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

Paper Reference(s)

6251/01

Edexcel GCE

Chemistry (Nuffield)

Advanced Subsidiary

Unit Test 1

Wednesday 8 June 2005 – Morning

Time: 1 hour 15 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
Total	

Materials required for examination
Nil

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and your signature.
Answer **ALL** questions in the spaces provided in this question paper.
Calculators may be used.
Final answers to calculations should be given to an appropriate number of significant figures.

Information for Candidates

A Periodic Table is printed on the back cover of this paper.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. (**2**).
The total mark for this paper is 60. There are 16 pages in this paper. All blank pages are indicated.

Advice to Candidates

You are advised to show all steps in any calculations.
You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, taking into account your use of grammar, punctuation and spelling.

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Answer ALL questions in the spaces provided.

SECTION A

1. (a) Describe TWO observations which can be made when crystals of hydrated magnesium nitrate are heated.

Observation 1 .....

.....

Observation 2 .....

.....

(2)

(b) Name ONE of the gases evolved. Describe a test for this gas to confirm its identity and give the result.

Name of gas .....

Test and result .....

.....

(2)

2. (a) (i) Give the **formula** of the ion which causes an aqueous solution to be alkaline.

.....

(1)

(ii) Explain why a 0.1 mol dm^{-3} solution of ammonia has a lower pH than a 0.1 mol dm^{-3} solution of sodium hydroxide.

.....

.....

.....

(1)

(b) Using the letters **P**, **Q** and **R** arrange the following in order of **increasing** pH

de-ionised water	0.1 mol dm^{-3} ethanoic acid	0.1 mol dm^{-3} hydrochloric acid
P	**Q**	**R**

.....

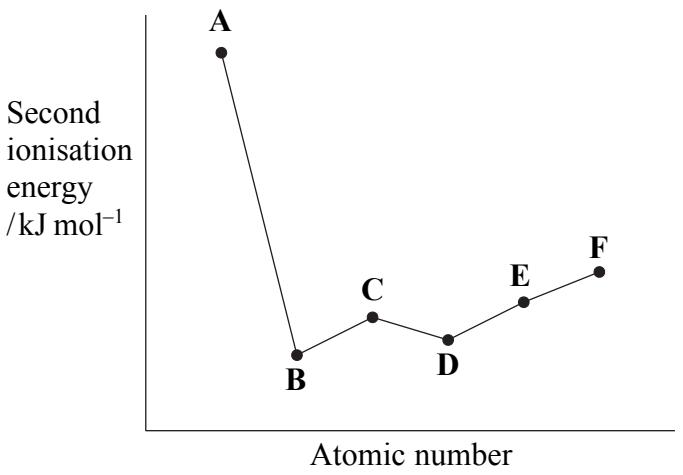
(1)

Leave blank

3. (a) (i) Write a balanced equation which represents the change that corresponds to the **second** ionisation energy of magnesium. Include state symbols in your answer.

(2)

(ii) The graph below shows how the **second** ionisation energy of six consecutive elements in the Periodic Table, represented by the letters **A** to **F**, varies with increasing atomic number.



Which of the elements, **A** to **F**, could represent magnesium?

.....

(1)

(b) Draw a 'dot and cross' diagram to show the ions in magnesium fluoride.

Include all electrons and the charges on the ions.

(2)

SA

TOTAL FOR SECTION A: 12 MARKS

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SECTION B

4. (a) One of the naturally occurring potassium isotopes is ^{39}K.

(i) Write down the numbers of protons, neutrons and electrons present in an atom of ^{39}K. Use the Periodic Table as a source of data.

protons ..... electrons .....

neutrons .....

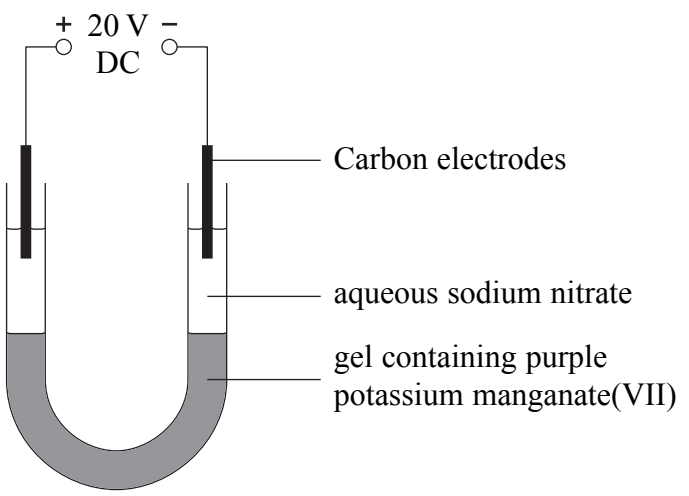
(2)

(ii) Write down the electronic configuration of a potassium atom using s,p,d notation.

.....

(1)

(b) To show that potassium manganate(VII), $KMnO_4$, is ionic, the apparatus below can be used.



The power supply is connected for about 30 minutes.

(i) Give the formula of the coloured ion present in potassium manganate(VII), $KMnO_4$.

.....

(1)

Leave blank

(ii) What would you expect to **see** after 30 minutes?

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(1)

(iii) The gel was replaced with one containing copper(II) sulphate and the experiment repeated. Describe and explain what would be seen.

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(2) **Q4**

(Total 7 marks)

Diagram adapted from Nuffield Advanced Science Chemistry Students' Book, 4th Edition, p. 64, Fig. 3.20.

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5. (a) Barium occurs in nature as its sulphate in a mineral known as barytes. Barium sulphate can be converted first to barium sulphide by heating it with carbon.

Process 1 $BaSO_4(s) + 4C(s) \longrightarrow BaS(s) + 4CO(g)$

(i) What is a possible large-scale source of carbon?

.....

(1)

(ii) Explain why carbon can be described as a **reducing agent** in this reaction.

.....

.....

.....

(1)

(b) The barium sulphide, from **Process 1**, can then be heated strongly in a mixture of carbon dioxide and air to form barium carbonate.

Process 2

$BaS(s) + CO_2(g) + O_2(g) \longrightarrow BaCO_3(s) + SO_2(g)$

Balance the above equation for **Process 2**.

(1)

(c) For ONE of the two processes, select a product and suggest an environmental problem associated with it.

.....

.....

(1)

Leave blank

(d) Barium carbonate can be converted into barium chloride solution by a reaction with hydrochloric acid. In a particular experiment, an excess of barium carbonate was added to 25 cm^3 of hydrochloric acid of concentration 1.0 mol dm^{-3}.

(i) Describe how you would obtain dry crystals of hydrated barium chloride, $BaCl_2.2H_2O$, from the reaction mixture.

.....

.....

.....

.....

.....

.....

.....

(4)

(ii) Write a balanced equation, including state symbols, for this reaction.

(2)

(iii) Calculate the number of moles of hydrochloric acid used in the experiment.

(1)

(iv) Calculate the mass of one mole of hydrated barium chloride, $BaCl_2.2H_2O$. Use the Periodic Table as a source of data.

(1)

(v) Calculate the theoretical mass of crystals which could be obtained.

(1)

Leave blank

(vi) Suggest a reason why this mass of crystals is unlikely to be obtained in practice.

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(1)

(e) (i) What colour do barium compounds produce in a flame test?

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(1)

(ii) When carrying out a flame test on a solid, state a suitable material on which it can be supported in the flame.

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(1)

Q5

(Total 16 marks)

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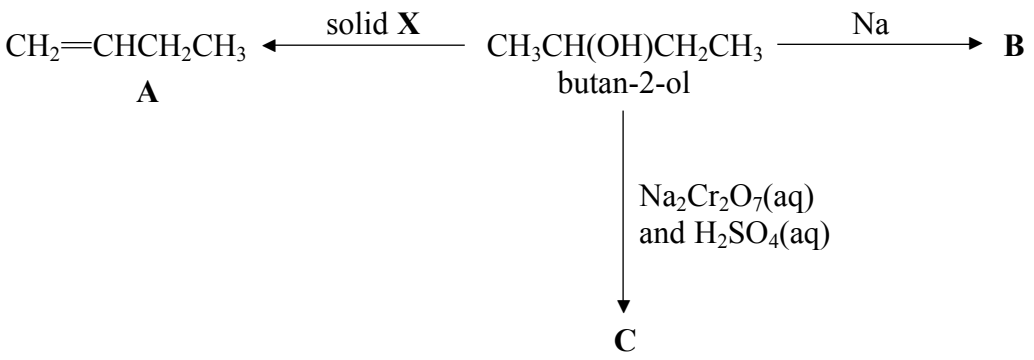
6. The following reaction scheme shows some of the reactions of butan-2-ol.



(a) Why is butan-2-ol classified as a **secondary** alcohol?

.....

.....

.....

(1)

(b) Compound **A** can be prepared from butan-2-ol by passing its vapour over a heated solid, **X**.

(i) Give the name of the organic compound **A**.

.....

(1)

(ii) Name the solid **X**.

.....

(1)

(iii) What **type** of reaction is taking place?

.....

(1)

Leave blank

(iv) Draw a labelled diagram of the apparatus you would use to prepare and collect gas **A** from butan-2-ol.

(4)

(v) Give the structural formula of another possible product of this reaction.

(1)

(c) (i) State TWO observations which could be made while butan-2-ol is reacting with sodium.

Observation 1 .....

.....

Observation 2 .....

.....

(2)

(ii) Give the **molecular** formula of **B**.

.....

(1)

Leave blank

(d) (i) Give the **structural** formula and the name of compound **C**.

Structural formula .....

Name .....

(2)

(ii) Describe the appearance of the mixture after compound **C** is boiled with Benedict's solution.

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.....

(1)

(e) Butan-2-ol can be used to clean plastic materials, such as CDs and DVDs.

Suggest ONE precaution which should be taken when using butan-2-ol in this way.

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(1)

Q6

(Total 16 marks)

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7. When solutions of potassium carbonate and calcium chloride are mixed together, the following reaction takes place

$$CaCl_2(aq) + K_2CO_3(aq) \longrightarrow CaCO_3(s) + 2KCl(aq)$$

(a) Re-write the above equation as an ionic equation. Include state symbols, but omit any spectator ions.

(2)

(b) An experiment was carried out to measure the enthalpy change for this reaction. 50 cm^3 of a 1.00 mol dm^{-3} solution of potassium carbonate was added to 50 cm^3 of a 1.00 mol dm^{-3} solution of calcium chloride. The temperature fell by 1.5 °C.

(i) Calculate the energy taken in from the surroundings using the relationship

energy	=	mass of solution	×	specific heat capacity of solution	×	temperature change
/J		/g		/J g^{-1} $°C^{-1}$		/°C

You may assume that
- 1.0 cm^3 of solution has a mass of 1.0 g.
- The specific heat capacity of the solution is 4.2 J g^{-1} $°C^{-1}$.

Energy taken in = ... J

(1)

(ii) How many moles of calcium chloride are used in this experiment?

(1)

Leave blank

(iii) Calculate the enthalpy change for the reaction, giving your answer to two significant figures. Include a sign and units in your answer.

(2)

(iv) Which measurement is likely to have caused the major source of error in this experiment? Explain your answer.

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(1)

(v) What apparatus should be used to contain the reaction mixture during this experiment?

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(1)

(c) If the experiment in (b) was repeated, but using only 25 cm^3 of each solution, predict what the fall in temperature would be.

.....

(1) **Q7**

(Total 9 marks)

TOTAL FOR SECTION B: 48 MARKS
TOTAL FOR PAPER: 60 MARKS

END

THE PERIODIC TABLE

Period	Group 1	2	3	4	5	6	7	0
1	1 H Hydrogen 1							2 He Helium 4
2	3 Li Lithium 7	4 Be Beryllium 9	5 B Boron 11	6 C Carbon 12	7 N Nitrogen 14	8 O Oxygen 16	9 F Fluorine 19	10 Ne Neon 20
3	11 Na Sodium 23	12 Mg Magnesium 24	13 Al Aluminium 27	14 Si Silicon 28	15 P Phosphorus 31	16 S Sulphur 32	17 Cl Chlorine 35.5	18 Ar Argon 40
4	19 K Potassium 39	20 Ca Calcium 40	21 Sc Scandium 45	22 Ti Titanium 48	23 V Vanadium 51	24 Cr Chromium 52	25 Mn Manganese 55	26 Fe Iron 56	27 Co Cobalt 59	28 Ni Nickel 59	29 Cu Copper 63.5	30 Zn Zinc 65.4	31 Ga Gallium 70	32 Ge Germanium 73	33 As Arsenic 75	34 Se Selenium 79	35 Br Bromine 80	36 Kr Krypton 84
5	37 Rb Rubidium 85	38 Sr Strontium 88	39 Y Yttrium 89	40 Zr Zirconium 91	41 Nb Niobium 93	42 Mo Molybdenum 96	43 Tc Technetium (99)	44 Ru Ruthenium 101	45 Rh Rhodium 103	46 Pd Palladium 106	47 Ag Silver 108	48 Cd Cadmium 112	49 In Indium 115	50 Sn Tin 119	51 Sb Antimony 122	52 Te Tellurium 128	53 I Iodine 127	54 Xe Xenon 131
6	55 Cs Caesium 133	56 Ba Barium 137	57 ▶ La Lanthanum 139	72 Hf Hafnium 178	73 Ta Tantalum 181	74 W Tungsten 184	75 Re Rhenium 186	76 Os Osmium 190	77 Ir Iridium 192	78 Pt Platinum 195	79 Au Gold 197	80 Hg Mercury 201	81 Tl Thallium 204	82 Pb Lead 207	83 Bi Bismuth 209	84 Po Polonium (210)	85 At Astatine (210)	86 Rn Radon (222)
7	87 Fr Francium (223)	88 Ra Radium (226)	89 ▶▶ Ac Actinium (227)	104 Unq Unnil-quadium (261)	105 Unp Unnil-pentium (262)	106 Unh Unnil-hexium (263)												

Key

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

	58	59	60	61	62	63	64	65	66	67	68	69	70	71
▶ Lanthanide elements	Ce Cerium 140	Pr Praseo-dymium 141	Nd Neodymium 144	Pm Promethium (147)	Sm Samarium 150	Eu Europium 152	Gd Gadolinium 157	Tb Terbium 159	Dy Dysprosium 163	Ho Holmium 165	Er Erbium 167	Tm Thulium 169	Yb Ytterbium 173	Lu Lutetium 175

	90	91	92	93	94	95	96	97	98	99	100	101	102	103
▶▶ Actinide elements	Th Thorium 232	Pa Protactinium (231)	U Uranium 238	Np Neptunium (237)	Pu Plutonium (242)	Am Americium (243)	Cm Curium (247)	Bk Berkelium (245)	Cf Californium (251)	Es Einsteinium (254)	Fm Fermium (253)	Md Mendelevium (256)	No Nobelium (254)	Lr Lawrencium (257)