

Name:

Centre/Index No:

School.....

Signature.....

P525/1
CHEMISTRY
Paper 1
July/August 2018
2 ¾ hours



WAKISSHA JOINT MOCK EXAMINATIONS

Uganda Advanced Certificate of Education

CHEMISTRY

Paper 1

2 hours 45 minutes

Instructions to Candidates

- Attempt *all* questions in section A and any *six* questions from section B.
- All questions are to be answered in the spaces provided.
- A Periodic Table with relevant atomic masses is supplied at the end of the paper.
- Mathematical tables (3 figures) and non-programmable silent scientific calculators may be used.
- Illustrate your answers with equations where applicable.

For Examiner's Use Only																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total

SECTION A (46 MARKS)

Attempt **all** questions in this section.

1. The atomization energies of carbon, hydrogen and chlorine are +715,+218 and +122 kJmol^{-1} respectively.

Given the bond energies in the table below.

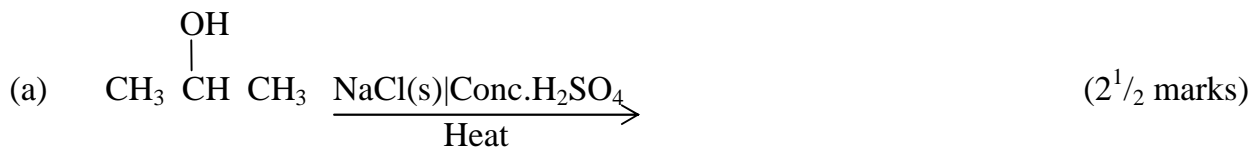
Bond	B.E (kJ mol^{-1})
C-H	413
C-CL	325.4

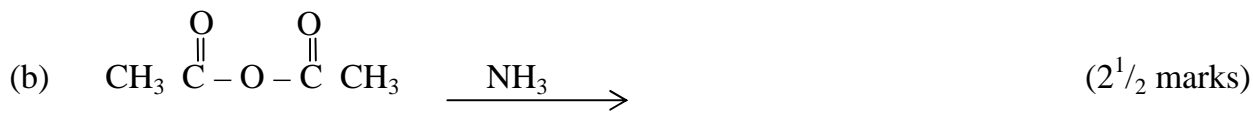
- (a) Distinguish between **bond energy** and **atomization energy**. (2marks)

- (b) (i) Calculate the enthalpy of formation of chloromethane. (3marks)

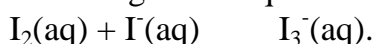
- (ii) State whether chloromethane is stable or not. Give a reason for your answer. (1mark)

2. Complete each of the organic reactions below and write a suitable mechanism for the reaction.





3. (a) Iodine is sparingly soluble in water but readily dissolves in potassium iodide according to the equilibrium.



(i) Write an expression for the concentration equilibrium constant K_c . (1 mark)

(ii) State any **two** characteristics of the above equilibrium. (1 mark)

b) State and explain the effect of adding sodium thiosulphate solution to the position of equilibrium. (2marks)

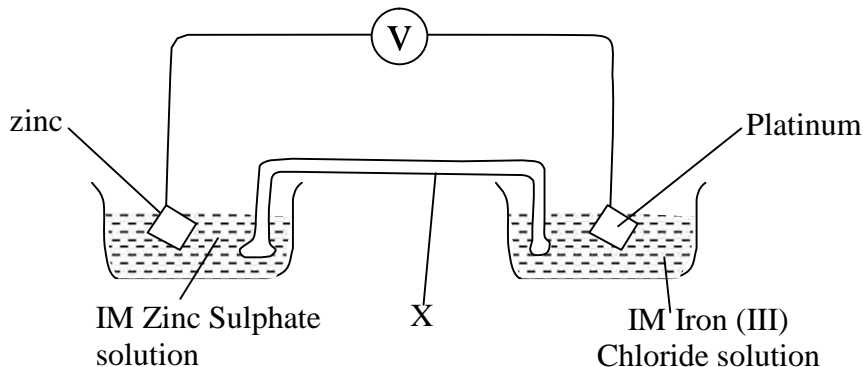
4. (a) Aluminium chloride is covalent and rapidly undergoes hydrolysis in moist air.

(i) State **three** other properties to show that aluminium chloride is covalent. (1½ marks)

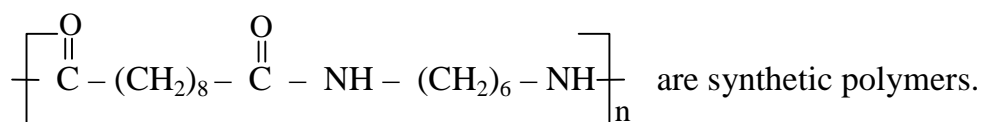
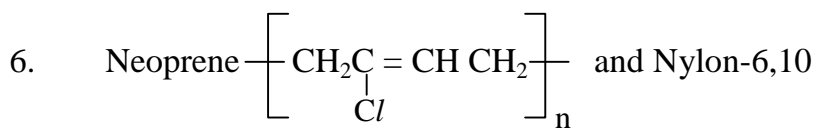
(ii) Write an equation for the hydrolysis of aluminium chloride in moist air. (1mark)

- (b) (i) Name **one** element of period 2 whose chemical properties resemble those of aluminium. (1/2 marks)
-
- (ii) State **two** other properties to show the similarity in chemical properties of aluminium and the element named in b (i) above. (1mark)
-
-
-

5. The figure below shows a voltaic cell setup between two electrodes.



- (a) (i) Define the term “voltaic cell” (1mark)
-
- (ii) Name x and state its role in the above setup. (1mark)
-
- (b) The reading on the voltmeter above was +1.53volts.
- (i) Write an equation for the redox reaction that takes place. (1mark)
-
- (ii) State whether the reaction in b(i) above is feasible. Give a reason for your answer. (1mark)
-
- (c) Calculate the electrode potential of the left hand electrode if the electrode potential of the right hand electrode is +0.77V. (1mark)
-
- (d) Write the cell convention for the voltaic cell above. (1mark)
-



(a) Name the type of polymerization by which each polymer is obtained.

Neoprene _____ (½mark)

Nylon-6,10 _____ (½mark)

b) Write the structural formulae of the monomer(s) of each polymer.

(i) Neoprene (1 mark)

(ii) Nylon -6,10 (1mark)

(c) State **one** use of each polymer (1mark)

7. (a) Lead(iv) oxide reacts with hydrochloric acid according to the redox reaction below.



(i) State the condition(s) for the above reaction. (1mark)

(ii) Write the half reduction and oxidation reactions from the overall redox reaction above. (2mark)

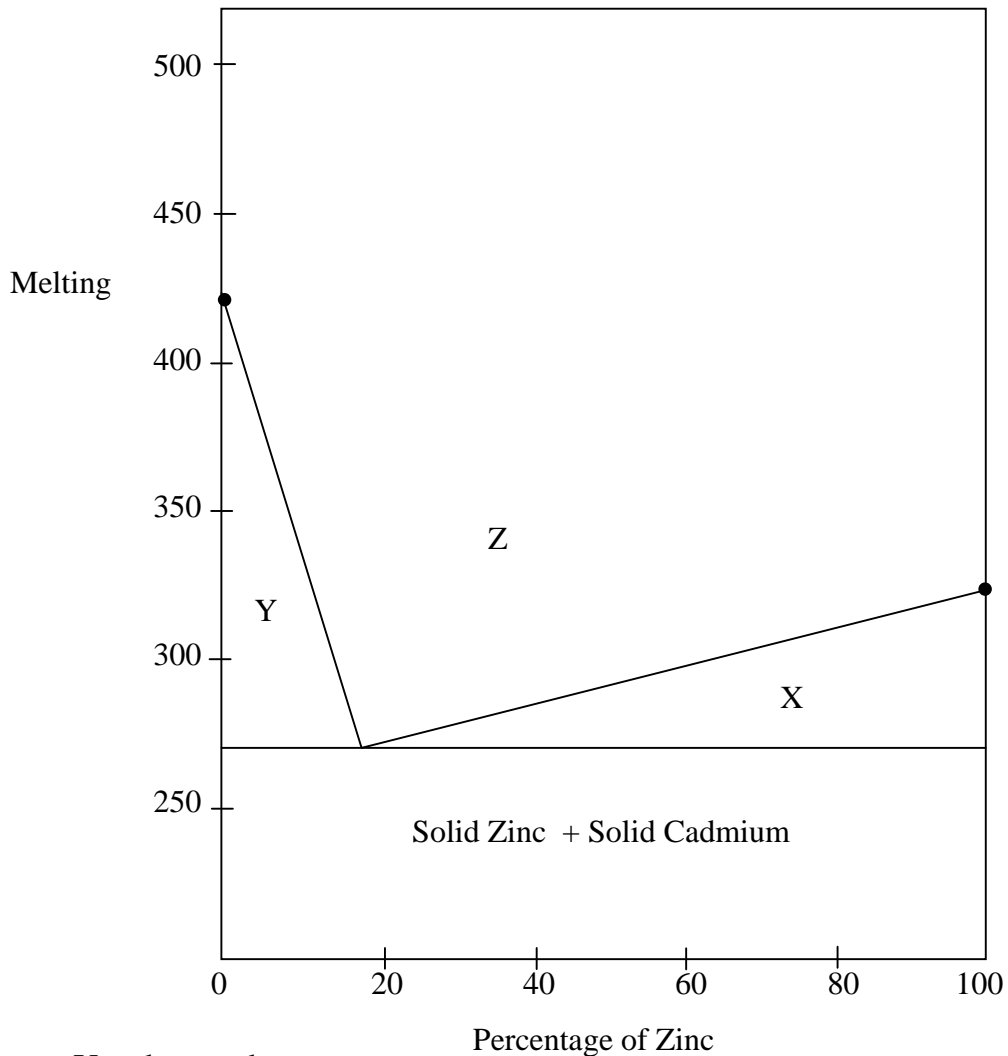
(b) Lead (iv) oxide was added to a solution of manganese(II) sulphate in the presence of concentrated nitric acid.

(i) State what was observed. (½ mark)

- (ii) Write the equation for the reaction that took place. (1 ½ marks)

8. (a) The graph shows the variation in melting point of a mixture of zinc and cadmium with composition.

EUTECTIC PHASE DIAGRAM FOR ZINC-CADMIUM SYSTEM



Use the graph to:

- (i) Determine the eutectic point of the system. (1 mark)

- (ii) Name the phases in region: (1 ½ marks)

X _____

Y _____

Z _____

- (b) Describe the changes that take place when a mixture containing 88% zinc is cooled from 450°C to 280°C. (2 ½ marks)

- (c) Calculate the mass of zinc that remained in solution when 120g of the liquid mixture containing 12% cadmium was cooled from 450⁰C to 280⁰C. (2marks)

9. (a) Name the reagents that can be used to distinguish between the following pairs of compounds. In each case state what would be observed. (2marks)

- (i) CH₃COOH and CH₃CH(Cl)COOH

Reagent(s)

Observation(s)

- (ii) CH₃CH₂OH and CH₃OH (2marks)

Reagent(s)

Observation(s)

- (b) Write equation(s) for the reaction(s) that take place in a (ii) above. (1mark)

SECTION B (54MARKS)

Answer only **six** questions from this section.

10. (a) An organic compound Q contains 54.55% carbon, 9.09% hydrogen and the rest being oxygen. The density of Q at 50°C and 2.0atm pressure is 3.3185gdm⁻³. Calculate the;
- (i) empirical formula of Q (1 ½ marks)
- _____
- _____
- _____
- _____
- _____
- _____
- (ii) molecular formula of Q (2 marks)
- _____
- _____
- _____
- _____
- _____
- _____
- (b) Q forms a yellow precipitate with a solution of 2, 4-dinitrophenylhydrazine in ethanol and concentrated sulphuric acid.
- (i) Identify Q by its structural formula and IUPAC name. (1mark)
- _____
- _____
- _____
- (ii) State what would be observed when Q is added to ammoniacal silver nitrate solution and the mixture warmed. (½ mark)
- _____
- (iii) Write an equation for the reaction that occurs in b(ii) above. (1mark)
- _____
- _____
- (c) Suggest a suitable mechanism for the reaction between Q and acidified hydroxylamine (H₂NOH). (3marks)
- _____
- _____
- _____
- _____

11. (a) Chromium like other transition elements forms an orange coloured solution of potassium dichromate and a complex ion of the formula: $[\text{Cr}(\text{C}_2\text{O}_4)_3]^{3-}$.
- (i) State any **two** other properties to show that chromium is a typical transition element. Illustrate each answer with an example. (2marks)

- (ii) Explain why chromium forms a complex. (1 ½ marks)

- (b) (i) State the co-ordination number and oxidation state of chromium in $[\text{Cr}(\text{C}_2\text{O}_4)_3]^{3-}$.
Co-ordination number _____ (½ marks)
Oxidation state _____ (½ marks)
- (ii) Name the donor atom in the ligands of $[\text{Cr}(\text{C}_2\text{O}_4)_3]^{3-}$.
_____ (½ marks)

- (c) State what would be observed and write an equation for the reaction that occurs when each of the following is added to an aqueous solution of potassium dichromate.

- (i) acidified hydrogen peroxide solution.
Observation; (½ marks)

Equation; (1 ½ marks)

- (ii) Dilute sodium hydroxide solution.
Observation; (½ marks)

Equation; (1 ½ marks)

12. (a) The solubility of lead (II) Iodide in 0.2M potassium Iodide solution at 25°C is $8.544 \times 10^{-4} \text{ g dm}^{-3}$.
- (i) Define the term solubility. (1mark)

Turn Over

(ii) Write an equation for the solubility equilibrium reaction of lead (II) iodide.

(1 mark)

(b) Calculate the:

(i) Solubility product (K_{sp}) of lead(II) iodide at 40°C .

(3½marks)

(ii) Solubility of lead (II) Iodide in water at 40°C .

(1 ½ marks)

(c) Explain the difference between your answer in b (ii) above and the solubility of lead (II) iodide in 0.2M potassium iodide.

(1 ½ marks)

(d) State any **two** practical applications of solubility product.

(1 mark)

13. Use equations to show how each of the following compounds can be synthesized.

(a) Ethoxycyclohexane from nitrobenzene.

(3 ½ marks)

(b) Ethanol from propanoic acid. (3marks)

(c) Propan -2-ol to propanone phenylhydrazone. (2½ marks)

14. (a) The melting points of magnesium and sulphur are 660°C and 119°C respectively. Explain the difference in the melting points. (2 ½ marks)

(b) (i) Write the formulae of the oxides formed by magnesium and sulphur. State the types of bond in each oxide. (2 ½ marks)

Element	Formula of oxide	Type of bond
Magnesium		
Sulphur		

(ii) Write an equation for the reaction between each oxide in b (i) above with sodium hydroxide solution. (2 marks)

(c) Both magnesium and sulphur react with silicon to form silicides of the formula Mg_2Si and SiS_2 respectively.

Write an equation for the reaction between:

(i) Mg_2Si and dilute hydrochloric acid. (1mark)

(ii) SiS_2 and cold water. (1mark)

15. Explain each of the following observations.

- (a) When separately added to copper (II) sulphate solution, potassium iodide forms a white precipitate in a brown solution while potassium chloride solution gives no observable change. (3marks)

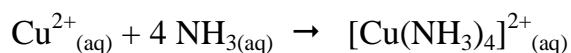
- (b) Neutrons are preferred to protons for bombardment in nuclear fission. (2marks)

- (c) Both halogens and oxygen are diatomic however halogens react more readily with metals than oxygen. (2marks)

- (d) Pentane and 2,2-dimethylpropane have the same relative formula mass but different boiling points. (2 marks)

16. (a) In an experiment to determine the partition coefficient of ammonia between water and trichloromethane, equal volumes of 0.1M copper (II) sulphate solution and 2M ammonia were mixed and the mixture shaken with trichloromethane in a closed vessel. At equilibrium, the concentration of ammonia in trichloromethane was 0.0308M.

- (i) Calculate the concentration of ammonia that reacted with copper (II) ions. (2marks)

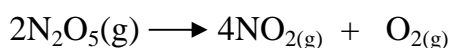


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-
- (ii) Determine the partition coefficient K_D of ammonia between water and trichloromethane. (4marks)

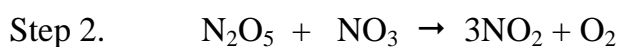
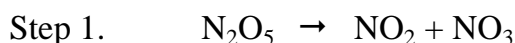
- (b) State any **two**;
(i) assumptions made in a(ii) above (2marks)

- (ii) practical applications of the partition law other than determining the formulae of complexes. (1mark)

17. (a) Dinitrogen pentoxide decomposes according to the equation.



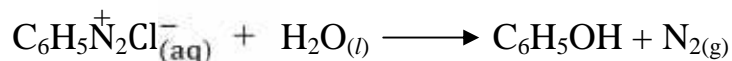
Mechanism



- (i) Define the term molecularity (1 mark)

- (ii) Given that the above reaction is unimolecular. identify the slowest step in the mechanism. Give a reason for your answer. (1mark)

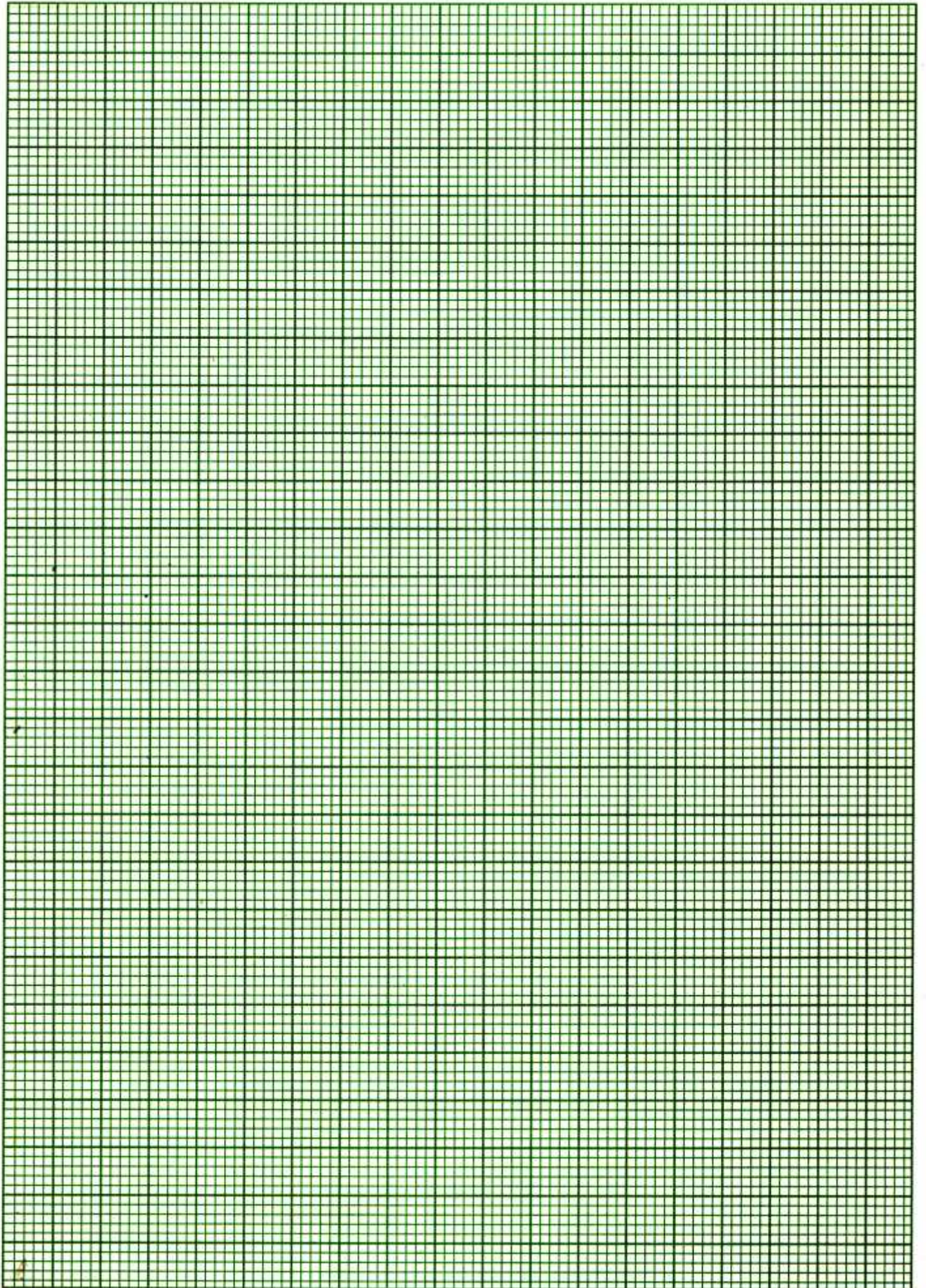
- (b) 0.2M benzene diazonium chloride decomposes in the presence of water by the equation:



The volume of nitrogen gas evolved was recorded at different time intervals shown below.

Time (seconds)	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0
Volume of N ₂ (dm ³)	0.0	0.42	0.70	0.90	1.08	1.22	1.28	1.30	1.30

- i) Plot a graph of volume of nitrogen gas against time.
Use your graph to determine the initial rate. (4marks)
- _____
- _____
- _____
- _____
- ii) The experiment was repeated with 0.05m benzene diazonium chloride at 40⁰c and the initial rate was 0.0205dm³/s.
Calculate the order of reaction with respect to Benzene diazonium chloride. (1½ marks)
- _____
- _____
- _____
- _____
- (c) Write the rate equation if the concentration of water remains constant during the reaction. (1mark)
- _____
- _____
- (d) State the effect of increasing temperature on the value of the rate constant. (½ marks)
- _____
- _____



THE PERIODIC TABLE

1	2											3	4	5	6	7	8
1.0 H 1																1.0 H 1	4.0 He 2
6.9 Li 3	9.0 Be 4											10.8 B 5	12.0 C 6	14.0 N 7	16.0 O 8	19.0 F 9	20.2 Ne 10
23.0 Na 11	24.3 Mg 12											27.0 Al 13	28.1 Si 14	31.0 P 15	32.1 S 16	35.4 Cl 17	40.0 Ar 18
39.1 K 19	40.1 Ca 20	45.0 Sc 21	47.9 Ti 22	50.9 V 23	52.0 Cr 24	54.9 Mn 25	55.8 Fe 26	58.9 Co 27	58.7 Ni 28	63.5 Cu 29	65.7 Zn 30	69.7 Ga 31	72.6 Ge 32	74.9 As 33	79.0 Se 34	79.9 Br 35	83.8 Kr 36
85.5 Rb 37	87.6 Sr 38	88.9 Y 39	91.2 Zr 40	92.9 Nb 41	95.9 Mo 42	98.9 Tc 43	101 Ru 44	103 Rh 45	106 Pd 46	108 Ag 47	112 Cd 48	115 In 49	119 Sn 50	122 Sb 51	128 Te 52	127 I 53	131 Xe 54
133 Cs 55	137 Ba 56	139 La 57	178 Hf 72	181 Ta 73	184 W 74	186 Re 75	190 Os 76	192 Ir 77	195 Pt 78	197 Au 79	201 Hg 80	204 Tl 81	207 Pb 82	209 Bi 83	209 Po 84	210 At 85	222 Rn 86
223 Fr 87	226 Ra 88	227 Ac 89															
			139 La 57	140 Ce 58	141 Pr 59	144 Nd 60	147 Pm 61	150 Sm 62	152 Eu 63	157 Gd 64	159 Tb 65	162 Dy 66	165 Ho 67	167 Er 68	169 Tm 69	173 Yb 70	175 Lu 71
			227 Ac 89	232 Th 90	231 Pa 91	238 U 92	237 Np 93	244 Pu 94	243 Am 95	247 Cm 96	247 Bk 97	251 Cf 98	254 Es 99	257 Fm 100	256 Md 101	254 No 102	260 Lw 103

END