Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	2	4	5	/	0	1	Signature	

Paper Reference(s)

6245/01

Edexcel GCE

Chemistry

Advanced

Unit Test 5

(including synoptic assessment)

Tuesday 23 January 2007 – Morning

Time: 1 hour 30 minutes

Examiner's use only		

Team Leader's use only		

Question Number	Leave Blank
1	
2	
3	
4	
5	
Total	

Materials required for examination
Nil

Items included with question papers
Nil

You may use a calculator.

Instructions to Candidates

In the boxes above, write your centre number and candidate number, your surname, initial(s) and signature.
Answer **ALL** the questions. Write your answers in the spaces provided in this question paper.
Show all the steps in any calculations and state the units.

Information for Candidates

The total mark for this paper is 75. The marks for individual questions and parts of questions are shown in round brackets: e.g. **(2)**. There are 16 pages in this question paper. All blank pages are indicated.
A Periodic Table is printed on the back cover of this booklet.

Advice to Candidates

You are reminded of the importance of clear English and careful presentation in your answers.
You will be assessed on your Quality of Written Communication in this paper.

Printer's Log. No.
N24701A
W850/R6245/57570 7/7/7/4/900

N 2 4 7 0 1 A 0 1 1 6

Turn over

edexcel
advancing learning, changing lives

Leave blank

Answer ALL the questions. Write your answers in the spaces provided.

1. (a) Consider the following table, which shows data for the reaction between reactants **A** and **B**.

Expt.	[A] / mol dm^{-3}	[B] / mol dm^{-3}	Rate / mol $dm^{-3}s^{-1}$
1	1.0	0.50	0.0020
2	0.50	0.50	0.0010
3	0.50	1.0	0.0040

(i) Define the term **order of reaction**.

.....

.....

.....

.....

(1)

(ii) Determine, giving reasons, the orders of reaction with respect to **A** and **B**.

Hence write the rate equation for the reaction.

.....

.....

.....

.....

.....

.....

.....

(3)

Leave blank

(iii) Calculate a value for the rate constant and give its units.

.....

.....

.....

.....

.....

(2)

(iv) State how, if at all, the value of the rate constant would change if the temperature were increased.

.....

(1)

Leave blank

(b) (i) Draw a Maxwell-Boltzmann curve for a sample of a gas.

(1)

(ii) On your diagram mark and label the activation energies for a catalysed and uncatalysed reaction.

(1)

(iii) The rate of a reaction can also be increased by raising the temperature.

Describe how the Maxwell-Boltzmann curve at a higher temperature differs from the curve you have drawn in (i).

.....

.....

.....

.....

(2)

Leave blank

(iv) Transition metals are important industrial catalysts.

Identify an industrial process involving a transition metal catalyst and name the catalyst used.

Explain why many transition metals and their compounds are successful catalysts.

.....

.....

.....

.....

.....

.....

.....

.....

(3)

(v) How do the rate constants for the catalysed and uncatalysed reactions compare?

.....

.....

(1)

Q1

(Total 15 marks)

Leave blank

2. (a) Identify the substances and conditions used in the standard chlorine half-cell.

.....

.....

.....

.....

(3)

(b) $Cu^{+}(aq) + e^{-} \rightarrow Cu(s)$ $\quad E^{\ominus} = +0.52$ V

$Cu^{2+}(aq) + e^{-} \rightarrow Cu^{+}(aq)$ $\quad E^{\ominus} = +0.15$ V

(i) Combine the half-equations above to produce the redox equation for the disproportionation reaction.

.....

.....

.....

(1)

(ii) Use the $E^{\ominus}$ values to explain why this reaction is feasible.

.....

.....

.....

(2)

(iii) Explain why the above reaction can be classified as a **disproportionation** reaction.

.....

.....

.....

(2)

(c) Complete the electronic configuration for a copper(I) ion, Cu^{+}.

$1s^2$.....

(1)

Leave blank

(d) When excess concentrated ammonia solution is added to a solution of hydrated copper(II) ions, the complex $[Cu(NH_3)_4(H_2O)_2]^{2+}$ is formed.

(i) State the type of reaction occurring and give the colour of the complex.

Type ..... Colour .....

(2)

(ii) Explain why this complex has a colour.

.....

.....

.....

.....

.....

(3)

(iii) Explain why copper(I) complex ions are **not** coloured.

.....

.....

.....

.....

(2)

(e) When concentrated hydrochloric acid is added to an aqueous solution of Cu^{2+} ions, the complex $CuCl_4^{2-}$ is formed.

Suggest the shape of this complex, state the bond angle and suggest why it has this shape.

.....

.....

.....

.....

.....

.....

(3)

Q2

(Total 19 marks)

Leave blank

3. This question concerns the following reaction scheme starting from benzene, C_6H_6.

$$C_6H_6 \xrightarrow{\text{reaction 1}} \underset{\text{(phenylethanone)}}{C_6H_5COCH_3} \xrightarrow{\text{reaction 2}} C_6H_5C(OH)(CN)CH_3$$

(a) Explain why the low resolution n.m.r. spectrum of benzene contains only a single peak.

.....

(1)

(b) (i) Identify the reagent and the catalyst needed for **reaction 1**.

.....

.....

(2)

(ii) What type of reaction is **reaction 1**?

.....

(1)

(iii) Draw the mechanism for **reaction 1**.

(4)

Leave blank

(c) (i) Identify the reagents needed for **reaction 2**.

.....

.....

(2)

(ii) What type of reaction is **reaction 2**?

.....

(1)

(iii) Draw the mechanism for **reaction 2**.

(3)

Leave blank

(d) The product of **reaction 2** is a mixture of two isomers.

(i) Draw the structures of these two isomers, making their three-dimensional shape clear.

(1)

(ii) What would be the effect of this mixture on monochromatic plane-polarised light? Justify your answer by reference to your mechanism in (c)(iii).

.....

.....

.....

.....

.....

.....

.....

(3)

(e) How could infra-red spectroscopy be used to show that the product of **reaction 2** did **not** contain traces of the reactant phenylethanone?

.....

(1)

Q3

(Total 19 marks)

BLANK PAGE

Leave blank

4. (a) The following equation shows the reaction of propane with chlorine to produce 1-chloropropane.

$$CH_3CH_2CH_3 + Cl_2 \rightarrow CH_3CH_2CH_2Cl + HCl$$

(i) Name the mechanism of the above reaction.

.....

(1)

(ii) State ONE essential condition.

.....

(1)

(b) The boiling temperature of 1-chloropropane is 46 °C and that of 1-bromopropane is 71 °C.

Draw a boiling temperature/composition diagram for a mixture of these two substances. Use it to explain how fractional distillation could be used to separate this mixture.

.....

.....

.....

.....

.....

.....

.....

.....

(5)

Leave blank

(c) Describe how to distinguish between pure samples of 1-chloropropane and 1-bromopropane using chemical tests.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(5)

(d) Suggest which technique, mass spectrometry or low resolution n.m.r., would be more successful to distinguish between 1-chloropropane and 1-bromopropane. Justify your answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

(3)

Q4

(Total 15 marks)

Leave blank

5. (a) An acidified solution of potassium manganate(VII) contains MnO_4^- ions, and can oxidise bromide ions, Br^-, to bromine.

It was found that 23.90 cm^3 of 0.200 mol dm^{-3} potassium manganate(VII) solution was required to oxidise a solution containing 2.46 g of sodium bromide dissolved in dilute sulphuric acid.

Calculate the ratio of the number of moles of manganate(VII) ions reacting to the number of moles of bromide ions reacting.

Hence write the equation for the oxidation of bromide ions by manganate(VII) ions in acid solution.

(5)

Leave blank

(b) Acidified potassium manganate(VII) solution can be safely stored in containers made of poly(ethene).

(i) Suggest a property of poly(ethene) which makes it suitable for the storage of this solution.

.....

(1)

(ii) Explain ONE environmental problem which may be caused by the disposal of a poly(ethene) container.

.....

.....

(1)

Q5

(Total 7 marks)

TOTAL FOR PAPER: 75 MARKS

END

THE PERIODIC TABLE

Period	1	2											3	4	5	6	7	0
	Group																	
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