Surname	Centre Number	Candidate Number
Other Names		0

GCSE

0245/02

SCIENCE CHEMISTRY
HIGHER TIER
CHEMISTRY 3

A.M. MONDAY, 21 May 2012

45 minutes

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

0245
020001

ADDITIONAL MATERIALS

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

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

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

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

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

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

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

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Answer **all** *questions.*

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

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

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

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

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

.....

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

.....

.....

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

.....

.....

5

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

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

.....

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

.....

.....

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

.....

.....

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Turn over.

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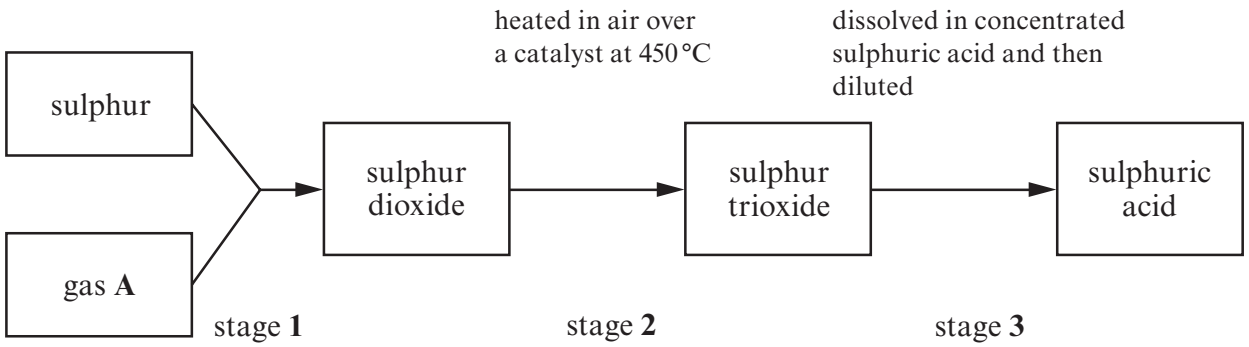
3. *(a)* The following diagram shows a flow chart for the manufacture of sulphuric acid using the Contact Process.



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

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

..... + ... ⇌ .....

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

.....

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

.....

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

.....

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

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

.....

(c) When dilute sulphuric acid is added to magnesium, hydrogen gas is given off. Give the test for hydrogen gas. [1]

.....

8

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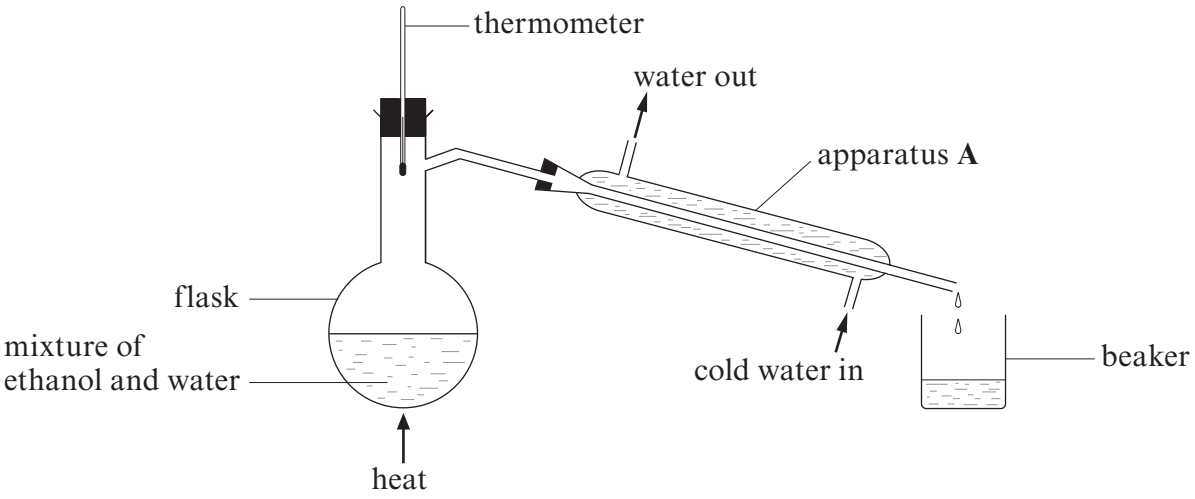
4. Ethanol and water have different boiling points as shown in the table below.

Liquid	Boiling point / °C
ethanol	79
water	100

A mixture of ethanol and water can be separated by using the apparatus shown.



(a) Give the reason why the thermometer is placed so that its bulb is near the flask sidearm rather than in the mixture below. [1]

.....

.....

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

.....

(c) State which liquid you would expect to be collected in the beaker first and explain your answer. [1]

The first liquid to appear in the beaker is .....

Explanation .....

.....

(d) Give the name of this method of separation. [1]

.....

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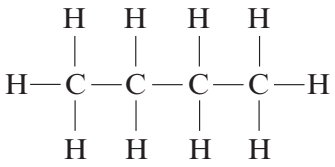
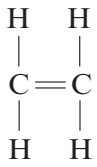
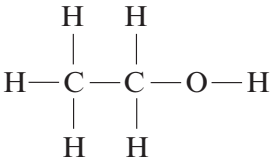
5. The structural formulae of six organic compounds, **A-F**, are shown below.



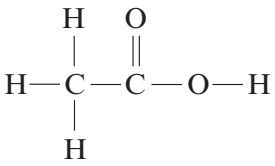
A



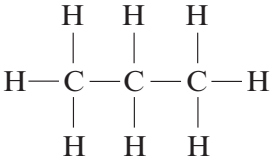
B



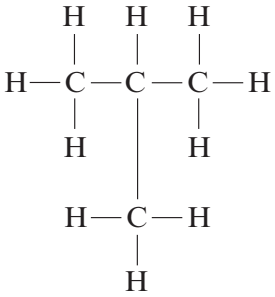
C



D



E



F

(a) Give the **molecular** formula of compound **E**. [1]

.....

(b) Give the letters of the two organic compounds that have the **same** molecular formulae. [1]

..... and .....

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

(i) is an alkene, [1]

.....

(ii) is ethanol, [1]

.....

(iii) undergoes an addition reaction to give a compound with a molecular formula of C_2H_6. [1]

.....

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6. *(a)* Carbonates undergo thermal decomposition forming carbon dioxide.

(i) The following table contains the decomposition temperatures of three metal carbonates.

Metal carbonate	Decomposition temperature / °C
calcium carbonate	900
copper carbonate	290
magnesium carbonate	540

State which of the three is the most stable and give a reason for your choice. [1]

.....

.....

(ii) Describe an experiment to show the thermal decomposition of copper carbonate. State how you would collect and identify the carbon dioxide gas produced. [3]

.....

.....

.....

.....

.....

.....

(b) Limestone is made of calcium carbonate. It decomposes on heating to form quicklime, calcium oxide, which reacts with water giving calcium hydroxide.

(i) Give **one** use of limestone. [1]

.....

(ii) Give the reason why farmers spread quicklime on their soil. [1]

.....

.....

(iii) State the common name for calcium hydroxide. [1]

.....

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7. The molecular formula of propene is C_3H_6.

(a) Draw the **structural** formula of propene. [1]

(b) Describe how bromine water can be used to distinguish between propane and propene. Give the observations expected for **both**. [2]

.....

.....

.....

(c) Propene undergoes an addition reaction with bromine, Br_2. Give the **molecular** and **structural** formulae of the product of this reaction. [2]

Molecular formula .....

Structural formula

5

Turn over.

Examiner only

8. Sodium hydroxide solution can be used to distinguish between ions such as iron(II), Fe^{2+}, and iron(III), Fe^{3+}.

(a) Describe what you would **see** when sodium hydroxide solution is added to iron(II) chloride and name the iron compound formed during the reaction. [2]

.....

Name of the iron compound formed .....

(b) Give the balanced **symbol** equation for the reaction that takes place in part *(a)*. [3]

..... + ... ⟶ ..... + ...

(c) Describe what you would **see** when silver nitrate solution is added to iron(II) chloride solution. [1]

.....

6

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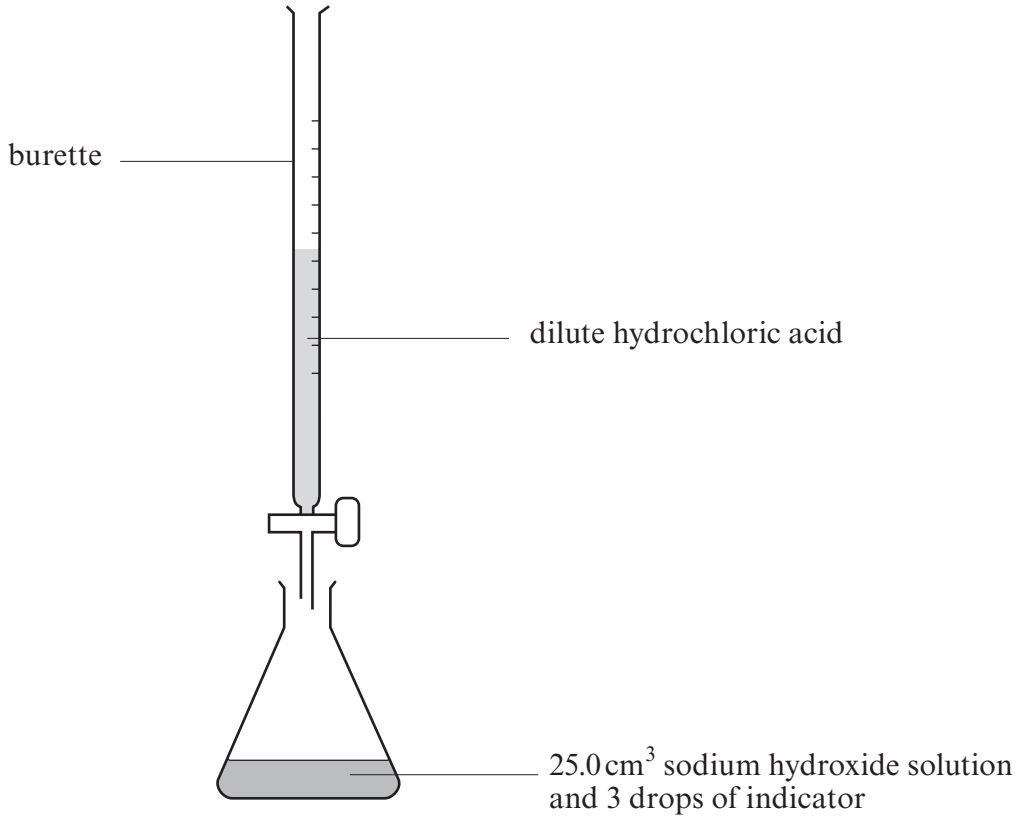
9. The diagram below shows the apparatus used to find the concentration of a sample of dilute hydrochloric acid.



The acid was added slowly by means of a 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 is given in the table below.

	1	2	3	4
Volume of hydrochloric acid / cm^3	23.50	20.00	20.05	19.95

(a) Not all the results in the table are reliable. Using **only** the reliable values, calculate the average volume of acid used. [1]

.....

.....

Average volume of acid = ... cm^3

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(b) Name the apparatus that could have been used to accurately measure out 25.0 cm^3 of sodium hydroxide solution. [1]

.....

(c) Calculate the number of moles of sodium hydroxide present in 25 cm^3 of solution if the concentration is 0.2 mol dm^{-3}. [2]

.....

.....

Moles of sodium hydroxide = ... mol

(d) The equation for the reaction between sodium hydroxide and hydrochloric acid is:

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

Using your answer to part *(c)* and this equation, state the number of moles of hydrochloric acid that need to be added to the sodium hydroxide solution for a neutral solution to be formed. [1]

.....

(e) Calculate the concentration of the acid in mol dm^{-3}. [2]

.....

.....

Concentration of the acid = ... mol dm^{-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											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: