Candidate Name	Centre Number	Candidate Number
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GCSE

245/02

SCIENCE CHEMISTRY
HIGHER TIER
CHEMISTRY 3

A.M. THURSDAY, 5 June 2008

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**6**	
3.	**4**	
4.	**7**	
5.	**3**	
6.	**7**	
7.	**6**	
8.	**5**	
9.	**4**	
10.	**3**	
Total	**50**	

ADDITIONAL MATERIALS

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

INSTRUCTIONS TO CANDIDATES

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

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

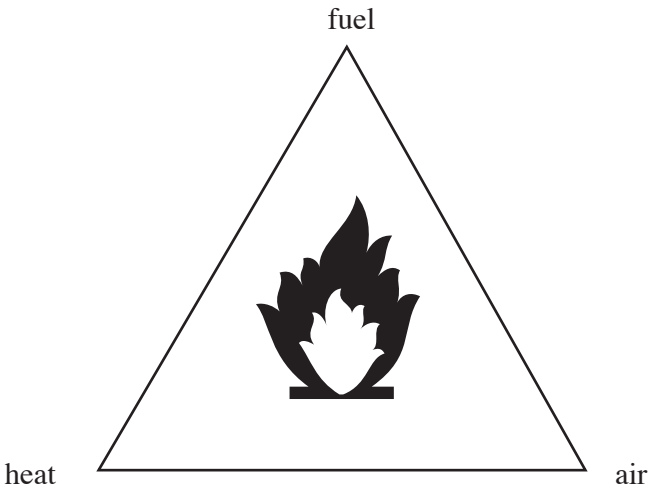
The number of marks is given in brackets at the end of each question or part-question.

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

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

Answer **all** *questions*.

1. The fire-triangle shows the factors necessary to start and maintain a fire.



(i) Give the name of the gas present in air which is necessary for burning. [1]

.....

(ii) Give a **different** fire-fighting method for each of the following situations and use the fire-triangle above to give a reason for your choice of method.

I. A garden bonfire which gets out of control. [1]

Method .....

Reason .....

II. A beaker of burning ethanol. [1]

Method .....

Reason .....

III. A science technician with her clothes on fire. [1]

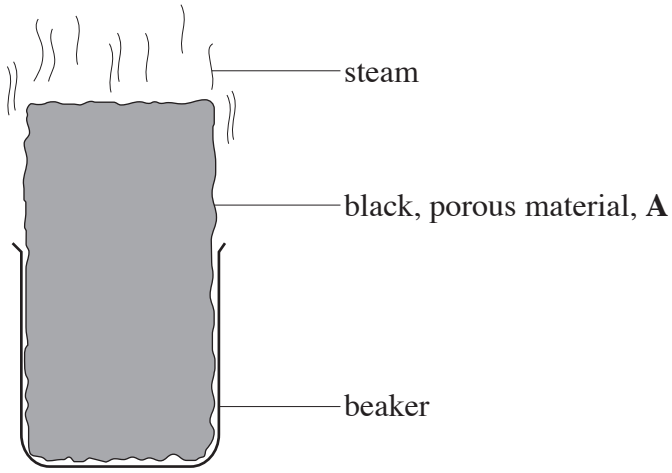
Method .....

Reason .....

(iii) Describe **one** type of fire on which water must **not** be used. [1]

.....

2. The diagram below shows the products formed when concentrated sulphuric acid is added to glucose, $C_6H_{12}O_6$. During the reaction a black, porous material, **A**, rises up the beaker and steam is formed.



(i) Give the

I. chemical **symbol** for the black, porous material, **A**, ... [1]

II. chemical **formula** for steam. ..... [1]

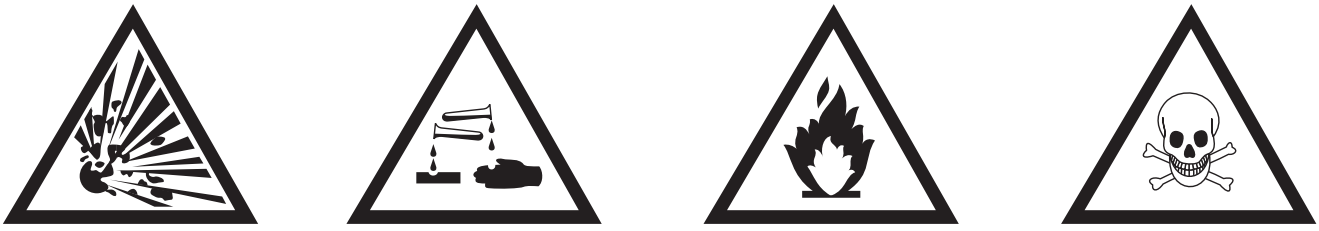
(ii) State the property that concentrated sulphuric acid is demonstrating in this reaction. [1]

.....

(iii) The beaker gets very hot during the reaction. Give the term used for a reaction which produces heat.

..... [1]

(iv)



A **B** **C** **D**

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

.....

II. State **one** safety precaution taken by teachers when they handle concentrated sulphuric acid. [1]

.....

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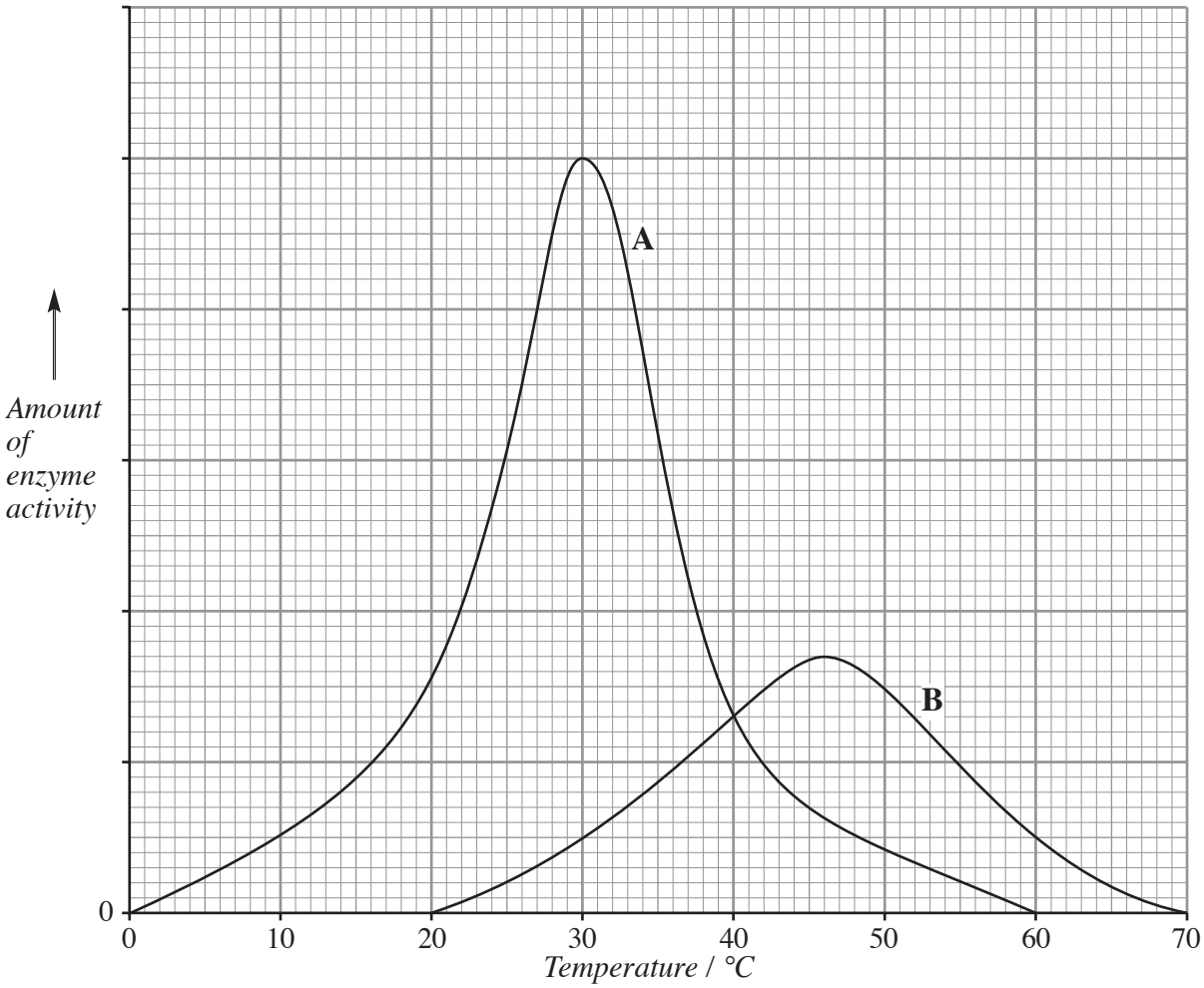
3. Enzymes are catalysts produced by living things.
The graph below shows the amount of activity of two different enzymes, **A** and **B**, over a range of temperatures.



Use the graph to

(i) give the temperature at which the amount of enzyme activity is greatest for enzyme **A**, [1]

..... °C

(ii) give the temperature at which the amount of enzyme activity is the **same** for both enzymes, [1]

..... °C

(iii) give the range of temperature over which **both** enzymes would be active, [1]

..... °C to ..... °C

(iv) compare the amounts of the enzyme activity of enzyme **B** at 30 °C and 60 °C. [1]

.....

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4. *(a)* 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

Ethanoic acid solution turns universal indicator orange.

Give the pH range of this solution. [1]

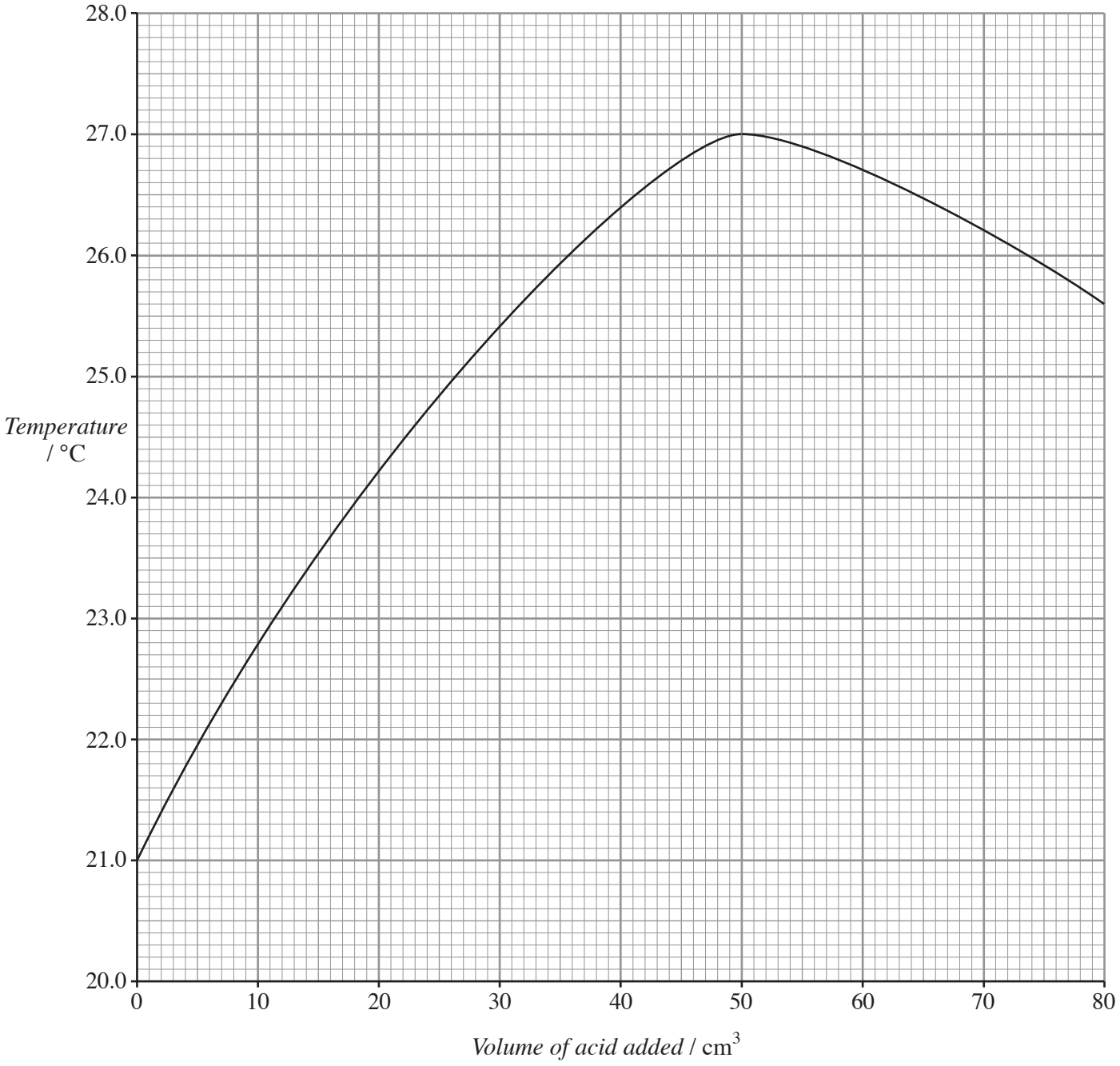
.....

(b) Two experiments were carried out to investigate the temperature rise when acids and alkalis react. 100 cm^3 of two acids, dilute ethanoic acid and dilute hydrochloric acid, were added separately, 10 cm^3 at a time, to 100 cm^3 of sodium hydroxide solution. After each addition of acid, the temperature was measured and recorded. All the solutions were of the same concentration.

The table below shows the results.

Volume of acid added / cm^3	0	10	20	30	40	50	60	70	80
Temperature rise using hydrochloric acid / °C	21.0	22.8	24.2	25.4	26.4	27.0	26.7	26.2	25.6
Temperature rise using ethanoic acid / °C	21.0	22.6	23.8	24.8	25.6	26.0	25.9	25.5	25.0

(i) Plot the results for ethanoic acid on the grid opposite and draw a curve of best fit. The curve for hydrochloric acid has been done for you. [3]



(ii) Use the graph to give the

I. temperature of both acids at the start of the experiment, ... °C [1]

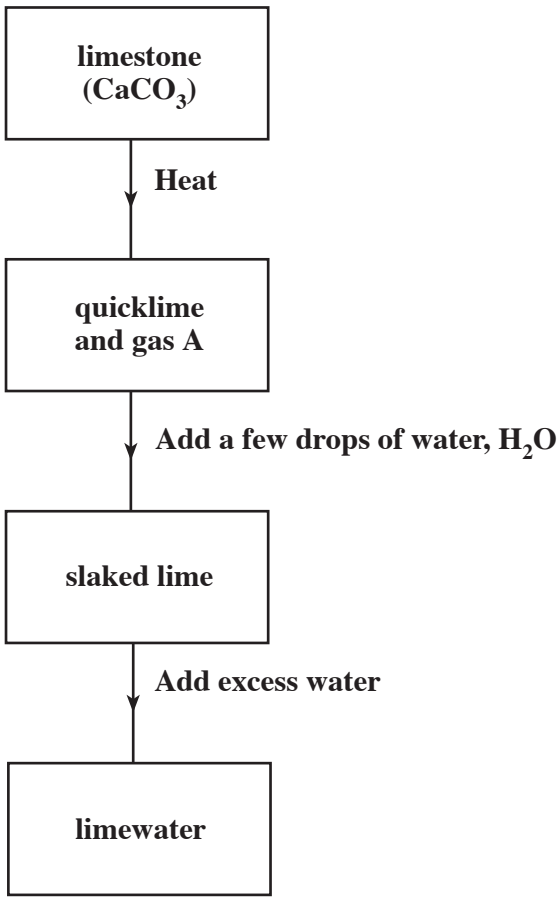
II. volume of both acids needed to neutralise the sodium hydroxide solution.

..... cm^3 [1]

(iii) Explain why the temperature increase is higher for hydrochloric acid than for ethanoic acid. [1]

.....

5. The flow diagram below shows the reactions necessary to turn limestone, $CaCO_3$, into limewater.



Give the chemical name for

(i) quicklime, ... [1]

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

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

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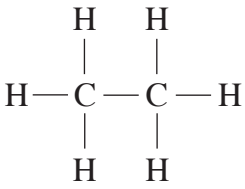
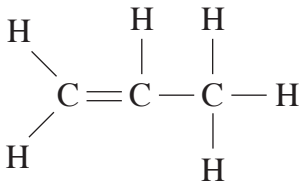
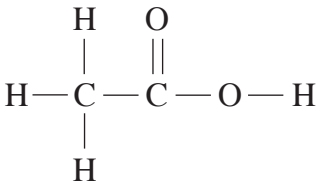
6. The structural formulae of five carbon compounds are shown below.



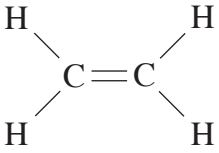
A



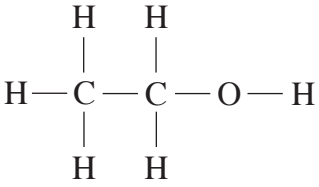
B



C



D



E

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

(i) Give the **letters** of **two** carbon compounds which belong to the same homologous series. [1]

..... and .....

(ii) Give the **letter** of the carbon compound which

I. has the molecular formula C_2H_5OH,

..... [1]

II. reacts with hydrogen to form compound **A**.

..... [1]

(iii) Give the name of the type of reaction that occurs during the formation of compound **A** in part (ii) II.

..... [1]

(iv) I. Draw the structural formulae for the two **different** compounds with the molecular formula, C_4H_{10}. [2]

Structure 1 Structure 2

II. Give the term used to describe compounds with the same molecular formula but different structural formulae. [1]

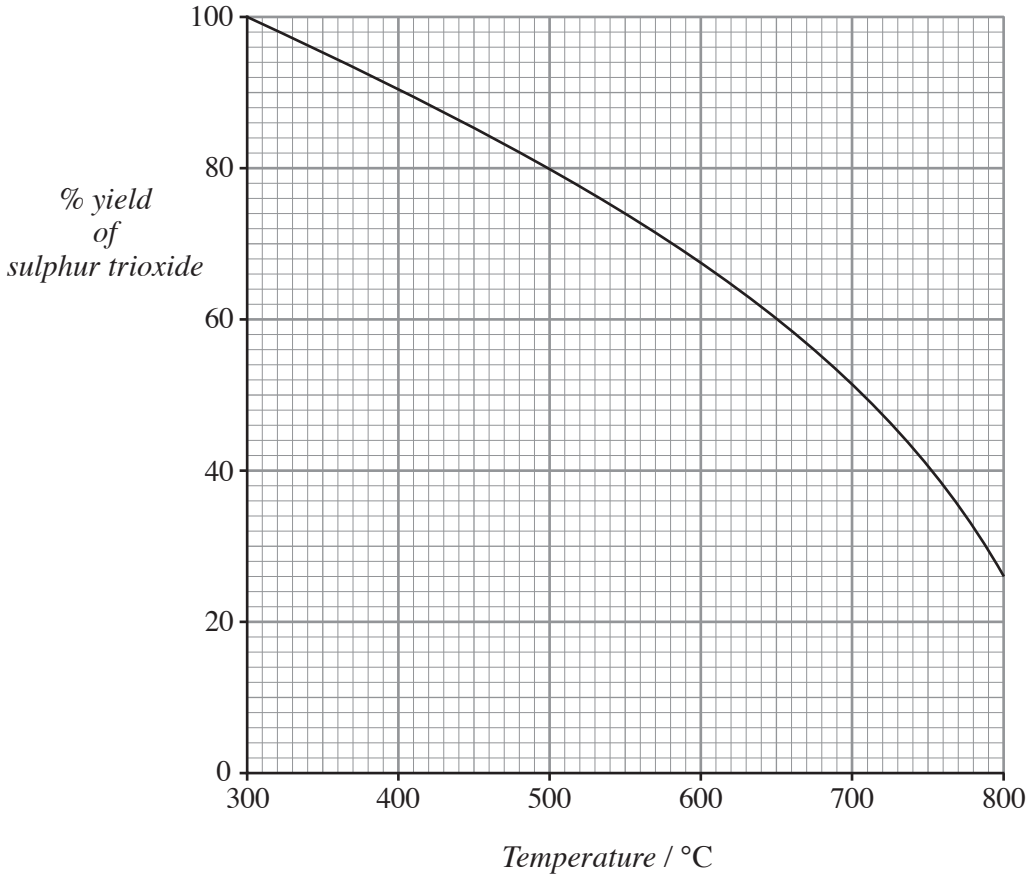
.....

7. One of the main stages in the manufacture of sulphuric acid is the reaction between sulphur dioxide and oxygen to form sulphur trioxide.

(i) Complete and balance the **symbol** equation for this reaction.

..... SO_2 + O_2 $\rightleftharpoons$ ..... [2]

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



I. State what happens to the percentage yield of sulphur trioxide as the temperature is increased. [1]

.....

II. Use the graph to calculate the **change** in percentage yield if the temperature is decreased from 650 °C to 400 °C. [1]

.....

(iii) Dissolving sulphur trioxide into water to form sulphuric acid is too exothermic to be carried out safely. Describe the **two-stage** process by which sulphur trioxide is converted safely into dilute sulphuric acid. [2]

.....

.....

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8. Ethanol, C_2H_5OH, is a biofuel alternative to petrol, and is widely used in cars in Brazil.

(i) Ethanol can be made from sugars by the process of fermentation. State why distillation can be used to separate the ethanol from the fermented mixture. [1]

.....

(ii) Apart from effects on the environment, give **one** advantage and **one** disadvantage of using ethanol rather than petrol to fuel cars.

Advantage ..... [1]

Disadvantage ..... [1]

(iii) I. Give **one health** problem associated with alcohol abuse over a **long** period of time. [1]

.....

II. Give **one social** problem associated with an excessive intake of alcohol. [1]

.....

5

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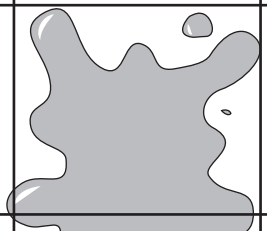
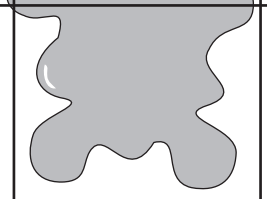
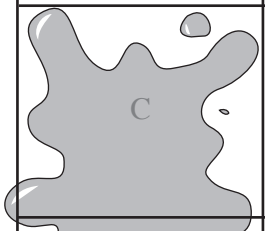
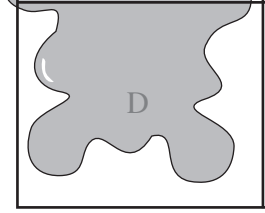
9. The table below shows the tests carried out by a pupil on four compounds, **A**, **B**, **C** and **D**, and the results of those tests.

The compounds were known to include four of the following five:

ammonium sulphate; calcium carbonate; sodium chloride; potassium chloride; potassium iodide.

Unfortunately, the pupil spilled water over his results.

Compound	*Test used to identify the positive ion*		*Test used to identify the negative ion*	
	Test using the solid form of compound	*Result*	*Test using a solution of compound*	*Result*
A		Lilac coloured flame	Add dilute nitric acid followed by silver nitrate solution.	Yellow precipitate
B		Red coloured flame	Add dilute hydrochloric acid. Bubble gas given off into limewater.	Fizzing occurs. Gas given off turns limewater milky.
	Add sodium hydroxide solution and warm mixture. Test gas given off with damp litmus paper.	Pungent smelling gas given off which turns damp red litmus paper blue.	Add dilute hydrochloric acid followed by barium chloride solution.	White precipitate
	Flame test	Yellow coloured flame	Add dilute nitric acid followed by silver nitrate solution	White precipitate

Use the information to identify the compounds **A**, **B**, **C** and **D**, from the list given above.

Compound **A** is .....

Compound **B** is .....

Compound **C** is .....

Compound **D** is ..... [4]

10. Hydrochloric acid reacts with sodium hydroxide solution according to the equation below.

$$HCl(aq) + NaOH(aq) \longrightarrow NaCl(aq) + H_2O(l)$$

It was found that 20.0 cm^3 of dilute hydrochloric acid was needed to neutralise 25.0 cm^3 of sodium hydroxide solution of concentration 0.04 mol dm^{-3}.

Calculate the concentration of the acid in mol dm^{-3}. [3]

.....

.....

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FORMULAE FOR SOME COMMON IONS

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

Turn over.

PERIODIC TABLE OF ELEMENTS

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

Key: