Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						7	0	8	1	/	0	2	Signature	

Paper Reference(s)

7081/02

Examiner's use only

Team Leader's use only

London Examinations GCE

Chemistry

Ordinary Level

Paper 2

Thursday 17 January 2008 – Morning

Time: 2 hours

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
8	
9	
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 signature.
Check that you have the correct question paper.
The paper is arranged in TWO sections, A and B.
In Section A, answer ALL questions. In Section B, answer TWO questions.
Write your answers in the spaces provided in this question paper.
Indicate which question you are answering by marking the box (☒). If you change your mind, put a line through the box (~~☒~~) and then indicate your new question with a cross (☒).

Information for Candidates

A Periodic Table is printed on the back cover of this question paper.
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 9 questions. All 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 Section B, organise your material and present your ideas in a clear and logical form.
In calculations, show **all** the steps in your working.

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Leave blank

SECTION A

Answer ALL the questions in this section.

Write your answers in the spaces provided.

There is useful data on the front cover and a Periodic Table is printed on the back of this question paper.

1. For each of the following gas preparations:

- give the names or formulae of suitable reactants
- give the drying agent needed
- state how a gas jar full of the dry gas would be collected.

(a) Carbon dioxide

Reactants .....

.....

Drying agent .....

Method of collection .....

(3)

(b) Ammonia

Reactants .....

.....

Drying agent .....

Method of collection .....

(3)

(c) Chlorine

Reactants .....

.....

Drying agent .....

Method of collection .....

(4)

Q1

(Total 10 marks)

Leave blank

2. (a) (i) What is an ionic bond?

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(2)

(ii) What is a covalent bond?

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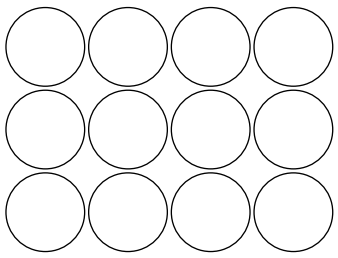
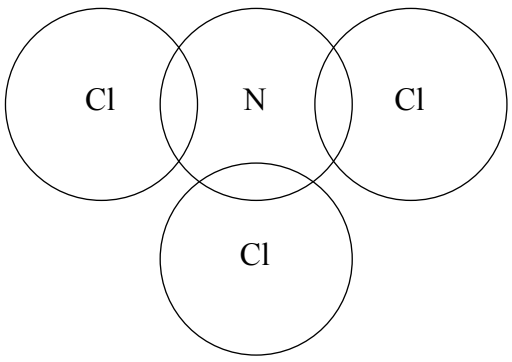
(2)

(b) (i) The diagram below represents a layer in a crystal of sodium chloride. Write the formulae of the ions in the circles.



(2)

(ii) The diagram below represents the outer shells of the atoms in a molecule of nitrogen(III) chloride, NCl_3. Complete the dot and cross diagram to show the electron arrangement.



(2)

(c) Explain why covalent compounds such as NCl_3 have low boiling points.

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(2)

Q2

(Total 10 marks)

Turn over

Leave blank

3. This question is about methods of separation.

(a) State how oxygen is obtained from air on an industrial scale.

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(2)

(b) Copper can be obtained from a mixture of copper and magnesium by using dilute sulphuric acid.

(i) What is the function of the sulphuric acid?

.....

(1)

(ii) Write the equation for the reaction that takes place.

.....

(1)

(iii) How would you separate copper from the reaction mixture?

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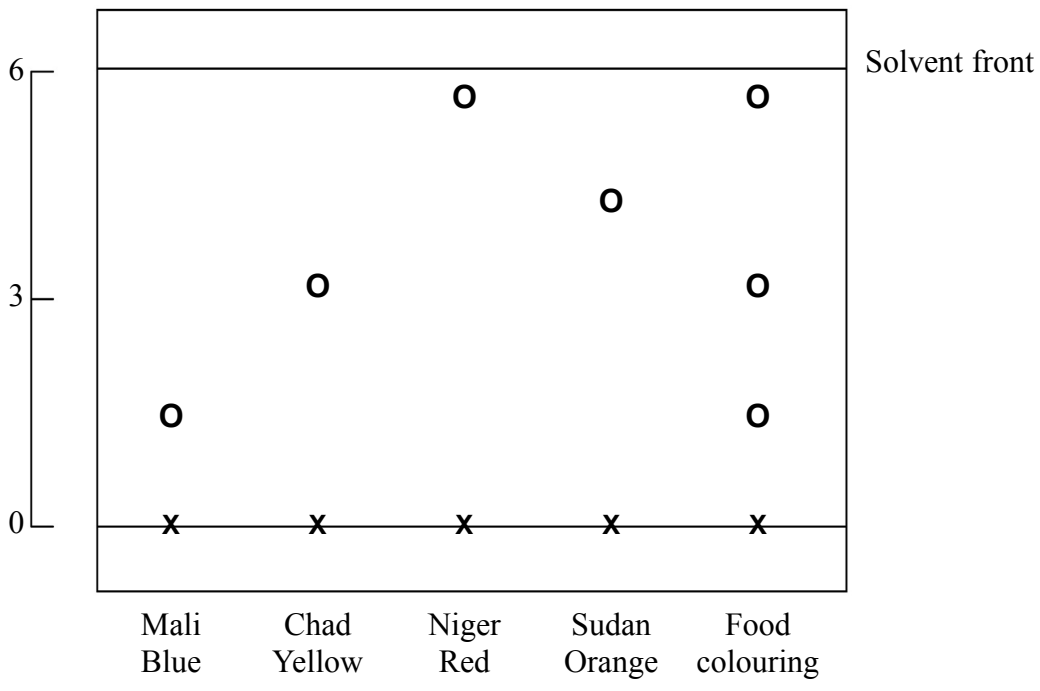
(1)

(c) A student used chromatography to investigate the dyes in a food colouring. A series of dyes and an extract of the food colouring were spotted on the paper at the points marked **X**. Ethanol was used as the solvent to carry the dyes up the paper. The chromatogram below shows the results.



Leave blank

(i) State which dye is the most soluble in ethanol.

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(1)

(ii) State which dye is not present in the food colouring.

.....

(1)

(iii) The R_f value of a dye is calculated by using the formula:

$$R_f \text{ value} = \frac{\text{distance travelled by dye}}{\text{distance travelled by solvent front}}$$

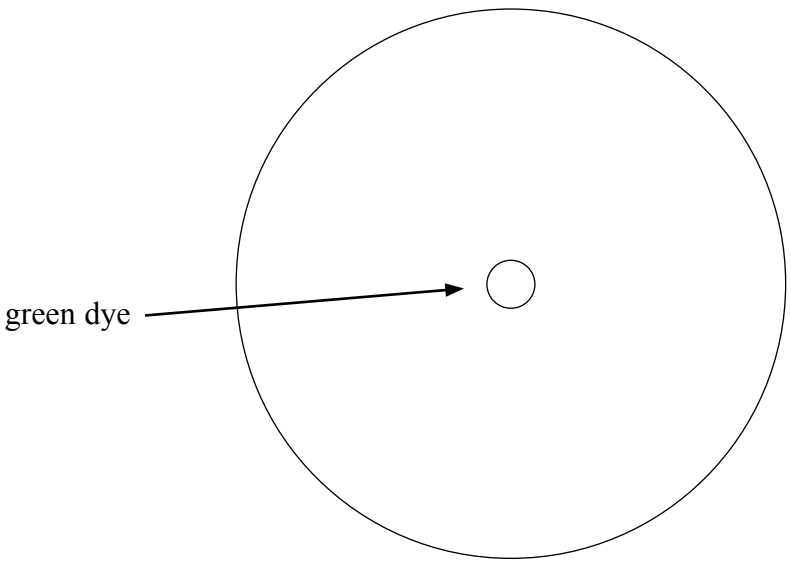
Calculate the R_f value for Chad Yellow.

.....

.....

(2)

(iv) A green dye was thought to consist of Mali Blue and Chad Yellow. A spot of the dye was placed in the centre of a piece of circular filter paper and ethanol was dropped on it so that the dyes spread out. Draw the final appearance of the filter paper if Mali Blue and Chad Yellow were present and label the lines to identify the components of the dye.



(1)

(Total 10 marks)

Q3

Leave blank

4. (a) Alkenes can be produced by breaking down long-chain hydrocarbons into smaller molecules.

(i) State what is meant by a **long-chain hydrocarbon**.

Long-chain .....

Hydrocarbon .....

(2)

(ii) Name the process used to break down the hydrocarbons and give one essential condition.

Process .....

Condition .....

(2)

(iii) Complete the equation to show how 1 mole of the alkane $C_{13}H_{28}$ could break down into 1 mole of ethene, 1 mole of propene and one other product.

$C_{13}H_{28}$ → ..... + ... + ...

(2)

(b) Ethanol is made on an industrial scale by heating ethene with steam.

(i) Give **two** other conditions for the reaction.

1 .....

2 .....

(2)

(ii) Write an equation for the reaction.

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(1)

(iii) Give one advantage of this method of producing ethanol compared with the fermentation method.

.....

(1)

Q4

(Total 10 marks)

Leave blank

5. An organic acid, HX, reacts with sodium hydroxide solution according to the equation

$$HX + NaOH \rightarrow NaX + H_2O$$

(a) A solution of the acid was titrated against sodium hydroxide solution, using phenolphthalein indicator.

(i) Name the piece of apparatus used to add the sodium hydroxide solution to the acid.

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(1)

(ii) State the colour of the solution at the end-point.

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(1)

(iii) Give **two** precautions that should be taken during the titration in order to obtain an accurate end-point.

1 .....

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2 .....

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(2)

Leave blank

(b) In the titration, a solution containing 1.50 g of the organic acid HX was exactly neutralised by 24.60 cm^3 of sodium hydroxide solution of concentration 0.500 mol dm^{-3}.

(i) Calculate the number of moles of NaOH in 24.60 cm^3 of solution.

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(2)

(ii) State the number of moles of HX in 1.50 g.

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(1)

(iii) Hence calculate the relative molecular mass of HX.

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(2)

(c) State why a titration should always be repeated.

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(1)

Q5

(Total 10 marks)

TOTAL FOR SECTION A: 50 MARKS

Leave blank

SECTION B

Answer TWO questions in this section. If you change your mind, put a line through the box (☒) and then indicate your new question with a cross (☒).

Where appropriate, give equations and diagrams to clarify your answers.

Write your answers in the spaces provided.

If you answer Question 6, put a cross in this box ☒.

6. Hydrogen peroxide decomposes in the presence of manganese(IV) oxide catalyst to form water and oxygen.

$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$

(a) (i) What is a **catalyst**?

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(2)

(ii) Give a test for oxygen.

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(1)

(b) Two experiments were performed to investigate the effect of a change in concentration on the rate of decomposition of hydrogen peroxide at room temperature. The catalyst had a mass of 1 g and was in the form of small pellets.

The results obtained are given in the table below.

Time / s	**0**	**20**	**40**	**60**	**80**	**100**	**120**	**140**
Experiment 1 4 cm^3 H_2O_2 + 46 cm^3 H_2O Volume of oxygen produced / cm^3	0	20	34	44	52	58	60	60
Experiment 2 6 cm^3 H_2O_2 + 44 cm^3 H_2O Volume of oxygen produced / cm^3	0	43	60	72	81	87	90	90

Leave blank

(i) Draw a labelled diagram to show how these experiments could be carried out.

(2)

(ii) On the grid opposite, choose a suitable scale for the vertical axis and draw graphs for Experiments 1 and 2.

(5)

(iii) Use the graph to determine the time when the reaction in Experiment 1 was half complete.

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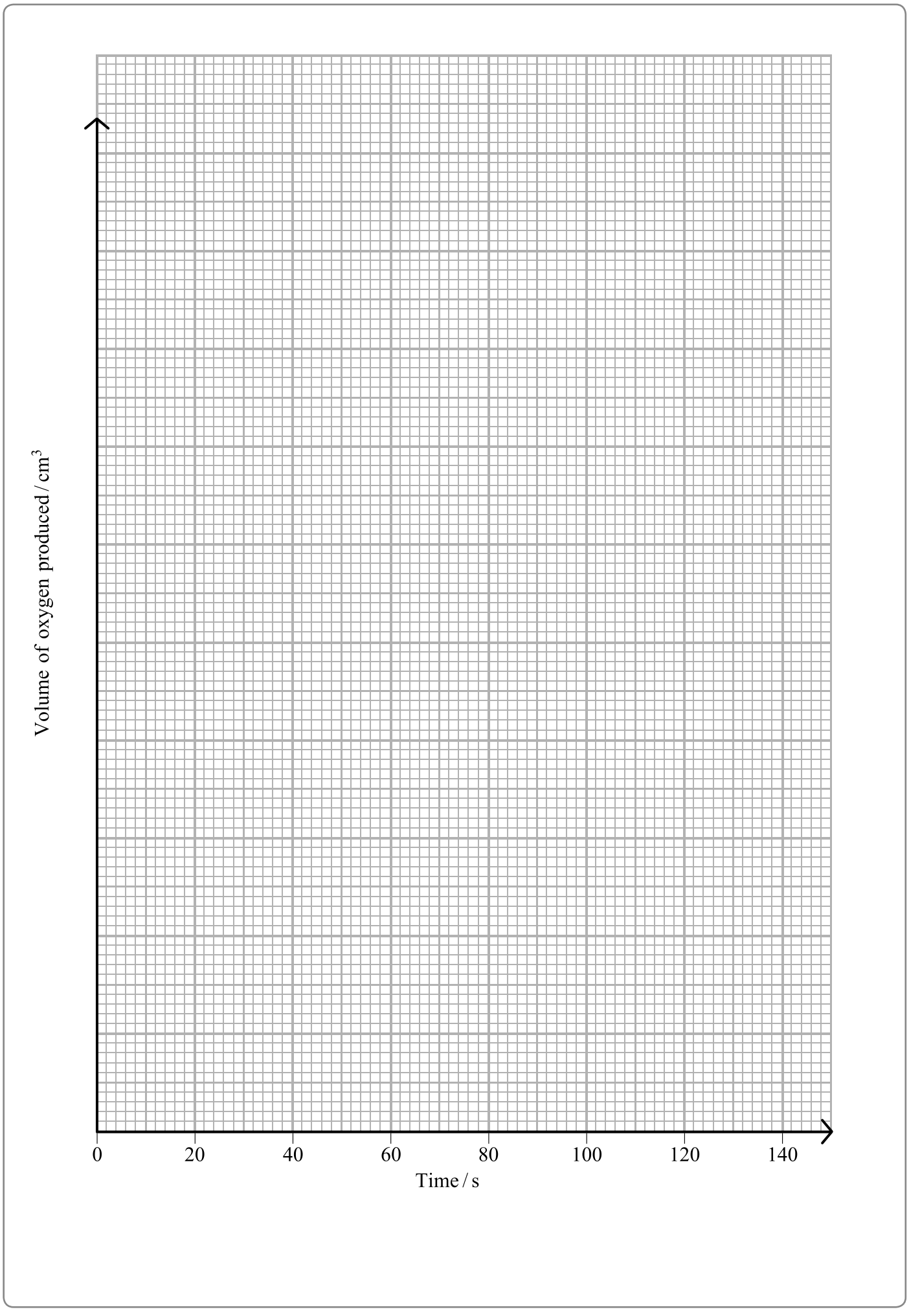
(1)


Volume of oxygen produced / cm3
0
20
40
60
80
100
120
140
Time / s

Leave blank

(c) State how the graphs support the following statements and explain each in terms of the kinetic theory.

(i) The rate of a reaction decreases with time.

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(3)

(ii) An increase in concentration increases the rate of decomposition of hydrogen peroxide.

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(3)

Leave blank

(d) Two further experiments were carried out.

In Experiment 3, a mixture of 2 cm^3 of hydrogen peroxide and 48 cm^3 of water was added to 1 g of catalyst in the form of small pellets.

In Experiment 4, a mixture of 6 cm^3 of hydrogen peroxide and 44 cm^3 of water was added to 1 g of powdered catalyst.

Sketch on the grid, using the same axes as before, two curves to show the progress of the reaction in both Experiment 3 and Experiment 4. Label each curve accordingly.

(4)

(e) Use the equation given at the start of this question to calculate the mass of hydrogen peroxide that would produce 60 cm^3 of oxygen gas at room temperature and normal atmospheric pressure.

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(4)

Q6

(Total 25 marks)

Leave blank

If you answer Question 7, put a cross in this box ☒.

7. (a) Starting from sulphur, describe how sulphuric acid is manufactured via the Contact Process. Give essential conditions and write equations for the chemical reactions that occur.

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(10)

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(b) When aqueous sulphuric acid is electrolysed, the products are hydrogen and oxygen. State the ions present in the acid solution and explain how the products are formed. Write equations for the reactions occurring at the electrodes.

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(6)

(c) (i) Describe how a pure sample of hydrated zinc sulphate crystals can be obtained starting from dilute sulphuric acid and zinc oxide. Write an equation for the reaction. (Diagrams are **not** required.)

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(5)

Leave blank

(ii) When 5.74 g of hydrated zinc sulphate, $ZnSO_4 .xH_2O$, is heated, 3.22 g of anhydrous zinc sulphate is formed. Use these figures to find the value of x.

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(4)

Q7

(Total 25 marks)

TURN OVER FOR QUESTION 8

Leave blank

If you answer Question 8, put a cross in this box ☒.

8. (a) A group in the Periodic Table is sometimes described as 'a family of elements'. Discuss how this description applies to Group 1 (Li to K) and Group 7 (Cl to I) by considering:

- the number of electrons in the outer shell
- the loss or gain of electrons to form a stable electronic configuration
- the appearance of the elements as each group is descended
- the change in reactivity as each group is descended in terms of electron configurations and the ability to lose or gain electrons.

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(15)

QUESTION 8 CONTINUES ON THE NEXT PAGE

Leave blank

(b) ‘In the Periodic Table, metals in the same period become less reactive from left to right’.

Support this statement by describing **three** contrasting observations made during the reactions of potassium and calcium with water. Write equations for the reactions that occur.

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(7)

(c) Explain why the elements in Group 0 are inert. Give one use for argon that depends on this inertness.

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(3)

Q8

(Total 25 marks)

Leave blank

If you answer Question 9, put a cross in this box ☒.

9. (a) (i) What is **allotropy**?

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(2)

(ii) State **two** ways in which the structures of diamond and graphite are similar.

1 .....

2 .....

(2)

(iii) State one way in which the structures of diamond and graphite are different.

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(2)

(iv) Explain why diamond is very hard whereas graphite is soft. (Diagrams are **not** required.)

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(4)

Leave blank

(b) (i) When burnt in air, carbon can form two gaseous products. Identify these products and state the conditions under which each forms. Write an equation for the formation of each gas.

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(6)

(ii) Give a test that would distinguish between the gases.

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(2)

(iii) One of the gases can act as reducing agent at high temperatures. Describe what you would see if this gas is passed over heated copper(II) oxide. Write an equation for the reaction.

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(3)

Leave blank

(c) When sodium carbonate solution is added to magnesium chloride solution, the reaction that occurs is represented by the equation:

$$Na_2CO_3(aq) + MgCl_2(aq) \rightarrow 2NaCl(aq) + MgCO_3(s)$$

Calculate the mass of sodium carbonate needed to make exactly 3.36 g of magnesium carbonate.

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(4) Q9

(Total 25 marks)

TOTAL FOR SECTION B: 50 MARKS

TOTAL FOR PAPER: 100 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	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