Centre No.					
Candidate No.					

Paper Reference (complete below)						
				/		

Surname	Initial(s)
Signature	

Paper Reference(s)

6251/01

Examiner's use only

Team Leader's use only

Edexcel GCE

Chemistry (Nuffield)

Advanced Level/Advanced Subsidiary

Unit Test 1

Friday 12 January 2001 – Morning

Time: 1 hour 20 minutes

Materials required for examination
Nil

Items included with question papers
Nil

Question Number	Leave Blank
Section A	
4	
5	
6	
7	
8	
Total	

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname and initials, the paper reference and your signature. The paper reference is shown above.
Answer ALL questions in the spaces provided in this question paper.
Show all the steps in any calculations. 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**).
There are 8 questions in this question paper. The total mark for this paper is 60.

Advice to Candidates

You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, taking account of your use of grammar, punctuation and spelling.

Turn over

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SECTION A

Leave blank

Answer **ALL** questions in the spaces provided.

1. (a) In some reactions, sulphur atoms are converted into sulphide ions. Draw a 'dot and cross' diagram for a sulphide ion. Show outer shell electrons only and the charge on the ion.

(2)

(b) State which noble gas has the same electronic configuration as a sulphide ion. Use the Periodic Table as a source of data.

.....

(1)

(c) Give the formula for potassium sulphide.

(1)

2. (a) Balance the equation for the action of heat on the nitrate of a Group 2 metal, X.

$$X(NO_3)_2(s) \longrightarrow \quad XO(s) + \quad NO_2(g) + \quad O_2(g)$$

(2)

(b) Describe ONE observation you would expect to make as the reaction takes place.

.....

.....

(1)

(c) Which Group 2 metal forms compounds giving an apple green colour in a flame test?

.....

(1)

Leave blank

3. (a) Write an equation to represent the first ionisation energy of sodium. Include state symbols in your equation.

(2)

(b) Give the full electronic configuration of a nitrogen atom, using the s p d notation.

.....

(1)

(c) Suggest a reason why helium has the highest first ionisation energy of all elements.

.....

.....

.....

.....

(1)

SA

TOTAL FOR SECTION A: 12 MARKS

SECTION B

Leave blank

4. The ages of volcanic rocks can be estimated by analysing the relative abundance of the helium isotopes present.

When volcanic rocks are formed, the isotopes of hydrogen, $^{3}_{1}H$, and helium, $^{4}_{2}He$, are incorporated into the rock. The isotope of hydrogen is radioactive and decays into $^{3}_{2}He$. Both isotopes of helium are stable.

A sample of helium from a volcanic rock was found to have the following percentage composition

$^{3}_{2}He$ 0.99% $^{4}_{2}He$ 99.01%

(a) (i) Explain what is meant by the term **isotope** using helium to illustrate your answer.

.....

.....

.....

(2)

(ii) Complete the table to show the number of each type of subatomic particle present in the atoms of hydrogen and helium shown.

Atom	Number of protons	Number of neutrons	Number of electrons
$^{3}_{1}H$			
$^{3}_{2}He$			

(2)

(iii) In what way are the two atoms, $^{3}_{1}H$ and $^{3}_{2}He$, similar?

.....

(1)

(b) (i) Give the name of the instrument used to measure the relative abundances of isotopes.

Leave blank

.....

(1)

(ii) Use the percentage composition data to calculate the average relative atomic mass of helium in this sample of helium from a volcanic rock. Give your answer to FOUR significant figures.

(2)

(c) Suggest how the ratio of $^{3}_{2}He$ to $^{4}_{2}He$ changes as the volcanic rock becomes older.

.....

.....

(1)

Q4

(Total 9 marks)

Leave blank

5. This question is about organic compounds with the molecular formula C_3H_8O.

(a) (i) Draw the structural formulae of the two isomers with the molecular formula C_3H_8O which are alcohols. Give the names of these alcohols.

ALCOHOL 1 ALCOHOL 2

Structural formula

Name ....

(4)

(ii) What is the molecular formula of the next member of this homologous series of alcohols?

.....

(1)

(b) Primary alcohols can be fully oxidised to carboxylic acids.

(i) Give the name and structural formula of the carboxylic acid formed when the primary alcohol C_3H_8O is fully oxidised.

Name .....

Structural formula

(2)

(ii) Name the two reagents needed for this oxidation.

Reagent 1 .....

Reagent 2 .....

(2)

(iii) What colour change would you observe as the reaction takes place?

From ..... to .....

(2)

(iv) Draw a fully labelled diagram of the apparatus you would use to fully oxidise the alcohol to the carboxylic acid.

Leave blank

(4)

(v) Name the process you would use to separate the carboxylic acid from the reaction mixture.

.....

(1)

Q5

(Total 16 marks)

6. Ammonium nitrate, NH_4NO_3, can be made by reacting ammonia solution with dilute nitric acid.

Leave blank

(a) Write a balanced equation for this reaction. Include state symbols in your equation.

(2)

(b) What type of reaction is this?

.....

(1)

(c) Describe how you would obtain a colourless neutral solution of ammonium nitrate, using this reaction.

.....

.....

.....

.....

.....

(2)

(d) Describe how you would obtain pure dry crystals of ammonium nitrate from the solution in (c).

.....

.....

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.....

.....

.....

.....

.....

(4)

Q6

(Total 9 marks)

Leave blank

7. Sprained ankles can be treated with an ice pack. An alternative is to use a divided pack containing ammonium nitrate and water which can be mixed to provide a low temperature.

$$NH_4NO_3(s) + aq \longrightarrow NH_4^+(aq) + NO_3^-(aq) \qquad \Delta H = +25.2\,kJ\,mol^{-1}$$

(a) What would be the enthalpy change in joules if 40 g of ammonium nitrate was dissolved in water? [molar mass of ammonium nitrate = 80 g mol^{-1}]

(1)

(b) Use your answer to (a) to calculate the final temperature if 40 g of ammonium nitrate was dissolved in 200 g of water which was initially at 20 °C.

$$\underset{(J)}{\text{Enthalpy change}} = \underset{(g)}{\text{mass of water}} \times 4.2 \times \underset{(K)}{\text{temperature change}}$$
$$(J\,g^{-1}\,K^{-1})$$

(2)

(c) Suggest TWO advantages of using the ammonium nitrate/water pack over an ice pack for treating injuries in a football match.

Advantage 1 .....

.....

Advantage 2 .....

.....

(2)

Q7

(Total 5 marks)

8. The decomposition of ammonium nitrate can be represented by the following equation

Leave blank

$$2NH_4NO_3(s) \longrightarrow 2N_2(g) + O_2(g) + 4H_2O(g)$$

(a) Show that the molar mass of ammonium nitrate is 80 g mol^{-1}.
Use the Periodic Table as a source of data.

(1)

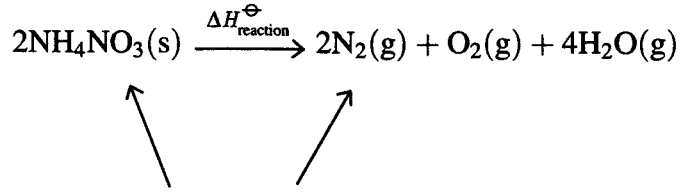
(b) What volume of nitrogen (at room temperature and pressure) would be produced if 20 g of ammonium nitrate was decomposed?

[1 mole of any gas has a volume of 24 dm^3 at room temperature and pressure.]

(2)

(c) (i) Complete the Hess cycle below so that $\Delta H^{\ominus}_{reaction}$ can be calculated using standard enthalpy changes of formation. Include state symbols.

Leave blank



.....

(1)

(ii) Calculate $\Delta H^{\ominus}_{reaction}$ given that

$\Delta H^{\ominus}_{f}[NH_4NO_3(s)] = -365.6 \text{ kJ mol}^{-1}$
$\Delta H^{\ominus}_{f}[H_2O(g)] = -241.8 \text{ kJ mol}^{-1}$

Include a sign and units in your answer.

(3)

(d) Use the equation and your answers to (b) and (c) to suggest TWO reasons why ammonium nitrate makes a good explosive.

Reason 1 .....

.....

Reason 2 .....

.....

(2)

Q8

(Total 9 marks)

TOTAL FOR SECTION B: 48 MARKS

END

THE PERIODIC TABLE

Period	1	2	Group 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}

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