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Paper Reference(s)

7081/01

London Examinations GCE

Chemistry

Ordinary Level

Paper 1

Tuesday 13 May 2008 – Morning

Time: 1 hour 15 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
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11	
12	
13	
14	
15	
Total	

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Answer ALL questions. Write your answers in the spaces provided in this question paper.

Information for Candidates

A Periodic Table is printed on the back cover of this booklet.
Calculators may be used.
The total mark for this paper is 100.
The marks for parts of questions are shown in round brackets: e.g. **(2)**.
This paper has 15 questions. Any blank pages are indicated.

DATA

One mole of any gas occupies 24 000 cm^3 at room temperature and atmospheric pressure.
One mole of electrons carries a charge of 96 500 coulombs or 1 faraday.

Advice to Candidates

Write your answers neatly and in good English.
In calculations, show **all** the steps in your working.

Turn over

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Answer ALL questions.

1. Complete the following table, giving the name or the formula of each compound as appropriate.

	Chemical name	Chemical formula
(a)	barium oxide	
(b)		SO_2
(c)		K_2CO_3
(d)	ethene	
(e)		Fe_2O_3
(f)	aluminium sulphate	

(Total 6 marks)

2. (a) Using the Periodic Table provided, complete the following table.

Name of element	Atomic number	Electronic configuration
	11	2.8.1
neon		2.8
sulphur	16	

(3)

(b) State which of the elements in the above table:

(i) is in Group 6 of the Periodic Table

....

(1)

(ii) forms positively charged ions

....

(1)

(iii) is a noble gas.

....

(1)

(Total 6 marks)

3. From the following list of non-metallic elements

argon	**bromine**	**iodine**
oxygen	**phosphorus**	**sulphur**

select an element that:

(a) is in the same group of the Periodic Table as nitrogen

....

(1)

(b) is a solid at room temperature and sublimes on heating

....

(1)

(c) reacts with hydrogen to form a compound which is a liquid at room temperature

....

(1)

(d) exists as molecules containing eight atoms (X_8) at room temperature

....

(1)

(e) is in Group 7 of the Periodic Table

....

(1)

(f) is used in filament lamps.

....

(1)   Q3

(Total 6 marks)

N 2 9 8 9 1 A 0 3 2 0

4. Fill in the missing colours for each of the following.

(a) A few drops of distilled water are added to anhydrous cobalt chloride paper.

Colour changes from .... to pink.

(1)

(b) Solid copper(II) carbonate is heated strongly.

Colour changes from green to ....

(1)

(c) Sulphur dioxide gas is bubbled through acidified potassium dichromate(VI) solution.

Colour changes from orange to ....

(1)

Q4

(Total 3 marks)

5. Which of the following best describes each of the reactions represented by the equations below?

oxidation	reduction
redox	**not oxidation or reduction**

(a) $Cu^{2+} + e^- \rightarrow Cu^+$ ....

(1)

(b) $H^+ + OH^- \rightarrow H_2O$ ....

(1)

(c) $C + CO_2 \rightarrow 2CO$ ....

(1)

(d) $Ag^+ + Br^- \rightarrow AgBr$ ....

(1)

(e) $Cu^{2+} + Fe \rightarrow Cu + Fe^{2+}$ ....

(1)

(f) $2Cl^- \rightarrow Cl_2 + 2e^-$ ....

(1)

Q5

(Total 6 marks)

6. Write down the:

(a) number of atoms in one molecule of CH_3COOCH_3

....
(1)

(b) number of moles of carbon dioxide formed by the complete combustion of one mole of propane, C_3H_8

....
(1)

(c) number of moles of ions in one mole of barium nitrate, $Ba(NO_3)_2$

....
(1)

(d) number of faradays of electrical charge needed to convert one mole of Zn^{2+} ions to Zn metal

....
(1)

(e) relative formula mass of urea, H_2NCONH_2

....
(1)

(f) number of moles of sodium hydroxide in $50 \, cm^3$ of a solution of concentration $0.2 \, mol \, dm^{-3}$.

....
(1)   Q6

(Total 6 marks)

7. (a) Give the symbol of:

(i) an anion that has the same electron configuration as a chloride ion

....
(1)

(ii) a cation that has the same electron configuration as a chloride ion.

....
(1)

(b) Draw a dot-and-cross diagram to show the bonding in a molecule of tetrachloromethane, CCl_4.

(2)

(c) Carbon exists as both diamond and graphite.

(i) What name is given to two different forms of the same element in the same physical state?

....
(1)

(ii) Explain why diamond is very hard while graphite is soft.

....

....

....

....

....
(2)

(Total 7 marks)

8. Give the names or formulae of two chemicals that would be used in the laboratory to make each of the following gases. State a simple test, with a result, that could be used to identify each gas.

(a) Oxygen

Names or formulae of the two chemicals

....

Test and result ....

....

....

(2)

(b) Hydrogen

Names or formulae of the two chemicals

....

Test and result ....

....

....

(2)

(c) Carbon dioxide

Names or formulae of the two chemicals

....

Test and result ....

....

....
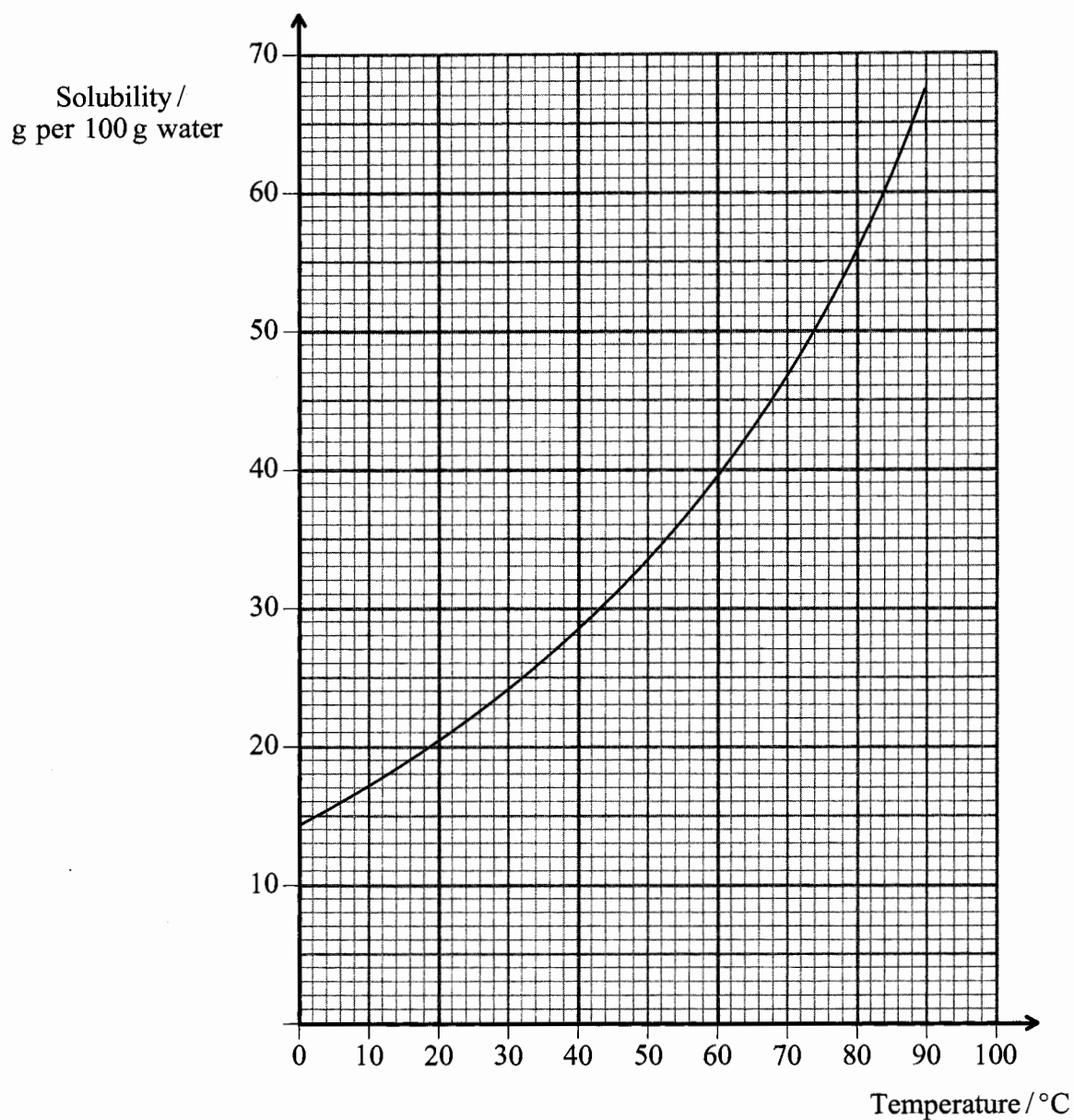
(2)

(Total 6 marks)

9. The graph below shows how the solubility of copper(II) sulphate changes with temperature.

(a) What is the solubility of copper(II) sulphate at 60 °C?

.... g/100 g water

(1)

(b) What is the minimum mass of copper(II) sulphate needed to form a saturated solution with 100 g of water at 50 °C?

.... g

(1)

(c) 30 g of copper(II) sulphate are dissolved in 100 g of water at 80 °C and the solution is allowed to cool. At what temperature will crystals first appear?

.... °C

(1)

(d) The solution in part (c) could be cooled slowly or quickly. Suggest how each of the following would be affected by the rate of cooling, if at all.

(i) The temperature at which crystals appear

....

....

(1)

(ii) The size of the crystals

....

....

(1) **Q9**

(Total 5 marks)

10. The following is a list of anions.

$$Br^- \quad HCO_3^- \quad NO_3^- \quad O^{2-} \quad OH^- \quad SO_4^{2-}$$

From this list give the formula of an anion which:

(a) has a relative formula mass of 61 ....

(1)

(b) is present in all alkalis ....

(1)

(c) forms a copper(II) compound that might be a blue or white solid ....

(1)

(d) forms an off-white or cream insoluble compound with $Ag^+(aq)$ ....

(1)

(e) forms soluble salts with all metals ....

(1)

(f) is present in bauxite. ....

(1)

(Total 6 marks)

11. The following equation represents the reaction between zinc oxide and dilute sulphuric acid.

$$ZnO(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2O(l)$$
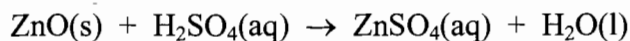
(a) What is the relative formula mass of zinc oxide?

....

(1)

(b) How many moles of sulphuric acid are needed to react with 4.05 g of zinc oxide?

....

....

(1)

(c) What volume of 2 mol dm^{-3} sulphuric acid would be needed to react with 4.05 g of zinc oxide?

....

....

(2)

(d) What is the maximum mass of zinc sulphate ($ZnSO_4$) which could be formed from 4.05 g of zinc oxide?

....

....

....

(2)

(e) The formula of zinc sulphate crystals is $ZnSO_4.xH_2O$.
A maximum mass of 14.35 g of zinc sulphate crystals can be obtained from 4.05 g of zinc oxide.

(i) How much of the mass of the crystals is due to the water of crystallisation?

....

(1)

(ii) Calculate x in the formula $ZnSO_4.xH_2O$.

....

....

....

(2)

(Total 9 marks)

Q11

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12. Iron is extracted from its ore, haematite, in a blast furnace.

(a) Give the chemical formula of haematite.

....

(1)

(b) Which gas is responsible for reducing the haematite to iron?

....

(1)

(c) Which is the main reaction that raises the temperature in the blast furnace?

....

(1)

(d) (i) What is the main impurity in the iron ore used in the blast furnace?

....

(1)

(ii) Explain how this is removed, giving appropriate chemical equations.

....

....

....

....

....

....

....

....

(4)

(iii) Why is it necessary to remove this impurity?

....

(1)

(Total 9 marks)

Q12

N 2 9 8 9 1 A 0 1 3 2 0

13. (a) Draw diagrams to show the shape of the following molecules (electron configurations are not required).
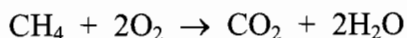
(i) Methane (CH_4)

(1)

(ii) Water (H_2O)

(1)

(b) Explain why, at room temperature, methane is a gas while water is a liquid.

....

....

(1)

(c) The following equation represents the complete combustion of methane in air.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

Use the information in the following table to calculate the enthalpy change, ΔH, resulting from the complete combustion of one mole of methane.

Bond	Bond energy / kJ per mole of bonds
C—H	+413
O=O	+496
C=O	+805
O—H	+463

(i) Bonds broken

Bond broken	Number of bonds	Energy required / kJ
C—H		
O=O		
	Total energy required =	

(2)

(ii) Bonds formed

Bond formed	Number of bonds	Energy released / kJ
C=O		
H—O		
	Total energy released =	

(2)

(iii) Enthalpy change $\Delta H =$ .... kJ mol^{-1}

(1)   Q13

(Total 8 marks)

N 2 9 8 9 1 A 0 1 5 2 0

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14. (a) A compound consists of 24.24% carbon, 4.04% hydrogen and 71.72% chlorine.

(i) Show that the empirical formula of this compound is CH_2Cl.

....

....

....

....

(2)

(ii) Give the simplest molecular formula for this compound.

....

(1)

(iii) Calculate the relative molecular mass of a compound with this molecular formula.

....

(1)

(b) (i) Draw the displayed formulae of two different compounds with molecular formula $C_2H_4Br_2$.

(2)

(ii) Name either of these compounds.

....
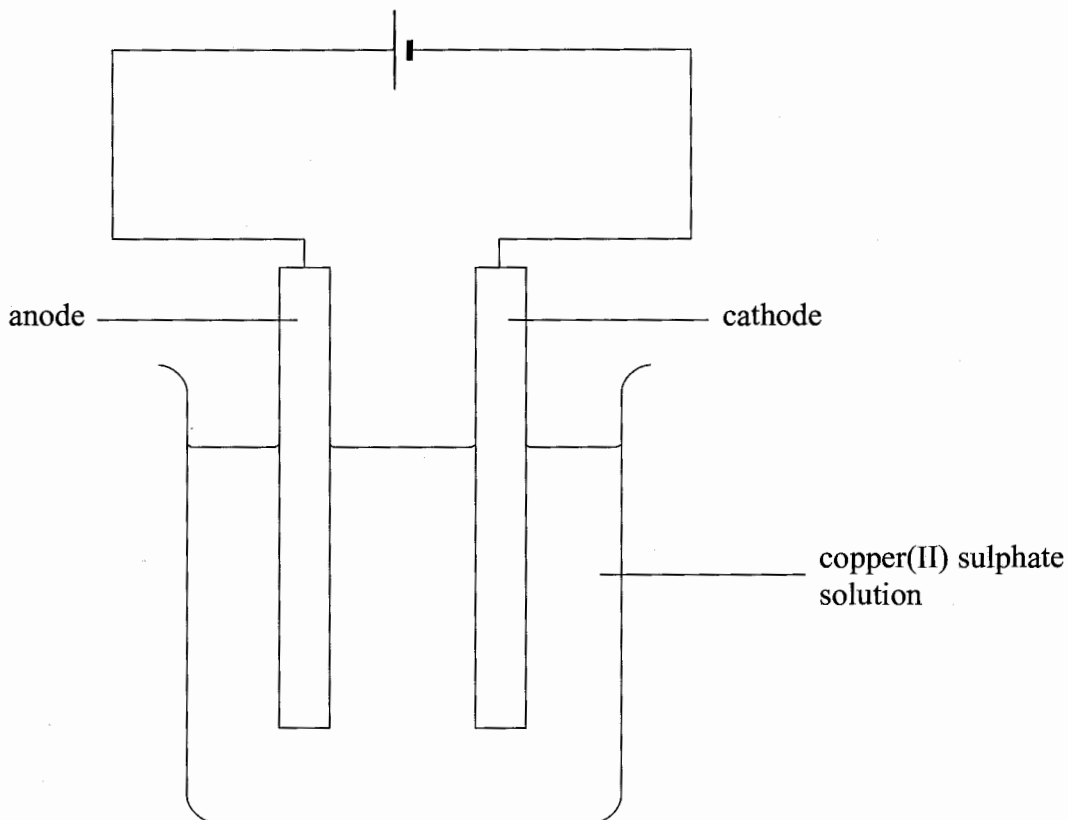
(1)

(Total 7 marks)

15. The electrolysis of 2 mol dm^{-3} copper(II) sulphate solution using pure copper electrodes was carried out using the following apparatus.

The masses of the electrodes at the start of the electrolysis were:
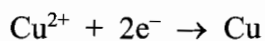
anode = 8.760 g   cathode = 9.040 g

(a) Name the particles responsible for the passage of current:

(i) in the wires ....

(1)

(ii) in the copper(II) sulphate solution. ....

(1)

(b) The following equation represents the reaction at the cathode.

$$Cu^{2+} + 2e^- \rightarrow Cu$$

Write an equation for the reaction at the anode.

....

(1)

(c) At the end of the electrolysis the mass of the cathode was 9.675 g.

(i) What was the gain in mass of the cathode?

....

(1)

(ii) What was the final mass of the anode?

....

(1)

(iii) How many coulombs of charge were needed to deposit the copper on the cathode.

....

....

....

....

(2)

(iv) The electrolysis was carried out for 6 minutes and 26 seconds. Calculate the current used.

....

....

(2)

(d) What was the concentration of the copper(II) sulphate solution at the end of the electrolysis? Underline the correct answer.

Less than 2 mol dm^{-3} Exactly 2 mol dm^{-3} More than 2 mol dm^{-3}

(1)   **Q15**

(Total 10 marks)

TOTAL FOR PAPER: 100 MARKS

END

THE PERIODIC TABLE

Group

Period	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	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 86	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 179	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															

Key

Atomic number
Symbol
Name
Relative atomic mass