Paper Reference(s)

7081/01

London Examinations GCE

Chemistry

Ordinary Level

Paper 1

Tuesday 13 May 2008 – Morning

Time: 1 hour 15 minutes

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 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.

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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)

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)

(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)

(Total 6 marks)

Q4

Q5

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)

Q7

(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)

Q8

(Total 6 marks)

9. The graph below shows how the solubility of copper(II) sulphate changes with temperature.
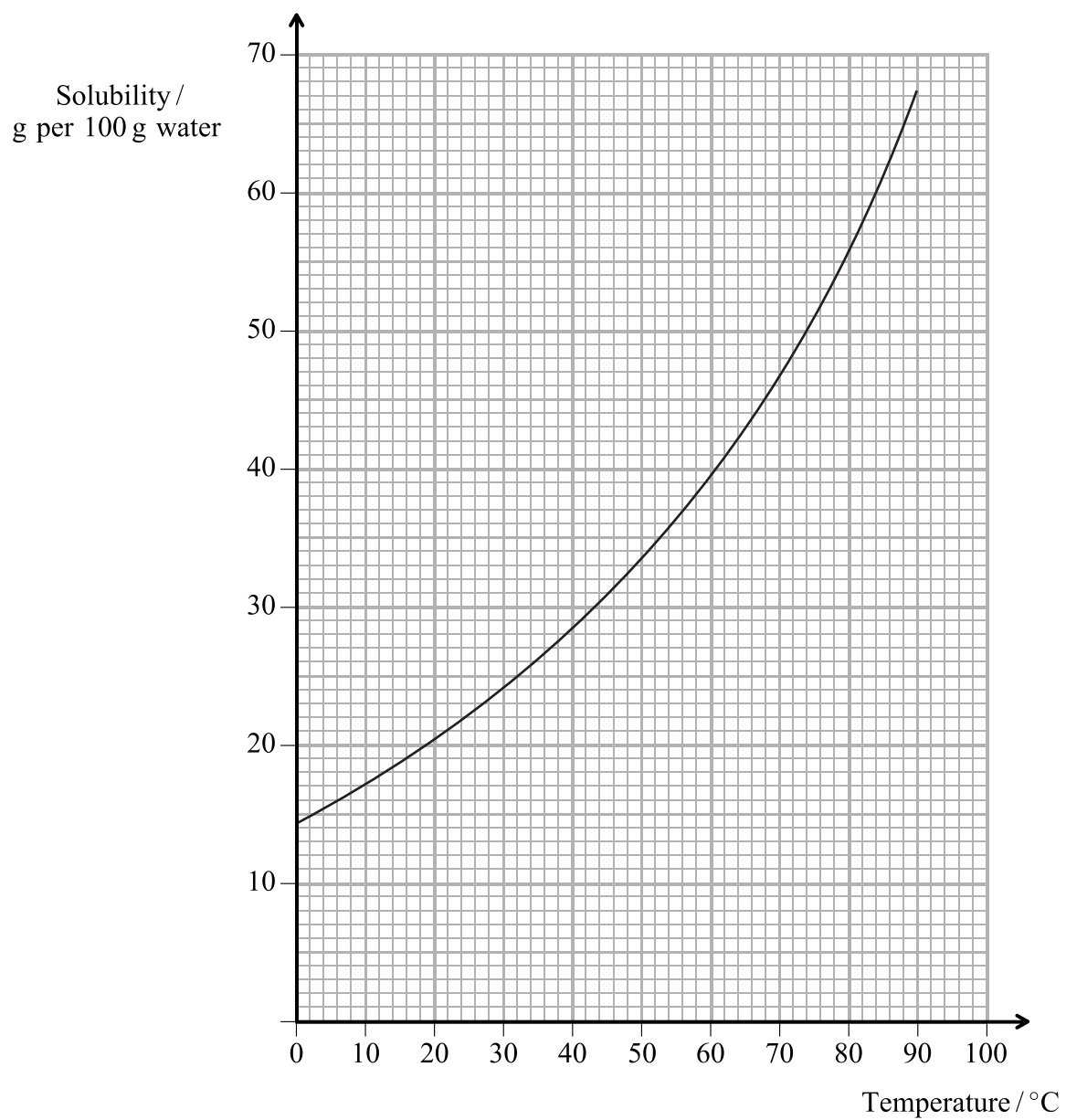
(a) What is the solubility of copper(II) sulphate at 60 °C?

.... 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.

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

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)

Q10

(Total 6 marks)

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

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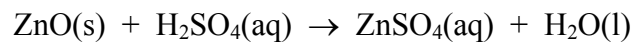
(a) What is the relative formula mass of zinc oxide?

....
(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) Q11

(Total 9 marks)

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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)   **Q12**

(Total 9 marks)

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.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$
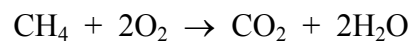
Use the information in the following table to calculate the enthalpy change, ΔH, resulting from the complete combustion of one mole of methane.

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 ΔH = ... kJ mol^{-1}

(1)   Q13

(Total 8 marks)

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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)

Q14

15. The electrolysis of $2 \, mol \, dm^{-3}$ copper(II) sulphate solution using pure copper electrodes was carried out using the following apparatus.
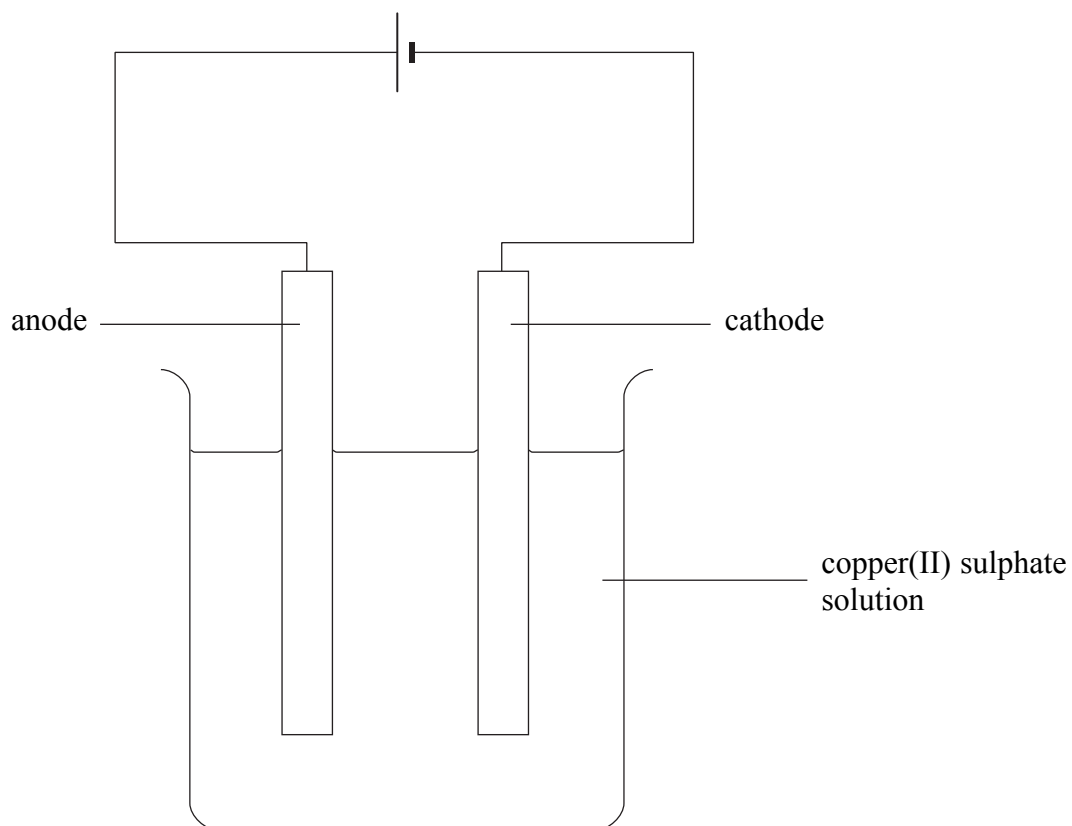
The masses of the electrodes at the start of the electrolysis were:

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.

$$Cu^{2+} \; + \; 2e^- \; \rightarrow \; Cu$$
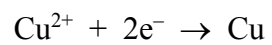
Write an equation for the reaction at the anode.

....
   (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							
1	**2**		**3**	**4**	**5**	**6**	**7**	**0**

1
H
Hydrogen
1

2
He
Helium
4

Period

1

2

3	4			5	6	7	8	9	10
Li	**Be**			**B**	**C**	**N**	**O**	**F**	**Ne**
Lithium	Beryllium			Boron	Carbon	Nitrogen	Oxygen	Fluorine	Neon
7	9			11	12	14	16	19	20

3

11	12			13	14	15	16	17	18
Na	**Mg**			**Al**	**Si**	**P**	**S**	**Cl**	**Ar**
Sodium	Magnesium			Aluminium	Silicon	Phosphorus	Sulphur	Chlorine	Argon
23	24			27	28	31	32	35.5	40

4

19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
K	**Ca**	**Sc**	**Ti**	**V**	**Cr**	**Mn**	**Fe**	**Co**	**Ni**	**Cu**	**Zn**	**Ga**	**Ge**	**As**	**Se**	**Br**	**Kr**
Potassium	Calcium	Scandium	Titanium	Vanadium	Chromium	Manganese	Iron	Cobalt	Nickel	Copper	Zinc	Gallium	Germanium	Arsenic	Selenium	Bromine	Krypton
39	40	45	48	51	52	55	56	59	59	63.5	65	70	73	75	79	80	84

5

37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Rb	**Sr**	**Y**	**Zr**	**Nb**	**Mo**	**Tc**	**Ru**	**Rh**	**Pd**	**Ag**	**Cd**	**In**	**Sn**	**Sb**	**Te**	**I**	**Xe**
Rubidium	Strontium	Yttrium	Zirconium	Niobium	Molybdenum	Technetium	Ruthenium	Rhodium	Palladium	Silver	Cadmium	Indium	Tin	Antimony	Tellurium	Iodine	Xenon
86	88	89	91	93	96	99	101	103	106	108	112	115	119	122	128	127	131

6

55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
Cs	**Ba**	**La**	**Hf**	**Ta**	**W**	**Re**	**Os**	**Ir**	**Pt**	**Au**	**Hg**	**Tl**	**Pb**	**Bi**	**Po**	**At**	**Rn**
Caesium	Barium	Lanthanum	Hafnium	Tantalum	Tungsten	Rhenium	Osmium	Iridium	Platinum	Gold	Mercury	Thallium	Lead	Bismuth	Polonium	Astatine	Radon
133	137	139	179	181	184	186	190	192	195	197	201	204	207	209	210	210	222

7

87	88	89
Fr	**Ra**	**Ac**
Francium	Radium	Actinium
223	226	227

Key

Atomic number
Symbol
Name
Relative atomic mass