WJEC GCSE CHEMISTRY

CHEMISTRY



EXAM QUESTION PACK

UNIT C3 FOUNDATION TIER 4493 PAPERS

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4493/01

S16-4493-01

CHEMISTRY

CHEMISTRY 3
FOUNDATION TIER

A.M. THURSDAY, 19 May 2016

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**6**	
2.	**4**	
3.	**7**	
4.	**7**	
5.	**7**	
6.	**5**	
7.	**8**	
8.	**7**	
9.	**9**	
Total	**60**	

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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.

Assessment will take into account the quality of written communication (QWC) used in your answer to question **9***(a)*.

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)* (i) Balance the symbol equation for the combustion of ethanol. [1]

$C_2H_5OH + 3O_2 \longrightarrow \square\, CO_2 + \square\, H_2O$

(ii) Where does the oxygen come from when ethanol is burned? [1]

.....

(b) Ethanol can be used as a fuel. State **one** other use of ethanol. [1]

.....

(c) When a student heated some ethanol in a beaker using a Bunsen burner, the ethanol caught fire.

Suggest how a teacher would put out the flame. Explain how the chosen method works. [3]

.....

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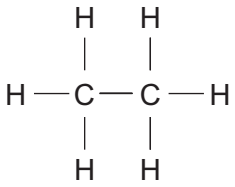
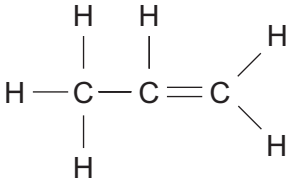
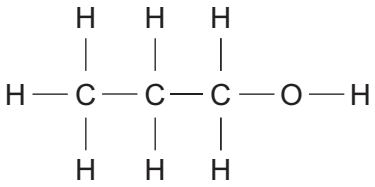
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2. The following table shows the names and formulae of some organic compounds.

Name	Formula	Structural formula
ethane	C_2H_6	
propane	C_3H_8	
propene	C_3H_6	
propanol		
ethene	C_2H_4	

(a) Complete the table. [3]

(b) Name the **two** compounds in the table which are alkenes. [1]

..... and .....

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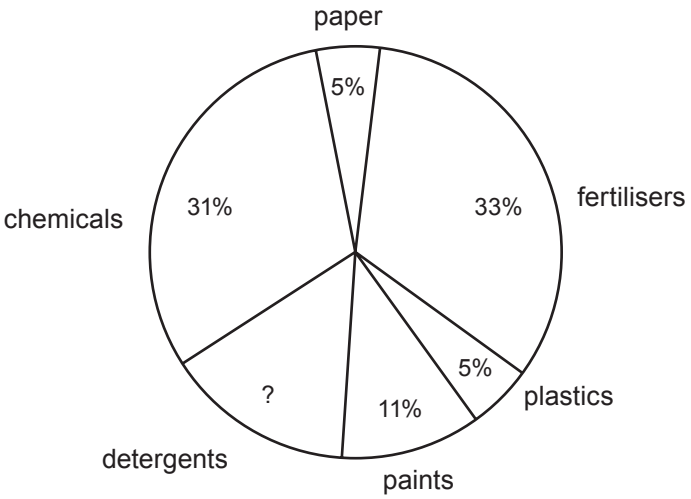
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3. *(a)* The following pie chart shows the main uses of sulfuric acid in a developing country.



(i) Calculate the percentage of sulfuric acid used to make detergents. [2]

Percentage = ... %

(ii) In this country, 200 000 tonnes of sulfuric acid are used each year. Calculate the mass of sulfuric acid used each year to make fertilisers. [2]

Mass of sulfuric acid = ... tonnes

(b) (i) State what is observed when magnesium reacts with sulfuric acid. [1]

.....

(ii) Explain how magnesium could be used to distinguish between sulfuric acid and ethanoic acid. [2]

.....

.....

.....

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4. *(a)* The following table contains the names and formulae of four nitrogenous fertilisers.

Name	Formula
ammonia	NH_3
ammonium sulfate	$(NH_4)_2SO_4$
potassium nitrate	KNO_3
urea	$CO(NH_2)_2$

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

(i) Give the names of **all** the elements present in urea. [1]

.....

(ii) Give the name of the compound with the formula NH_4NO_3. [1]

.....

(b) State why it is an advantage for a fertiliser to release its nitrogen slowly. [1]

.....

(c) Describe **two** consequences of nitrogenous fertilisers being washed into rivers. [3]

.....

.....

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(d) Another substance which is added to soil by farmers is calcium hydroxide, commonly known as slaked lime.

Give the reason why slaked lime is added to soil. [1]

.....

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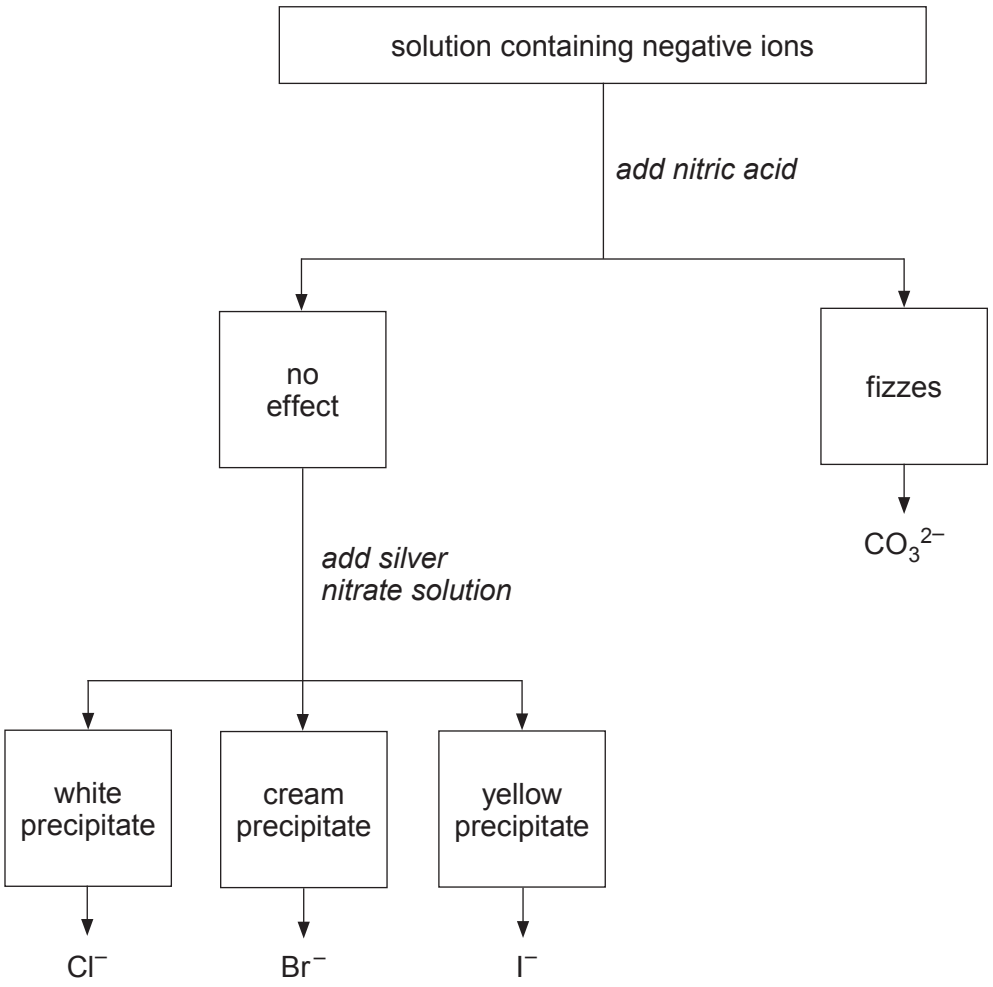
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5. The following key shows how to identify some negative ions.



(a) Give the meaning of the term *precipitate*. [1]

.....

(b) Name the gas given off when identifying CO_3^{2-} ions. [1]

.....

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(c) Substance **X** was known to be sodium iodide, potassium iodide or potassium bromide.

(i) State how a flame test could be used to decide whether substance **X** is a sodium or a potassium compound. [2]

.....

.....

(ii) Describe how you would carry out a test to show whether **X** is potassium iodide or potassium bromide. Include the expected observations. [2]

.....

.....

.....

.....

(iii) Give the **word** equation for the reaction between silver nitrate and potassium bromide. [1]

..... + ... ⟶ ..... + ...

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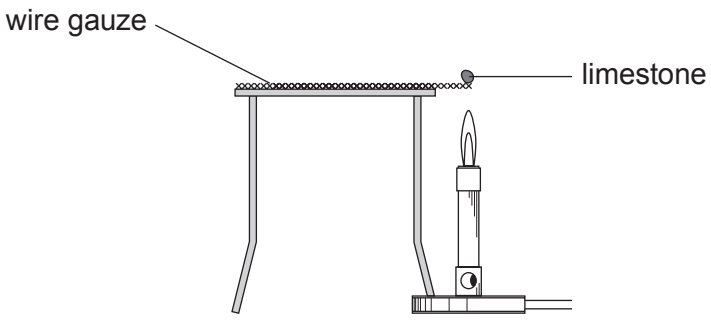
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6. A small piece of limestone, which contains calcium carbonate, was heated strongly for about 10 minutes using a Bunsen burner flame as shown in the diagram.

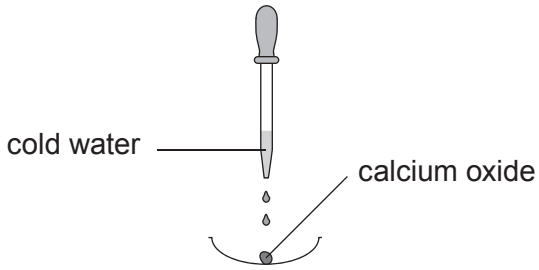


(a) During the reaction calcium oxide was formed.

Give the common name of calcium oxide. [1]

.....

(b) The calcium oxide was allowed to cool and cold water was added dropwise as shown.



(i) Describe what was observed. [2]

.....

.....

.....

(ii) Give the balanced **symbol** equation for the reaction. [2]

..... + ... ⟶ .....

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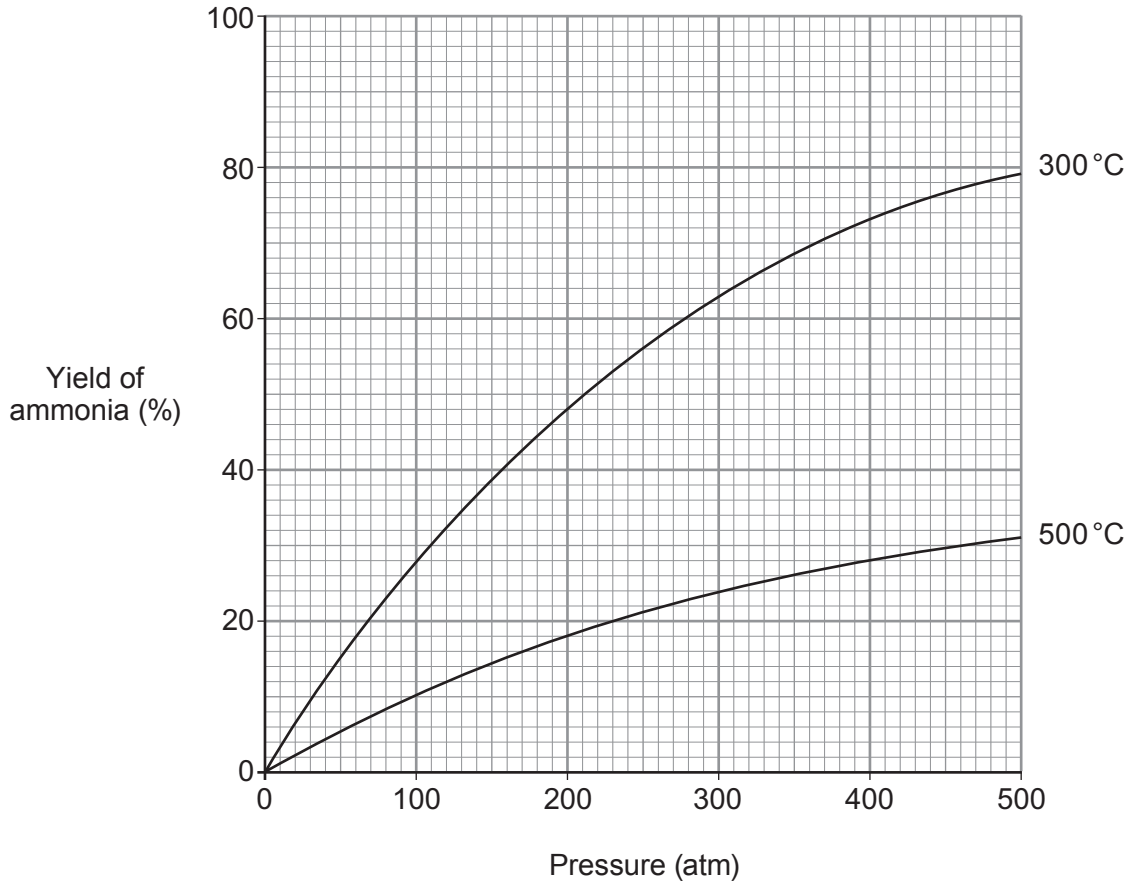
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7. In the Haber process, nitrogen reacts with hydrogen to give ammonia.

The following graphs show the effect of changing pressure on the yield of ammonia at 300 °C and 500 °C.



The table shows the percentage yield of ammonia at various pressures at 400 °C.

Pressure (atm)	0	100	200	300	400	500
Yield of ammonia (%)	0	22	37	44	49	51

(a) Plot the points on the grid above and draw a suitable line. [2]

(b) Using the graphs, state the temperature and pressure which produce the highest yield of ammonia. [1]

..... °C and ..... atm

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(c) State what conclusions can be drawn from the graphs. [2]

.....

.....

.....

(d) (i) Complete and balance the following equation for the production of ammonia. [2]

N_2 + ☐ H_2 $\rightleftharpoons$ ☐ .....

(ii) State the meaning of $\rightleftharpoons$ in the equation in part (i). [1]

.....

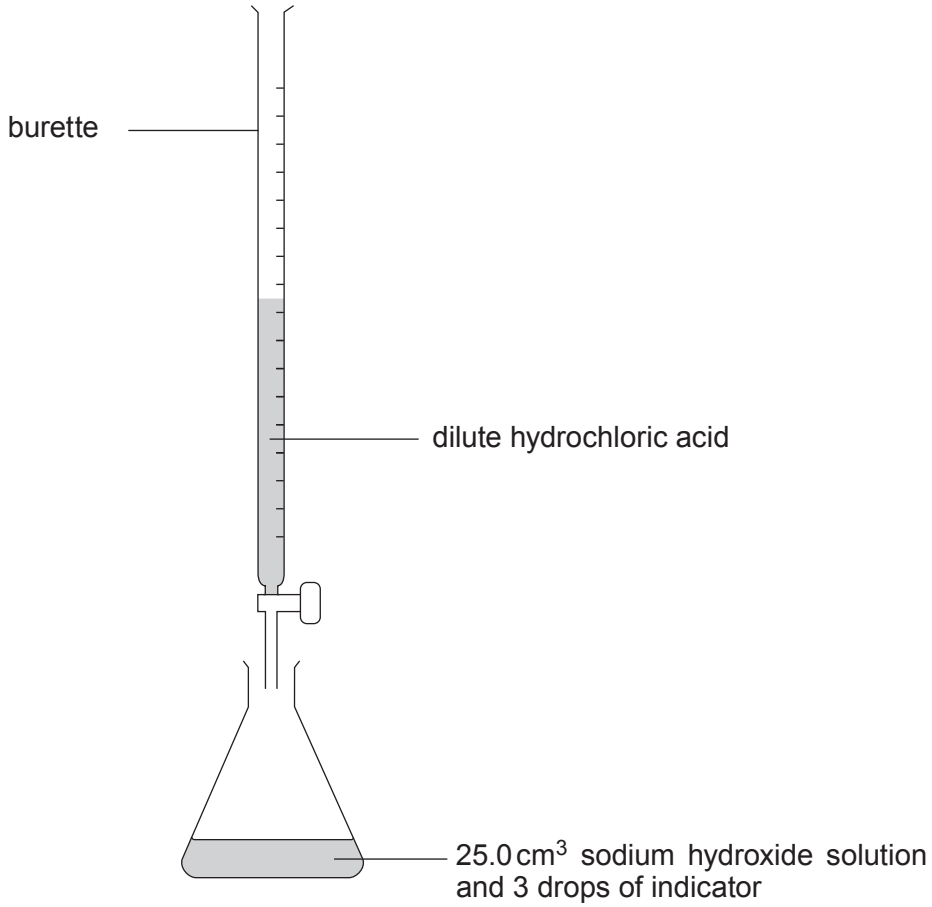
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8. The diagram shows the apparatus that was used to find the volume of hydrochloric acid needed to neutralise 25.0 cm^3 of sodium hydroxide solution.

The balanced equation for the reaction between sodium hydroxide and hydrochloric acid is as follows.

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



The acid was added slowly from the burette. The volume of acid needed to change the indicator colour was recorded.

The titration was carried out four times and the volume of acid added each time was recorded in the table below.

Run	1	2	3	4
Volume of hydrochloric acid (cm^3)	33.5	29.5	29.6	29.4

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(a) State why an indicator was used in this experiment. [1]

.....

(b) State whether the acid or the alkali is the more concentrated. Give a reason for your answer. [1]

.....

.....

(c) (i) Calculate the mean volume of hydrochloric acid needed to neutralise 25.0 cm^3 of the sodium hydroxide solution. [1]

Mean = ... cm^3

(ii) Using all the information provided and your mean volume, describe how a pure sample of sodium chloride crystals could be made. [4]

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9. *(a)* You have been given three gases, **A**, **B** and **C**. The gases are carbon dioxide, hydrogen and oxygen, but not necessarily in that order.

Describe the tests for carbon dioxide, hydrogen and oxygen and plan a method to identify gases **A**, **B** and **C** **without** using all three tests. [6 QWC]

(b) When a mixture of sodium hydroxide solution and ammonium chloride is heated a gas is given off.

(i) Name the gas. ..... [1]

(ii) Describe a test you could carry out to identify the gas. [2]

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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^{+}	Sulfate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		
Zinc	Zn^{2+}		

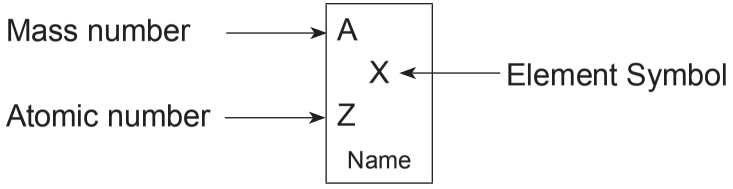
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PERIODIC TABLE OF ELEMENTS

1	2	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 Sulfur	$^{35}_{17}$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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(4493-01)

GCSE MARKING SCHEME

SUMMER 2016

SCIENCE - CHEMISTRY C3
4493/01/02

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INTRODUCTION

This marking scheme was used by WJEC for the 2016 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was 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 conference was to ensure that the marking scheme was 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' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

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GCSE Science - Chemistry 3

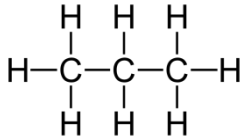
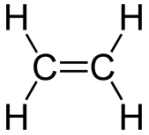
Summer 2016

Mark Scheme

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
1		*(a)*	(i)		1	$2CO_2 + 3H_2O$			
			(ii)		1	air / atmosphere			
		(b)			1	any of following • solvent • alcoholic drinks / beer / named alcoholic drink • antibacterial wipes / mouthwash	drinks		
		(c)			3	wet cloth / safety mat over the top / fire blanket (1) remove air / oxygen (1) any reference to breaking fire triangle (1)		fire extinguisher / paper	

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Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	Sub-section							
2		*(a)*			3	 (1) C_3H_7OH / C_3H_8O (1)  (1)			
		(b)			1	ethene and propene – both needed	C_2H_4 and C_3H_6		

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Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
3		*(a)*	(i)		2	15 (2) if answer incorrect award (1) for **one** correct step i.e. addition of values in pie chart to get 85 **or** subtraction of incorrect total from 100			
			(ii)		2	66 000 tonnes (2) if answer incorrect award (1) for identification of 33%			
		(b)	(i)		1	any of following • bubbles / fizz / effervescence • metal disappears • temperature increases		exothermic	
			(ii)		2	reacts more quickly with sulfuric acid – bubbles more quickly, metal disappears more quickly, temperature rises more quickly (greater temperature rise) (1) sulfuric acid stronger (1)	converse answer for ethanoic acid	stronger reaction	

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Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
4		*(a)*	(i)		1	carbon oxygen nitrogen hydrogen all needed, any order		C O N H	
			(ii)		1	ammonium nitrate			ammonia nitrate
		(b)			1	any of following • lasts longer in the soil • fertiliser does not need to be spread as often • less washed away by rain		saves money less waste reference to eutrophication	
		(c)			3	gets into water supply (1) causes overgrowth of plants in water / clogs up waterways (1) additional (1) for development of either point e.g. blue baby syndrome caused by nitrogen compounds in water supply, decrease in oxygen content / dead fish resulting from overgrowth of plants			
		(d)			1	neutralise soil acidity / reduce acidity	raise pH	reacts with acids	

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Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
5		*(a)*			1	any of following • solid formed in solution • solid formed when two solutions react • insoluble substance formed in solution • insoluble substance formed when two solutions react		solid formed	
		(b)			1	carbon dioxide	CO_2		
		(c)	(i)		2	sodium compound will give yellow flame (1) potassium compound will give lilac flame (1)	yellow-orange		
			(ii)		2	add silver nitrate solution (1) bromide gives cream precipitate and iodide gives yellow precipitate - **both** needed (1)			
			(iii)		1	silver nitrate + potassium bromide silver bromide + potassium nitrate reactants **and** products needed	correct symbol equation		

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
6		*(a)*			1	quicklime		CaO	
		(b)	(i)		2	solid expands / crumbles (1) visible vapour given off / hissing sound (1)	breaks up heat given off steam given off	 exothermic	
			(ii)		2	$CaO + H_2O$ (1) $Ca(OH)_2$ (1)		word equation	

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Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
7	1	*(a)*			2	all points plotted correctly – tolerance ±½ square (1) (ignore missing 0,0) smooth curve (1)			
		(b)			1	300°C and 500 atm – both needed			
		(c)			2	the higher the pressure, the higher the yield / the lower the pressure, the lower the yield (1) the higher the temperature, the lower the yield / the lower the temperature, the higher the yield (1)			
		(d)	(i)		2	NH_3 (1) balancing mark may only be awarded if above formula is correct $3H_2$ and $2NH_3$ (1)			
			(ii)		1	either of following • reversible reaction • reaction that can go both ways			

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Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
8	2	*(a)*			1	any of following • to identify the end-point • to find the exact volume of acid required to neutralise the alkali • to find the exact volume of acid required to use up **all** the alkali			
		(b)			1	alkali is more concentrated because more than 25.0 cm^3 of acid are needed to neutralise it			HCl is dilute
		(c)	(i)		1	29.5 cm^3			
			(ii)		4	add 29.5 cm^3 [or mean value from (i)] of hydrochloric acid to 25.0 cm^3 of sodium hydroxide (1) no indicator (1) evaporate (1) additional (1) for a practical aspect e.g. measure solutions using pipette/burette or leave on window sill max (2) to be awarded if indicator added			

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Question Number						
FT	HT	Sub-section			Mark	Answer
9	3	*(a)*			6	**Indicative content** Tests given for all three gases – clearly identified • carbon dioxide – turns limewater milky • hydrogen – squeaky pop when ignited • oxygen – re-lights a glowing splint Plan using two test only e.g. • shake gases **A**, **B** and **C** with limewater, carbon dioxide will make it turn milky • test two remaining gases with a glowing splint, oxygen will re-light it • the remaining gas is hydrogen **5-6 marks**: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks**: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks**: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks**: The candidate does not make any attempt or give a relevant answer worthy of credit.

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
9	3	*(b)*	(i)		1	ammonia	NH_3		ammonium ammonium hydroxide
			(ii)		2	damp red litmus paper / universal indicator paper (1) turns blue (1)			

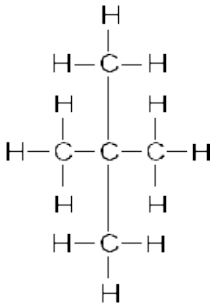
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Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	Sub-section							
	4	*(a)*			2	similarity – either of following for (1) • both give off carbon dioxide • both form oxides difference – either of following for (1) • calcium carbonate stays white but copper(II) carbonate changes colour / turns from green to black • calcium carbonate has a much higher decomposition temperature			
		(b)			2	$CaCO_3$ (1) $CaO + CO_2$ (1)			
		(c)			2	no carbon dioxide given off / no reaction (1) either of following for (1) • sodium carbonate more stable than calcium carbonate and copper(II) carbonate • requires more energy to break bonds • sodium is more reactive than calcium and copper			

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Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	5	*(a)*			1	**A** and **F** – both needed			
		(b)			2	**D** (1) any of following for (1) • one carbon atom has only three bonds • one carbon atom has five bonds • carbon atoms must always have four bonds		not enough hydrogens in the formula	
		(c)			1				
		(d)			3	bubble through bromine water (1) **C** – no change (1) **E** – orange/brown solution turns colourless (1)			
		(e)			3	ethanol (1) O—H at around 3300 (1) C—O at around 1100 (1)			

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Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	6	*(a)*	(i)		2	pale green (1) precipitate forms (1)			
			(ii)		3	$Fe^{2+} + 2OH^- \rightarrow Fe(OH)_2$ (3) if incorrect award (1) for correct reactants and/or (1) for correct product			
		(b)			2	add barium chloride solution (1) white precipitate forms (1)			

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Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	7	*(a)*			2	0.0025 mol (2) if answer incorrect award (1) for 25.0 × 0.1			
		(b)			1	0.005 mol error carried forward (ecf) from part (a)			
		(c)			2	0.233 / 0.23 mol/dm^3 (2) if answer incorrect award (1) for 0.005 / 21.5 ecf from part (a)			
		(d)			2	10.75 cm^3 (1) this reaction involves a 1:1 ratio rather than 2:1 therefore half the volume of alkali is needed (1)			

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Question Number			
FT	HT	Mark	Answer
	8	6	**Indicative content** Burn sulfur in air to give sulfur dioxide; $S + O_2 \rightarrow SO_2$ Convert sulfur dioxide into sulfur trioxide; 450 °C, vanadium(V) oxide catalyst; $2SO_2 + O_2 \rightarrow 2SO_3$ Problems linked with converting SO_3 to the acid Dissolve sulfur trioxide in concentrated sulfuric acid forming oleum; add water **5-6 marks**: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks**: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks**: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks**: The candidate does not make any attempt or give a relevant answer worthy of credit.

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4493/01

S15-4493-01

CHEMISTRY

CHEMISTRY 3
FOUNDATION TIER

A.M. THURSDAY, 14 May 2015

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**6**	
3.	**7**	
4.	**12**	
5.	**6**	
6.	**10**	
7.	**8**	
8.	**6**	
Total	**60**	

4493 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.

Assessment will take into account the quality of written communication (QWC) used in your answer to question **8**.

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 fire triangle is used in fighting fires. State what is meant by the term 'fire triangle' and how it is used to fight fires. [3]

.....

.....

.....

.....

(b) The pictures below show two methods of fighting fires. State how each method puts out the fire. [2]

Method 1



.....

.....

Method 2



.....

.....

5

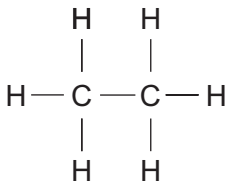
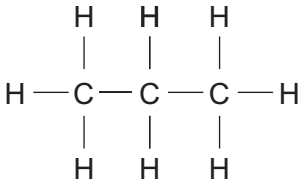
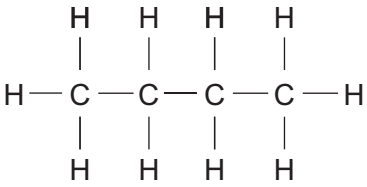
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2. *(a)* (i) The table below shows the names, molecular formulae and structural formulae of some alkanes.

Complete the table. [2]

Name	Molecular formula	Structural formula
methane	CH_4	
ethane	.....	
propane	C_3H_8	
butane	C_4H_{10}	

(ii) Octane contains 8 carbon atoms. Give the molecular formula for octane. [1]

.....

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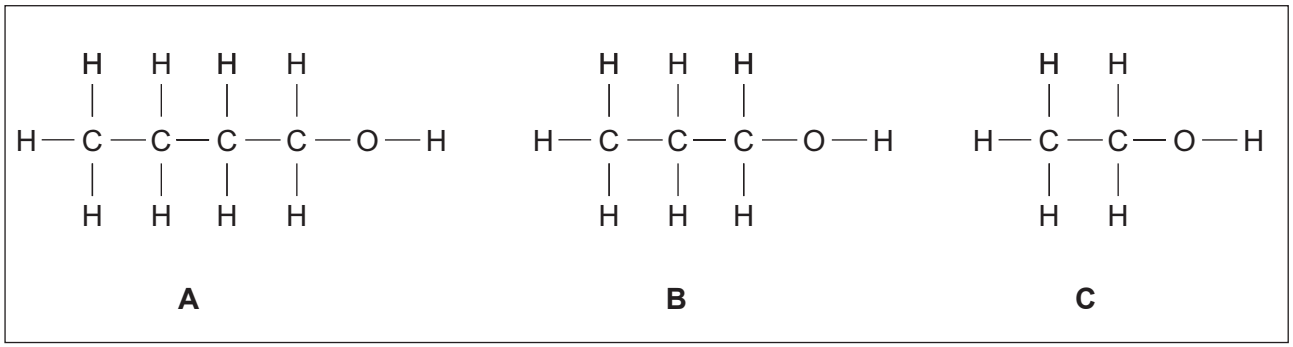
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(b) (i) Compound **X** is made by a process called fermentation. The equation below shows the reaction that occurs.

$$\underset{\text{glucose}}{C_6H_{12}O_6} \xrightarrow{\text{yeast}} \underset{\text{compound } \mathbf{X}}{2C_2H_5OH} + 2CO_2$$

Give the name of compound **X**. ..... [1]

(ii) Choose from the box below the structural formula, **A**, **B** or **C**, of compound **X**. [1]



Letter .....

(iii) Give **one** everyday use of compound **X**. [1]

.....

6

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3. Ammonia is manufactured from nitrogen and hydrogen using the Haber process.

(a) The equation below shows the formation of ammonia.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

(i) State the numbers of nitrogen atoms and hydrogen atoms on the **left** hand side of the equation. Use these numbers to show that the equation is balanced. [2]

Number of nitrogen atoms ..... *Number of hydrogen atoms* .....

.....

(ii) Give the meaning of (g) in the equation. [1]

.....

(b) The box below shows some of the conditions and terms used when describing the Haber process.

ammonia	**hydrogen**	**450 °C**	**iron**	**cooling**
nitrogen	**reversible**	**200 atmospheres**		**recycling**

(i) Choose from the box

I. the process used to remove the product from the reaction mixture, [1]

.....

II. the method used to reduce the waste of reactants. [1]

.....

(ii) Choose from the box the catalyst used in the reaction. State the purpose of a catalyst. [2]

Catalyst .....

Purpose .....

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7

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4. *(a)* The table below shows information about three substances. Complete the table. [3]

Common name	Chemical name	Chemical formula
.....	calcium carbonate	$CaCO_3$
quicklime	calcium oxide	.....
slaked lime	.....	$Ca(OH)_2$

(b) A group of pupils investigated the composition of egg shells. They suspected that egg shells contain calcium carbonate. They carried out the following tests.

(i) Flame test

Choose from the box below the colour you would expect to see if egg shells contain calcium ions. [1]

brick-red	**lilac**	**yellow**	**green**	**white**

Colour .....

(ii) Test for carbonate ions by adding dilute hydrochloric acid

Name the gas formed if egg shells contain carbonate ions. Describe the test you would carry out to identify this gas. Include the result for your test. [2]

Gas .....

Test and result .....

.....

(iii) The pupils were told that 2.0 g of egg shells contain 1.9 g of calcium carbonate. Calculate the percentage of calcium carbonate in these egg shells. [2]

Percentage = ... %

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(c) The box below shows some of the concerns a local conservation group have about the opening of a new limestone quarry in their area.

Concerns
Noise pollution from blasting
Unsightly quarry pits
Dust pollution from rock blasting
Noise and dust pollution from lorries
Habitat destruction

The quarry owner suggests that planting trees around the quarry will reduce the impact of noise pollution. Suggest **two** other things the quarry owner could do to reduce the impact of the quarry on the local environment. [2]

.....

.....

.....

(d) Suggest **two** advantages of limestone quarrying. [2]

Advantage 1 .....

Advantage 2 .....

12

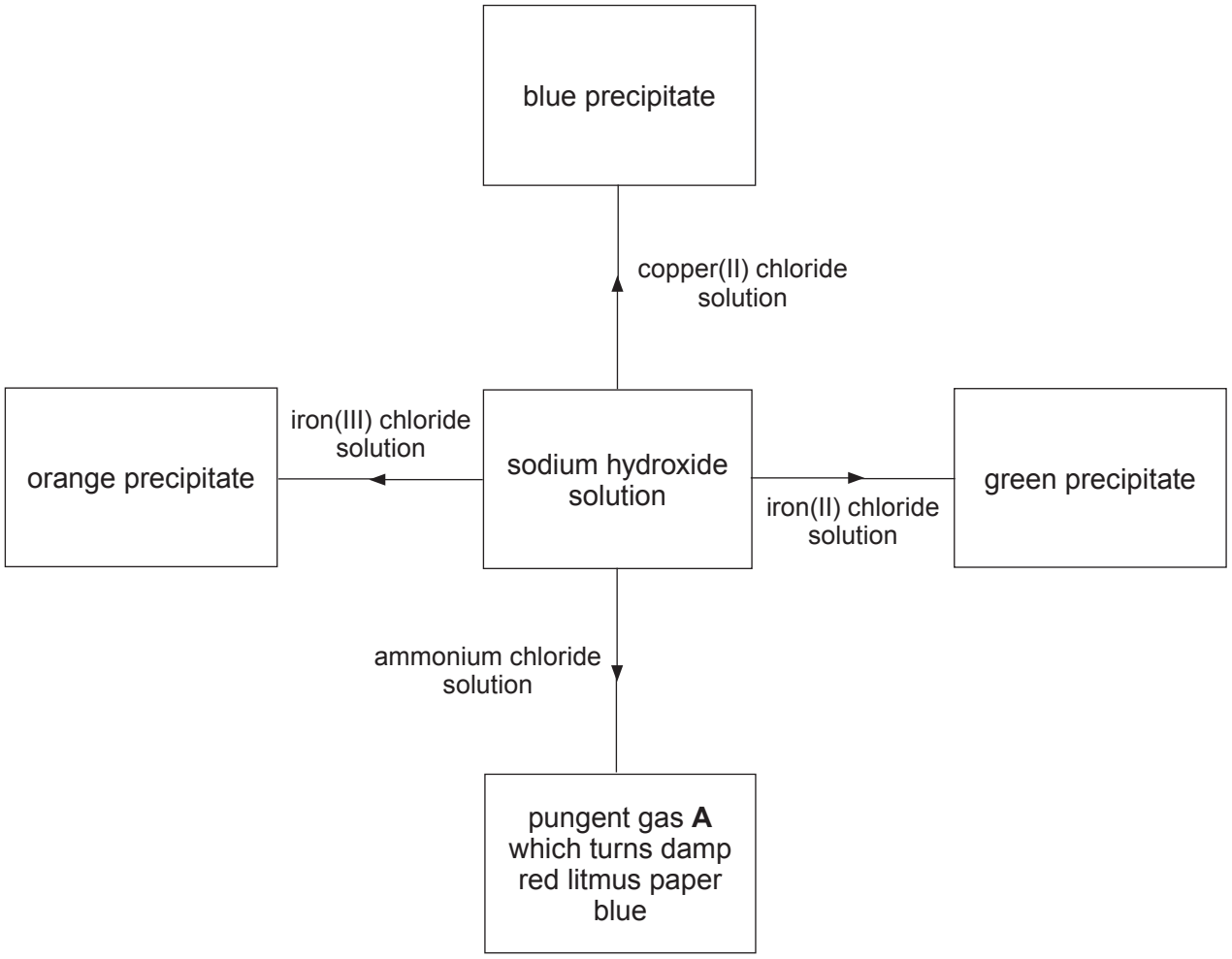
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5. *(a)* A Year 11 pupil added sodium hydroxide to solutions of four compounds. The observations made by the pupil are shown below.



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

.....

(ii) Give the chemical name of the blue precipitate formed. [1]

.....

(iii) The green precipitate formed is iron(II) hydroxide. Give the chemical formula for this compound. [1]

.....

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(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

(i) Universal indicator turns red in sulfuric acid and orange in ethanoic acid. State what these results tell you about the **relative** strength of these acids. [1]

.....

(ii) Both acids react with magnesium ribbon forming hydrogen gas.

I. State how the reactions would differ. [1]

.....

II. Give the test you would carry out to identify hydrogen. Include the result of your test. [1]

.....

.....

6

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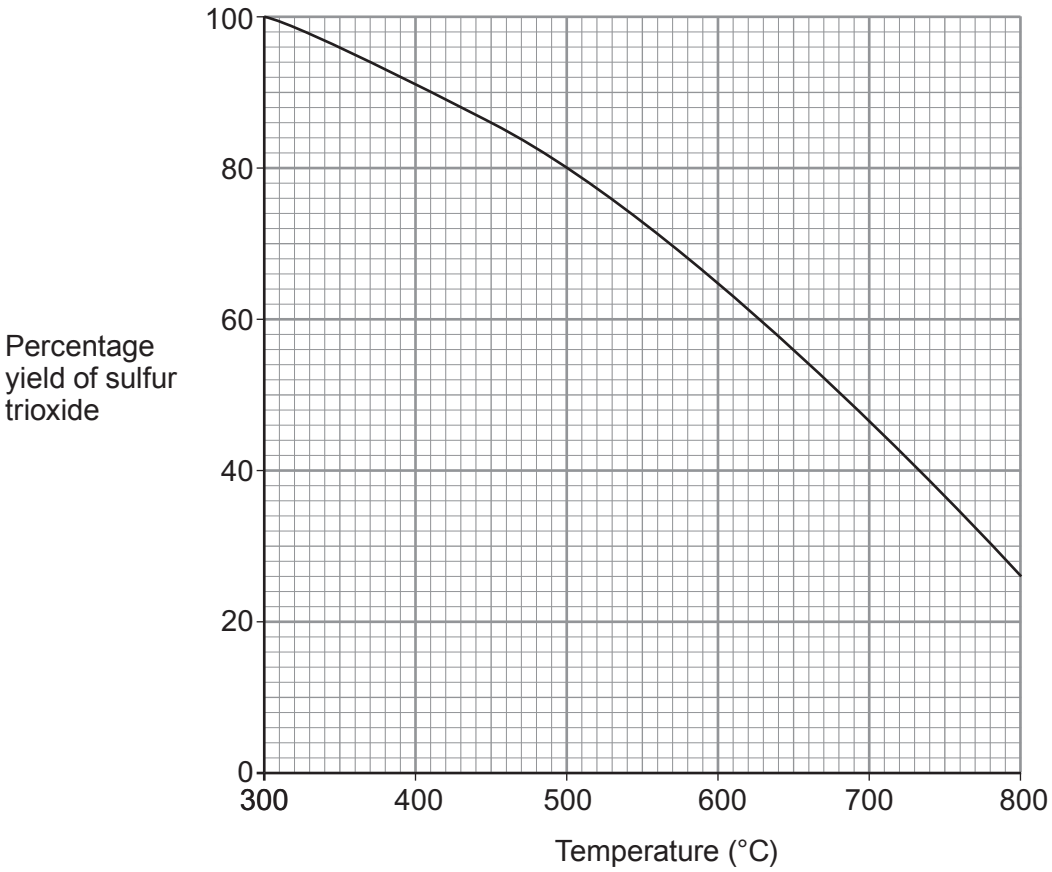
Examiner only

6. *(a)* One of the main stages in the manufacture of sulfuric acid is the reaction between sulfur dioxide and oxygen to form sulfur trioxide.

(i) Write the balanced **symbol** equation which represents this reaction. [3]

..... + ... ⇌ .....

(ii) The graph below shows how the percentage yield of sulfur trioxide changes with temperature between 300 °C and 800 °C.



Use the graph to find the increase in percentage yield if the temperature is reduced from 650 °C to 450 °C. [2]

Increase in percentage yield = ... %

(iii) One molecule of sulfur trioxide reacts with one molecule of sulfuric acid to form one molecule of oleum as the **only** product.

Write a balanced **symbol** equation for this reaction. [2]

..... + ... ⟶ .....

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(b) State what you would observe when a few drops of concentrated sulfuric acid are added to a beaker containing a small amount of sugar. Name the product left in the beaker. [3]

.....

.....

.....

.....

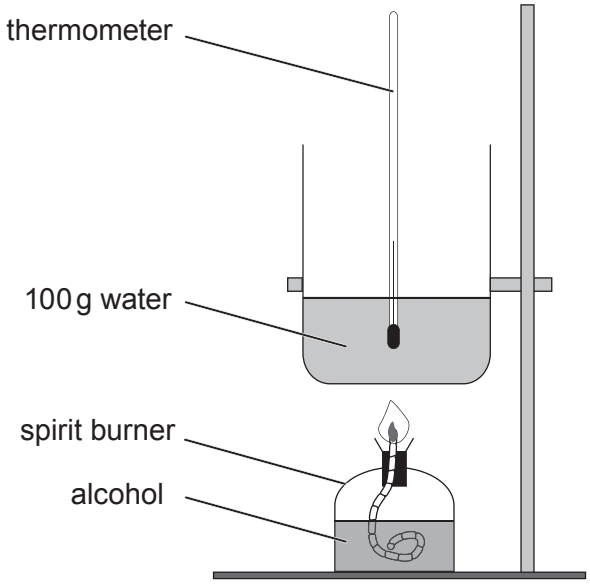
10

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7. Methanol, ethanol, propanol and butanol belong to the alcohol family.

An experiment was carried out to discover which alcohol gives out the most energy when burned. The diagram below shows the apparatus used.



1 g of each alcohol was used to heat 100 g of water. The results are shown below.

Alcohol	Initial temperature of water (°C)	Final temperature of water (°C)	Temperature change (°C)	Energy given out (J / g)
methanol	18	31	13	5 460
ethanol	20	45	25	10 500
propanol	19	48	29	12 180
butanol	20	50	30	

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(a) The energy given out by each alcohol can be calculated using the formula:

energy given out = mass of water × 4.2 × temperature change

Calculate the energy given out in burning 1 g of butanol. [2]

Energy given out = ... J / g

(b) Apart from using 1 g of each alcohol and 100 g of water, give **one** other step that should be taken to ensure a fair test. [1]

.....

(c) The theoretical values for the energy given out by each alcohol are given in the table below.

Alcohol	Theoretical value for energy given out (J / g)
methanol	22 700
ethanol	29 700
propanol	33 600
butanol	36 100

Compare the experimental and theoretical values and give the **main** reason for the difference between them. [3]

.....

.....

.....

.....

(d) Some people are opposed to the large-scale use of bioethanol as a fuel. Describe briefly why someone could take this view. [2]

.....

.....

.....

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Turn over.

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8. Describe the benefits of the use of nitrogenous fertilisers and the problems that arise when they are washed into rivers. [6 QWC]

.....

.....

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6

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^{+}	Sulfate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		
Zinc	Zn^{2+}		

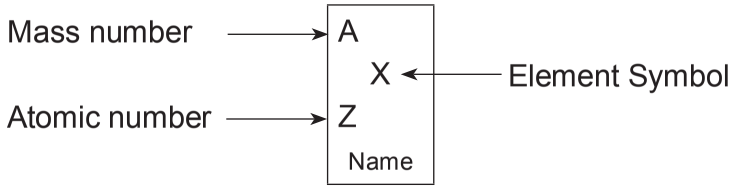
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PERIODIC TABLE OF ELEMENTS

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 Sulfur	$^{35}_{17}$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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(4493-01)

GCSE MARKING SCHEME

SCIENCE - CHEMISTRY

SUMMER 2015

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2015 examination in GCSE SCIENCE - CHEMISTRY. 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.

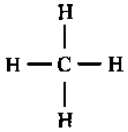
WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

	Page
C1	1
C2	17
C3	32

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
1		(a)			3	three factors – air/oxygen, fuel and heat all three for (2) any two for (1) remove any one to put out fire (1)			
		(b)			2	Method 1: removes air/oxygen (1) Method 2: removes fuel (1)			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
2		(a)	(i)		2	 (1) C_2H_6 (1)			
			(ii)		1	C_8H_{18}			
		(b)	(i)		1	ethanol		alcohol	
			(ii)		1	**C**			
			(iii)		1	wine / beer / alcoholic drinks fuels / biofuels solvents antibacterial gels perfumes / aftershaves any one for (1)		alcohol / drinking / drinks / medicine / cleaning	

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
3		(a)	(i)		2	number of nitrogen atoms **2** number of hydrogen atoms **6** **both** needed for (1) equal / same number (of these atoms) on right hand side (1)			
			(ii)		1	gas / gaseous			
		(b)	(i)	I	1	cooling			
				II	1	recycling			
			(ii)		2	iron (1) speeds up reaction (1)			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
4		(a)			3	limestone / chalk / marble (1) CaO (1) calcium hydroxide (1)			
		(b)	(i)		1	brick-red	red		
			(ii)		2	carbon dioxide / CO_2 (1) must have correct gas to award test mark turns limewater milky (1)			
			(iii)		2	1.9/2.0 (1) 95 (1) award (2) for correct answer only (cao)			
		(c)			2	landscaping during /after quarry to remove visual pollution restrict quarry size to reduce visual pollution trains instead of lorries blast at agreed times spray lorry wheels with water to reduce dust remove endangered species to safe site any two for (1) each	other sensible	reference to economic benefits	
		(d)			2	local jobs money into local economy limestone for building / named buildings e.g. houses, walls, etc. local industries / named industry e.g. for making cement/iron building better local road system any two for (1) each	other sensible		

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Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
5		(a)	(i)		1	ammonia	NH_3		
			(ii)		1	copper(II) hydroxide	copper hydroxide $Cu(OH)_2$		
			(iii)		1	$Fe(OH)_2$			
		(b)	(i)		1	sulfuric acid is stronger / more acidic (than ethanoic acid) ethanoic acid is weaker / less acidic (than sulfuric acid)	sulfuric acid is strong and ethanoic acid is weak	pH of sulfuric acid is 1 and pH of ethanoic acid is 3	
			(ii)	I	1	reaction with sulfuric acid would be faster more reactive / more bubbles / gets hotter with sulfuric acid	converse answers		
				II	1	(gas) pops with **lighted** splint			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
6	1	(a)	(i)		3	SO_2 O_2 (1) SO_3 (1) formulae must be correct to get balancing mark 2, 1, 2 (1)			
			(ii)		2	30 (2) if incorrect answer credit (1) for two correct readings from graph i.e. 86 and 56			
			(iii)		2	H_2SO_4 (1) [no mark for SO_3] $H_2S_2O_7$ (1)			
		(b)			3	black mass forms / black solid forms / sugar turns black (1) steam / water vapour / hissing (1) smell (1) any two for (1) each carbon (1)		temperature rise / water formed / bubbles / fizzing	

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Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
7	2	(a)			2	100 × 4.2 × 30 (1) 12600 (1) award (2) for cao			
		(b)			1	same height between flame and can same can/same wick/ same spirit burner same stirring (or not) not using a lid for all alcohols changing the water each time / using cold water each time any one for (1)		same room temperature / conditions	
		(c)			3	theoretical values greater (than experimental values) (1) both values increase down alcohol group (1) loss of heat to the surroundings / can (1)	rank order the same		
		(d)			2	two linked points required e.g. biofuels have a lower energy output than traditional fuels (1) and therefore require greater quantities to be consumed (in order to produce the same amount of energy) (1) credit sensible alternatives uses land that would otherwise be used to grow food crops (1) leading to food shortage/price increase (1) growth requires large amounts of water (1) which is therefore not available for other uses (1)			

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Question Number			
FT	HT	Mark	Answer
8	3	6	**Indicative content** **Benefits e.g.** increase crop yield, more food, healthier plants, improves quality of soil, cheaper food and releases land for other purposes. **Problems e.g.** increased soil acidity (which needs neutralising using lime), pollutes water supplies/ nitrates in drinking water (possible health problems), overgrowth of plants in canals (which requires unblocking) and 'eutrophication' or full description – (algae over growth, bloom formation, sunlight blocked, plants die, bacteria removes oxygen during decomposition, water de-oxygenated and water becomes lifeless) **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.

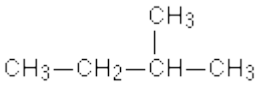
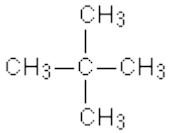
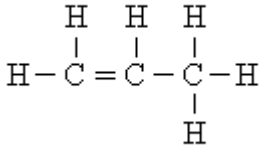
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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	4				6	three **different** methods needed award max (2) for each method use water (1) remove heat (1) 'beat' (1) remove air/oxygen (1) bulldoze/back burn / backfire / making a firebreak (1) remove fuel (1) method must be correct for second mark to be awarded			CO_2 extinguisher / fire blanket as a method of removing oxygen in this context

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Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	Sub-section							
	5	(a)	(i)		1	C_8H_{18}			
			(ii)		2	 (1)  (1)			
		(b)	(i)		1	C_nH_{2n}			
			(ii)		1				
		(c)			1	**B** contains C=C peak both needed for (1)			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	6	(a)	(i)		1	1000 atmospheres 100 ^{o}C both needed for (1)			
			(ii)		2	low rate/ slow reaction (1) (iron) catalyst (1)	decreased rate		incorrectly named catalyst e.g. V_2O_5
			(iii)		1	cost of container/more expensive to build/thicker container walls/ cost of getting to high pressure		‘cost’	
		(b)	(i)		1	exothermic			
			(ii)		1	4 $\longrightarrow$ 4			
			(iii)		2	$CuCO_3 + 2HNO_3 \longrightarrow Cu(NO_3)_2 + H_2O + CO_2$ formulae correct (1) balancing (1) formulae must be correct for balancing mark to be awarded			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	7	(a)			4	**A** sodium iodide **B** ammonium carbonate **C** calcium chloride **D** iron**(II)** carbonate mark positive and negative ions independently 8 ions correct = 4 marks 6/7 ions correct = 3 marks 4/5 ions correct = 2 marks 2/3 ions correct = 1 mark	NaI $(NH_4)_2CO_3$ $CaCl_2$ $FeCO_3$ no credit for either ion if incorrect formula given **instead** of name – ignore formulae if names also given		
		(b)			1	barium chloride (solution forms a) white precipitate test **and** result needed	barium nitrate / $Ba^{2+}(aq)$		

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	8	(a)			2	moles =conc × vol/1000 = $\frac{0.1 \times 17.5}{1000}$ (1) = 0.00175 (1) award (2) for cao			
		(b)			1	176			
		(c)			2	ecf possible from parts (a) and (b) mass = moles × M_r = 0.00175 ×176 (1) 0.308 g /308 mg (correct unit required) therefore statement incorrect (1)	alternative method using given 300 mg mass		

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Question Number			
FT	HT	Mark	Answer
	9	6	**Indicative content** appropriate apparatus required, measured amount of alkali (or acid) in conical flask, add indicator *e.g. phenolphthalein,* add acid (alkali), drop-wise near end point/colour change, record volume of acid (alkali) added, repeat without indicator adding recorded volume of acid (alkali), boil off some of the water, leave solution to evaporate, dry crystals obtained *Credit awarded for sequenced labelled diagrams as part of the response.* **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4493/01

CHEMISTRY

CHEMISTRY 3
FOUNDATION TIER

A.M. THURSDAY, 15 May 2014

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**5**	
3.	**6**	
4.	**4**	
5.	**10**	
6.	**6**	
7.	**10**	
8.	**8**	
9.	**6**	
Total	**60**	

4493
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.

Assessment will take into account the quality of written communication (QWC) used in your answer to question **9**.

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 fire triangle is shown below.



(a) Describe what the fire triangle shows. [1]

.....

.....

(b) Use your understanding of the fire triangle to state how each of the following fire-fighting methods work. [3]

Placing a heatproof mat over a beaker that contains burning ethanol

.....

Using water to put out a bonfire

.....

Cutting down trees to provide a fire break in a forest

.....

(c) A cook notices that a frying pan containing oil has caught fire. He decides to get a fire extinguisher to put the fire out. Choose from the following box the type of fire extinguisher that should **not** be used. [1]

carbon dioxide	**foam**	**powder**	**water**

Type of fire extinguisher **not** *to be used* .....

5

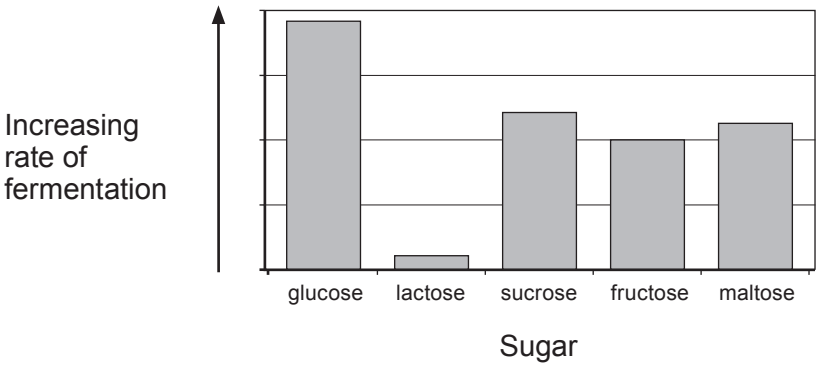
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2. Ethanol can be used as a fuel. It can be made by the fermentation of sugars using yeast.

The following graph shows the rate of fermentation using different sugars at 25 °C.



(a) Identify the best sugar for producing ethanol and give a reason for your choice. [1]

Best sugar .....

Reason .....

.....

(b) The following table contains some statements relating to the use of ethanol as a fuel.

It is a renewable resource
Large areas of land required to grow the crops
Produces less soot than petrol when burnt
Engines require modifications to run on ethanol
Produces less heat per litre than petrol
Produces only carbon dioxide and water when burnt

(i) In your opinion, should ethanol be used as a fuel? Give reasons to support your answer. [3]

Opinion (Yes/No) .....

Reasons .....

.....

.....

.....

(ii) Complete the **word** equation for the complete combustion of ethanol. [1]

ethanol + oxygen ⟶ ..... + ...

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3. *(a)* Draw a line from each gas below to the observation made in identifying it. [3]

Gas	Observation
	relights a glowing splint
carbon dioxide	turns flame red
ammonia	turns limewater milky
oxygen	pops with a burning splint
	turns damp red litmus blue

(b) The following box contains observations made when testing for some common metal ions.

lilac flame	**yellow flame**	**green flame**
blue precipitate	**brown precipitate**	**green precipitate**
	white precipitate	

Choose from the box the result you would expect for the following tests. [3]

A flame test is carried out on a sample of sodium chloride

.....

A flame test is carried out on a sample of copper(II) sulfate

.....

Sodium hydroxide solution is added to a solution of iron(III) chloride

.....

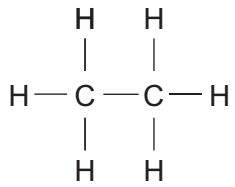
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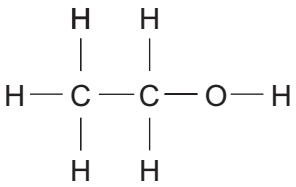
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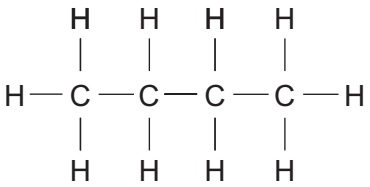
4. *(a)* The structural formulae of some organic compounds are shown below.



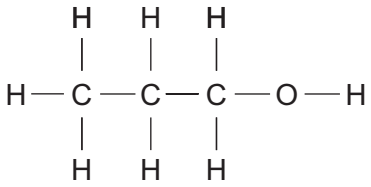
A



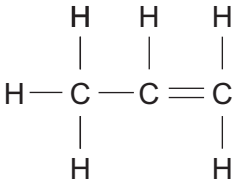
B



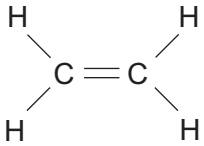
C



D



E



F

(i) Give the letters, **A**-**F**, of **two** alkanes and **two** alcohols. [2]

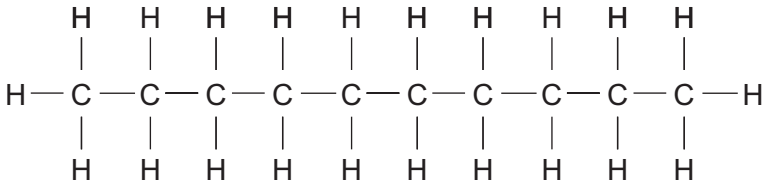
Alkanes ..... and .....

Alcohols ..... and .....

(ii) State which compound, **A**-**F**, has the molecular formula C_3H_6. [1]

.....

(b) Give the molecular formula of decane. [1]



.....

4

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5. *(a)* Sulfuric acid is produced by the contact process. The main stages in the process are shown below.

Stage 1: Burning sulfur in air to produce gas **A**

Stage 2: Passing gas **A** over a catalyst at 450 °C to produce gas **B**

Stage 3: Dissolving gas **B** in concentrated sulfuric acid to produce oleum

Stage 4: Diluting oleum to produce sulfuric acid

(i) Give the names of gases **A** and **B**. [2]

Gas **A** .....

Gas **B** .....

(ii) Which stage involves a reversible reaction? ..... [1]

(iii) Give a reason why gas **B** is not dissolved directly in water during stage 3. [1]

.....

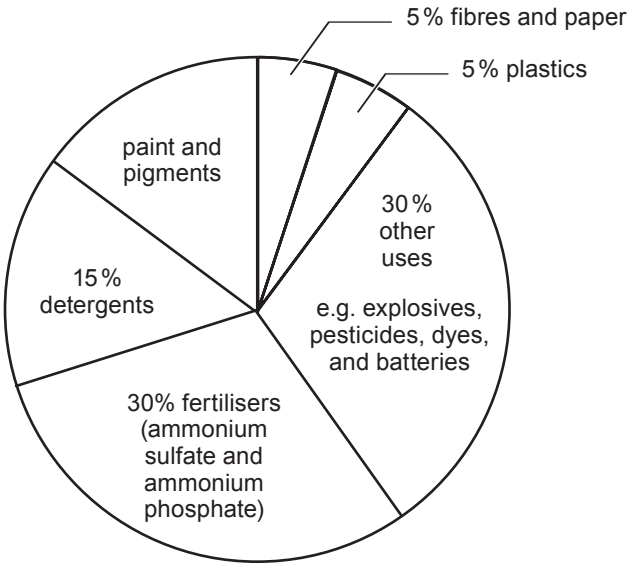
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(b) The following pie chart shows the uses of sulfuric acid.



(i) Calculate the percentage of sulfuric acid used for making paint and pigments. [2]

Percentage used for making paint and pigments = ... %

(ii) One important use of sulfuric acid is in the production of fertilisers. Complete the following **word** equation for the production of ammonium sulfate. [1]

sulfuric acid + ... ⟶ ammonium sulfate

(iii) This type of fertiliser can be washed into rivers. Explain why this is a cause for concern. [3]

.....

.....

.....

.....

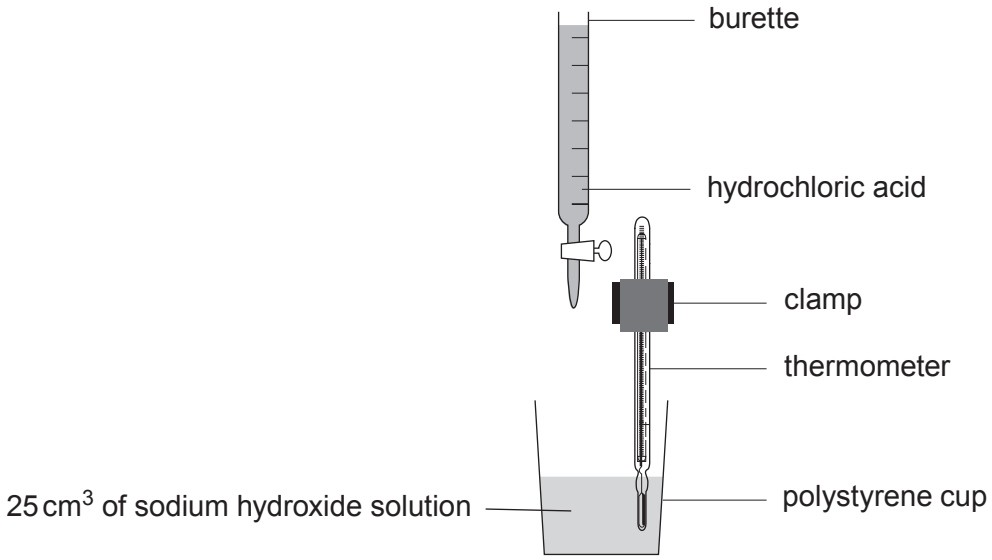
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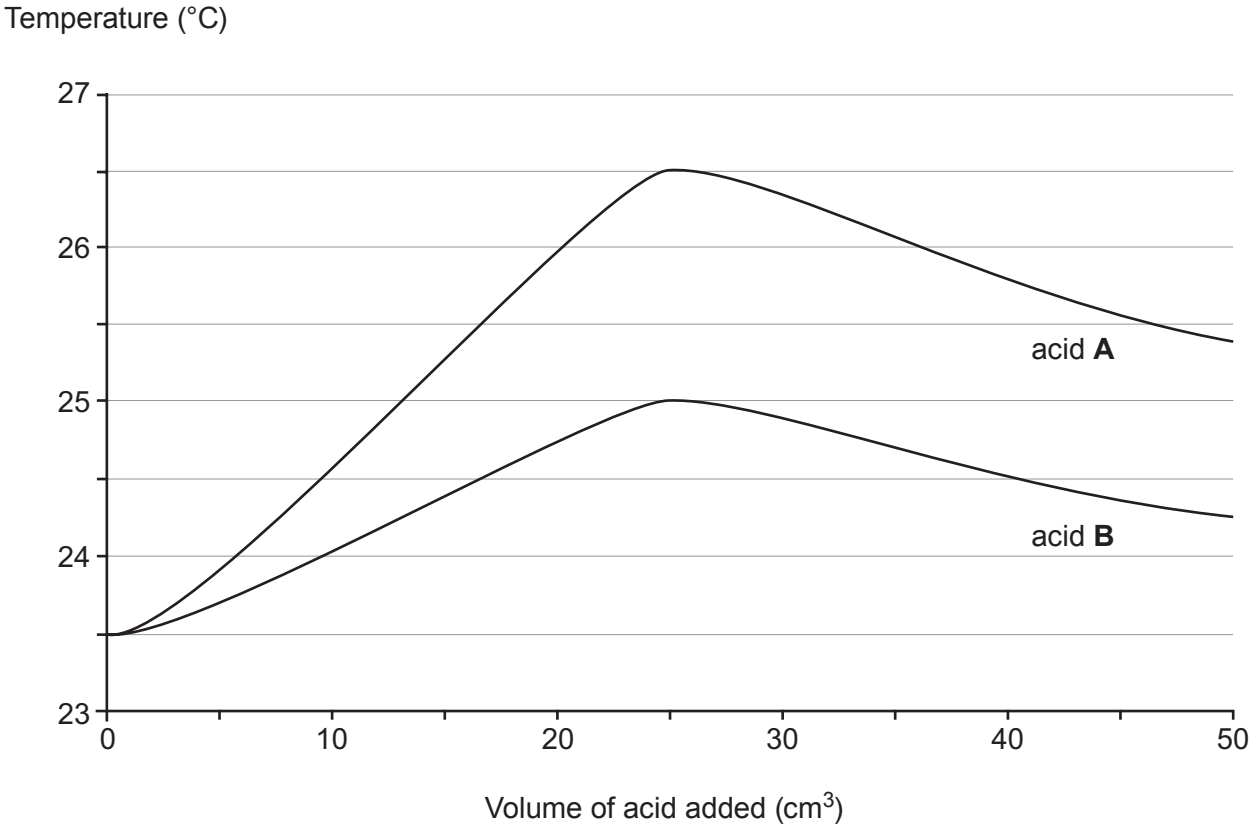
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6. The apparatus below can be used to measure the temperature as a neutralisation reaction takes place.



The graphs below show how the temperature changes when acids **A** and **B** are added separately to 25 cm^3 of sodium hydroxide solution.



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(a) Use the graphs opposite to find the

(i) volume of acid required to neutralise the sodium hydroxide solution in both experiments, [1]

.....

(ii) maximum temperature **rise** for acid **B**. [1]

.....

(b) State which acid, **A** or **B**, is stronger and give a reason for your answer. [1]

Stronger acid .....

Reason .....

.....

(c) Describe how an indicator could be used to find the exact volume of acid needed for neutralisation. [3]

.....

.....

.....

.....

6

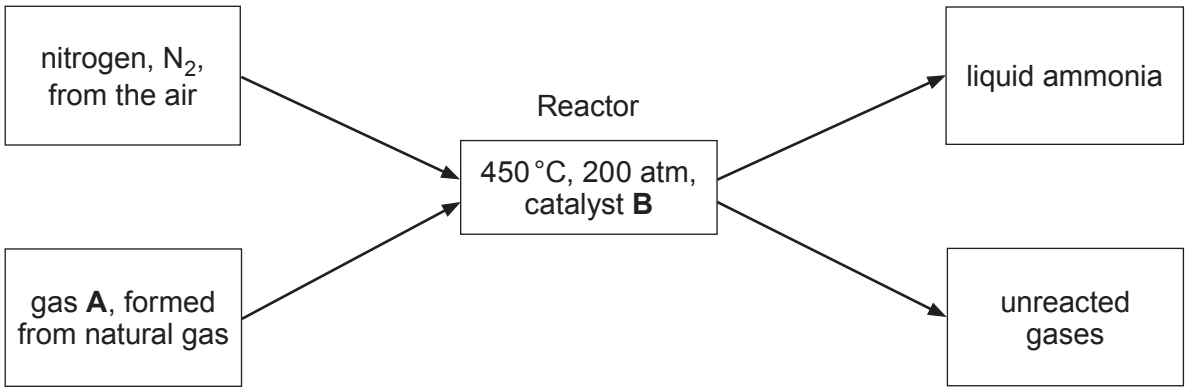
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7. Ammonia is produced during the Haber process. The reaction is summarised in the diagram below.



(a) Give the name of gas **A**. ..... [1]

(b) Name catalyst **B** and state why it is used. [2]

.....

.....

(c) The yield of ammonia is only 28 % therefore 72 % of the gases remain unreacted.

Describe what happens to these unreacted gases and state why this is important. [2]

.....

.....

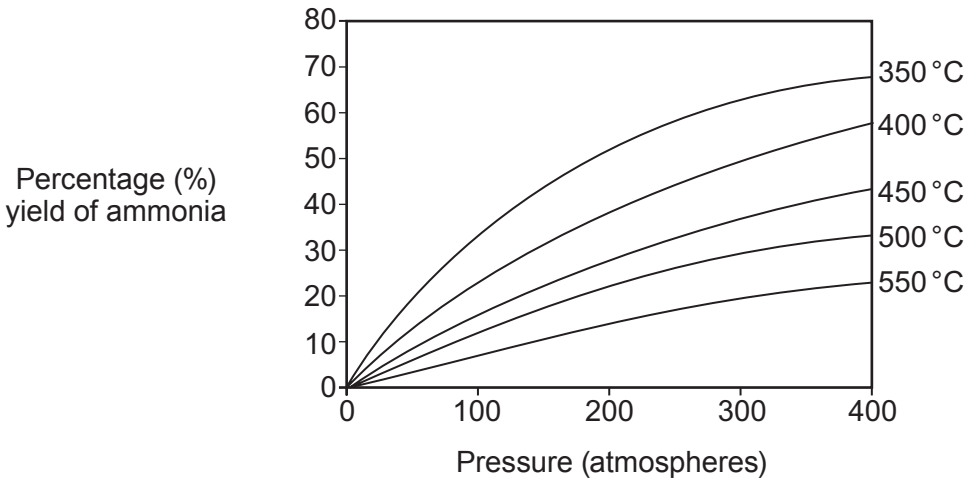
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(d) The following graph shows the effect of temperature and pressure on the yield of ammonia during the Haber process.



Describe how the yield of ammonia varies with temperature and pressure. [2]

Temperature

.....

.....

Pressure

.....

.....

(e) Write a balanced **symbol** equation for the production of ammonia. [3]

..... + ... ⇌ .....

10

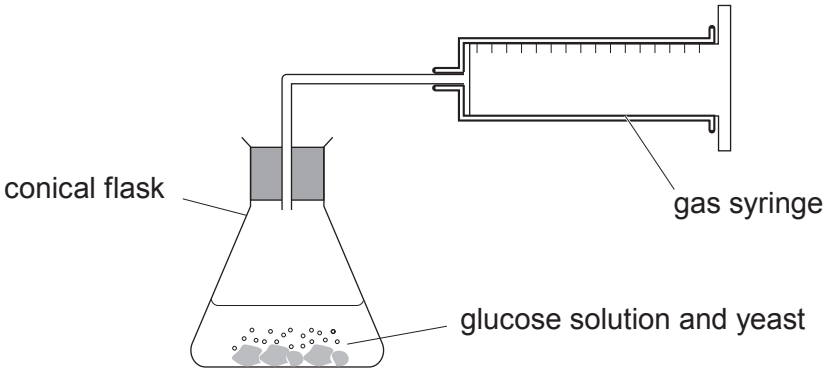
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8. A pupil investigated the effect of temperature on the rate of fermentation using the apparatus shown below.



The experiment was carried out three times at five different temperatures. The volume of gas collected after 10 minutes was recorded each time. The results are shown below.

Temperature (°C)	Volume of gas collected after 10 minutes (cm^3)			
	1	2	3	Mean
20	9	8	7	8
30	38	40	(32)	39
40	52	53	54	53
50	35	32	33	33
60	12	11	12	12

(a) Suggest why the circled value is considered to be anomalous. [1]

.....

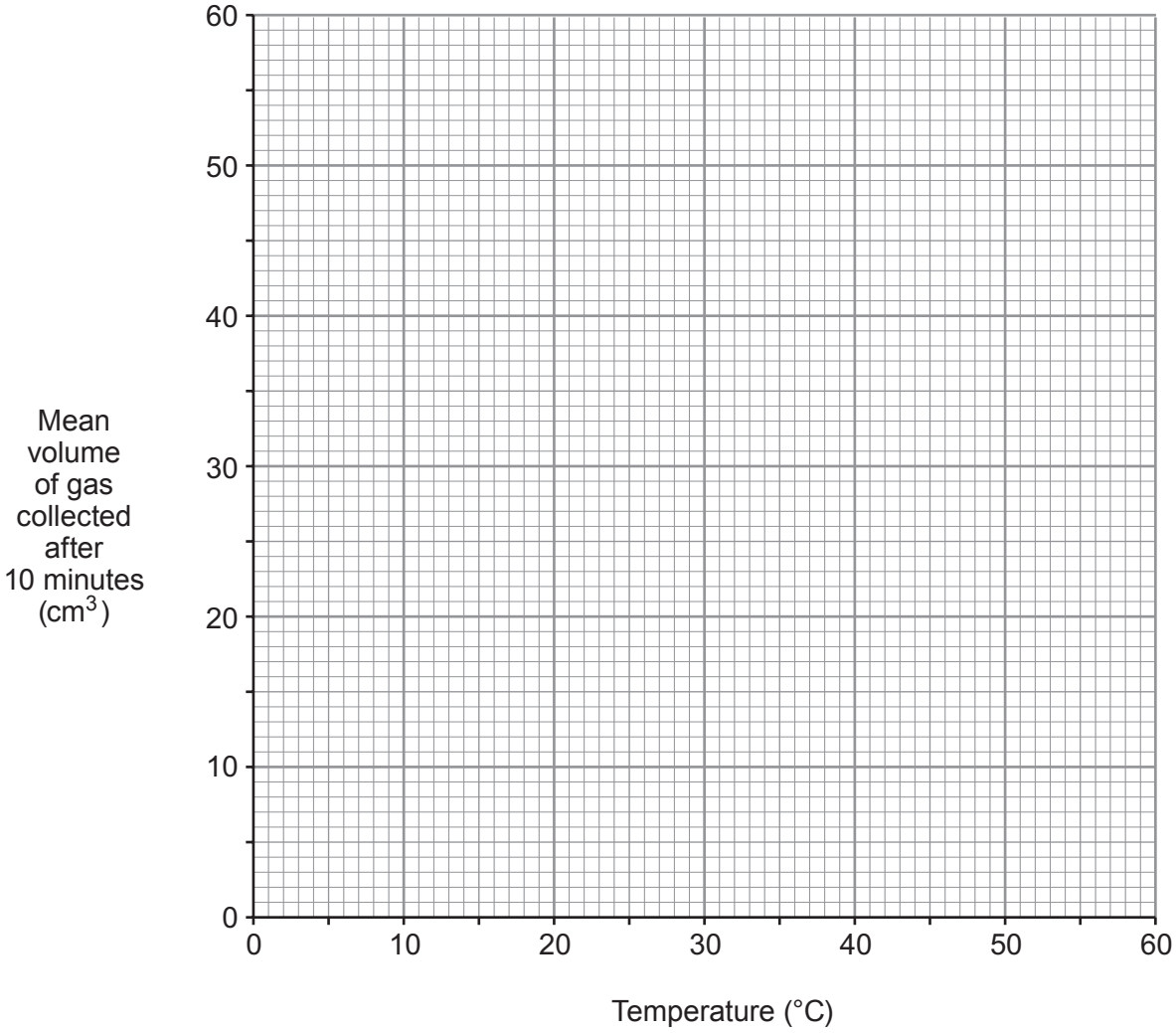
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(b) Plot a graph of the **mean** volume of gas collected against temperature on the grid opposite. [2]

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(c) State what conclusions can be drawn from the graph. [2]

.....

.....

.....

.....

(d) Write a **word** equation for the reaction taking place. [2]

..... ⟶ ..... + ...

(e) Yeast produces a catalyst that allows this reaction to take place. Name the **type** of catalyst produced by yeast. [1]

.....

8

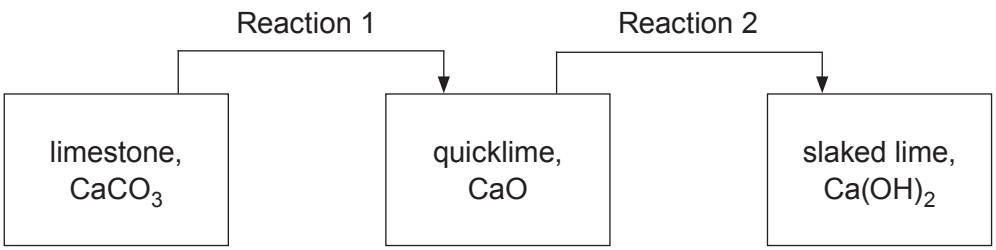
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9. Limestone, $CaCO_3$, is an important raw material. It can be converted into other useful materials as shown in the diagram below.



Describe how these reactions can be carried out in a laboratory.
Your answer should include:

- the conditions required for each reaction;
- observations at each stage;
- equations for the reactions taking place. [6 QWC]

6

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^{+}	Sulfate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		
Zinc	Zn^{2+}		

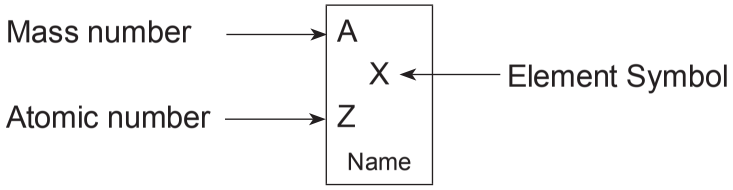
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PERIODIC TABLE OF ELEMENTS

1	2	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 Sulfur	$^{35}_{17}$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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(4493-01)

GCSE MARKING SCHEME

SCIENCE - CHEMISTRY

SUMMER 2014

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2014 examination in GCSE SCIENCE - CHEMISTRY. 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 – Foundation tier only questions

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
1		*(a)*			1	(three) factors needed for a fire to burn / fire goes out if any one factor is removed	heat, oxygen and fuel are needed		
		(b)			3	removes air / oxygen (1) removes heat (1) removes fuel (1)			
		(c)			1	water			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
2		*(a)*			1	glucose highest rate of fermentation / reacts faster (both needed)	better **rate** than the others	biggest bar	
		(b)	(i)		3	opinion needed, unless implied in answer Yes (1) per reason why ethanol should be used up to 3 max renewable / produces less soot / only produces carbon dioxide and water when burnt No (1) per reason why ethanol should not be used up to 3 max large areas of land required / engines require modification / less heat per litre credit possible for use of advantages and disadvantages for argument clearly showing that advantages outweigh disadvantages or vice versa – up to 3 max	no mark for opinion sensible reason not in table sensible reason not in table further qualification of a point credited additional mark e.g. large areas of land required to grow crops (1) therefore less available to grow food crops (1)		
			(ii)		1	carbon dioxide + water **both** needed	correct formulae for **both**		

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
3		*(a)*			3	carbon dioxide → turns limewater milky (1) ammonia → turns damp red litmus blue (1) oxygen → relights a glowing splint (1)			
		(b)			3	yellow flame (1) green flame (1) brown precipitate (1)			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
4		*(a)*	(i)		2	**A** and **C** - **both** needed (1) **B** and **D** - **both** needed (1)	correct formulae/names for **both** correct formulae/names for **both**		
			(ii)		1	**E**	propene		
		(b)			1	$C_{10}H_{22}$	$H_{22}C_{10}$		

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
5		*(a)*	(i)		2	sulfur dioxide (1) sulfur trioxide (1)	SO_2 SO_3		
			(ii)		1	2			
			(iii)		1	far too / very exothermic or acid forms mist / white fumes form or acid is difficult to collect		dangerous / explosive / reactive	
		(b)	(i)		2	5 + 5 + 30 + 30 + 15 (1) 15 (1) follow through error (ft) correct answer only (cao) (2)			
			(ii)		1	ammonia	NH_3		
			(iii)		3	overgrowth of algae (1) good description of eutrophication – up to (3) gets into water supplies (1) must be some linking of points in explanation for full marks to be awarded	 gets into water supplies and can lead to blue baby syndrome (2)	kills fish pollution	

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
6		*(a)*	(i)		1	$25cm^3 \pm 1cm^3$			
			(ii)		1	1.5 °C			
		(b)			1	acid **A** (no mark) temperature rise is greater / produces more heat – mark can **only** be awarded if **A** given			
		(c)			3	add acid slowly from burette (1) add indicator to sodium hydroxide solution / solution in cup (1) indicator changes colour (1)	indication of precision record volume required to change colour of indicator (2)		add indicator to acid/burette

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Chemistry 3 – Common questions

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
7	1	*(a)*			1	hydrogen	H_2	H	
		(b)			2	iron (1) speeds up the reaction / increases the rate of the reaction (1)			
		(c)			2	recycled / returned into reactor (1) basic qualification required e.g. reduces cost of process / less waste of raw materials (1)	fed back in re-used	more efficient / reacted again / more yield / saves time	
		(d)			2	lower yield with higher temperature (1) higher yield with a higher pressure (1)	vice versa		
		(e)			3	$N_2 + H_2$ (1) NH_3 (1) (1), 3, 2 (1) formulae must be correct to award balancing mark			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
8	2	*(a)*			1	significantly different/ long way out when compared to other two readings		not the same / 6 or 8 out etc.	
		(b)			2	all points plotted correctly (2) 4 points correct (1) curve not needed so ignore if drawn			
		(c)			2	volume / rate increases with temperature up to an optimum (1) then volume / rate goes back down (1)	up to maximum / up to 40 °C		
		(d)			2	glucose (1) ethanol + carbon dioxide (1)	$C_6H_{12}O_6$ $C_2H_5OH + CO_2$		+ yeast
		(e)			1	enzyme	zymase	biological	

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Question Number			
FT	HT	Mark	Answer
9	3	6 QWC	**Indicative content** • heat required to turn limestone into quicklime; water added to turn quicklime into slaked lime • limestone glows and becomes crumbly when heated; sizzling/ steam being released when water is added • thermal decomposition causes calcium carbonate to decompose forming carbon dioxide gas and calcium oxide; water reacts with calcium oxide to form calcium hydroxide • $CaCO_3 \rightarrow CaO + CO_2$; $CaO + H_2O \rightarrow Ca(OH)_2$ **5-6 marks**: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks**: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks**: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks**: The candidate does not make any attempt or give a relevant answer worthy of credit.

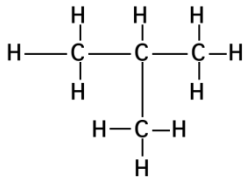
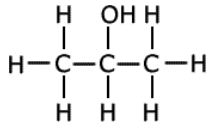
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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	4	*(a)*	(i)		1	air			
			(ii)		2	dissolve sulfur trioxide in concentrated sulfuric acid (1) dilute with water to produce concentrated sulfuric acid (1)		add to oleum	
			(iii)		1	vanadium pentoxide	V_2O_5		
		(b)			2	acid dehydrates the sugar removing the **elements of water / hydrogen and oxygen** (1) carbon remains (1)	 C		

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Question Number								
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	5	*(a)*			2	alcohols (1) alkenes (1)			
		(b)			2	add bromine water (1) stays brown/orange/no reaction with **C** and **E** turns from brown/orange to colourless (1)	add bromine		red
		(c)	(i)		1	same molecular formula but different structure	same type and number of atoms but arranged differently	same atoms	same compound
			(ii)		1				
		(d)			2	**D** (1)  (1)	ether isomer of **B** or **D**		

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Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	6	*(a)*	(i)		1	sodium chloride / sodium carbonate			
			(ii)		1	sodium carbonate / lithium carbonate			
		(b)			3	add silver nitrate solution (1) white **precipitate** with potassium chloride (1) yellow **precipitate** with potassium iodide (1) allow (1) for **both** colours correct if precipitate not used in either case	answer based on displacement reaction – bromine water; description of colour changes	add HNO_3 flame test	
		(c)			2	ammonia (1) turns (damp) red litmus blue (1)			
		(d)			3	$Fe^{3+} + 3OH^-$ (1) $Fe(OH)_3$ (1) correct state symbols (1)			

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Question Number								
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	7	*(a)*			2	number of moles = 0.05 (1) concentration = 0.2 (1) follow through error (ft) cao (2)			
		(b)			4	calculation of mean 22.5 cm^3 (1) 0.2×0.0225 (1) 0.0045 / 0.025 (1) 0.18 (1) follow through error (ft) cao (4)	mean of 22.65 cm^3		0.2 without workings

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Question Number			
FT	HT	Mark	Answer
	8	6 QWC	**Indicative content** • observations made when both acids react with metals, carbonates and bases e.g. temperature rise, liberation of gas, time to dissolve • difference in rate of reaction and explanation in terms of strong/weak acid • salts formed • word / chemical equations **5-6 marks**: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks**: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks**: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks**: The candidate does not make any attempt or give a relevant answer worthy of credit.

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Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4493/01

CHEMISTRY

CHEMISTRY 3
FOUNDATION TIER

P.M. MONDAY, 20 May 2013

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**8**	
3.	**7**	
4.	**7**	
5.	**5**	
6.	**4**	
7.	**8**	
8.	**6**	
9.	**4**	
10.	**6**	
Total	**60**	

4493 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.

Assessment will take into account the quality of written communication (QWC) used in your answer to question **10**.

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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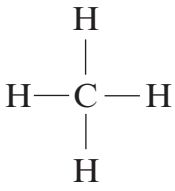
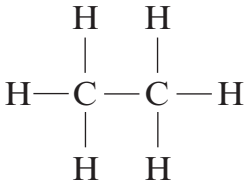
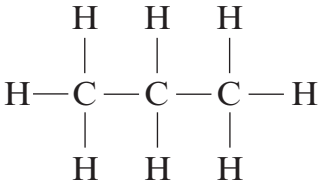
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Answer **all** *questions.*

1. *(a)* The table below shows the names, molecular formulae and structural formulae of some alkanes.

Complete the table. [3]

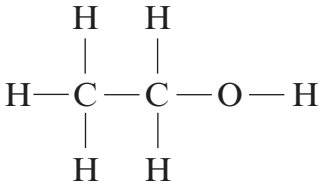
Name	Molecular formula	Structural formula
	CH_4	
ethane	C_2H_6	
propane		
butane	C_4H_{10}	

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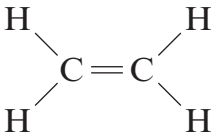
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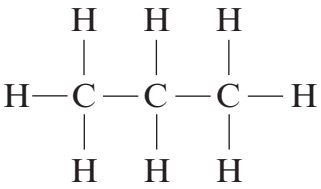
(b) The structural formulae of five carbon compounds are shown below.



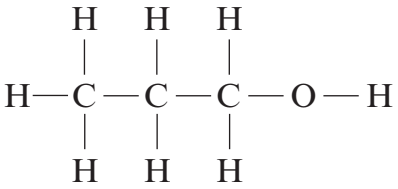
A



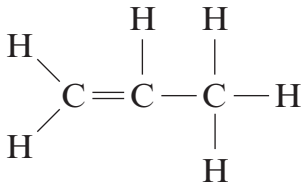
B



C



D



E

Give the letter **A-E** of the structure which shows

(i) ethanol, C_2H_5OH, ... [1]

(ii) propene, C_3H_6. ..... [1]

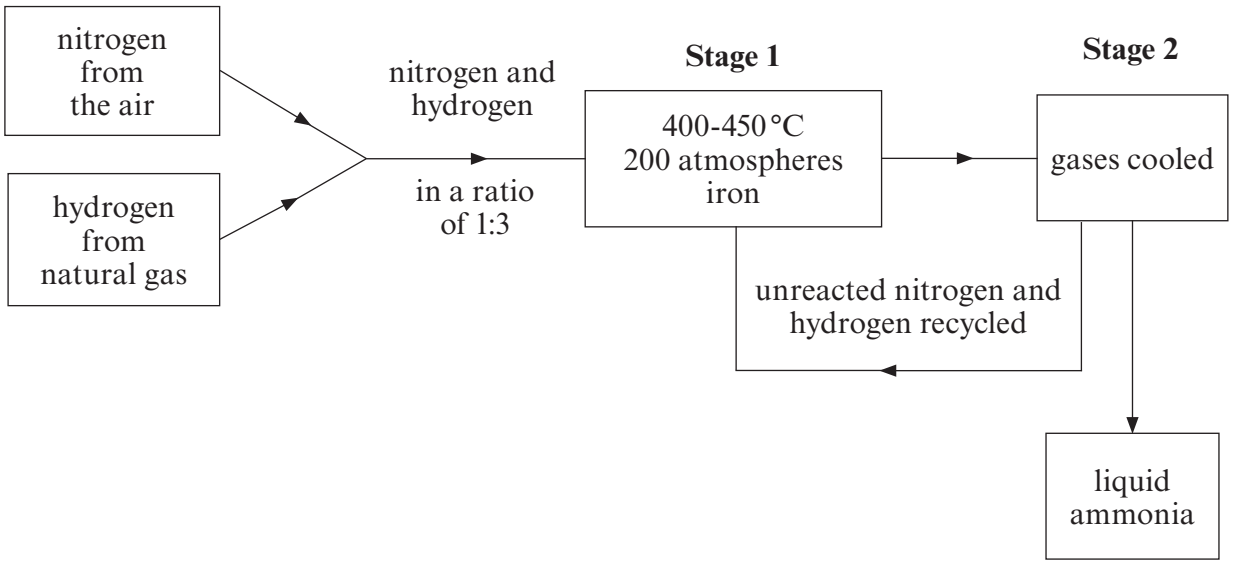
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2. *(a)* The flow diagram below outlines the manufacture of ammonia by the Haber process.



(i) Name the **two** *raw materials* used in the Haber process. [1]

..... and .....

(ii) Balance the **symbol** equation for the production of ammonia. [1]

$$N_2 + \square\ H_2 \rightleftharpoons \square\ NH_3$$

(iii) State why iron is added in **stage 1**. [1]

.....

(iv) Give the reason why gases are cooled in **stage 2**. [1]

.....

(v) Suggest a reason why recycling unreacted nitrogen and hydrogen saves money. [1]

.....

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(b) One of the main uses of ammonia is in the production of nitrogenous fertilisers.

ammonium chloride	**ammonium nitrate**
ammonium phosphate	**ammonium sulfate**

Choose from the box above the fertiliser which is made by reacting ammonia with nitric acid. [1]

.....

(c) The box below contains some statements relating to the use of nitrogenous fertilisers.

causes overgrowth of plants in canals	**increases crop yield**	**pollutes water supplies**
releases land for building houses	**increases soil acidity**	

Choose the **main** [2]

(i) benefit to farmers, ...

(ii) problem for farmers. .....

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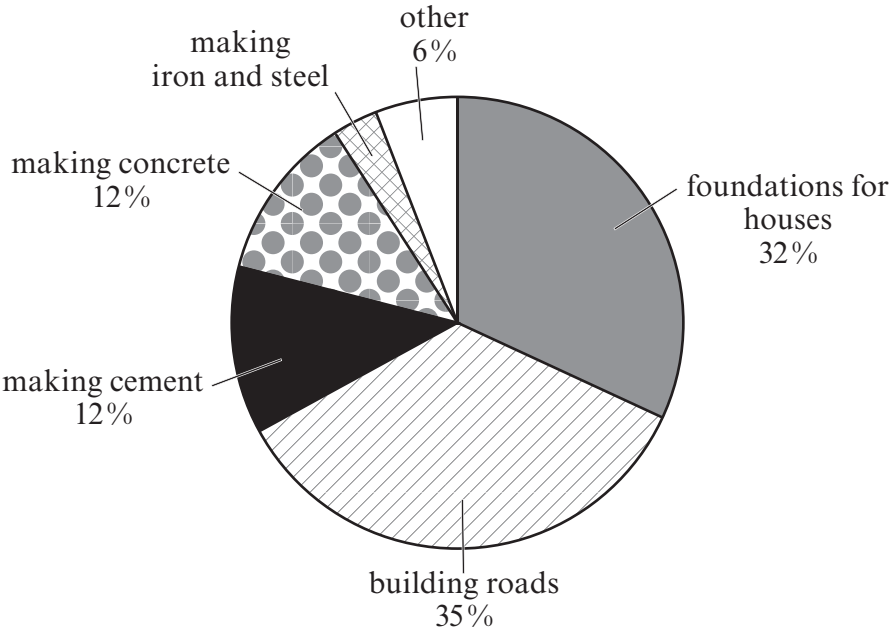
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3. Limestone is an important raw material.

(a) The pie chart below shows some uses of limestone in the construction industry.



Calculate the percentage of limestone used for making iron and steel. [2]

Percentage used for making iron and steel = ... %

(b) The photograph below shows a limestone quarry.



Give **two** environmental problems relating to limestone quarrying. [2]

Problem 1 .....

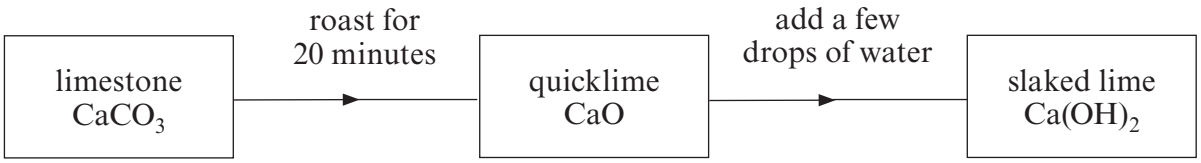
Problem 2 .....

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(c) Limestone, $CaCO_3$, is the raw material for the production of slaked lime, $Ca(OH)_2$. The flow diagram below shows the steps involved.



(i) Using the **chemical names** write a **word** equation for the production of slaked lime from quicklime. [1]

..... + ... ⟶ .....

(ii) The addition of water to quicklime is a very exothermic reaction. Describe what you **observe** during this reaction. [2]

.....

.....

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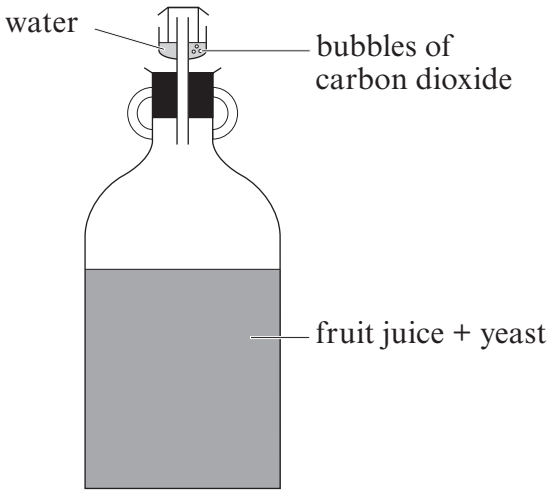
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Turn over.

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4. Home-made wine is made by adding yeast to fruit juice.



The equation below shows the reaction that occurs.

$$\underset{\text{glucose in fruit juice}}{C_6H_{12}O_6} \xrightarrow{\text{yeast}} \underset{\text{ethanol}}{2C_2H_5OH} + \underset{\text{carbon dioxide}}{2CO_2}$$

(a) Give the term for the process taking place when ethanol is formed from glucose. [1]

.....

(b) Yeast is needed for the process to occur. Give the reason why yeast is written above the arrow in the equation. [1]

.....

(c)

0 °C	**10 °C**	**30 °C**	**70 °C**	**100 °C**

Choose from the box above a suitable temperature for the process to occur.

..... °C

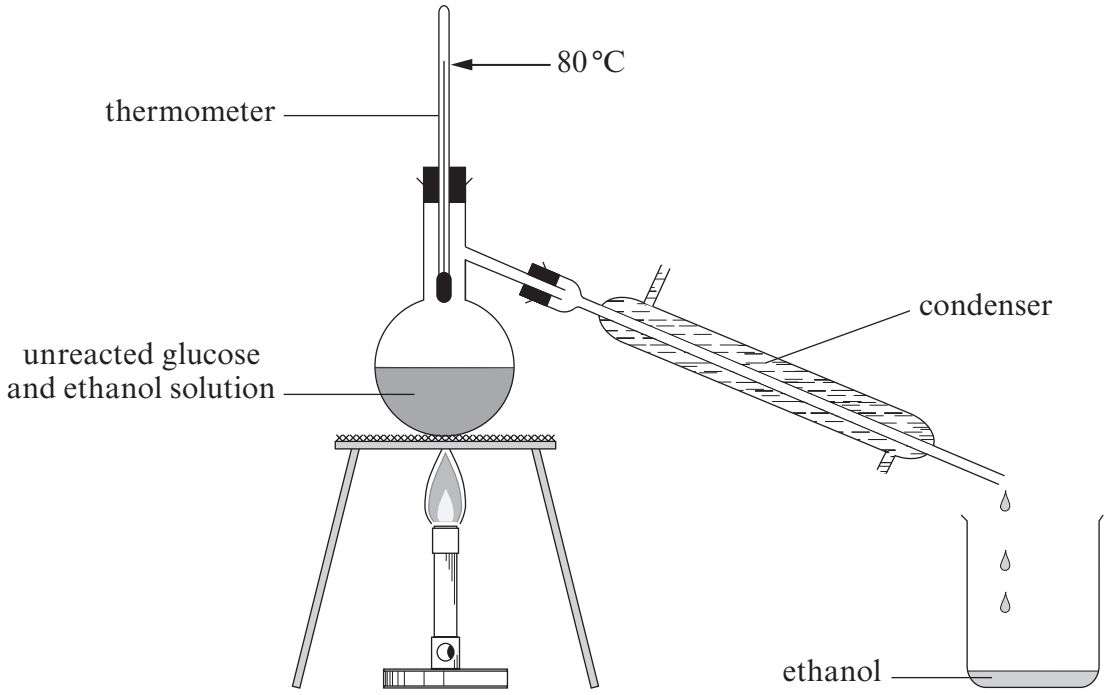
[1]

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(d) Once the reaction stops, the yeast can be removed by filtering to recover a mixture of unreacted glucose and ethanol. The apparatus below could be used to separate ethanol from the unreacted glucose in the solution.



(i) Give the name of the process which separates ethanol from the solution. [1]

.....

(ii) Explain how this process separates ethanol from the solution. [2]

.....

.....

.....

.....

(e) Give **one** anti-social behaviour caused by the excessive use of alcohol. [1]

.....

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5. Indigestion is caused by excess acid in the stomach. Antacid tablets contain mainly calcium carbonate. The calcium carbonate in an antacid tablet neutralises the excess acid. A group of pupils was asked to carry out an investigation to find

"Which brand of antacid tablet is the best?"

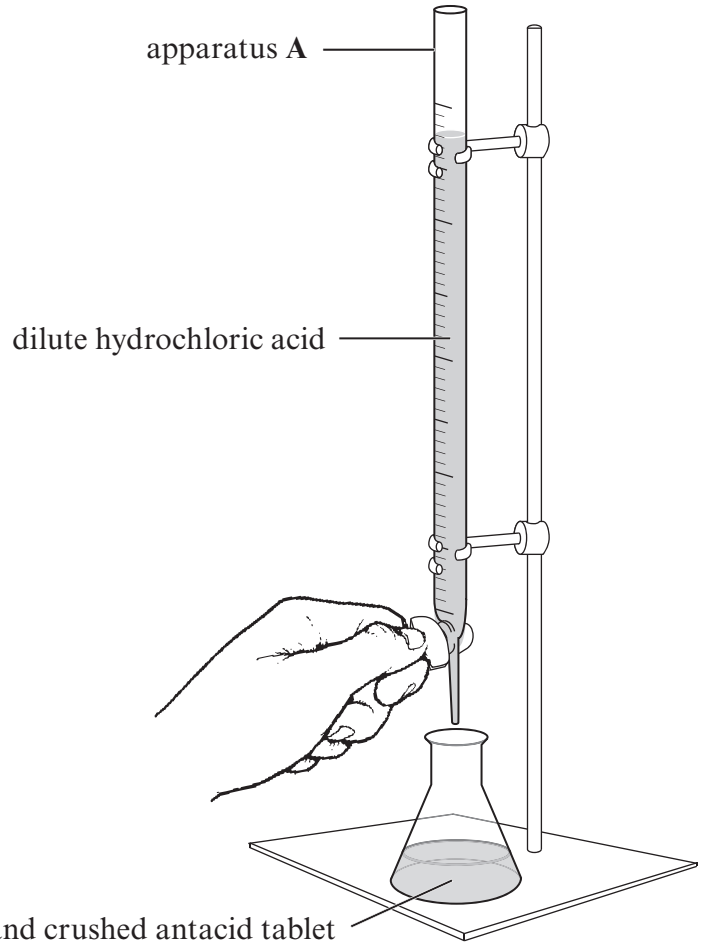
The group was provided with three different tablets, **A**, **B** and **C**, each of equal mass. The apparatus below was used to find out how much dilute hydrochloric acid was needed to react with all the calcium carbonate in each antacid tablet.

Tablet **A** was crushed and added to 50 cm^3 of water in a conical flask. Five drops of methyl orange were then added.

The mixture was titrated with dilute hydrochloric acid. The acid was added 0.5 cm^3 at a time until the methyl orange turned red.

The total volume of acid added was recorded.

This procedure was repeated using tablets **B** and **C**.



The results for each tablet are shown below.

	Tablet		
	A	**B**	**C**
Volume of acid needed to neutralise all the calcium carbonate in a single tablet (cm^3)	12.5	13.5	11.0

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(a)

burette	measuring cylinder	pipette	gas syringe	test tube

Choose from the box above the name of apparatus **A** in the diagram.

.....

[1]

(b) Give the name for substances, such as methyl orange, which have one colour in acids and a different colour in alkalis.

..... [1]

(c) State, giving a reason, how the results could be made more accurate. [2]

.....

.....

(d) State, giving a reason, which brand of indigestion tablet is the best. [1]

.....

.....

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6. *(a)* A Year 11 class investigated tests used to identify positive and negative ions. The results recorded by one pupil are shown below.

Put a **circle** around the **three** *incorrect* observations. [3]

Flame tests

Metal ion	Flame colour
Na^+	yellow
K^+	lilac
Cu^{2+}	brick-red

Adding sodium hydroxide to metal ions in solution

Metal ion solution	Colour of precipitate
Cu^{2+}	blue
Fe^{2+}	green
Fe^{3+}	white

Testing negative ions

Ion	Test	Observation
Cl^-	add dilute nitric acid followed by silver nitrate solution	yellow precipitate
CO_3^{2-}	add dilute hydrochloric acid	bubbles formed
SO_4^{2-}	add dilute hydrochloric acid followed by barium chloride solution	white precipitate

(b) Compounds containing ammonium ions, NH_4^+, are identified by adding sodium hydroxide solution, warming and testing the gas formed with damp red litmus paper. The damp red litmus paper turns blue.

The symbol equation below shows the reaction between ammonium chloride and sodium hydroxide solution.

$$NH_4Cl + NaOH \longrightarrow NaCl + H_2O + NH_3$$

Name the **three** products of the reaction. [1]

.....

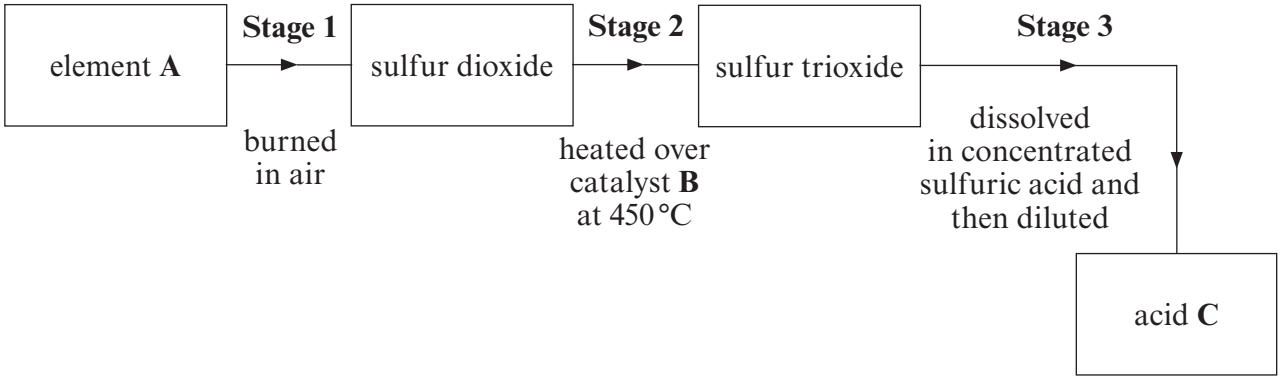
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7. *(a)* The flow diagram below shows the stages in the Contact Process.



(i) Give the name of

I element **A**, ... [1]

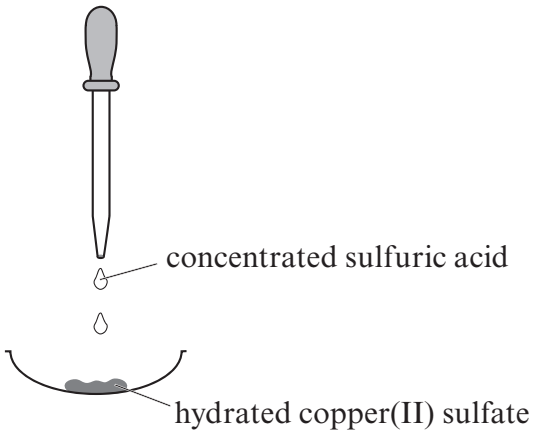
II catalyst **B**, ... [1]

III acid **C**. ..... [1]

(ii) Write a **balanced symbol** equation for the formation of sulfur trioxide, in **stage 2**. [3]

..... + ... ⇌ .....

(b) A few drops of concentrated sulfuric acid were added to some crystals of hydrated copper(II) sulfate, $CuSO_4.5H_2O$.



Describe **two** changes in the appearance of copper(II) sulfate as it is dehydrated. [2]

.....

.....

.....

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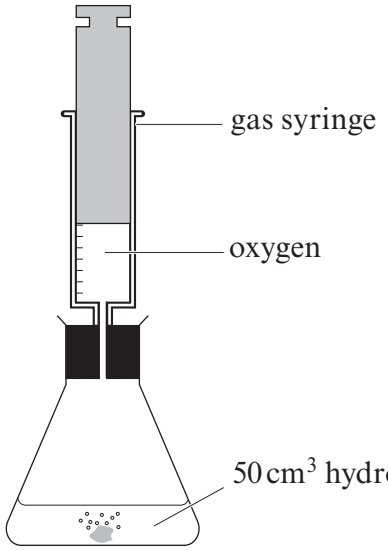
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8. Enzymes are catalysts produced by living cells. The enzyme catalase is found in both animal and plant cells. Catalase breaks down hydrogen peroxide into water and oxygen.

$$2H_2O_2 \longrightarrow 2H_2O + O_2$$

Some pupils were given samples of apple, carrot, potato and liver. They were asked to investigate the effect of these substances on hydrogen peroxide solution.

1 g of each substance was added separately to 50 cm^3 of hydrogen peroxide solution and the volume of oxygen formed was recorded every 10 seconds. The diagram below shows the apparatus used.



The table below shows the results recorded by the group.

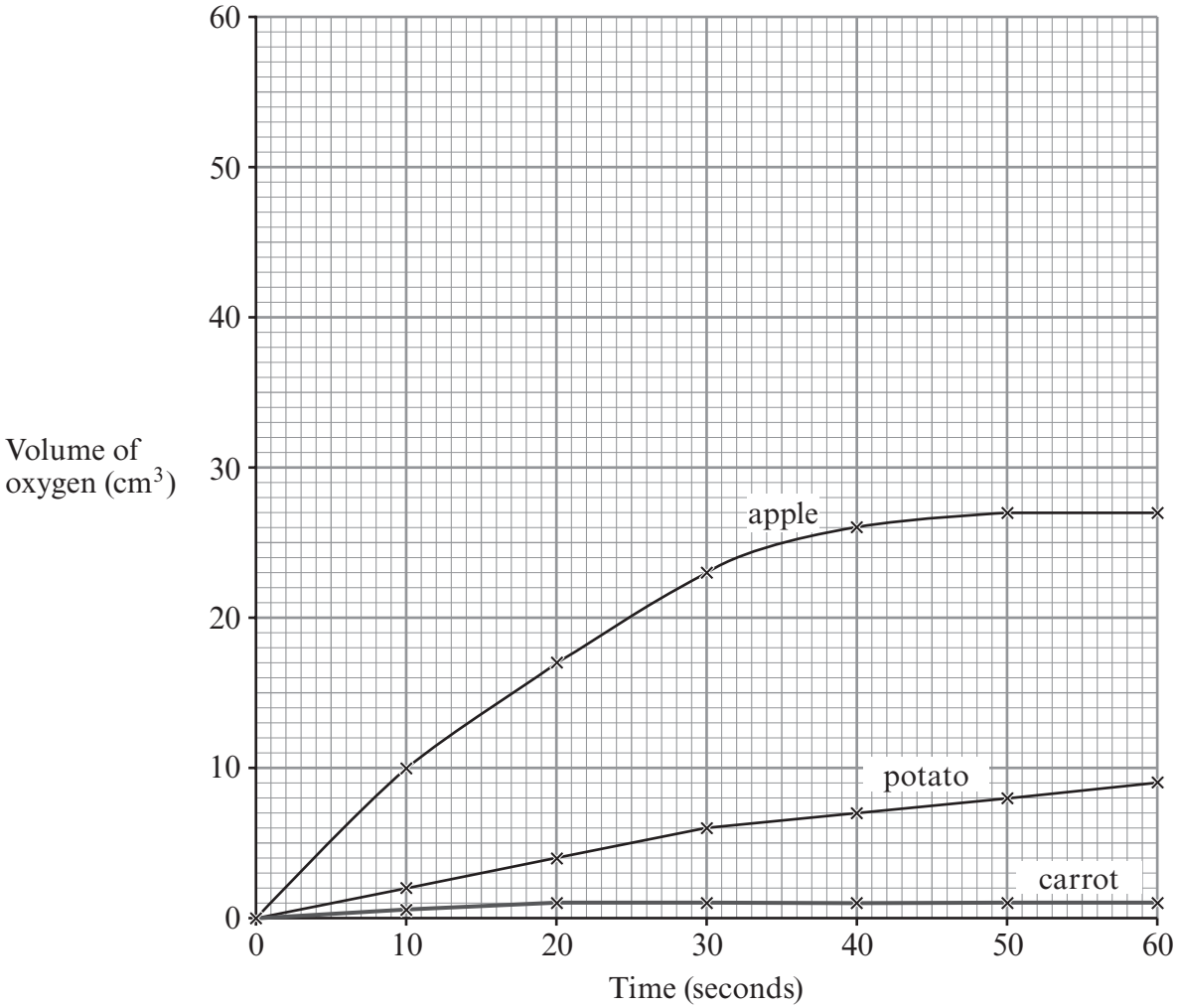
	Substance	Time (seconds)						
		0	10	20	30	40	50	60
Volume of oxygen formed (cm^3)	apple	0	10	17	23	26	27	27
	carrot	0	0.5	1	1	1	1	1
	potato	0	2	4	6	7	8	9
	liver	0	29	43	49	50	50	50

The results for the apple, carrot and potato have been plotted on the graph opposite.

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(a) Plot the results for liver on the grid and draw a suitable line. [3]

(b) Apart from using the same mass of each substance and the same volume of hydrogen peroxide solution, state **one** *other* way you would try to make the investigation a fair test. [1]

.....

(c) Assuming it is the presence of catalase that is responsible for the decomposition of hydrogen peroxide, give **one** conclusion that can be drawn from the results. [1]

.....

.....

(d) Describe the chemical test you would carry out to show that the gas formed is oxygen. [1]

.....

.....

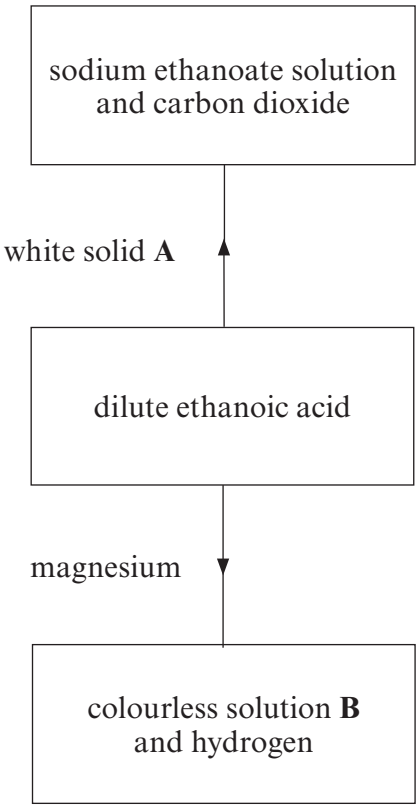
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9. *(a)* The flow diagram below shows some reactions of ethanoic acid, CH_3COOH.



(i) Name white solid **A**. ..... [1]

(ii) Name colourless solution **B**. ..... [1]

(b) Dilute ethanoic acid reacts with magnesium less vigorously than dilute sulfuric acid of equal concentration.

Give the reason for this difference in behaviour. [1]

.....

(c) Ethanoic acid is formed when an alcoholic drink such as wine is left exposed to the air. Give the name of the compound in wine which turns into ethanoic acid. [1]

.....

4

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10. Write an account of your understanding of the fire triangle and its use in fire fighting.

In your answer you should explain how the fire triangle gives rise to three different methods of fire fighting and give an example of each. [6 QWC]

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^{+}	Sulfate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		
Zinc	Zn^{2+}		

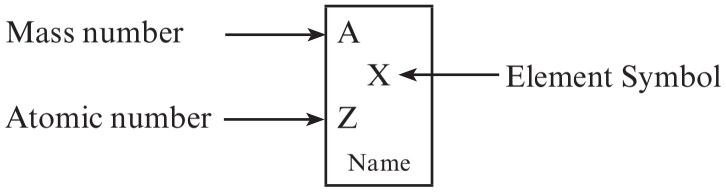
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PERIODIC TABLE OF ELEMENTS

1	2	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	$^{32}_{16}S$ Sulfur	$^{35}_{17}Cl$ 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

SUMMER 2013

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INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2013 examination in GCSE SCIENCE - CHEMISTRY. 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.

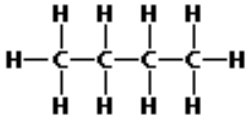
It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

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

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Unit C1	1
Unit C2	17
Unit C3	34

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
1		(a)			3	methane (1) C_3H_8 (1)  (1)			
		(b)	(i)		1	A			
			(ii)		1	E			

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Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
2		(a)	(i)		1	air and natural gas – both needed	methane		nitrogen and hydrogen
			(ii)		1	3 : 2			
			(iii)		1	catalyst / speeds up reaction / increases rate			
			(iv)		1	remove / separate / get ammonia (from the unreacted gases)		condenses ammonia / turns ammonia to liquid	
			(v)		1	re-use (unreacted nitrogen and hydrogen) not to waste (unreacted nitrogen and hydrogen) not having to make more nitrogen and hydrogen	conserves natural gas less energy needed		
		(b)			1	ammonium nitrate			
		(c)	(i)		1	increases crop yield			
			(ii)		1	increases soil acidity			

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Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	Sub-section							
3		(a)			2	32 + 35 + 12 + 12 + 6 = 97 (1) 100-97 = 3 (1) – correct answer only (cao) (2) – follow through error (ft)			
		(b)			2	dust noise / blasting (heavy) lorries / traffic destroys landscape / ruins landscape / unsightly destroys habitats / ruins habitats / destroys wildlife – any two for (1) each		pollution	
		(c)	(i)		1	calcium oxide + water → calcium hydroxide			reference to quicklime and/or slaked lime
			(ii)		2	steam / water boils quicklime crumbles / expands / 'puffs up' / breaks up hisses – any two for (1) each	fizzes	explodes heat released	

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Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
4		(a)			1	fermentation / fermenting			
		(b)			1	any one from: (yeast/it) doesn't change acts as a catalyst is not used up not a reactant		increases rate 'catalyst'	
		(c)			1	30			
		(d)	(i)		1	distillation			fractional distillation
			(ii)		2	ethanol's boiling point is lower (than that of water / glucose solution) ethanol boils at 80°C and water / glucose solution boils at any value between 100-110°C (1) ethanol distils over first / boils leaving the glucose solution behind / ethanol is collected first (1)		ethanol and glucose solution have *different* boiling points	
		(e)			1	any one from: drink driving / road accidents domestic violence aggressive behaviour argumentative behaviour		time wasted by emergency services / cost of emergency services being drunk	alcohol poisoning / death by choking on vomit / depression / liver disease

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
5		(a)			1	burette			
		(b)			1	indicator(s)			pH indicator universal indicator
		(c)			2	adding smaller volume of acid (at a time) / adding 0.1 cm^3 acid (at a time) / *accept any volume below 0.5 cm^3* (1) to obtain the exact end point value / to get the exact volume indicator turns red / changes colour to get the exact volume when complete neutralisation occurs (1) *answer must imply a 'better'/more accurate volume reading obtained*	adding drops (at a time)	repeat readings	
		(d)			1	B need the *most* acid – both needed		needs lot of acid / more acid	

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
6		(a)			3	brick-red (for Cu^{2+} flame test) (1) yellow precipitate (for Cl^- ion test) (1) white (precipitate for Fe^{3+} test) (1)			
		(b)			1	sodium chloride, water and ammonia – all needed			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
7	1	(a)	(i)	I	1	sulfur / S			
				II	1	vanadium(V) oxide / vanadium oxide / vanadium pentoxide / V_2O_5		VO	
				III	1	sulfuric acid / H_2SO_4	oleum	dilute / conc	
			(ii)		3	reactants: SO_2 + O_2 (1) product: SO_3 (1) balancing: 2(SO_2) 2(SO_3) (1) – reactants and product must be correct before balancing mark awarded			
		(b)			2	(blue hydrated copper(II) sulfate) turns white (1) (crystalline hydrated copper (II) sulfate) turns powdery / turns crumbly / loses its crystalline appearance (1)		changes colour	

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Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
8	2	(a)			3	all points plotted correctly (±½ square) (2) any five points plotted correctly (1) smooth continuous curve through all points – judgement by eye (1)			
		(b)			1	any one from: same surface area (of substances) same concentration (of peroxide solution) same temperature / all at room temperature			
		(c)			1	any one from: liver contains the most catalase / enzyme carrot contains the least catalase / enzyme any correct comparison in terms of catalase e.g. liver contains more catalase than apple / apple contains more catalase than potato / potato contains more catalase than carrot catalase present in all substances			
		(d)			1	re-lights a glowing splint – both needed			lighted splint burns brighter

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Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
9	3	(a)	(i)		1	sodium carbonate / Na_2CO_3	sodium hydrogencarbonate / $NaHCO_3$		
			(ii)		1	magnesium ethanoate / $(CH_3COO)_2Mg$			
		(b)			1	(ethanoic acid/it) is a weaker acid / has a higher pH (than that of sulfuric acid) ethanoic acid pH is 3/4 and sulfuric acid pH is 1/2 ethanoic acid has a lower H^+ ion concentration than sulfuric acid	less acidic	ethanoic acid pH is 3/4	
		(c)			1	ethanol / C_2H_5OH			

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Question Number			
FT	HT	Mark	Guidance

10	4	6	Indicative content:
			Reference to *principle* of fire triangle – fuel, heat and air (oxygen) are needed, removing any one factor will put fire out
			
			Types of fire fighting methods related to examples
			• heat removed by water e.g. house fires, bonfires
			• air removed:
			  ○ fire blanket e.g. chip pan fire, person on fire
			  ○ CO_2 / powder e.g. indoor fires, chemical fire, electrical fire
			  ○ foam e.g. aeroplane fire
			• fuel removed:
			  ○ fire-break e.g. forest fire
			  ○ gas supply switched off e.g. natural gas fire
			
			5-6 marks: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.
			
			3-4 marks: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.
			
			1-2 marks: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.
			
			0 marks: The candidate does not make any attempt or give a relevant answer worthy of credit.

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	5	(a)			2	(glucose) solution / add water (to glucose) warm / warm temperature / any temperature in the range 20-40°C absence / lack of oxygen pH 4-7 – any two for (1) each		yeast optimum / 'right' temperature	
		(b)			1	2 : 2			
		(c)	(i)		1	filtration / filtering / filter	decant		
			(ii)		1	distillation			fractional distillation
		(d)			1	renewable (fuel / energy resource) carbon-neutral reduces demand on fossil fuels doesn't produce sulfur dioxide (so doesn't cause acid rain)		cleaner / less pollution / less carbon dioxide / more environmentally friendly	more efficient

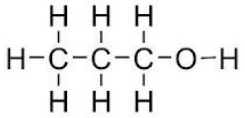
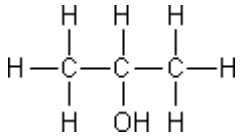
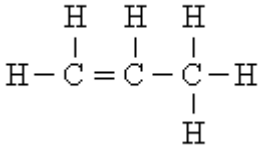
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Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	6	(a)	(i)		3	reactants: $CaO + H_2O$ (1) product: $Ca(OH)_2$ (1) balancing: 1 : 1 : 1 (1) – reactants and product must be correct before balancing mark awarded			
			(ii)	I	1	2			
				II	1	1			
			(iii)		1	(bubble in) carbon dioxide (limewater) turns milky – both needed			
		(b)			2	*Opinion and response must match to be awarded marks* Yes and advantages given e.g. building material, (local) jobs, used in blast furnace / used to extract iron, used to make cement / used to make mortar / used to make concrete, used to make glass, used to neutralise acid soil / manufacture of medicinal antacids, aggregate for roads, abrasive in toothpastes – any two for (1) each No and disadvantages given e.g. dust, noise / blasting, (heavy) lorries / traffic, landscape destruction, habitat destruction / wildlife destruction – any two for (1) each NB – Accept the counter argument i.e. 'even though' / 'but'statements e.g. No – provides jobs but only in the local areas not country wide Yes – landscape destroyed but can be reclaimed			

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Question Number								
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	7	(a)			1	$C_nH_{2n+1}OH$	$C_nH_{2n+2}O$		
		(b)			2	 (1)  (1)	$CH_3CH_2CH_2OH$ $CH_3CH_2CH_3$ (OH)		
		(c)			2	propene (1)  (1)			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	8	(a)			3	A NH_4Cl B Na_2CO_3 C $CuSO_4$ all ions correctly identified (2) 3, 4 or 5 ions correctly identified (1) all formulae correct (1)	correct names only for all three compounds (2)		
		(b)			1	D			

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Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	9	(a)			1	25.0	25		
		(b)			3	number of moles NaOH = concentration × volume = 0.1 × 25/1000 = 0.0025 (1) (stoichiometry / equation shows 1:1) 0.0025 mol CH_3COOH : 0.0025 mol NaOH (1) concentration CH_3COOH = number of moles ÷ volume = 0.0025 ÷ 25/1000 = 0.1 (1) – correct answer only (cao) (3) – follow through error (ft)	cV = cV c × 25 = 0.1 × 25 (2) $c = \frac{0.1 \times 25}{25} = 0.1$		
		(c)	(i)		1	60			
			(ii)		2	number of moles = concentration × volume = 0.1 × 100/1000 = 0.01 (1) number of moles = mass /M_r mass = number of moles × M_r = 0.01 × 60 = 0.6 g (∴ label information incorrect) (1)	number of moles in 100cm^3 = 0.083 (1) concentration calculated above as 0.1 mol/dm^3 – not 0.83 mol/dm^3 (1)		

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Question Number			
FT	HT	Mark	Guidance
	10		Indicative content: Explanation of choice of temperature and pressure conditions and rationale of presence of catalyst e.g. reversible reaction, left to right reaction required to produce ammonia (left to right reaction is exothermic and) higher yield is favoured by lower temperature however lower temperature results in lower rate so compromise made – moderately high temperature increases rate at the expense of yield rate further increased by using iron catalyst higher yield is favoured by higher pressure however increasing pressure increases plant costs and is potentially more hazardous – moderate pressure chosen provides moderate yield lower yield acceptable because unreacted nitrogen/hydrogen can be easily separated and returned to reaction vessel 5-6 marks: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. 3-4 marks: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. 1-2 marks: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. 0 marks: The candidate does not make any attempt or give a relevant answer worthy of credit.

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