	
4.	**8**	
5.	**6**	
6.	**6**	
7.	**4**	
8.	**7**	
9.	**4**	
Total	**50**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

The Periodic Table is printed on the back cover of the examination paper and the formulae for some common ions on the inside of the back cover.

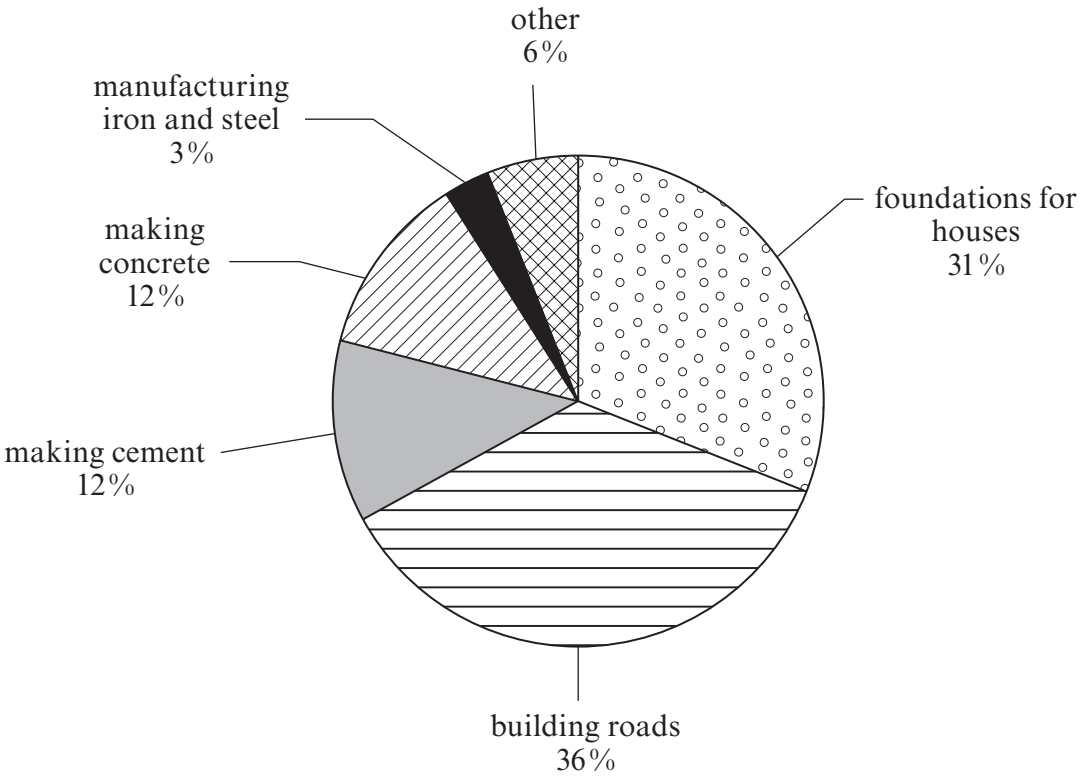
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Answer **all** *questions.*

1. *(a)* The pie chart below shows some of the major uses of limestone.



Use the pie chart to answer parts (i) and (ii).

(i) Give the percentage of limestone used to make cement. [1]

..... %

(ii) Which use accounts for the largest amount of limestone? [1]

.....

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(b) The box below contains some statements about the effects of limestone quarrying.

creates more wealth for the community	**disfigures the landscape**
dust from lorries and blasting	**more jobs locally**
noise from blasting	**provides materials for the building industry**

Choose from the box above the **three** statements which give the advantages of limestone quarrying. [3]

1. .....

2. .....

3. .....

5

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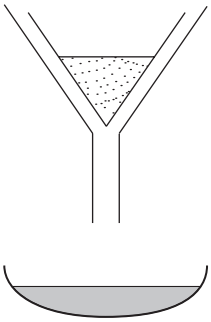
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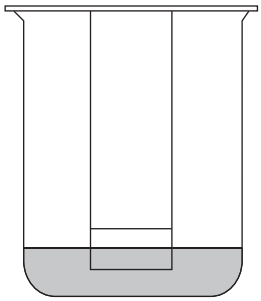
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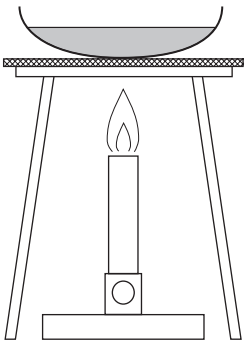
2. The diagrams below show three methods used to separate mixtures.



Method **A**



Method **B**



Method **C**

(a) Identify the correct name for each of methods **A**, **B** and **C** from the following box. [3]

chromatography	**distillation**	**evaporation**	**filtration**

A .....

B .....

C .....

(b) Give the letter, **A**, **B** or **C**, of the method you would use to

(i) separate coloured dyes, ... [1]

(ii) remove an insoluble substance from a solution. ..... [1]

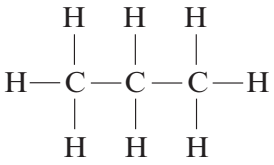
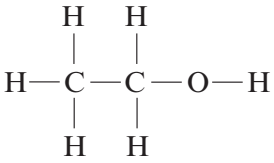
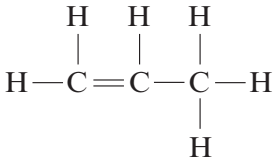
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3. The table below shows information about three substances.

propane		C_3H_8
ethanol		C_2H_5OH
propene		C_3H_6

Use the information to answer parts (a) and (b).

(a) (i) Name the substance represented by C_3H_8. ..... [1]

(ii) Give the **structural** formula for ethanol. [1]

(iii) Give the **molecular** formula for propene. ..... [1]

(b) Name the substance which is an example of

(i) an alkane, ... [1]

(ii) an alcohol. ..... [1]

5

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4. *(a)* The three main stages in the manufacture of sulphuric acid are as follows.

Stage 1	Sulphur reacts with oxygen to form sulphur dioxide
Stage 2	$2SO_2 + O_2 \rightleftharpoons 2SO_3$
Stage 3	Sulphur trioxide is absorbed into concentrated sulphuric acid and then diluted to various concentrations

(i) Name the **raw material** which provides oxygen gas. ..... [1]

(ii) Write the **word** equation for the reaction occurring in stage 2. [2]

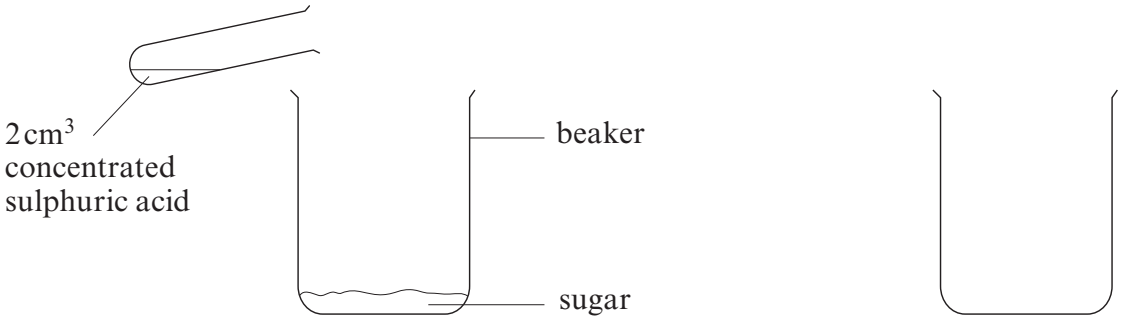
..... + ... $\rightleftharpoons$ .....

(iii) Vanadium(V) oxide is used in stage 2 to speed up the reaction.

Give the term used to describe a substance which speeds up a reaction. [1]

.....

(b) When concentrated sulphuric acid is added to sugar a violent reaction takes place, forming carbon, C, and steam, H_2O.



Before adding the acid **Some minutes after adding the acid**

A **B**

(i) Complete diagram **B** above showing what is seen some minutes after adding the concentrated sulphuric acid. [1]

(ii) Give the names of the **two** *elements* removed from sugar during the reaction. [1]

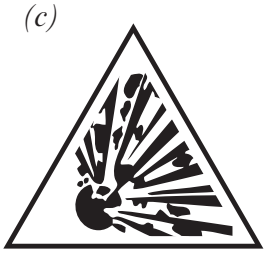
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(c)



A



B



C



D

(i) Which of the hazard symbols above would you expect to see on a bottle of concentrated sulphuric acid in a laboratory? [1]

.....

(ii) State **one** safety precaution required when handling concentrated sulphuric acid. [1]

.....

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8

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5. *(a)* The tables below show some tests that can be used to identify unknown substances.

Positive ion	Test used to identify ion	Result
sodium, Na^+	flame test	yellow flame
potassium, K^+	flame test	lilac flame
calcium, Ca^{2+}	flame test	brick-red flame
copper, Cu^{2+}	add sodium hydroxide solution	blue precipitate
iron(II), Fe^{2+}	add sodium hydroxide solution	green precipitate
magnesium, Mg^{2+}	add sodium hydroxide solution	white precipitate

Negative ion	Test used to identify ion	Result
carbonate, CO_3^{2-}	add dilute hydrochloric acid	bubbles formed
sulphate, SO_4^{2-}	add dilute hydrochloric acid followed by barium chloride solution	white precipitate
chloride, Cl^-	add dilute nitric acid followed by silver nitrate solution	white precipitate

Use only the information in the tables to answer parts (i) and (ii).

(i) Edward carried out the two tests needed to identify a compound thought to be copper chloride. Complete the table below by noting the expected result. [2]

Test used to identify ion	Result
add sodium hydroxide solution	
add dilute nitric acid followed by silver nitrate solution	

(ii) Jelena carried out the two tests needed to identify a compound thought to be sodium carbonate. Complete the table below by noting the expected result. [2]

Test used to identify ion	Result
flame test	
add dilute hydrochloric acid	

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(b) Draw a line from each gas to the test you would use to identify it. [2]

Gas	Test
ammonia	pops with a lighted splint
	relights a glowing splint
oxygen	turns limewater milky
	turns damp red litmus paper blue

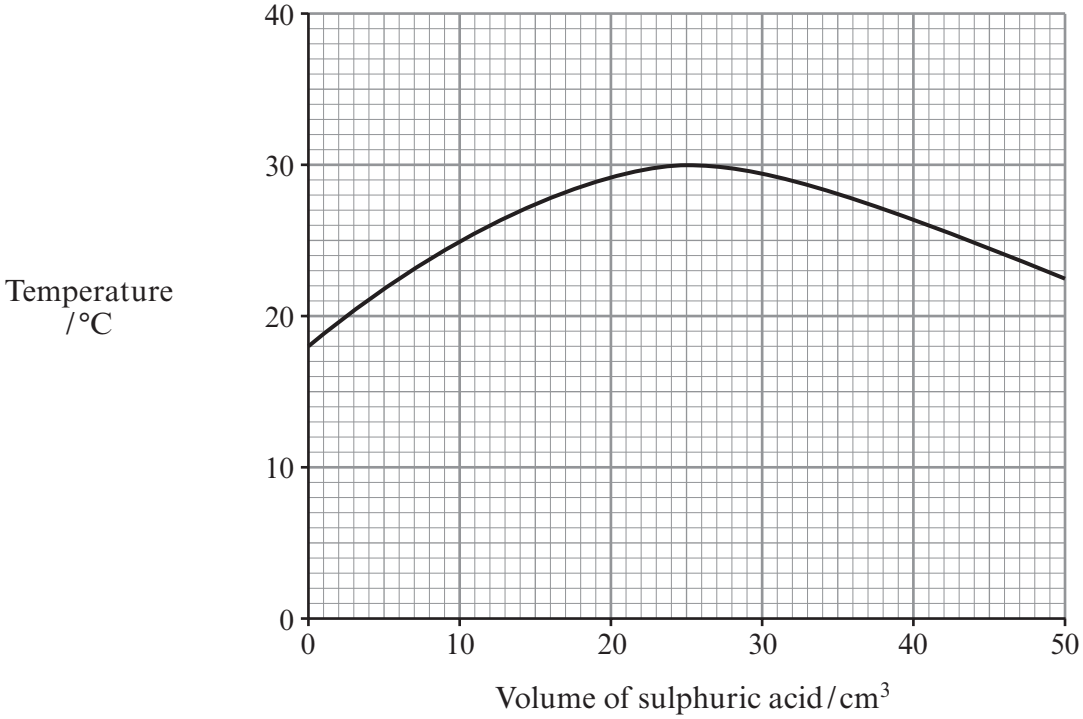
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6. The graph below shows the temperature recorded when 50 cm^3 of dilute sulphuric acid solution was added, 1 cm^3 at a time, to 20 cm^3 of sodium carbonate solution.



(a) Use the graph to give the

(i) temperature of the sodium carbonate solution **before** any sulphuric acid was added, [1]

..... °C

(ii) maximum temperature reached during the reaction, [1]

..... °C

(iii) volume of sulphuric acid needed to use up all the sodium carbonate. [1]

..... cm^3

(b) (i) Insert the names of **three** products to complete the **word** equation for the reaction between sulphuric acid and sodium carbonate. [2]

sulphuric acid + sodium carbonate ⟶ ..... + ... + ...

(ii) Give the chemical formula of the salt formed during the reaction. [1]

.....

6

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7. The fire triangle can be used to explain how fires start and how they can be put out. Use your knowledge of the fire triangle to describe and explain **two** methods which are used to put out large forest fires. [4]

.....

.....

.....

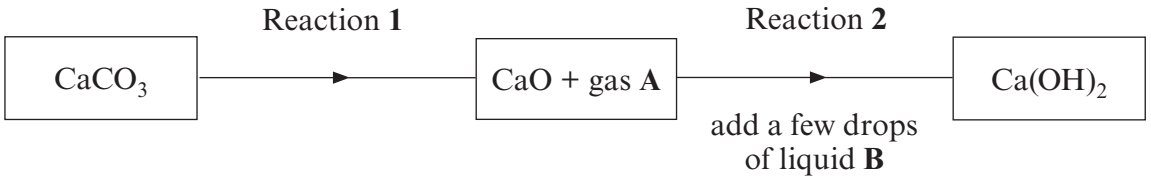
.....

.....

.....

4

8. *(a)* The flow diagram below shows the reactions used to prepare slaked lime, $Ca(OH)_2$, from limestone, $CaCO_3$.



(i) I Briefly describe what needs to be done to limestone for reaction **1** to take place. [1]

.....

II Give the name for the type of reaction taking place. [1]

.....

(ii) Name gas **A**. [1]

.....

(iii) Name liquid **B**. [1]

.....

(b) Write a balanced **symbol** equation for the reaction which takes place when slaked lime, $Ca(OH)_2$, is neutralised by hydrochloric acid, HCl. [3]

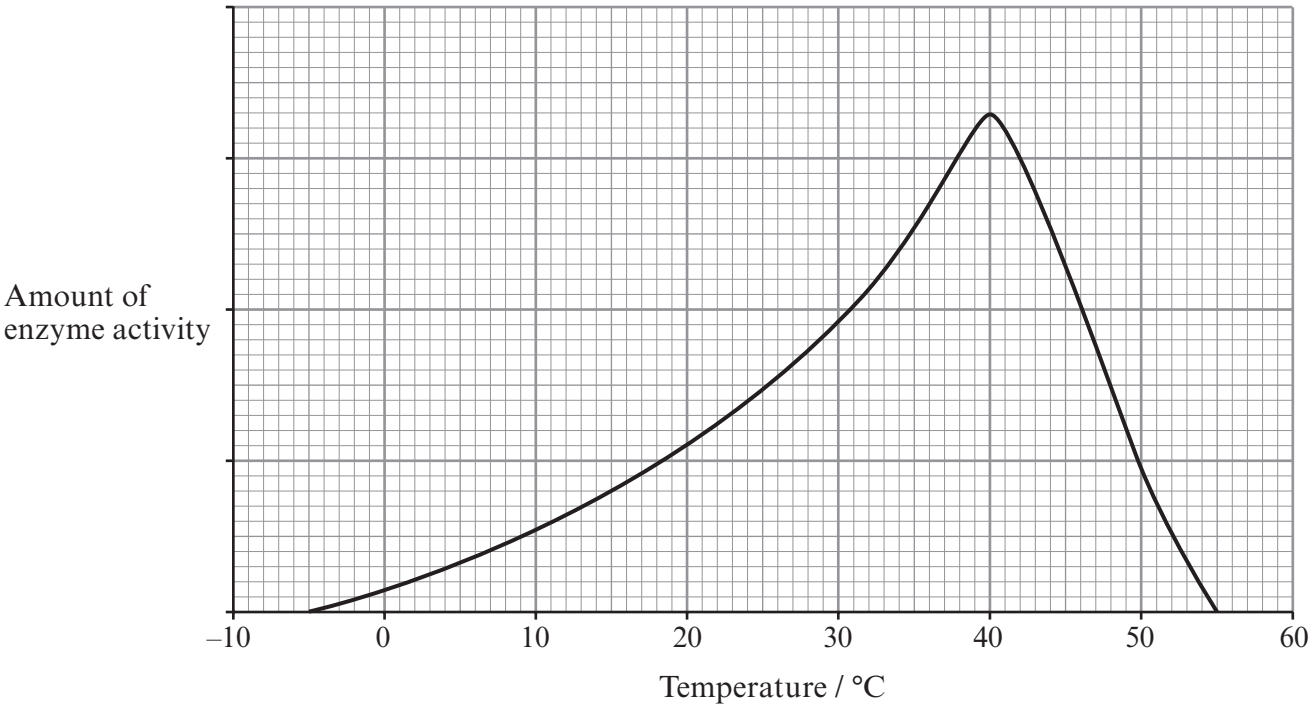
..... + ... ⟶ ..... + ...

7

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9. The temperature range in which enzyme activity occurs can be different for different enzymes. The graph below shows the amount of activity of an enzyme, **A**, over a temperature range.



(a) Use the graph to give the temperature range where the enzyme activity is **increasing**. [1]

..... °C to ..... °C

(b) Sketch carefully the graph of the amount of enzyme activity of a different enzyme, **B**, which is active between 5 °C and 50 °C and has the greatest activity at 30 °C. [2]

(c) Give a temperature value at which **both** enzymes would be destroyed. [1]

..... °C

4

END OF PAPER

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FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	**Formula**	**Name**	**Formula**
Aluminium	Al^{3+}	Bromide	Br^{-}
Ammonium	NH_4^{+}	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^{-}
Calcium	Ca^{2+}	Fluoride	F^{-}
Copper(II)	Cu^{2+}	Hydroxide	OH^{-}
Hydrogen	H^{+}	Iodide	I^{-}
Iron(II)	Fe^{2+}	Nitrate	NO_3^{-}
Iron(III)	Fe^{3+}	Oxide	O^{2-}
Lithium	Li^{+}	Sulphate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		
Zinc	Zn^{2+}		

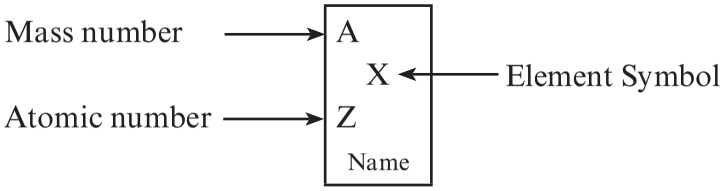
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PERIODIC TABLE OF ELEMENTS

1	2											3	4	5	6	7	0
								$^{1}_{1}$H Hydrogen									$^{4}_{2}$He Helium
$^{7}_{3}$Li Lithium	$^{9}_{4}$Be Beryllium											$^{11}_{5}$B Boron	$^{12}_{6}$C Carbon	$^{14}_{7}$N Nitrogen	$^{16}_{8}$O Oxygen	$^{19}_{9}$F Fluorine	$^{20}_{10}$Ne Neon
$^{23}_{11}$Na Sodium	$^{24}_{12}$Mg Magnesium											$^{27}_{13}$Al Aluminium	$^{28}_{14}$Si Silicon	$^{31}_{15}$P Phosphorus	$^{32}_{16}$S Sulphur	$^{35}_{17}$Cl Chlorine	$^{40}_{18}$Ar Argon
$^{39}_{19}$K Potassium	$^{40}_{20}$Ca Calcium	$^{45}_{21}$Sc Scandium	$^{48}_{22}$Ti Titanium	$^{51}_{23}$V Vanadium	$^{52}_{24}$Cr Chromium	$^{55}_{25}$Mn Manganese	$^{56}_{26}$Fe Iron	$^{59}_{27}$Co Cobalt	$^{59}_{28}$Ni Nickel	$^{64}_{29}$Cu Copper	$^{65}_{30}$Zn Zinc	$^{70}_{31}$Ga Gallium	$^{73}_{32}$Ge Germanium	$^{75}_{33}$As Arsenic	$^{79}_{34}$Se Selenium	$^{80}_{35}$Br Bromine	$^{84}_{36}$Kr Krypton
$^{86}_{37}$Rb Rubidium	$^{88}_{38}$Sr Strontium	$^{89}_{39}$Y Yttrium	$^{91}_{40}$Zr Zirconium	$^{93}_{41}$Nb Niobium	$^{96}_{42}$Mo Molybdenum	$^{99}_{43}$Tc Technetium	$^{101}_{44}$Ru Ruthenium	$^{103}_{45}$Rh Rhodium	$^{106}_{46}$Pd Palladium	$^{108}_{47}$Ag Silver	$^{112}_{48}$Cd Cadmium	$^{115}_{49}$In Indium	$^{119}_{50}$Sn Tin	$^{122}_{51}$Sb Antimony	$^{128}_{52}$Te Tellurium	$^{127}_{53}$I Iodine	$^{131}_{54}$Xe Xenon
$^{133}_{55}$Cs Caesium	$^{137}_{56}$Ba Barium	$^{139}_{57}$La Lanthanum	$^{179}_{72}$Hf Hafnium	$^{181}_{73}$Ta Tantalum	$^{184}_{74}$W Tungsten	$^{186}_{75}$Re Rhenium	$^{190}_{76}$Os Osmium	$^{192}_{77}$Ir Iridium	$^{195}_{78}$Pt Platinum	$^{197}_{79}$Au Gold	$^{201}_{80}$Hg Mercury	$^{204}_{81}$Tl Thallium	$^{207}_{82}$Pb Lead	$^{209}_{83}$Bi Bismuth	$^{210}_{84}$Po Polonium	$^{210}_{85}$At Astatine	$^{222}_{86}$Rn Radon
$^{223}_{87}$Fr Francium	$^{226}_{88}$Ra Radium	$^{227}_{89}$Ac Actinium															

Key:



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GCSE MARKING SCHEME

CHEMISTRY (LEGACY)

JANUARY 2013

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2013 examination in GCSE CHEMISTRY (LEGACY). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

Unit	Page
C1 (LEGACY)	1
C2 (LEGACY)	17
C3 (LEGACY)	31

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GCSE CHEMISTRY (LEGACY)

C3 Mark Scheme - January 2013

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
1		(a)	(i)		1	12			
			(ii)		1	building roads			
		(b)			3	creates more wealth for the community (1) more jobs locally (1) provides materials for the building industry (1) any order			

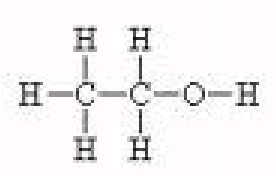
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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
2		(a)			3	A filtration B chromatography C evaporation			
		(b)	(i)		1	B	chromatography		
			(ii)		1	A	filtration / filter		

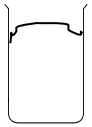
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Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	Sub-section							
3		(a)	(i)		1	propane			
			(ii)		1				
			(iii)		1	C_3H_6			
		(b)	(i)		1	propane			
			(ii)		1	ethanol			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
4		(a)	(i)		1	air			oxygen
			(ii)		2	sulphur dioxide + oxygen (1) sulphur trioxide (1)	$SO_2 + O_2$ SO_3		
			(iii)		1	catalyst			
		(b)	(i)		1	volume of 'material' in beaker increased e.g. 			
			(ii)		1	hydrogen and oxygen both needed	'H' and 'O'		H_2 and O_2
		(c)	(i)		1	B			
			(ii)		1	(wear) goggles / gloves / laboratory coat (carry out procedure in a) fume cupboard	visor / protective clothing		

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
5		(a)	(i)		2	blue precipitate (1) white precipitate (1)			
			(ii)		2	yellow flame (1) bubbles formed (1)	fizzing	gas formed / carbon dioxide	
		(b)			2	ammonia turns damp red litmus paper blue (1) oxygen relights glowing splint (1)			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
6		(a)	(i)		1	18			
			(ii)		1	30			
			(iii)		1	25 ±1			
		(b)	(i)		2	sodium sulphate (1) water and carbon dioxide (1)			
			(ii)		1	Na_2SO_4			

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Question Number									
FT	HT	Sub-section			Mark	Answer		Accept	Neutral answer	Do not accept
7	1				4	Method 1:	water (1) cools / removes heat (1)			
						Method 2:	bulldoze down trees / remove trees (1) removes fuel (1)	fire breaks		

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
8	2	(a)	(i)	I	1	heat	roast / high temperature	warm / raise temperature	
				II	1	(thermal) decomposition			
			(ii)		1	carbon dioxide	CO_2		
			(iii)		1	water	H_2O		
		(b)			3	$Ca(OH)_2$ + HCl (1) $CaCl_2$ + H_2O (1) balancing: 1:2(HCl):1:2(H_2O) (1) all formulae must be correct before balancing mark awarded			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
9	3	(a)			1	-5 to 40			
		(b)			2	curve drawn from 5°C to 50°C (1) with peak at 30°C (any height) (1)			
		(c)			1	any value of -5°C or below or 55°C or above			

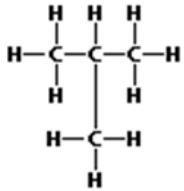
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Question Number									
FT	HT	Sub-section			Mark	Answer		Accept	Neutral answer	Do not accept
	4	(a)			4	sulphuric acid: red (1) strong acid (1) ethanoic acid: orange (1) weak acid (1)		yellow		
		(b)	(i)		3	all points plotted correctly (2) any 8 points plotted correctly (1) smooth curve of 'best fit' (1)				
			(ii)		2	green (1) acid / alkali has been *neutralised* / *all* the acid and alkali have been used up (1)		solution is neutral / neutralisation has occurred		

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	5	(a)	(i)		1	alkane(s)			
			(ii)		1	alkene(s)			
		(b)	(i)		1	D			
			(ii)		1	C			
		(c)	(i)		1				
			(ii)		2	(compounds that have the) same molecular formula (1) (but) different structural formulae (1)	chemical formula		

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	6	(a)			1	H_2SO_4			
		(b)	(i)		3	all points plotted correctly (2) any four points plotted correctly (1) curve of best fit (1)			
			(ii)	I	1	the higher the temperature, smaller the yield			
				II	1	515 ±5			
			(iii)		3	SO_2 + O_2 (1) SO_3 (1) balancing: 2 : 1 : 2 (1) all formulae must be correct before balancing mark awarded			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	7	(a)			2	heat until mixture boils / reference to different boiling points e.g. ethanol boils at 80°C and water boils at 100°C / ethanol boils at a lower temperature than water (1) ethanol vapour condenses / cools forming a liquid (1)	vapour cooled and collected		
		(b)			2	Advantages: renewable / carbon-neutral fuel / energy resource Disadvantages: less energy released / need a lot of land (to grow crops) / need a lot of sunlight (to grow crops)	climate might be unsuitable		ref. to 'efficiency'
		(c)	(i)		1	liver disease / stomach problems / throat / affects brain / heart disease / depression			
			(ii)		1	drink driving / road accidents / increase in violent behaviour	domestic violence		alcohol poisoning / death by choking on vomit / depression

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	8				4	calculated mean = 25 cm^3 (1) moles = conc × vol/1000 moles = 0.2 × 20/1000 = 0.004 (1) 0.004 : 0.004 (1) conc = 1000/25 × 0.004 = 0.16 (1) correct answer only (4)	alternative method		

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

0245/01

SCIENCE CHEMISTRY
FOUNDATION TIER
CHEMISTRY 3

A.M. MONDAY, 21 May 2012

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**3**	
2.	**4**	
3.	**8**	
4.	**9**	
5.	**5**	
6.	**6**	
7.	**5**	
8.	**3**	
9.	**7**	
Total	**50**	

0245 010001

ADDITIONAL MATERIALS

In addition to this paper you will need a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

The Periodic Table is printed on the back cover of the examination paper and the formulae for some common ions on the inside of the back cover.

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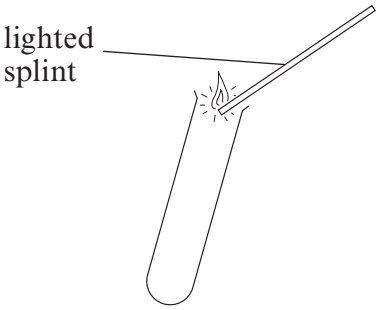
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Answer **all** *questions.*

1. *(a)* Choose a gas from the box below to answer this part-question.

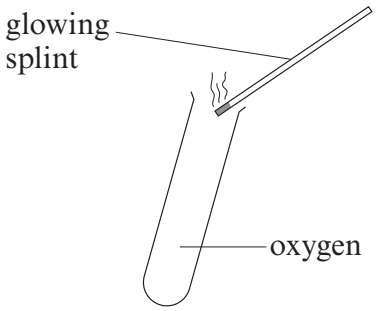
ammonia	**chlorine**	**hydrogen**	**sulphur dioxide**



When a lighted splint was introduced into a gas a 'pop' was heard.

Name the gas. ..... [1]

(b) A glowing splint was introduced into a test tube of oxygen.
State what you would expect to happen. [1]



.....

.....

(c) A flame test was carried out on a sample of sodium chloride.
Place a tick (✓) in the box which gives the colour seen during the flame test. [1]

lilac ☐

green ☐

red ☐

yellow ☐

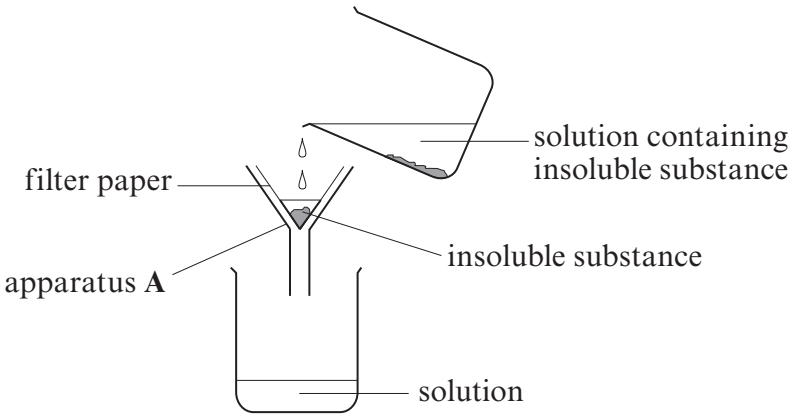
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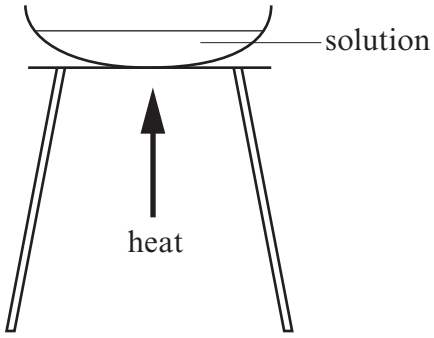
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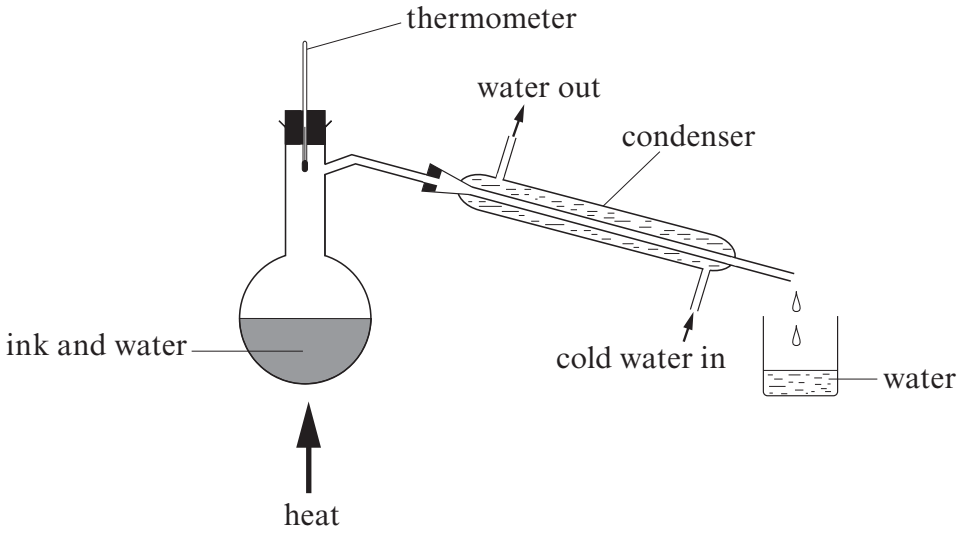
2. The diagrams below show three methods used to separate mixtures.



filtration



method B



distillation

(a) Name apparatus **A**. [1]

.....

(b) Give the name of method **B**. [1]

.....

(c) You have been given a mixture of sand, salt and water.

(i) Name the method used to remove sand from the mixture. [1]

.....

(ii) Name the method used to obtain water from the mixture. [1]

.....

0245 010003

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Turn over.

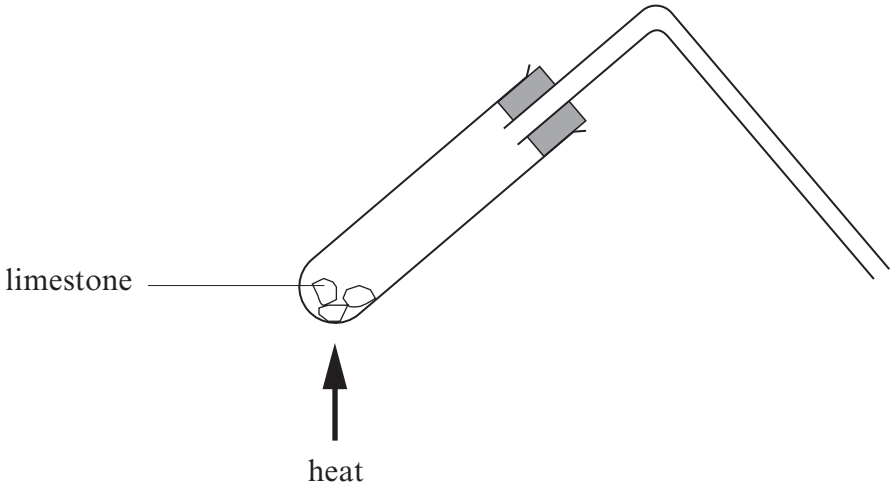
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3. *(a)* Limestone has a variety of uses.
Place a tick (✓) in the box next to the **two** uses of limestone. [2]

making bleach	☐
making cement	☐
making soap	☐
the extraction of aluminium	☐
the extraction of iron	☐

(b) The following diagram shows some of the apparatus that can be used to show the effect of heat on limestone, which is made of calcium carbonate. During heating a gas is given off. The gas is tested by passing it through limewater.



(i) Complete the diagram showing the gas passing through limewater. [1]

(ii) State what happens to the limewater. [1]

.....

(iii) Give the **word** equation for the reaction that takes place during heating. [2]

..... → ..... + ...

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(c) Limestone occurs naturally and is obtained by quarrying.

Give **one** benefit and **one** drawback of limestone quarrying. [2]

Benefit .....

.....

Drawback .....

.....

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Turn over.

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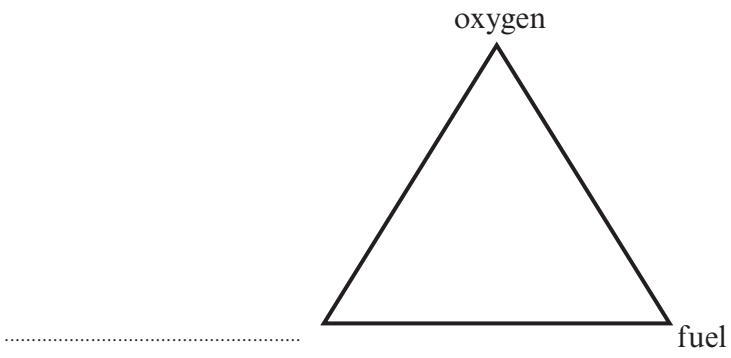
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4. *(a)* Use your knowledge of alkanes and trends in the data, to complete the following table. [3]

Alkane	methane	ethane	propane	butane	pentane
Molecular formula	CH_4	C_2H_6	.....	C_4H_{10}	C_5H_{12}
Boiling point / °C	–164	–87	–42	.....	36
State at 20 °C	gas	.....	gas	gas	liquid

(b) The fire triangle can be used to explain how fires can be extinguished.



(i) Complete the fire triangle by naming the missing factor in the diagram above. [1]

(ii) A beaker of pentane caught fire in a laboratory. State how a teacher would extinguish the fire. [1]

.....

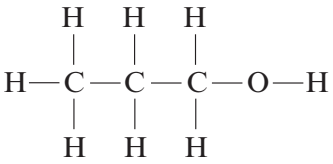
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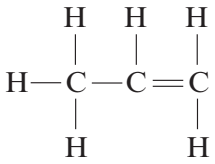
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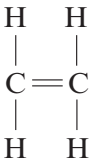
(c) The structural formulae of six organic compounds, **A-F**, are shown below.



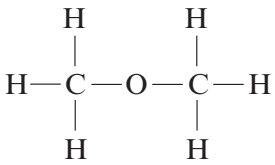
A



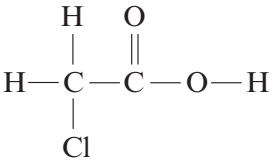
B



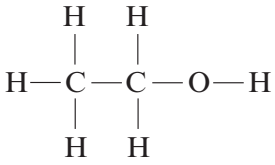
C



D



E



F

(i) Give the letter, **A-F**, of the organic compound

I. with a molecular formula of C_3H_6, ... [1]

II. which contains **four** different elements, ... [1]

III. with the same molecular formula as **D**. ..... [1]

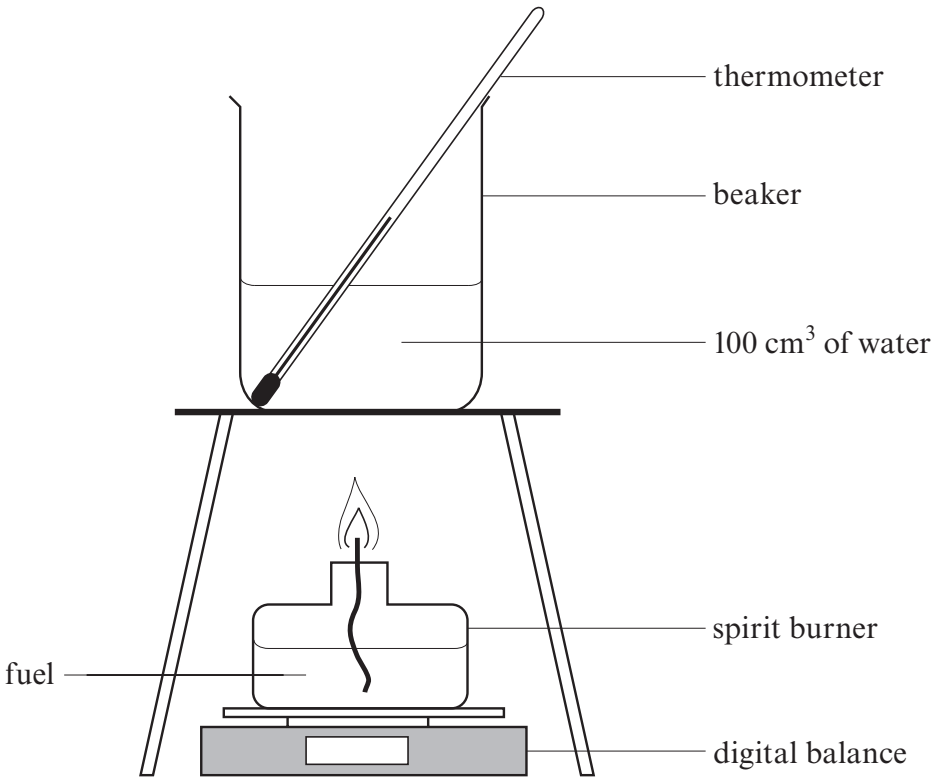
(ii) State the **molecular** formula of **C**. ..... [1]

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5. Methanol and ethanol are both fuels. A group of students were asked to carry out an experiment to find out which was the better fuel. The apparatus used is shown in the following diagram and their results are recorded in the table below.



Fuel	methanol	ethanol
Mass of spirit burner and fuel before heating / g	140.5	136.8
Mass of spirit burner and fuel after heating / g	140.0	136.3
Volume of water used / cm^3	100	100
Temperature of water before heating / °C	20	21
Temperature of water after heating / °C	27	32

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(a) Calculate the mass of ethanol burnt during the experiment. [1]

.....

(b) Give **two** ways in which the students made the experiment a fair test. [2]

.....

.....

.....

.....

(c) State which is the better fuel and give a reason for your answer. [1]

.....

.....

(d) Their teacher said that burning this amount of ethanol should have given off enough heat to warm up 100 cm^3 of water by 18 °C. Suggest **one** reason why the temperature of the water only increased by 11 °C. [1]

.....

.....

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6. The three tables below show how some ions can be identified.

Positive ion	Action with sodium hydroxide solution
magnesium, Mg^{2+}	white precipitate
iron(II), Fe^{2+}	green precipitate
copper, Cu^{2+}	blue precipitate
sodium, Na^{+}	no visible change

Negative ion	Action with silver nitrate solution
chloride, Cl^{-}	white precipitate
bromide, Br^{-}	cream precipitate
iodide, I^{-}	yellow precipitate
carbonate, CO_3^{2-}	white precipitate

Negative ion	Action with dilute hydrochloric acid
chloride, Cl^{-}	no visible change
bromide, Br^{-}	no visible change
iodide, I^{-}	no visible change
carbonate, CO_3^{2-}	bubbles

Use only the information in the tables to answer parts *(a)* and *(b)*.

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(a) A substance is suspected to be iron(II) iodide. State the **two** ions present, the tests you would carry out to identify these ions and the results of each test. [4]

Ion 1 .....

Test .....

Result .....

Ion 2 .....

Test .....

Result .....

(b) An unknown solution, **X**, gave a white precipitate with silver nitrate solution and no precipitate with sodium hydroxide solution. When dilute hydrochloric acid was added bubbles were seen.

(i) Give the **formulae** of the two ions present in **X**. [1]

..... and .....

(ii) Give the **formula** of substance **X**. [1]

.....

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7. The following table shows the colours of universal indicator at different pH values.

Colour	red	orange	yellow	green	blue	navy blue	purple
pH range	0-2	3-4	5-6	7	8-9	10-12	13-14

(a) A solution of coffee turns universal indicator yellow.

(i) Give the pH range of this solution. ..... [1]

(ii) State what the pH range tells you about this solution. [1]

.....

(b) Ethanoic acid turns universal indicator orange and sulphuric acid turns it red. State what this information tells you about the relative strengths of the two acids. [1]

.....

.....

(c) An *excess* of the strong alkali, sodium hydroxide, was added to a small amount of sulphuric acid containing some universal indicator. State what would happen to the pH of the solution and give the final colour of the universal indicator. [2]

.....

.....

5

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8. Wine is a solution containing about 13% ethanol. Ethanol is formed as glucose is broken down by the action of enzymes present in yeast.

(a) Give the name of this process. [1]

.....

(b) Give **one** *health* problem associated with excessive use of alcohol over many years. [1]

.....

.....

(c) Give **one** *social* problem associated with alcohol misuse. [1]

.....

.....

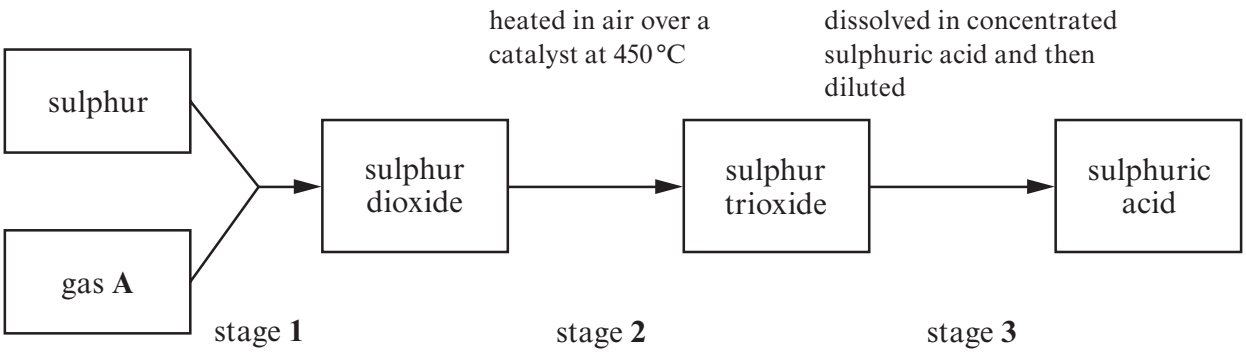
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9. *(a)* The following diagram shows a flow chart for the manufacture of sulphuric acid using the Contact Process.



(i) Name gas **A**. ..... [1]

(ii) Give the **word** equation for the reaction taking place in stage **2**. [2]

..... + ... ⇌ .....

(iii) Give the reason for using a catalyst in stage **2**. [1]

.....

(iv) If sulphur trioxide is allowed to react with water directly in stage **3**, a large quantity of heat is released. Give the term used for a reaction that produces heat. [1]

.....

(b) (i) When concentrated sulphuric acid is added to sugar, $C_{12}H_{22}O_{11}$, a black solid is formed. Give the **names** of the elements that are removed from sugar during this reaction. [1]

.....

(ii) The following hazard symbol is seen on a bottle of concentrated sulphuric acid.



What does it tell you about the acid? [1]

.....

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FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	**Formula**	**Name**	**Formula**
Aluminium	Al^{3+}	Bromide	Br^{-}
Ammonium	NH_4^{+}	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^{-}
Calcium	Ca^{2+}	Fluoride	F^{-}
Copper(II)	Cu^{2+}	Hydroxide	OH^{-}
Hydrogen	H^{+}	Iodide	I^{-}
Iron(II)	Fe^{2+}	Nitrate	NO_3^{-}
Iron(III)	Fe^{3+}	Oxide	O^{2-}
Lithium	Li^{+}	Sulphate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		

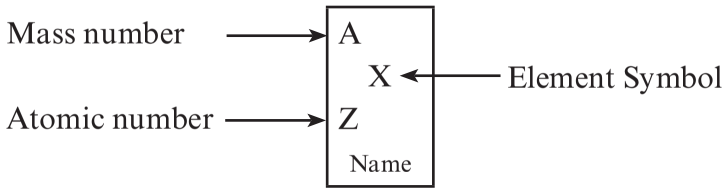
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PERIODIC TABLE OF ELEMENTS

1	2	Group										3	4	5	6	7	0
								$^{1}_{1}$H Hydrogen									$^{4}_{2}$He Helium
$^{7}_{3}$Li Lithium	$^{9}_{4}$Be Beryllium											$^{11}_{5}$B Boron	$^{12}_{6}$C Carbon	$^{14}_{7}$N Nitrogen	$^{16}_{8}$O Oxygen	$^{19}_{9}$F Fluorine	$^{20}_{10}$Ne Neon
$^{23}_{11}$Na Sodium	$^{24}_{12}$Mg Magnesium											$^{27}_{13}$Al Aluminium	$^{28}_{14}$Si Silicon	$^{31}_{15}$P Phosphorus	$^{32}_{16}$S Sulphur	$^{35}_{17}$Cl Chlorine	$^{40}_{18}$Ar Argon
$^{39}_{19}$K Potassium	$^{40}_{20}$Ca Calcium	$^{45}_{21}$Sc Scandium	$^{48}_{22}$Ti Titanium	$^{51}_{23}$V Vanadium	$^{52}_{24}$Cr Chromium	$^{55}_{25}$Mn Manganese	$^{56}_{26}$Fe Iron	$^{59}_{27}$Co Cobalt	$^{59}_{28}$Ni Nickel	$^{64}_{29}$Cu Copper	$^{65}_{30}$Zn Zinc	$^{70}_{31}$Ga Gallium	$^{73}_{32}$Ge Germanium	$^{75}_{33}$As Arsenic	$^{79}_{34}$Se Selenium	$^{80}_{35}$Br Bromine	$^{84}_{36}$Kr Krypton
$^{86}_{37}$Rb Rubidium	$^{88}_{38}$Sr Strontium	$^{89}_{39}$Y Yttrium	$^{91}_{40}$Zr Zirconium	$^{93}_{41}$Nb Niobium	$^{96}_{42}$Mo Molybdenum	$^{99}_{43}$Tc Technetium	$^{101}_{44}$Ru Ruthenium	$^{103}_{45}$Rh Rhodium	$^{106}_{46}$Pd Palladium	$^{108}_{47}$Ag Silver	$^{112}_{48}$Cd Cadmium	$^{115}_{49}$In Indium	$^{119}_{50}$Sn Tin	$^{122}_{51}$Sb Antimony	$^{128}_{52}$Te Tellurium	$^{127}_{53}$I Iodine	$^{131}_{54}$Xe Xenon
$^{133}_{55}$Cs Caesium	$^{137}_{56}$Ba Barium	$^{139}_{57}$La Lanthanum	$^{179}_{72}$Hf Hafnium	$^{181}_{73}$Ta Tantalum	$^{184}_{74}$W Tungsten	$^{186}_{75}$Re Rhenium	$^{190}_{76}$Os Osmium	$^{192}_{77}$Ir Iridium	$^{195}_{78}$Pt Platinum	$^{197}_{79}$Au Gold	$^{201}_{80}$Hg Mercury	$^{204}_{81}$Tl Thallium	$^{207}_{82}$Pb Lead	$^{209}_{83}$Bi Bismuth	$^{210}_{84}$Po Polonium	$^{210}_{85}$At Astatine	$^{222}_{86}$Rn Radon
$^{223}_{87}$Fr Francium	$^{226}_{88}$Ra Radium	$^{227}_{89}$Ac Actinium															

Key:



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GCSE MARKING SCHEME

SCIENCE - CHEMISTRY (LEGACY)

SUMMER 2012

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2012 examination in GCSE SCIENCE - CHEMISTRY (LEGACY). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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CHEMISTRY 3 (Legacy)

Foundation Tier

Q.1	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	hydrogen	H_2		H
b	1	relights/rekindles		glows brighter	
c	1	yellow			

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Q.2	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	(filter) funnel			
b	1	evaporation	vaporise		
c i	1	filtration			
ii	1	distillation		evaporation / method B	

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Q.3	Mark	Answer	Accept	Neutral answer	Do not accept
a	2	making cement (1) the extraction of iron (1)			
b i	1	a reasonable correct diagram with the delivery tube going into the lime water inside test tube/beaker			
ii	1	goes milky/white/cloudy			
iii	2	calcium carbonate (1) calcium oxide + carbon dioxide (1)	$CaCO_3$ $CaO + CO_2$		limestone quicklime
c	2	benefit – creates wealth/more jobs – any one for 1 mark drawback – noise/dust/spoils the landscape – any one for 1 mark		pollution	

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Q.4	Mark	Answer	Accept	Neutral answer	Do not accept
a	3	C_3H_8 (1) any number from -41 to 19 (1) gas (1)			
b i	1	heat			
ii	1	cover with damp cloth/fire proof mat / fire blanket	carbon dioxide	fire extinguisher – unless qualified	water/foam
c i I II III	1 1 1	**B** **E** **F**			
ii	1	C_2H_4			

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Q.5	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	136.8 – 136.3 = 0.5 (g)			
b	2	same volume/amount/100 cm^3 of water same mass/amount/0.5 g of alcohols / fuels spirit burner the same distance from the beaker/water - any two for 1 mark each			
c	1	ethanol – the increase in temperature is more/greater - both needed for the mark	more heat given out	final temperature higher	
d	1	loss of heat/not all the heat transferred to the water /not properly insulated	not stirred/draft		

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Q.6	Mark	Answer	Accept	Neutral answer	Do not accept
a	4	iron (II)/Fe^{2+} add sodium hydroxide – both needed for 1 mark green precipitate (1) iodide/I^- add silver nitrate – both needed for 1 mark yellow precipitate (1)			
b i	1	Na^+ and CO_3^{2-}- both needed for 1 mark		sodium and carbonate	
ii	1	Na_2CO_3			

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Q.7	Mark	Answer	Accept	Neutral answer	Do not accept
a i	1	5-6	5/6		
ii	1	(weak) acid			strong acid
b	1	sulphuric acid is **stronger** than ethanoic acid / pH of 0-2 is a stronger acid than a pH of 3-4 any one for 1 mark		sulphuric acid is a strong acid	
c	2	pH value would increase/go up (1) purple (1)	 navy blue		 green / blue

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Q.8	Mark	Answer	Accept	Neutral answer
a	1	fermentation		
b	1	liver or kidney damage/vitamin deficiency/heart disease/ memory loss/depression/stomach disorders / cancer / brain damage / high blood pressure		
c	1	violent behaviour/driving accidents/ anti-social behaviour		

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Q9	Mark	Answer	Accept	Neutral answer	Do not accept
a i	1	oxygen	O_2	air	O
ii	2	sulphur dioxide + oxygen (1) sulphur trioxide (1)	$SO_2 + O_2$ SO_3		
iii	1	increase the speed/reduce the time of the reaction			
iv	1	exothermic			
b i	1	hydrogen and oxygen both needed		H_2/H/O_2/O	
ii	1	corrosive	burns your skin	harmful / irritant	

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CHEMISTRY 3 (Legacy)

Higher Tier

Q.1	Mark	Answer	Accept	Neutral answer	Do not accept
a i	1	5-6	5/6		
ii	1	(weak) acid	acid		strong acid
b	1	sulphuric acid is **stronger** than ethanoic acid / pH of 0-2 is a stronger acid than a pH of 3-4 any one for 1 mark		sulphuric acid is a strong acid	
c	2	pH value would increase/go up (1) purple (1)	 navy blue		 green /blue

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Q2	Mark	Answer	Accept	Neutral answer
a	1	fermentation		
b	1	liver or kidney damage/vitamin deficiency/heart disease/ memory loss/depression/stomach disorders / cancer / brain damage / high blood pressure		
c	1	violent behaviour/driving accidents/ anti-social behaviour		

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Q3	Mark	Answer	Accept	Neutral answer	Do not accept
a i	1	oxygen	O_2		O
ii	2	sulphur dioxide + oxygen (1) sulphur trioxide (1)	$SO_2 + O_2$ SO_3		
iii	1	increase the speed/reduce the time of the reaction			
iv	1	exothermic			
b i	1	hydrogen and oxygen - both needed		H_2/H/O_2/O	
ii	1	corrosive	burns your skin	harmful / irritant	
c	1	lighted splint/flame gives a ‘pop’ noise			

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Q4	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	to record temperature of vapour (rather than liquid below)			
b	1	(liebig) condenser			
c	1	ethanol – **lower** boiling point – both needed for 1 mark		boils/evaporates first	
d	1	distillation	fractional distillation		

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Q5	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	C_3H_8			
b	1	**A/F**			
c i	1	**B**	C_2H_4/ethene		
ii	1	**C**	C_2H_5OH		
iii	1	**B**	C_2H_4/ethene		

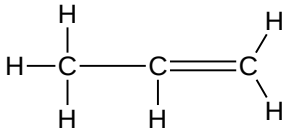
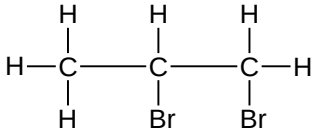
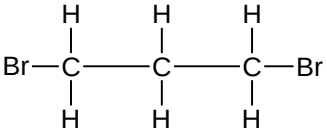
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Q6	Mark	Answer	Accept	Neutral answer	Do not accept
a i	1	calcium carbonate – **highest** decomposing temperature/needs the most heat to decompose			
ii	3	heating (1) collecting – delivery tube, teat pipette, gas jar (1) lime water goes milky/white/cloudy (1)			
b i	1	production of iron/steel, road making, making cement, neutralise soil acidity, glass production, statues – any one for 1 mark			
ii	1	neutralise acidic (soils)			
iii	1	slaked lime	lime water		

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Q7	Mark	Answer	Accept	Neutral answer	Do not accept
a	1				
b	2	bromine to propane - no change/bromine colour remains/solution stays yellow or orange (1) bromine to propene – solution becomes colourless/decolourises (1)			
c	2	$C_3H_6Br_2$ (1)  (1)			

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Q8	Mark	Answer	Accept	Neutral answer	Do not accept
a	2	(muddy) green precipitate (1) iron**(II)** hydroxide (1)	$Fe(OH)_2$		iron hydroxide
b	3	$FeCl_2$ + NaOH (1) $Fe(OH)_2$ + NaCl (1) correct balancing (1)			
c	1	white precipitate			

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Q9	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	$\frac{20.00 + 20.05 + 19.95}{3} = 20.0$ (1)			
b	1	pipette/ burette		measuring cylinder unless qualified (e.g. 25 cm^3)	
c	2	$0.2 \times \frac{25}{1000}$ (1) = 0.005 (2) – 2 marks for correct answer			
d	1	0.005	consequential marking		
e	2	conc $\times \frac{20.0}{1000} = 0.005$ (1) conc = 0.25 (1) - 2 marks for correct answer	consequential marking		

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

245/01

SCIENCE CHEMISTRY
FOUNDATION TIER
CHEMISTRY 3

A.M. WEDNESDAY, 25 May 2011

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**4**	
2.	**8**	
3.	**7**	
4.	**6**	
5.	**4**	
6.	**6**	
7.	**5**	
8.	**8**	
9.	**2**	
Total	**50**	

0245 010001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

The Periodic Table is printed on the back cover of the examination paper and the formulae for some common ions on the inside of the back cover.

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Answer **all** *questions.*

1. The box below gives the names of some separation methods used in chemistry.

chromatography	**crystallisation**	**distillation**
evaporation	**filtration**	

From the box, choose the most suitable method to separate:

(a) sand from water; ..... [1]

(b) the colours in ink; ..... [1]

(c) alcohol and water; ..... [1]

(d) salt from water. ..... [1]

4

2. *(a)* Read the information in the box below.

Sulphuric acid and ethanoic acid are two common acids. They both have a pH below 7 and turn litmus red. Both react with alkalis to produce a salt and water. This type of reaction is known as neutralisation.

An example of neutralisation is the reaction between sulphuric acid and sodium hydroxide to produce sodium sulphate and water.

Acids also react with metals. Sulphuric acid reacts with magnesium to produce magnesium sulphate and hydrogen. The reaction is fast and produces a lot of bubbles. It produces heat and is therefore an exothermic reaction. Ethanoic acid reacts more slowly with magnesium and the reaction produces less heat.

Use only the information in the box to answer the questions that follow.

(i) Give the pH of an acid. ..... [1]

(ii) State what is meant by a neutralisation reaction. [1]

.....

.....

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(iii) Name the salt produced when sulphuric acid reacts with sodium hydroxide solution. [1]

.....

(iv) Give the **word equation** for the reaction taking place between sulphuric acid and magnesium. [2]

..... + ... ⟶ ..... + ...

(v) State how the reaction with magnesium shows that ethanoic acid is a weaker acid than sulphuric acid. [1]

.....

(b) The following table shows the colours of universal indicator at different pH values.

Colour	Red	Orange	Yellow	Green	Blue	Navy blue	Purple
pH	0-2	3-4	5-6	7	8-9	10-12	13-14

A student is given some common household substances and is asked to find their pH values using universal indicator. His results are shown in the table below.

Substance	Colour of universal indicator	pH	Acid, alkali or neutral
vinegar	orange	4	alkali
toothpaste	blue	9	alkali
water	green	5	neutral
lemonade	yellow	5	acid

There are two errors in the table. Identify the **two** errors. [2]

Error 1 .....

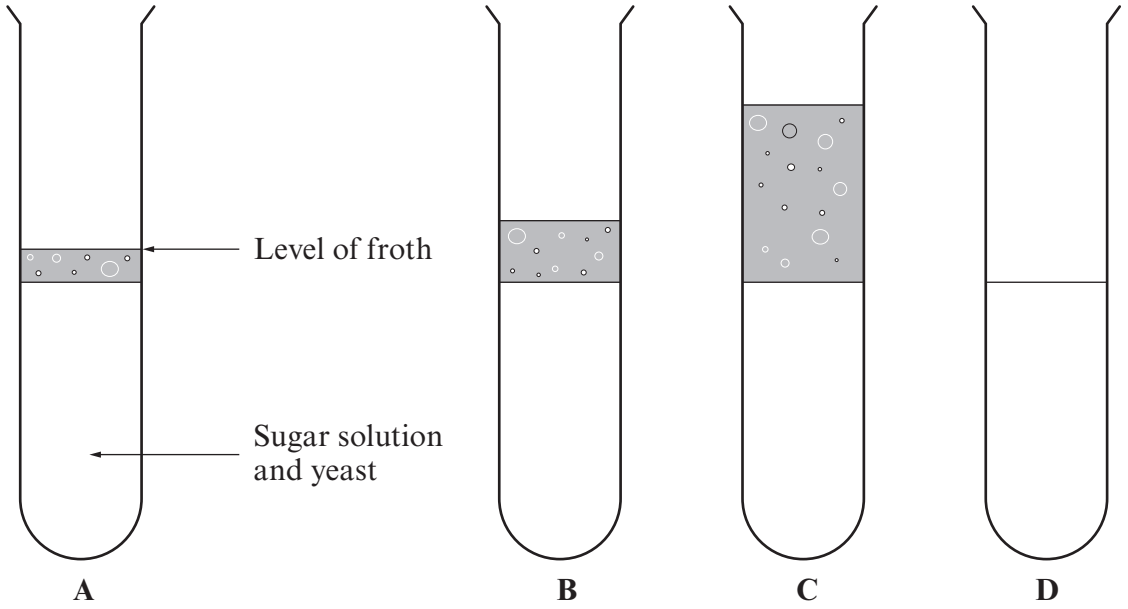
Error 2 .....

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3. A student carried out an experiment to find out how changes in temperature affected the rate of fermentation of sugar. He placed 20 cm^3 of sugar solution in each of boiling tubes **A**, **B**, **C** and **D**, and added 1 cm^3 of yeast to each tube. They were placed in water baths at different temperatures for 30 minutes. The results of the experiment are shown below.



(a) (i) Complete the diagram by showing the level of froth expected for tube **D**. [1]

(ii) Give a reason for your answer. [1]

.....

.....

(b) State **two** ways in which the experiment was made a fair test. [2]

1. .....

2. .....

(c) The gas produced during this reaction turns limewater milky. Choose from the box below the name of this gas. [1]

ammonia	**carbon dioxide**	**nitrogen**	**oxygen**

The gas produced is ..... .

(d) Give a **word** equation for the fermentation process. [2]

..... $\xrightarrow{\text{yeast}}$ ..... + ...

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4. *(a)* The boxes below show some common ions and tests that could be used to identify them. Draw **one** line from each ion to the appropriate test. [4]

Ion	Test
	produces carbon dioxide gas when it reacts with acid
Na^+	produces a lilac colour in flame test
Cu^{2+}	gives a blue precipitate with sodium hydroxide solution
Cl^-	gives a white precipitate with silver nitrate solution
CO_3^{2-}	produces a yellow colour in flame test
	gives a yellow precipitate with silver nitrate solution

(b) A pupil was given a gas jar containing oxygen.
Describe a test that could be carried out to prove that it was oxygen. Give the expected result for the test. [2]

.....

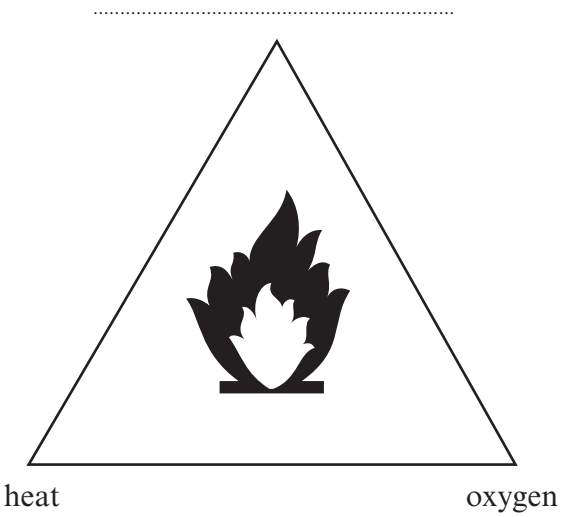
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5. The following diagram shows the fire triangle.



(a) Complete the diagram of the fire triangle. [1]

(b) Describe **briefly** what information the fire triangle provides. [1]

.....

.....

(c) Use your knowledge of the fire triangle to explain how each of the following fire fighting methods works.

(i) Pouring water on to paper burning in a bin. [1]

.....

(ii) Putting a damp cloth over the top of a burning chip pan. [1]

.....

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6. Limestone, made of calcium carbonate, is an important raw material. It is converted into other important substances as shown below:

limestone ⟶ **quicklime** ⟶ **slaked lime**

(a) (i) State how limestone is converted into quicklime. [1]

.....

(ii) State what is added to quicklime in order to form slaked lime. [1]

.....

(b) The following box gives the formulae of some calcium compounds.

$CaCO_3$	$Ca(OH)_2$	CaO	$CaCl_2$

Choose the correct formula for

(i) limestone, ... [1]

(ii) quicklime, ... [1]

(iii) slaked lime. ..... [1]

(c) Give a use for limestone. ..... [1]

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7. *(a)* The following table shows the number of people admitted to a particular hospital for treatment for the effects of alcohol abuse over a period of five years.

Year	2004	2005	2006	2007	2008
Number of people treated	264	346	466	499	571

(i) State how the number of people treated for the effects of alcohol abuse has changed over time. [1]

.....

(ii) Give **one** social problem caused by alcohol abuse. [1]

.....

(iii) State **one** possible effect of long term alcohol abuse on an individual's health. [1]

.....

(b) Alcohol is used as a biofuel. State **one** advantage and **one** disadvantage of the use of alcohol as a biofuel. [2]

Advantage .....

.....

Disadvantage .....

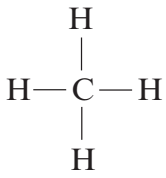
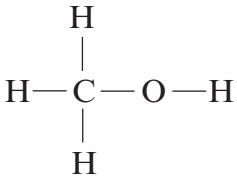
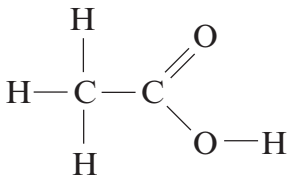
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5

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8. The following table shows the names and formulae of some organic compounds.

Name	Formula	Structural formula
methane	CH_4	
propane	C_3H_8	
	CH_3OH	
ethene	C_2H_4	
ethanoic acid		

(a) Complete the table. [4]

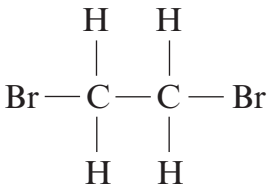
(b) Name the **two** compounds in the table that are members of the **alkane** homologous series. [1]

..... and .....

(c) Name the compound produced when alcoholic drinks containing ethanol are left exposed to air for a period of time. [1]

.....

(d) (i) Name the substance that reacts with bromine water to form [1]



.....

(ii) Give **one** observation that you would make during this reaction. [1]

.....

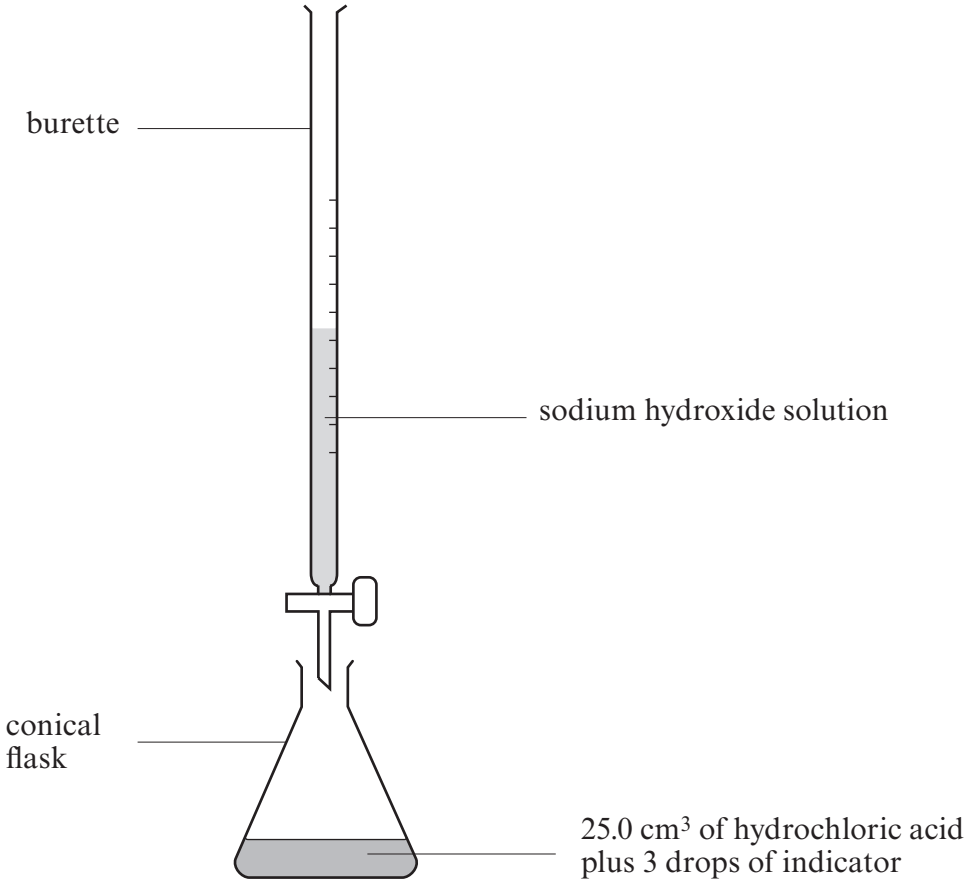
8

Turn over.

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9. A student added sodium hydroxide solution to 25.0 cm^3 of hydrochloric acid as shown in the diagram below.



$$NaOH + HCl \longrightarrow NaCl + H_2O$$

The titration was carried out three times and the results are shown below.

	Titration readings		
	1	2	3
Volume of sodium hydroxide used / cm^3	24.9	25.1	25.0

State what the readings tell you about the relative concentrations of hydrochloric acid and sodium hydroxide solution. Give a reason for your answer. [2]

.....

.....

.....

2

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FORMULAE FOR SOME COMMON IONS

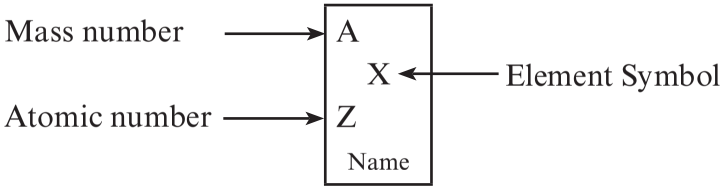
POSITIVE IONS		NEGATIVE IONS	
Name	**Formula**	**Name**	**Formula**
Aluminium	Al^{3+}	Bromide	Br^{-}
Ammonium	NH_4^{+}	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^{-}
Calcium	Ca^{2+}	Fluoride	F^{-}
Copper(II)	Cu^{2+}	Hydroxide	OH^{-}
Hydrogen	H^{+}	Iodide	I^{-}
Iron(II)	Fe^{2+}	Nitrate	NO_3^{-}
Iron(III)	Fe^{3+}	Oxide	O^{2-}
Lithium	Li^{+}	Sulphate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		

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PERIODIC TABLE OF ELEMENTS

1	2	Group										3	4	5	6	7	0
								$^{1}_{1}$H Hydrogen									$^{4}_{2}$He Helium
$^{7}_{3}$Li Lithium	$^{9}_{4}$Be Beryllium											$^{11}_{5}$B Boron	$^{12}_{6}$C Carbon	$^{14}_{7}$N Nitrogen	$^{16}_{8}$O Oxygen	$^{19}_{9}$F Fluorine	$^{20}_{10}$Ne Neon
$^{23}_{11}$Na Sodium	$^{24}_{12}$Mg Magnesium											$^{27}_{13}$Al Aluminium	$^{28}_{14}$Si Silicon	$^{31}_{15}$P Phosphorus	$^{32}_{16}$S Sulphur	$^{35}_{17}$Cl Chlorine	$^{40}_{18}$Ar Argon
$^{39}_{19}$K Potassium	$^{40}_{20}$Ca Calcium	$^{45}_{21}$Sc Scandium	$^{48}_{22}$Ti Titanium	$^{51}_{23}$V Vanadium	$^{52}_{24}$Cr Chromium	$^{55}_{25}$Mn Manganese	$^{56}_{26}$Fe Iron	$^{59}_{27}$Co Cobalt	$^{59}_{28}$Ni Nickel	$^{64}_{29}$Cu Copper	$^{65}_{30}$Zn Zinc	$^{70}_{31}$Ga Gallium	$^{73}_{32}$Ge Germanium	$^{75}_{33}$As Arsenic	$^{79}_{34}$Se Selenium	$^{80}_{35}$Br Bromine	$^{84}_{36}$Kr Krypton
$^{86}_{37}$Rb Rubidium	$^{88}_{38}$Sr Strontium	$^{89}_{39}$Y Yttrium	$^{91}_{40}$Zr Zirconium	$^{93}_{41}$Nb Niobium	$^{96}_{42}$Mo Molybdenum	$^{99}_{43}$Tc Technetium	$^{101}_{44}$Ru Ruthenium	$^{103}_{45}$Rh Rhodium	$^{106}_{46}$Pd Palladium	$^{108}_{47}$Ag Silver	$^{112}_{48}$Cd Cadmium	$^{115}_{49}$In Indium	$^{119}_{50}$Sn Tin	$^{122}_{51}$Sb Antimony	$^{128}_{52}$Te Tellurium	$^{127}_{53}$I Iodine	$^{131}_{54}$Xe Xenon
$^{133}_{55}$Cs Caesium	$^{137}_{56}$Ba Barium	$^{139}_{57}$La Lanthanum	$^{179}_{72}$Hf Hafnium	$^{181}_{73}$Ta Tantalum	$^{184}_{74}$W Tungsten	$^{186}_{75}$Re Rhenium	$^{190}_{76}$Os Osmium	$^{192}_{77}$Ir Iridium	$^{195}_{78}$Pt Platinum	$^{197}_{79}$Au Gold	$^{201}_{80}$Hg Mercury	$^{204}_{81}$Tl Thallium	$^{207}_{82}$Pb Lead	$^{209}_{83}$Bi Bismuth	$^{210}_{84}$Po Polonium	$^{210}_{85}$At Astatine	$^{222}_{86}$Rn Radon
$^{223}_{87}$Fr Francium	$^{226}_{88}$Ra Radium	$^{227}_{89}$Ac Actinium															

Key:



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