| Centre No. | | | | | | Paper Reference (complete below) | | | | | | | Surname | Initial(s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Candidate No. | | | | | | | | | | / | | | Signature | |

Paper Reference(s)

# 6241/P.01

# Edexcel GCE

## Chemistry

## Advanced Level/Advanced Subsidiary

Unit Test 1

Friday 12 January 2001 – Morning

Time: 1 hour 20 minutes

Examiner's use only

Team Leader's use only

**Materials required for examination**
Nil

**Items included with question papers**
Nil

| Question Number | Leave Blank |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
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| | |
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| | |
| | |
| | |
| 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. 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 seven questions in this question paper. Pages 7, 14 and 15 are blank.

The total marks for this paper is 75.

### 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.

*Turn over*

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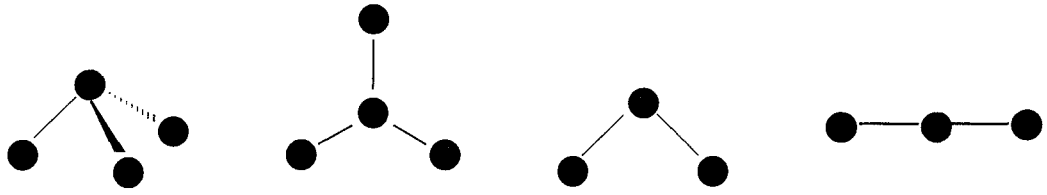
**1.** (a) Consider the following shapes



**A** **B** **C** **D**

Indicate by a letter (**A**, **B**, **C** or **D**) the shape of the following ions or molecules:

(i) $H_2O$ .....

(ii) $NH_3$ .....

(iii) $CO_2$ .....

(iv) $CO_3^{2-}$ .....

**(4)**

(b) Write a balanced equation for each of the following reactions. You should omit state symbols.

(i) The reaction of potassium metal with water.

.....

**(1)**

(ii) The reaction of calcium metal with oxygen.

.....

**(1)**

(iii) The reaction of magnesium oxide with nitric acid.

.....

**(2)**

**Q1**

**(Total 8 marks)**

**2.** (a) Identify each of the following.

*Leave blank*

(i) The Group 1 element which forms a compound of formula $MO_2$.

.....

**(1)**

(ii) A nitrate which, when heated strongly, produces oxygen as the only gas.

.....

**(1)**

(iii) One of the products of the reaction of solid potassium iodide with concentrated sulphuric acid.

.....

**(1)**

(iv) The steamy fumes produced when solid sodium chloride is heated with concentrated sulphuric acid.

.....

**(1)**

(b) Deduce the formula of the gaseous Group 7 element if 9.5 g of it occupy 6 $dm^3$ at room temperature and pressure. Show your working.
(1 mole of a gas at room temperature and pressure occupies a volume of 24 $dm^3$)

**(3)**

**Q2**

**(Total 7 marks)**

*Leave blank*

**3.** (a) Complete the table below.

| Element | Chlorine | Bromine | Iodine |
|---|---|---|---|
| State at room temperature | | | solid |
| Colour | | | grey |
| What would be seen on adding to an aqueous solution of potassium iodide | | | |

**(6)**

(b) Solid iodine has a simple covalent molecular structure.

(i) Define the term **covalent bond**.

.....

.....

**(2)**

(ii) Explain how the covalent structure of iodine leads to it having a low melting temperature (114 °C).

.....

.....

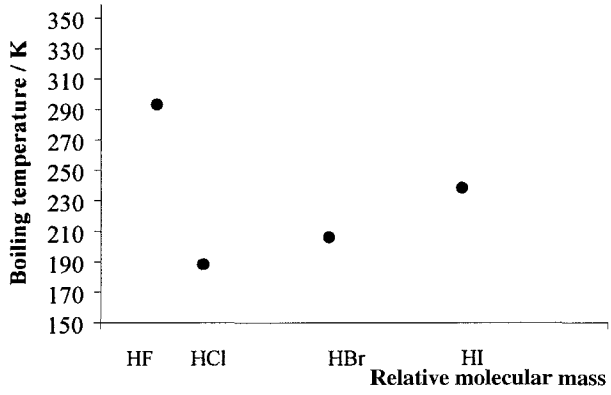
.....

.....

**(3)**

(c) The diagram below shows a plot of boiling temperature against relative molecular mass for four hydrogen halides, HF, HCl, HBr, and HI.

*Leave blank*




(i) Explain the increase in the boiling temperature from hydrogen chloride, HCl, to hydrogen iodide, HI.

.....

.....

.....

**(2)**

(ii) Explain why the boiling temperature of hydrogen fluoride, HF, is higher than the boiling temperature of hydrogen chloride, HCl.

.....

.....

.....

**(2)**

**Q3**

**(Total 15 marks)**

**4.** (a) (i) Write the equation for the reaction of magnesium metal with chlorine, showing state symbols.

*Leave blank*

.....

**(2)**

(ii) The product of this reaction is ionic. Use this information to explain why it has a relatively high melting temperature (714 °C).

.....

.....

.....

**(2)**

(b) Why is magnesium iodide more covalent than magnesium chloride?

.....

.....

.....

**(2)**

(c) Describe the bonding in magnesium metal.

.....

.....

.....

.....

**(3)**

**Q4**

**(Total 9 marks)**

*Leave blank*

**5.** (a) Define the term **oxidation number**.

.....

.....

.....

**(2)**

(b) The equation below shows the disproportionation of chlorine.

$$Cl_2(g) + H_2O(l) \rightarrow HClO(aq) + HCl(aq)$$

..... ..... .....

(i) Underneath the chlorine-containing species write the oxidation number of chlorine in each case.

**(1)**

(ii) Use these oxidation numbers to explain the term **disproportionation**.

.....

.....

.....

**(2)**

(c) Explain why hydrogen chloride forms an acidic solution when dissolved in water.

.....

.....

.....

**(2)**

(d) Outline how aqueous silver nitrate followed by aqueous ammonia may be used in the identification of chloride, bromide and iodide ions in aqueous solution.

*Leave blank*

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**(6)**

**Q5**

**(Total 13 marks)**

**6.** (a) Iron has several isotopes. One of them has the electronic configuration $[Ar]3d^6 4s^2$, an atomic number of 26 and a mass number of 56.

*Leave blank*

(i) Which of these pieces of information would be the most use in helping a chemist decide on the likely chemical reactions of iron?

.....

.....

**(1)**

(ii) State how many of each of the following particles is found in an atom of $^{56}Fe$.

Protons ..... electrons ..... neutrons .....

**(2)**

(iii) What are isotopes?

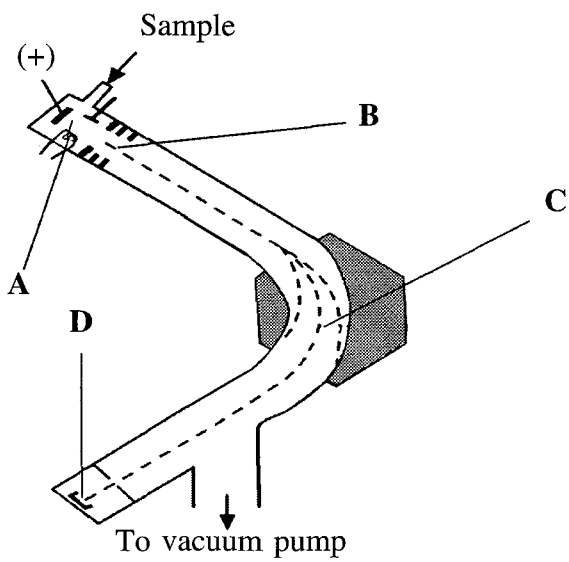
.....

.....

**(2)**

(b) The relative atomic mass of a sample of iron may be found by using a mass spectrometer to determine the isotopic composition.

(i) The diagram below represents a low-resolution mass spectrometer in which four areas have been identified. State what happens in each of these areas.



Area **A** .....

Area **B** .....

Area **C** .....

Area **D** .....

**(4)**

*Leave blank*

(ii) In such a determination the following isotopic composition was found.

| Isotope | Percentage composition |
|---|---|
| $^{54}Fe$ | 5.8 |
| $^{56}Fe$ | 91.6 |
| $^{57}Fe$ | 2.2 |
| $^{58}Fe$ | 0.33 |

Calculate the relative atomic mass of this sample of iron, giving your answer to two decimal places.

**(2)**

**Q6**

**(Total 11 marks)**

**7.** (a) The first ionization energy of chlorine is $+1260\,kJ\,mol^{-1}$ and the first electron affinity of chlorine is $-364\,kJ\,mol^{-1}$.

*Leave blank*

(i) Define the term **first ionization energy**.

.....

.....

.....

**(3)**

(ii) State and explain the general trend in the values of the first ionization energy for the elements across the period sodium to argon in the Periodic Table.

.....

.....

.....

**(3)**

(iii) Write an equation to show the change occurring when the **first electron affinity** of chlorine is measured.

.....

**(2)**

(b) 0.50 moles of chlorine gas were passed into an aqueous solution containing 0.66 moles of EACH of sodium bromide and sodium iodide. Assuming that **all of the chlorine** reacted, calculate:

*Leave blank*

(i) the number of moles of iodine produced;

(ii) the number of moles of bromine produced.

**(4)** **Q7**

**(Total 12 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 Berylium 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 |