

Candidate's Name:

Signature:

(Do not write your School/Centre Name or Number
anywhere on this booklet)

Random No.					Personal No.		

P525/1
CHEMISTRY
Paper 1
2 ¾ hours

Uganda Advanced Certificate of Education
PRE- TEST SIX 2024
CHEMISTRY
Paper 1
2 hours 45 minutes

INSTRUCTIONS TO CANDIDATES:

Answer **all** questions in section **A** and **six** questions in section **B**

All questions must be answered in the spaces provided

The Periodic Table, with relative atomic masses, is supplied.

Mathematical tables(3 – figure tables) are adequate or non-programmable scientific
electronic calculators may be used

Illustrate your answers with equations where applicable.

Where necessary, use the following:

Molar gas constant $R = 8.31 \text{ JK}^{-1} \text{ mol}^{-1}$

Molar volume of a gas at s.t.p is 22.4 litres.

Standard temperature = 273 K

Standard pressure = 101325 N m^{-2}

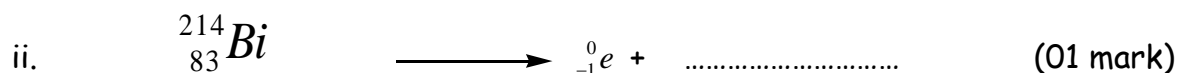
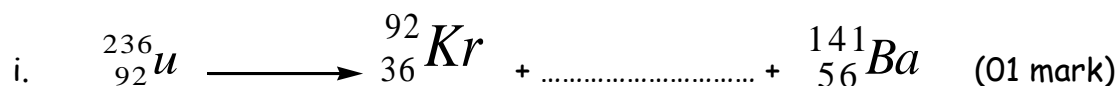
For Examiner's Use Only																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total

Turn Over.

SECTION A-46 MARKS

Attempt all questions in this section.

1. (a) Complete the following equations.



(b) The **half-life** of bismuth is **20 minutes**. Determine the **time taken** for Bismuth to decay by **75%**. (02½ marks)

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2. Beryllium, magnesium and calcium are some of the group(II) elements.

(a) Write the general outer configuration of the elements. (01 mark)

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b) Each of these elements reacts with carbon to form carbides. Write the equation for the reaction which occurs when each carbide reacts with water. (03 marks)

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2. (a) Write an equation for the reaction between hot concentrated Sodium hydroxide solution and

(i) Fluorine (01½ marks)

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(ii) Iodine (01½ marks)

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(b) Compare the reactivity of fluorine, chlorine and iodine with water (01 mark)

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(c) Explain why Lead(IV) chloride exists while lead(IV) bromide does not. (02mks)

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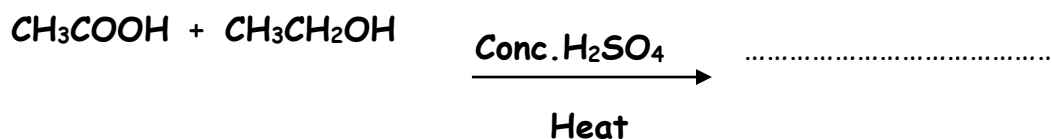
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4. Complete the **equation** below and write the **suggested mechanism** for the reaction.



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5. Write equations for the reaction of the following oxides with sodium hydroxide

(a) Aluminium oxide. (1 $\frac{1}{2}$ marks)

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(b) Beryllium oxide (1 $\frac{1}{2}$ marks)

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(c) Lead (II) oxide (1 $\frac{1}{2}$ marks)

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6. (a) State what is meant by the term **diagonal relationship**? (1mark)

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(b) State three reasons why beryllium and aluminium resemble in their chemical properties. (1 $\frac{1}{2}$ marks)

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(c) Mention three properties to show the diagonal relationship between lithium and magnesium. (3marks)

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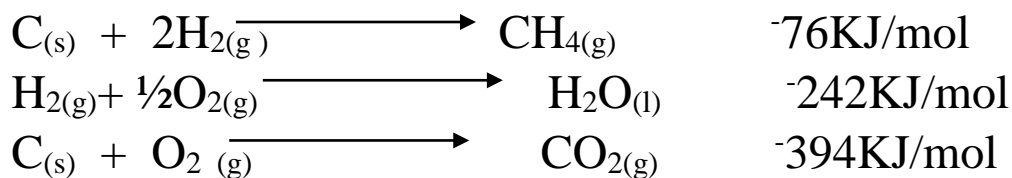
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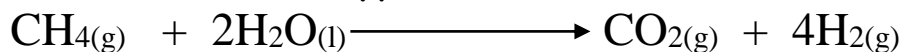
7. Methane reacts with steam according to the following equation:



The enthalpy of formation of methane, water and carbon dioxide are -76, -242 and -394KJ/mol.



(a) Calculate the **enthalpy of reaction**. (03 marks)



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b) State whether the reaction above is **feasible**, give a **reason** for your answer. (01 mark)

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8. Sodium propanoate undergoes hydrolysis when dissolved in water.

(a) Write equation for the hydrolysis of sodium propanoate (1mark)

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(b) Write the expression for the hydrolysis constant, K_h (1mark)

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(c) The hydrolysis constant, K_h for sodium propionate is $5.9 \times 10^{-10} \text{ mol dm}^{-3}$ at 25°C . What is the concentration of hydrogen ions in solution at equilibrium for a 0.1M sodium propionate? (2marks)

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9 (a). Define the **order of reaction**. (01 mark)

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(b).The experimental results in the table were obtained for the reaction between nitrogen monoxide gas and oxygen gas.



Initial concentrations (mol/dm^3)		Rate of reaction ($\text{mol/dm}^3/\text{s}$)
NO	O ₂	
0.03	0.03	2.7×10^{-5}
0.03	0.06	5.5×10^{-5}
0.06	0.03	10.8×10^{-5}

(i). Determine the **order of reaction** with respect to:

Nitrogen monoxide.

(01 mark)

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Oxygen.

(01 mark)

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(ii). Write the **rate equation** for the reaction.

(0½ mark)

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(c). Calculate the:

(i). **Overall order of reaction.**

(0½ mark)

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(ii). **Rate constant** for the reaction and **state its S.I units.** (01 mark)

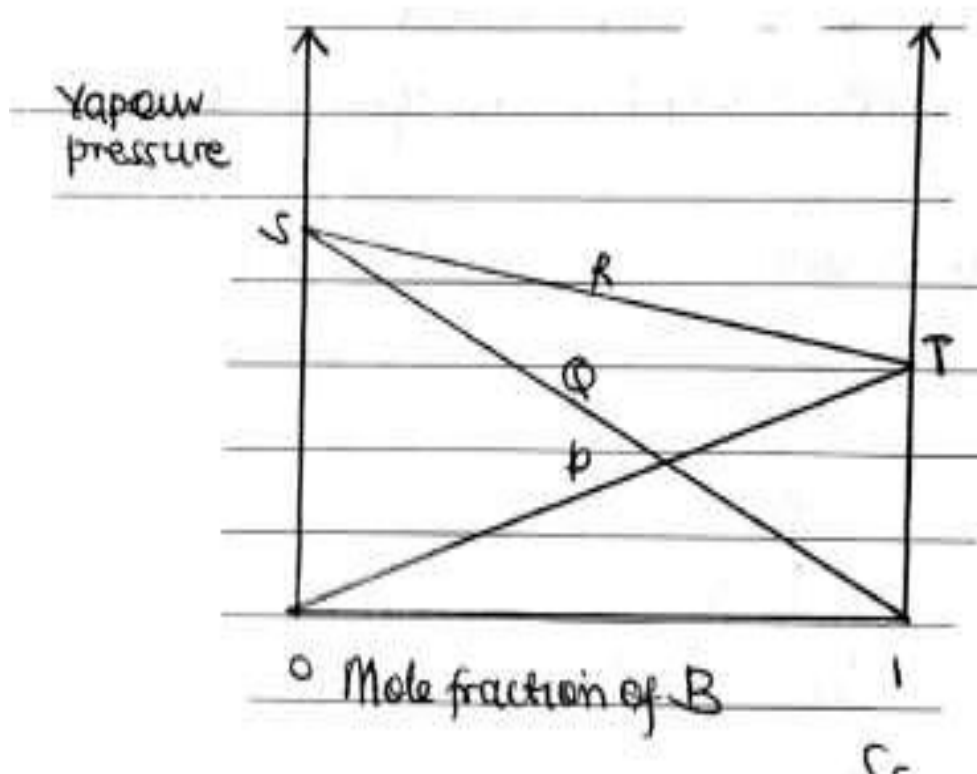
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SECTION B (54 MARKS)

Attempt Any six questions in this section.

10. (a) The vapour pressure - composition diagram for an ideal solution of liquids **A** and **B** is shown below.



- (i) Identify lines **P**, **Q** and **R** and the points **S** and **T**. ((02½ marks)

P.....

Q.....

R.....

S.....

T.....

(b) (i) Draw a fully labelled boiling point - composition diagram for a mixture of liquids **A** and **B**. (01½ marks)

(ii) State what would be obtained as the distillate and the residue if a liquid mixture containing **40%** of **A** is fractionally distilled. (02½ marks)

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- (c) A mixture of benzene and methylbenzene form **an ideal** solution
(i) A solution containing 1.95g of benzene and 4.6g of methylbenzene at 20°C.

[the vapour pressure of pure benzene and methylbenzene at 20°C are 10.0kPa and 8.2kPa respectively]

- (ii) Determine the composition of the vapour of the mixture above. (02½ marks)

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11. Name one reagent that can be used to distinguish between the following pairs of compounds. In each case state what would be observed if each member of the pair is treated with the named reagent.

- a) But-2-yne and But-1-yne

Reagent. (01 mark)

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Observations. (02 marks)

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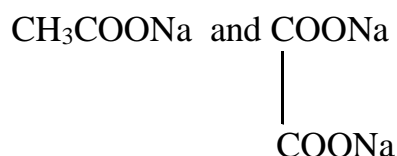
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- b) Bromobenzene and bromoethane

Reagent. (01 mark)

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Observations. (02 marks)



Reagent.

(01 mark)

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Observations.

(02 marks)

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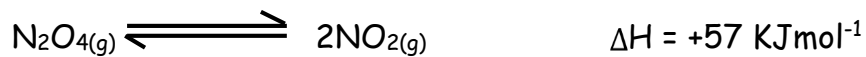
12. (a) State three characteristics of a **chemical equilibrium**. (1 $\frac{1}{2}$ marks)

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(b) Dinitrogen tetraoxide dissociates at 40°C and 1 atm according to the following equation.



(i) Write an expression for the equilibrium constant, K_p (0 $\frac{1}{2}$ mark)

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(ii) Draw a labelled energy level diagram for the reaction in (b) (2 marks)

(c) The reaction mixture in (b) was found to contain 60% by volume of nitrogen dioxide. Calculate the equilibrium constant K_p at 60°C for the reaction. (3marks)

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(e) Explain the effect of increasing pressure on the position of the above equilibrium. (2marks)

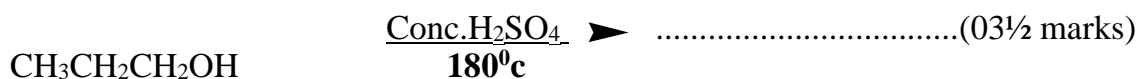
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13. Complete the following equations and write the suggested mechanism for the reaction.

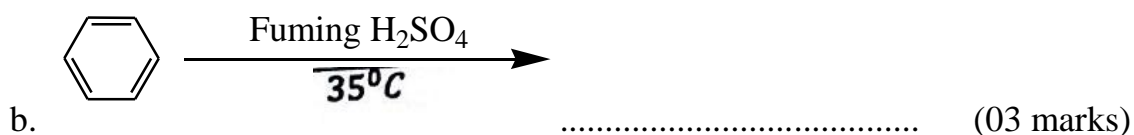


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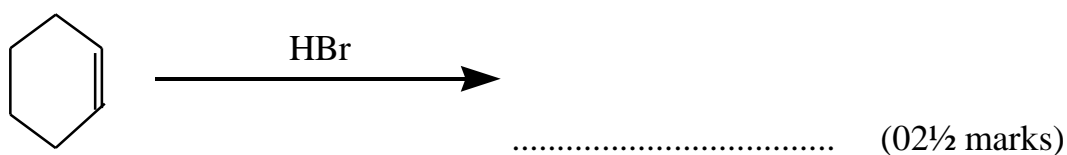


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14. The table shows the atomic radius and first ionization energy of some elements in period 3 of the periodic table.

Elements	Na	Mg	Al	Si	P	S	Cl
Atomic radius	0.186	0.160	0.143	0.117	0.110	0.104	0.099
1 st . I.E(KJ/mol)	496	738	577	787	1060	1000	1251

a. (i). State how **atomic radius** of the elements **varies across** the period. (01 mark)

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(ii).Explain your answer in a (i). (03 marks)

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b. (i).Explain how atomic radius affects the ionization energy. (02 marks)

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(ii).Why the first ionization energy of aluminium is lower than that of magnesium. (03 marks)

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15. (a) Sketch a **pH** curve that can be obtained for when ethanoic acid was titrated with sodium hydroxide solution (01 mark)

(b) Explain the shape of the curve (04 marks)

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(c) Name one indicator that can be used in the titration in (a) (01 mark)

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(b). Calculate the mass of sodium ethanoate that should be added to 1 litre of **0.1M** ethanoic acid solution in order to produce a solution of pH **4.0**
(K_a for ethanoic acid is $1.8 \times 10^{-5} \text{ mol dm}^{-3}$) (03 marks)

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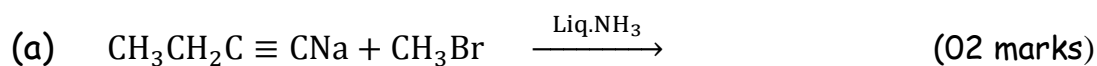
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16. Complete the following equations and in each case outline a suitable **mechanism** for the reaction.



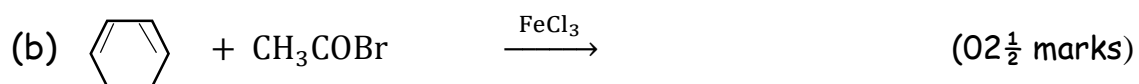
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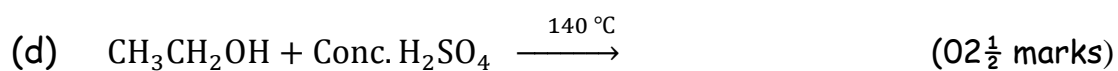
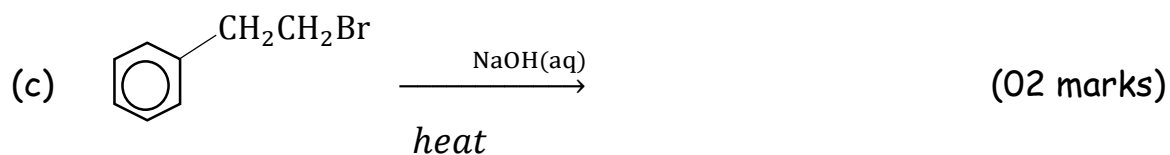


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17. Carbon, silicon, germanium, tin and lead are some of group(IV) elements on a periodic table. These elements exhibit **inert pair effect**

a) What is meant by the term **inert pair effect** (01 mark)

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b) Briefly explain inert pair effect among group(IV) elements using their dioxides.
(02 marks)

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c)Describe the reaction of silicon and lead with

(i) air (03marks)

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(ii) hot concentrated sodium hydroxide solution (03marks)

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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