Centre No.						Paper Reference (complete below)							Surname	
Candidate No.										/			Signature	

Paper Reference(s)

6243.B/P.01

Edexcel GCE

Chemistry

Advanced Level/Advanced Subsidiary

Unit Test 3B

Tuesday 12th June 2001 – Morning

Time: 1 hour

Materials required for examination
Nil

Items included with question papers
Nil

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
Total	

Instructions to Candidates

In the boxes above, write your centre number, candidate number, the paper reference, your signature, surname and initials.
The paper reference is shown above. If more than one paper reference is shown, you should write the one for which you have been entered.
Answer ALL questions in the spaces provided in this question paper.
Show all the steps in any calculations and state the units. Calculators may be used.
Final answers to calculations should be given to an appropriate number of significant figures.
Include diagrams in your answers where these are helpful.
Additional answer sheets may be used.

Information for Candidates

A periodic table is printed on the back cover of this question paper.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. (2).
There are five questions in this question paper.
The total mark for this paper is 50.

Advice to Candidates

You are reminded of the need to organise and present information, ideas, descriptions and arguments clearly and logically, taking account of your use of grammar, punctuation and spelling.

Printer's Log. No.
N9351

83019/R6243 7/5/3/16,300

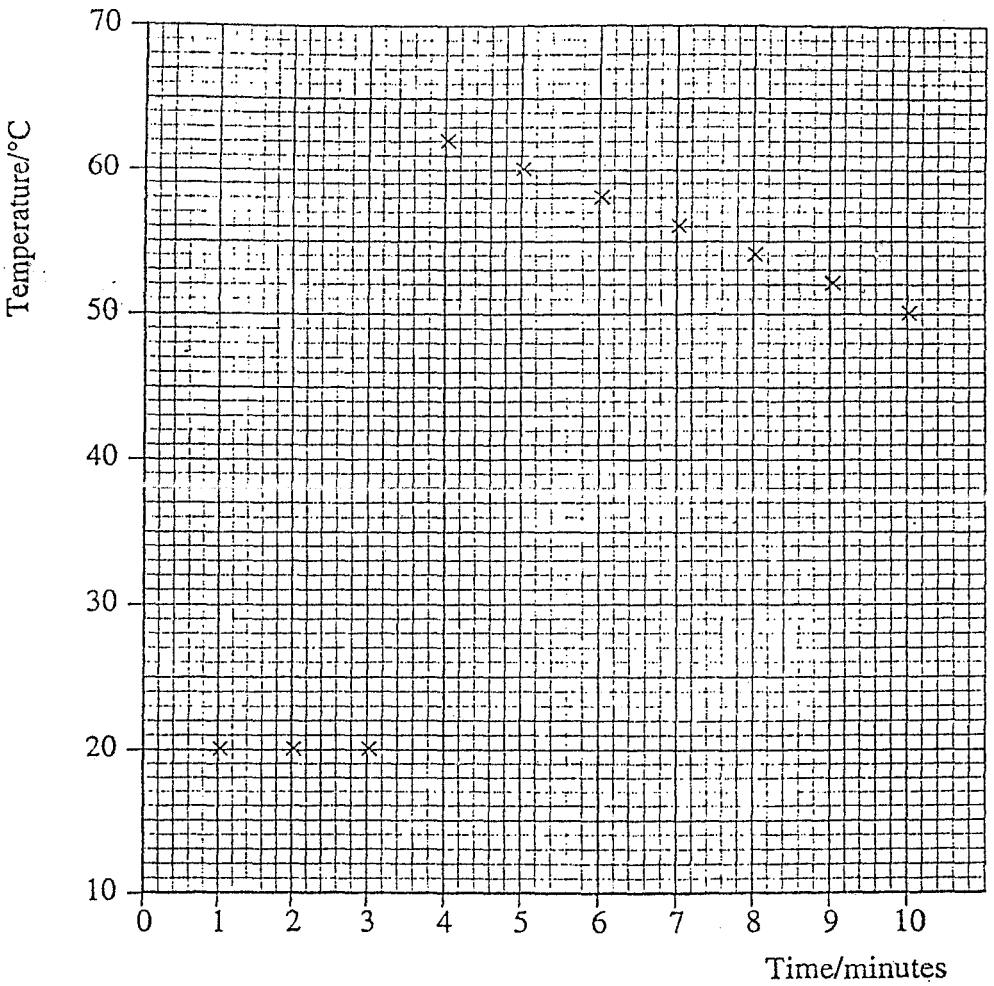
Edexcel
Success through qualifications

1. In an experiment to find the enthalpy change when copper is displaced from a solution of copper ions excess zinc was added to 50.0 cm^3 of 1.00 mol dm^{-3} aqueous copper(II) sulphate in a plastic cup.

$$Zn(s) + Cu^{2+}(aq) \longrightarrow Zn^{2+}(aq) + Cu(s)$$

The temperature of the solution in the cup was measured every minute for 10 minutes with the zinc being added after 3.5 minutes.

The temperature readings are shown on the graph below.



(a) Suggest two reasons why a series of temperature readings is taken rather than simply initial and final readings.

First reason .....

.....

Second reason .....

.....

(2)

(b) Use the graph to calculate the maximum temperature change, ΔT, as the reaction takes place.

Leave blank

ΔT = ... °C

(2)

(c) Calculate the enthalpy change for the reaction using the formula below, giving your answer to an appropriate number of significant figures.

$$\Delta H = -4.18 \times \Delta T \text{ kJ mol}^{-1}$$

(2)

Q1

(Total 6 marks)

13

2. 2-bromobutane was heated with excess aqueous potassium hydroxide until hydrolysis was complete. The resulting mixture was divided into two portions.

Leave blank

(a) When aqueous nitric acid followed by aqueous silver nitrate was added to one portion a precipitate was formed.

(i) Explain why aqueous nitric acid was added to the reaction mixture before aqueous silver nitrate.

.....

.....

.....

(2)

(ii) Give the colour and formula of the precipitate formed.

Colour ..... Formula .....

(2)

(iii) Suggest the effect of adding concentrated aqueous ammonia to the precipitate.

.....

.....

(1)

(b) The alcohol produced by the hydrolysis was separated from the second portion of the reaction mixture. Give the formula of a reagent which could be used to test for the presence of the $-OH$ group in the alcohol. Describe the observation you would expect to make and give the formula of any one of the products of the test.

Formula of reagent .....

Observation .....

.....

Formula of product .....

(3)

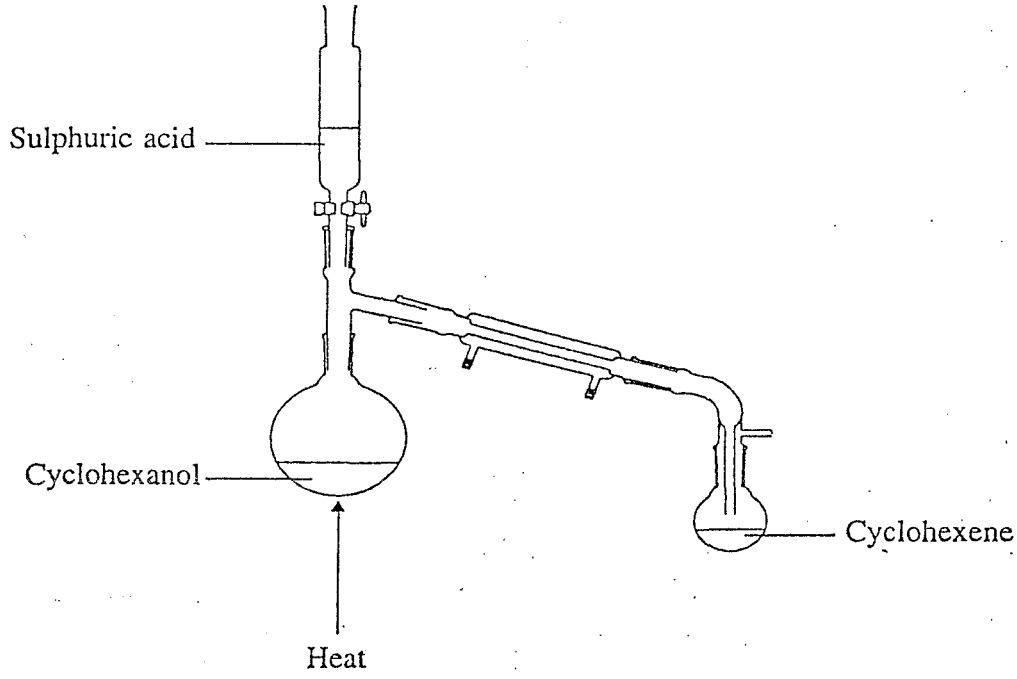
(Total 8 marks)

Q2

14

3. In an experiment to prepare cyclohexene, C_6H_{10}, concentrated sulphuric acid was added drop by drop to 6.00 g of cyclohexanol, $C_6H_{11}OH$, in the apparatus shown in the diagram below.

Leave blank



As the reaction took place cyclohexene distilled over into the collection flask and a black deposit of carbon formed in the reaction flask.

The equation for the main reaction is

$$C_6H_{11}OH(l) \longrightarrow C_6H_{10}(l) + H_2O(l)$$

After purification 1.80 g of cyclohexene was collected.

(a) (i) Calculate the amount (number of moles) of cyclohexanol used in the experiment.

(2)

(ii) Calculate the mass of cyclohexene that would be formed if all of the cyclohexanol was converted into cyclohexene.

15

(iii) Calculate the percentage yield of cyclohexene.

Leave blank

(1)

(b) Explain the relevance of the boiling points of cyclohexanol (161 °C) and cyclohexene (83.3 °C) to the success of the preparation.

.....

.....

.....

(2)

(c) Explain why the formation of carbon reduces the yield of cyclohexene.

.....

.....

(1)

(d) Using the information below, suggest what precautions should be taken when clearing up the apparatus after the preparation.

Sulphuric Acid H_2SO_4
(Concentrated)
Very corrosive, causes severe burns.
With water, heat is evolved.

.....

.....

.....

(2)

(e) Suggest a reagent which could be used to test for the presence of the alkene double bond in cyclohexene. Give the expected result of the test.

Reagent .....

Result .....

(2)

Q3

(Total 12 marks)

16

4. A student carried out an experiment to find the percentage of calcium carbonate, $CaCO_3$, in a sample of limestone following his own plan. The student's account of the experiment, results and calculation of the mean titre are given below.

Leave blank

Account

I Mass of piece of limestone = 5.24 g

II A measuring cylinder was used to transfer 50 cm^3 of 2.00 mol dm^{-3} aqueous hydrochloric acid (an excess) to a 100 cm^3 beaker. The piece of limestone was placed in the beaker and left until there was no more effervescence.

Equation

$$CaCO_3(s) + 2HCl(aq) \longrightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$$

III The acidic solution in the beaker was filtered into a 250 cm^3 volumetric flask. A small amount of solid impurity remained in the filter paper. The solution in the volumetric flask was carefully made up to 250 cm^3 with distilled water.

IV A pipette was used to transfer 25.0 cm^3 portions of the acidic solution to conical flasks. The solution was then titrated with 0.100 mol dm^{-3} aqueous sodium hydroxide.

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

Results

	1	2	3
Burette reading (final)	14.90	15.40	30.25
Burette reading (at start)	0.00	0.05	15.40
Titre / cm^3	14.90	15.35	14.85

$$\text{Mean titre} = \frac{14.90 + 15.35 + 14.85}{3} = 15.033 \text{ cm}^3$$

17

(a) The accuracy of the student's method was judged to be poor by his teacher. The teacher suggested that the procedure in II could be improved and that the titres used to calculate the mean were incorrectly chosen.

Leave blank

(i) Suggest, with a reason, one improvement to the student's procedure in II.

Improvement .....

.....

Reason .....

.....

(2)

(ii) Recalculate a value of the mean making clear which titres you choose and giving your answer to an appropriate number of significant figures.

(2)

(b) (i) Using your answer to (a)(ii), calculate the amount (number of moles) of sodium hydroxide in the mean titre.

(1)

(ii) Hence state the amount (number of moles) of hydrochloric acid in a 25.0 cm^3 portion of the acidic solution transferred in IV.

(1)

(iii) Hence calculate the amount (number of moles) of hydrochloric acid remaining after the reaction in II.

(1)

18

(iv) Calculate the number of moles of hydrochloric acid transferred to the beaker in II.

Leave blank

(1)

(v) Hence calculate the amount (number of moles) of hydrochloric acid used in the reaction in II.

(1)

(vi) Hence calculate the amount (number of moles) of calcium carbonate and the mass of calcium carbonate in the sample of limestone, $\{M_r(CaCO_3) = 100\}$.

(2)

(vii) Hence calculate the percentage of calcium carbonate by mass in the sample of limestone.

(1)

19

(c) The burette used in the titrations had an uncertainty for each reading of ±0.05 cm^3.

Leave blank

(i) Which of the following should be regarded as the actual value of the titre in titration 3?

Circle the letter corresponding to your chosen answer.

A between 14.80 cm^3 and 14.90 cm^3

B between 14.825 cm^3 and 14.875 cm^3

C between 14.75 cm^3 and 14.95 cm^3

(1)

(ii) Suggest one reason why a student may obtain volumes outside the uncertainty of the burette when carrying out a titration.

.....

.....

(1)

Q4

(Total 14 marks)

20

5. This is a planning exercise in which you are to describe a series of laboratory tests, the results of which will allow you to identify the five colourless aqueous solutions listed below:

Leave blank

ammonium sulphate, $(NH_4)_2SO_4$
barium chloride, $BaCl_2$
dilute hydrochloric acid, HCl
sodium sulphate, Na_2SO_4
sodium sulphite, Na_2SO_3.

The five solutions are in unlabelled bottles.

You are provided with aqueous sodium hydroxide, a book of red litmus paper, a supply of test tubes in racks, dropping pipettes and a Bunsen burner but with **no other reagents or apparatus.**

In your plan you should make use of the tests described in the table below.

Ion	Test	Result
Ammonium ion, NH_4^+	Warm with aqueous sodium hydroxide.	Alkaline gas evolved.
Sulphate, SO_4^{2-}	Add aqueous barium chloride, $BaCl_2$, followed by dilute hydrochloric acid, HCl.	White precipitate, insoluble in dilute hydrochloric acid, HCl.
Sulphite, SO_3^{2-}	Add aqueous barium chloride, $BaCl_2$, followed by dilute hydrochloric acid, HCl.	White precipitate, soluble in dilute hydrochloric acid, HCl. Gas evolved as precipitate dissolves.

In your plan describe the sequence of tests, their expected results and your conclusions. Name any gases evolved in the tests. Make clear at which point you can identify a solution.

There is no need to include quantities of solutions in your plan.

.....

.....

.....

.....

.....

.....

21

Leave blank

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(10) Q5

(Total 10 marks)

TOTAL FOR PAPER: 50 MARKS

END

N9351

THE PERIODIC TABLE

Period	1	2	Group										3	4	5	6	7	0
1	1 H Hydrogen 1																	4 He Helium 2
2	7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
3	23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
4	39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	63.5 Cu Copper 29	65.4 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
5	85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
6	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
7	223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

Key

Molar mass g mol^{-1}
Symbol
Name
Atomic number

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	(147) Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	163 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	(231) Pa Protactinium 91	238 U Uranium 92	(237) Np Neptunium 93	(242) Pu Plutonium 94	(243) Am Americium 95	(247) Cm Curium 96	(245) Bk Berkelium 97	(251) Cf Californium 98	(254) Es Einsteinium 99	(253) Fm Fermium 100	(256) Md Mendelevium 101	(254) No Nobelium 102	(257) Lr Lawrencium 103