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Chemistry Revision



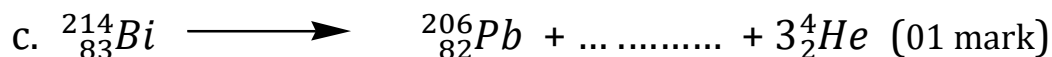
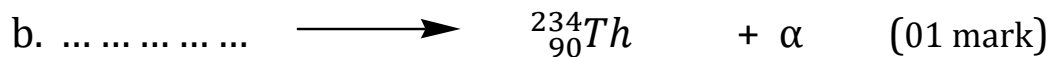
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A Level Revision Papers

SECTION A-46 MARKS

ATTEMPT ALL QUESTIONS IN THIS SECTION.

1. Complete the following **equations for nuclear reactions**.



2. The **first three** successive ionisation energies of element **T** are **549**, **1064** and **4226KJ/mol**.

a. Explain the **trend in the variation energy** of **T**. (03 marks)

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b. State the **group in the periodic table** to which **T belongs** to. (01 mark)

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3. **10.0cm³** of a hydrocarbon **P (C_xH_y)** was exploded in **90.0cm³** of oxygen gas. On cooling to room temperature, the residual gases occupied

70.0cm³, when the residual gases were passed through potassium hydroxide solution, the volume reduced to **40.0cm³**.

- a. (i). Write the **equation** for the reaction between hydrocarbon **P** and **oxygen gas**. (01 mark)

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- (ii). Determine the **molecular formula** of hydrocarbon P. (03 marks)

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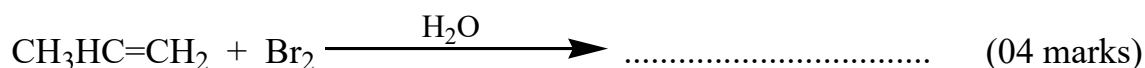
- b. Write equations to show how hydrocarbon **P** can be prepared from **propan-2-ol**. (02 marks)

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



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5. Thermo energy data for some processes are shown in the table below.

Processes	Energy (KJ/mol)
✓ Atomization of calcium	+178
✓ First ionization energy of calcium	+590
✓ Second ionization energy of calcium	+1146
✓ Formation of calcium fluoride	-1220
✓ Electron affinity of fluorine	-328
✓ Bond dissociation of fluorine	+242.7

a. (i). Calculate the **lattice energy** of calcium fluoride crystal.

(02 marks)

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(ii).Determine the enthalpy of solution of calcium fluoride crystal.
[Enthalpies of Ca^{2+} and F^- ions are -1587 and -515KJ/mol]

(02½ marks)

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b. (i).State the **effect of temperature** of the solution of calcium fluoride. (01 mark)

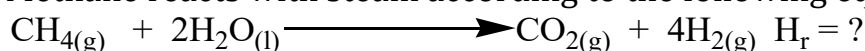
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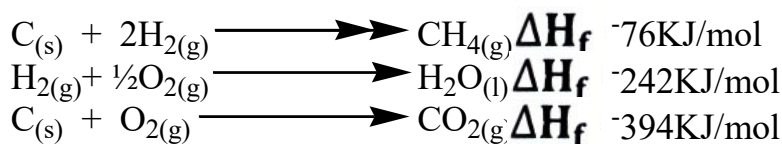
(ii).Give a **reason** for your answer in b (i). (0½ mark)

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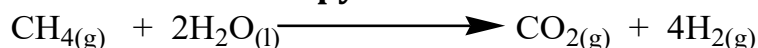
6. Methane reacts with steam according to the following equation:



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



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



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

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7. **2.0g** of phosphorus raises the boiling point of **37.4g** of carbondisulphide by **1.003°C**, whereas **4.65g** of sulphur raises the boiling point of **100g** of carbondisulphide by **0.42°C**.

a. (i). Calculate the **boiling point constant** for carbondisulphide. (Molar mass of sulphur is **256**) (03 marks)

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(ii). **Molar mass** of phosphorus in carbondisulphide. (03 marks)

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b. Determine **the molecular formula** of phosphorus. (02 marks)

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8. (a). (i). State the **conditions for the reaction** between Benzene and sulphuric acid. (01 mark)

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(ii). Outline the **mechanism for the reaction** in (a). (i). (02 marks)

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(b). Write **equation (s)** to show the product in **(a) (ii)** can be converted to hydroxybenzene. (02 marks)

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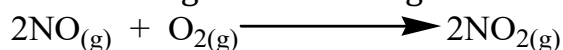
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9. (a). Define the **order of reaction**. (01 mark)

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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 (mol/dm ³ /s)
NO	O ₂	
0.03	0.03	2.7 X 10 ⁻⁵
0.03	0.06	5.5 X 10 ⁻⁵
0.06	0.03	10.8 X 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 it's S.I unit.** (0½ mark)

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SECTION B-54 MARKS

ATTEMPT ANY SIX QUESTIONS IN THIS SECTION.

10.(a). Define the term **radioactivity**. (01 mark)

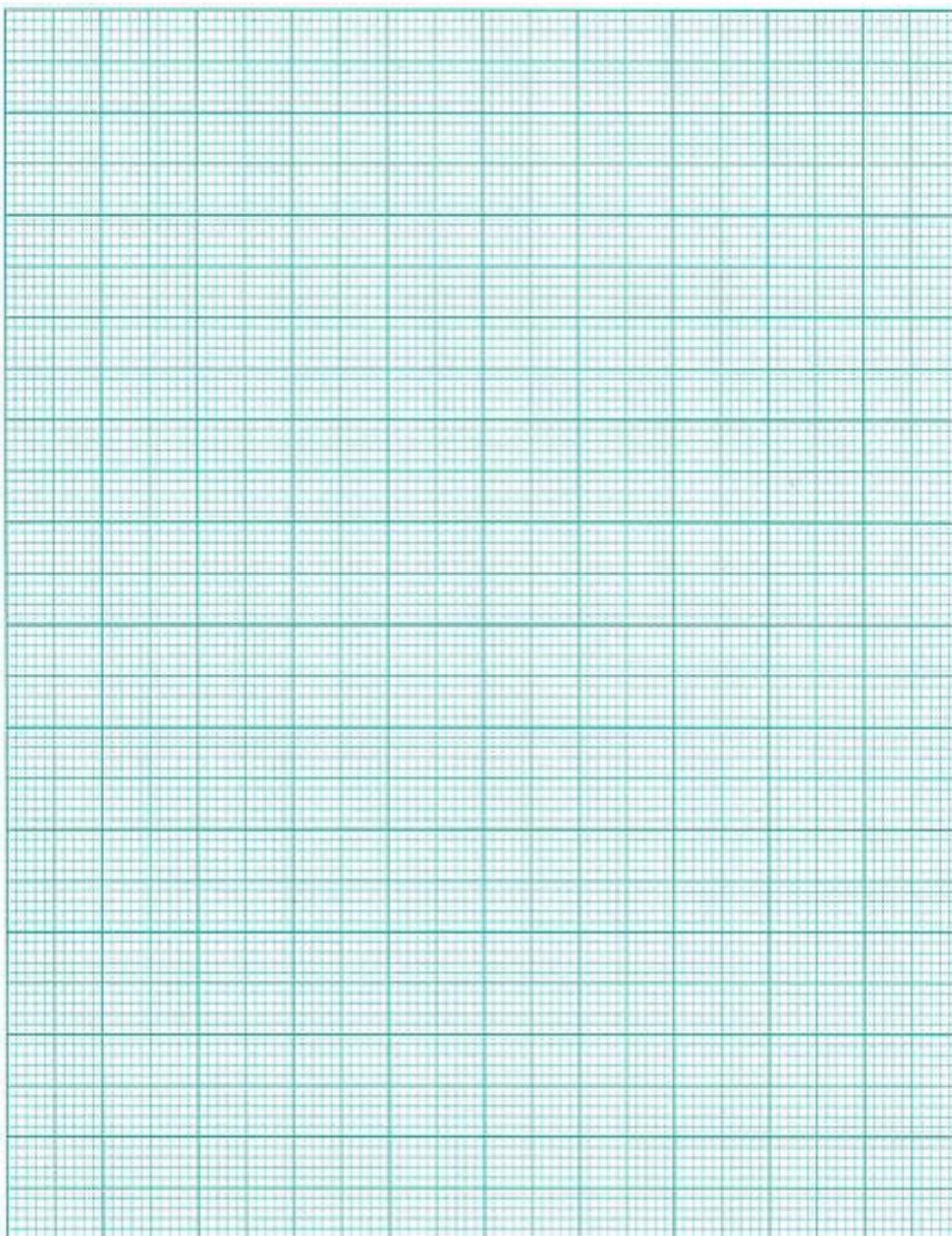
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(b).The table below shows how the mass of radioactive protactinium, $^{234}_{91}\text{Pa}$ varies with time.

mass of protactinium (g)	60.0	38.5	26.0	17.2	11.1
Time (s)	0	40	80	120	160

(i).Plot a **graph of mass** of protactinium against **time**. (03 marks)



(ii). Use your graph to determine the **half-life** of protactinium.

(01 mark)

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(iii). Calculate the **radioactive decay** of protactinium. (02 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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b. CO_3^{2-} and HCO_3^-

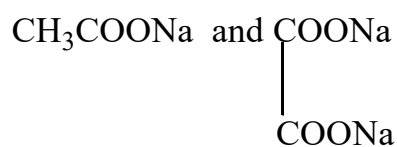
Reagent. (01 mark)

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Observations. (02 marks)

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c. Reagent. (01 mark)

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Observations. (02 marks)

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12. The vapour pressure of a solution containing **108.2g** of a substance **Y** in **1000g** of water at **20°C** was reduced by **0.186mmHg**.

(The vapour pressure of water at **20°C** is **17.54mmHg**)

a. Calculate the **molecular mass** of substance **Y**. (04 marks)

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b. State **three assumption made** in (a). (03 marks)

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- c. Explain why the vapour pressure of a solution containing a non-volatile solute is **less** than the vapour pressure of the pure solvent. (03 marks)

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- 13.(a). Draw the structure and name the shape of the following oxy anions of nitrogen gas. (03 marks)

Oxy anions	Structure	Shape
NO_2^-		
NO_3^-		

- (b)(i). Name the reagent (s) that can be used to distinguish between the oxyanions in (a) above. (01½ marks)

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- (ii). State what would be observed if the solution of each oxy anion is separately treated with the reagent (s) you have named in b (i) above. (02 marks)

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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

[illegible]

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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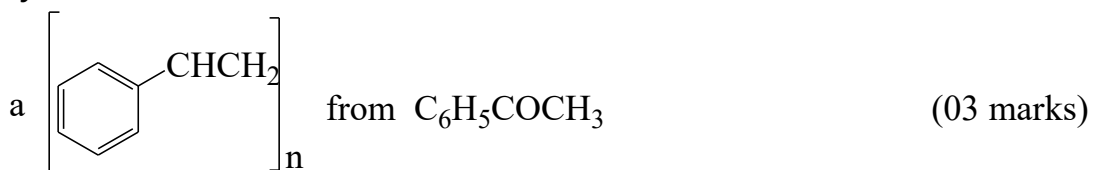
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15. Write equations to show how the following compounds can be synthesized and in each case state the conditions for the reaction.



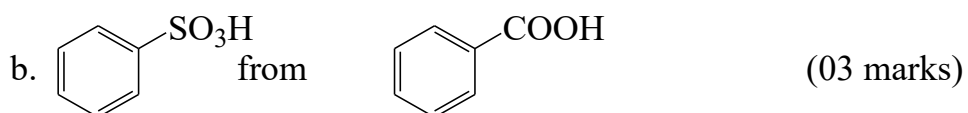
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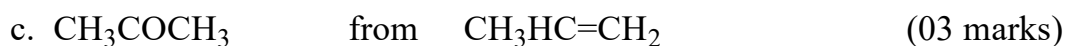


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16. Write an equation for dissolution of each of the following compounds in water. State whether the resultant solution is **neutral**, **acidic** or **basic**.

a) Sodium Sulphide. (02 marks)

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b) Ammonium Methanoate. (02 marks)

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c) Phenyl Ammonium Chloride. (03 marks)

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d) Sodium Benzoate. (02 marks)

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

a. $\text{CH}_3\text{CH}_2\text{C}\equiv\text{CH} \xrightarrow{2\text{HBr}}$ (03 marks)

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b.  + $\text{Conc.H}_2\text{SO}_4 \xrightarrow{\text{Conc.HNO}_3}$ (02 ½ marks)

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c. $\text{C}(\text{CH}_3)_3\text{Br} \xrightarrow[\text{Heat}]{\text{NaOH}_{(\text{aq})}/\text{CH}_3\text{CH}_2\text{OH}}$ (03½ marks)

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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

♥ ===END===

SECTION A-46 MARKS

ATTEMPT ALL QUESTIONS IN THIS SECTION.

1. Beryllium, magnesium & calcium are 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. Define nuclear stability. (01 mark)

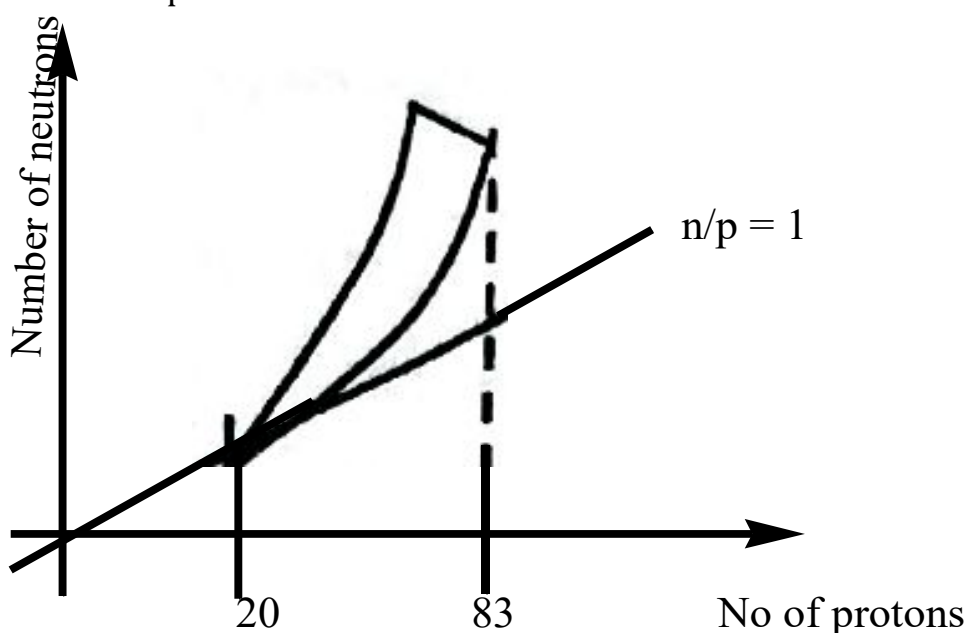
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- b (i). The graph below shows the variation of numbers of neutrons in an atom with proton numbers.



Explain why the bend of nuclear stability deviates from $\frac{n}{p} = 1$ after atomic number 20. (02 marks)

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(ii). Given that the respective mass numbers and atomic numbers of thorium and lead are **232** and **90**, **208** and **82**. Determine **the number of alpha** and **beta particles** that must be emitted by thorium to transform to lead. (02 marks)

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3. **50.0cm³ of 0.1M** aqueous ammonia was added to **50.0cm³ of 0.1 M** hydrochloric acid and the resultant solution had a **pH** less than 7.
- a. Give a reason for this observation. (02 marks)

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- b. Calculate the pH of the solution.
(K_h for the ammonium chloride is 6.34 X 10⁻⁸mol/dm³) (03 marks)

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4. State what would be observed and write equation between the following compounds and the reagent commonly used in identifying organic compounds.

a. Neutral iron (III) chloride and phenol. (02 marks)

Observations:

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Equation:

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b. Sodium nitrite in presence of concentrated hydrochloric acid and ethyl methylamine. (02 marks)

Observations:

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Equation:

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c. Fehling's solution and ethanol. (02 marks)

Observations:

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Equation:

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5. a. (i). Define the term Ore. (01 mark)

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(ii). Name the common ores for the following metals. (@0½ mark)

Aluminium

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Iron

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Copper

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Zinc

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- b. State the role of the following process in the extraction of metals.
(@ 01 mark)

i. Froth flotation.

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ii. Roasting.

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iii. Smelting.

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6. a. Explain the term partition law. (01½ marks)

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- b. An aqueous solution contains **10.0g** of **H** in a litre of solution.
100.0cm³ of this solution was shaken with **20.0cm³** of ether and the ether extracted **0.8g** of **H**.
Calculate the volume of the ether that is required to extract **80%** of **H** from **500.0cm³** of the aqueous solution. (03 marks)

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- c. Give a reason why extracting using aliquots improves the yield.
(01½ marks)

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7. Both Aluminium and phosphorus form compounds in the oxidation states of +3.

a. Briefly explain in terms of the electronic configuration why aluminium conducts electricity but all the common allotropes of phosphorus do not. (03 marks)

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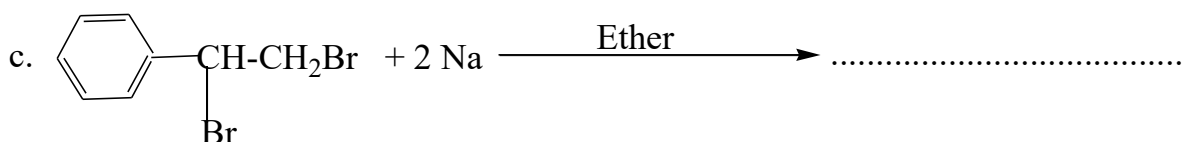
b. Write equation for the reaction between each element with sodium hydroxide solution. (03 marks)

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8. Complete the following equations and name the main organic product. (@01½ marks)

a. $(\text{CH}_3\text{CH}_2\text{COO})_2\text{Ca} \xrightarrow{\text{Heat}}$

b. $2\text{CH}_3\text{CHO} \xrightarrow{\text{Dil. NaOH}}$



9. a. State **Graham's law of gaseous diffusion**. (01 mark)

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- b. Nickel forms a carbonyl; $\text{Ni}(\text{CO})_n$. **Deduce the value of n** if carbon monoxide diffuses **2.46 times** faster than the carbonyl compound. (03 marks)

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c.State:

- i. **Oxidation state** of Nickel in the compound. (0½ mark)

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- ii. **Co-ordination numbers** of Nickel in the compound. (0½ mark)

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SECTION B-54 MARKS

ATTEMPT ANY SIX QUESTIONS IN THIS SECTION.

10. Write equations to show how the following synthesis can be carried out. In each case indicates the necessary reagents and conditions.

- a. Benzene to 2-phenylpropene. (03 marks)

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b. Ethane to hydroxyethanoic acid. (02½ marks)

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c. Chloroethane to propanamide. (03½ marks)

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11.A compound **Z** contains **19.15%** nitrogen, **43.5%** oxygen and the **rest** being manganese.

a. (i). Calculate the **empirical formula of Z**. (01½ marks)

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(ii). **10.0g** of **Z** in **1000.0g** of water lowered to freezing point of water by **0.127°C**.
Calculate the **molecular formular** of **Z**. (K_f for water is **1.86°C/mol/kg**) (02 marks)

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b. **Z** was dissolved in water to form a **pink solution** and divided in to two parts. State would be **observed** and **write equation** for the reaction that took place when:

i. Acidified potassium manganite (VII) solution was added to the first part. (02 marks)

Observations:

Equation:

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ii. Concentrated nitric acid and lead (IV) oxide was added to the second part and the mixture boiled. (02 marks)

Observations:

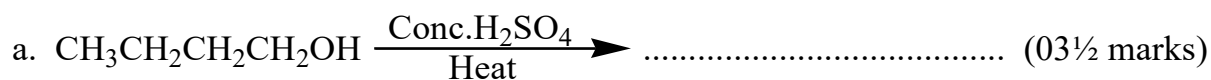
Equation:

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



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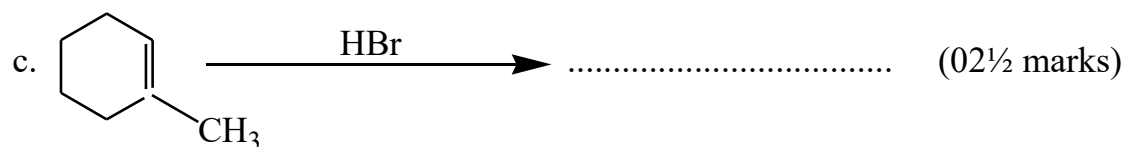
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13. **25moles** of hydrogen and **18moles** of iodine vapour were heated in a **1 litre** sealed tube at **465°C**. When equilibrium was attained, the tube was rapidly cooled and found to contain **30.8moles** of hydrogen iodide.

a. Give a **reason** why the tube was rapidly cooled. (02 marks)

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b. Calculate the:

i. Value of the equilibrium constant, **K_c** for the reaction taking place in the flask. (03 marks)

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ii. Degree of dissociation of hydrogen iodide. (02 marks)

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- c. State what would happen to the equilibrium position of the reaction in the flask above when sodium thiosulphate solution was added to the flask. Give a reason for your answer. (02 marks)

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14.Explain the following observations:

- a. When sodium carbonate solution was added to a solution of chromium (III) sulphate, bubbles of a colourless gas and green precipitate were observed. (03 marks)

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- b. The bond angle of phosphorus trifluoride is **96°** while that of phosphorus trichloride is **100°**. (03 marks)

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c. Aluminium utensils should be cleaned using soap. (03 marks)

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15.a). State **rate law**. (01 mark)

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b). Explain why reactions with **high molecularity** are rare. (03 marks)

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c).A solution of hydrogen peroxide titrated against acidified potassium manganate (VII) solution at different time intervals, give the following results.

Times (Minutes)	0	10	20
Volume of accidified KMnO_4 used (cm^3)	23.8	14.7	9.1

- i. Show that the **decomposition** of hydrogen peroxide is first.
(03½ marks)

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- ii. Calculate the **half-life** of decomposition of hydrogen peroxide.
(01½ marks)

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16.The chemistry of fluorine differs from that of chlorine.

- a. (i). State **two differences** between the **chemistry** of **chlorine** and **fluorine** besides their reactions with **sodium hydroxide solution**.
(02 marks)

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- (ii).Write the **equations of reaction** between **hot concentrated potassium hydroxide solution** and: (@01½ marks)

i. Fluorine

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ii. Chlorine

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b. Write **equation for ionisation of hydrogen fluoride** in aqueous solutions that are: (@01½ marks)

i. Dilute

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ii. Concentrated

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c. State **one reason** why the chemistry of fluorine differs from that of chlorine. (01 mark)

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17.a). (i). Define **enthalpy of a reaction**. (01 mark)

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(ii). State **three factors affecting the quantity of an enthalpy change** of a reaction. (03 marks)

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b). The **standard heat of formation** of ethanol, carbon dioxide and water are **-227.0, -393.5, & -285.5KJ/mol** respectively.

i. Draw a **Born-Haber cycle** to relate the energy changes stated above. (02 marks)

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- ii. Calculate the **standard heat of combustion** of ethanol using the drawn cycle. (01½ marks)
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- iii. From **your calculation in b (ii) above** and **energy changes** in b (i), what can be **ideal use of ethanol in chemistry**. Give a **reason** for **your answers**. (01½ marks)
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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

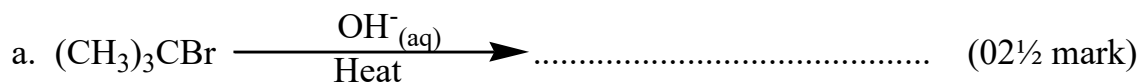


===END===

SECTION A-46 MARKS

ATTEMPT ALL QUESTIONS IN THIS SECTION.

1. Complete the following **equations** and outline the **mechanism** for each of the reactions.



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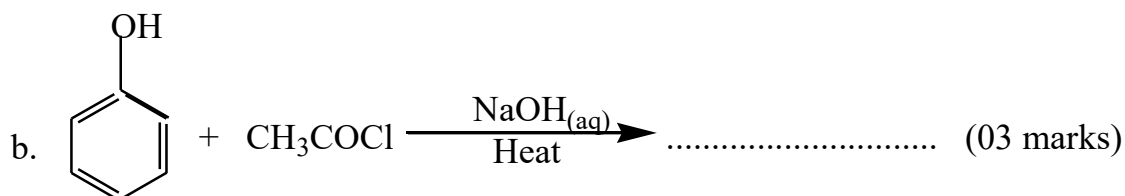
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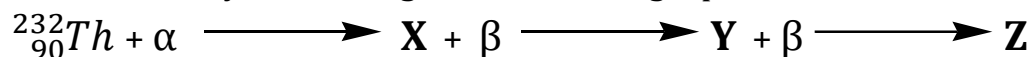
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2. Thorium decays according to the following equation.



- a) Identify the following **species**. (03 marks)

X:

Y:

Z:

- b) The **half-life** of Thorium-232 is **234 days**. Determine the **time taken** for Thorium to **decay** by **12.5%** of its **original value**.

(03 marks)

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3. Write equations for the reaction between water and: (@01½ marks)

a) Sodium hydride.

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b) Phosphorus (V) oxide.

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c) Beryllium carbide.

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4. **50.0cm³** of a vaporized alcohol **G**, **C_nH_{2n+2}OH** diffused through a porous plug in **19.85 seconds**. Under the same conditions, the same volume of hydrogen gas diffused through under the same conditions in **21.85 seconds**.

a) (i). Calculate the **molecular mass** of **G**. (02 marks)

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(ii).Determine the **molecular formula** of **G**. (01 mark)

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b) (i).Write the **structural formulae** and the **IUPAC names** of all the possible isomers of **G**. (02 marks)

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(ii).**G** reacts with **aqueous sodium hydroxide solution** and **iodine solution** to give a **yellow precipitate**. **Identify G**. (0½ mark)

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5. The standard electrode potentials for some half-cells are shown below.



a) Write the cell convention for the combined cell. (01½ marks)

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b) Write equation for the: (@01 mark)

i. Reaction at the cathode.

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ii. Reaction at the anode.

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iii. Overall cell reaction. (0½ mark)

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c) Calculate the **e.m.f** of the cell. (01 mark)

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6. Compare the reactivity of the following elements with water:

a) (i). Fluorine. (0½ mark)

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(ii).Chlorine. (0½ mark)

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(iii).Iodine. (0½ mark)

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b) Write equation for the reaction between fluorine and: (@01½ marks)

i. Cold dilute sodium hydroxide solution.

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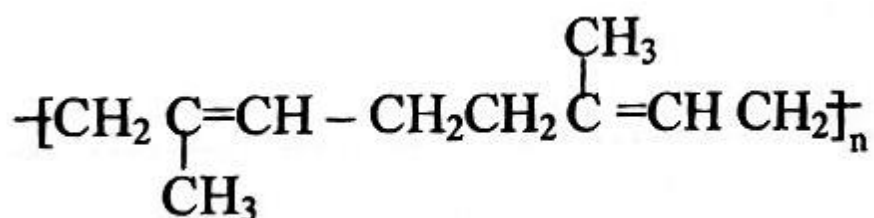
ii. Hot concentrated sodium hydroxide solution.

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c) State what would be observed in b(i) and (ii) above. (01 mark)

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7. Natural rubber has the following structure.



a) Write the **structure** and **name of the monomer** of natural rubber.

(02 marks)

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b) When **120.0g** of the monomer was polymerized, **3.49 X 10⁻⁴moles** of natural rubber was formed. Calculate the **relative formula mass** of natural rubber. (02 marks)

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8. State what would be **observed** and **write equation** for the reaction that would take place if **dilute sulphuric acid** is reacted with:

a) A solution containing iodate ions and iodide ions. (01 mark)

Observations:

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Equation: (01½ marks)

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b) Aqueous sodium chromate.

Observations: (01 mark)

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Equation: (01½ marks)

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9. a). Define the term '**solubility product**'. (01 mark)

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b). Calculate the **solubility product** of a saturated solution containing **8.35 X 10⁻³g** of magnesium hydroxide in **1 litre** solution at **25°C**.

(03 marks)

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c).State **one application** of solubility product. (01 mark)

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SECTION B-54 MARKS

ATTEMPT ANY SIX QUESTIONS IN THIS SECTION.

10.Freezing point depression is one of the methods of determining the relative molecular mass of a solute or compound.

a) (i). State **four limitations** of determining molecular mass by freezing point depression method. (02 marks)

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(ii).Explain how association of solute molecules in a solution affects the molecular mass of determined by freezing point. (03 marks)

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b) A solution containing **0.142g** of naphthalene in **20.25g** of benzene caused a lowering of freezing point of **0.284°C**.

Calculate the **molar mass** of naphthalene. (04 marks)

(Cryoscopic constant, K_f of benzene= $5.12^{\circ}\text{C mol}^{-1}\text{kg}^{-1}$)

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11.(a). (i). Write the **electronic configuration** of chromium. (01 mark)

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(ii).State three characteristics of chromium as a transition metal. (01½ marks)

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(b).Chromium (III) chloride was dissolved in water and the solution tested with litmus paper. State what was observed and explain your answer. (04 marks)

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(c).Ammonia solution was added drop wise to an aqueous solution of chromium (III) chloride until in excess.

i. State what was observed. (01 mark)

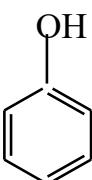
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ii. Write equation for the reaction that took place. (01½ marks)

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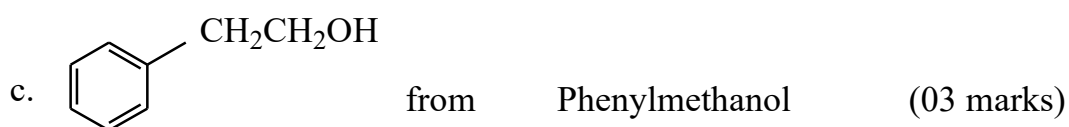
12. Write equations to show how the following compounds can be synthesized. In each case, indicate the reagents and conditions for the reactions.

a. $\text{CH}_3\text{CH}_2\text{CO}_2\text{H}$ from Propene (03 marks)

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b.  from Benzene (03 marks)

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13. Sodium, aluminium, phosphorus and sulphur are some elements in period 3 of the periodic table.

- a) For each element, write the formula and name the structure of the chloride. (04 marks)

Elements	Formula of chloride	structure
Sodium		
Aluminium		
Phosphorus		
Sulphur		

- b) Write equation for the reaction between water and chloride of:

- i. Aluminium. (01½ marks)

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- ii. Phosphorus. (01½ marks)

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- iii. Sulphur. (01½ marks)

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14.(a). Kohlraush's law of independent ionic conductivities. (02 marks)

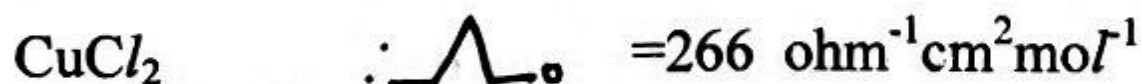
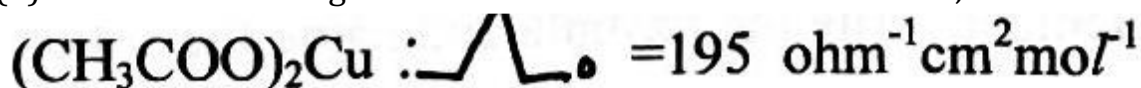
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(b). Given the following molar conductivities at infinite dilution, Λ° .



Calculate the molar conductivity at infinite dilution, Λ° for ethanoic acid. (03 marks)

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(c). The ionic radii and ionic mobilities at infinite dilution of some ions are shown in the table below.

Ions	Ionic radius(nm)	Ionic mobility (cm/sec)
Li^+	0.060	4.01×10^{-4}
Na^+	0.095	5.19×10^{-4}
K^+	0.133	7.62×10^{-4}

Explain the trend in the ionic mobilities. (04 marks)

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15.State what would be observed and write equation(s) for the reaction(s) that would take place when:

- a) Phenylethene is added to a solution of bromine in carbon tetrachloride. (02 marks)

Observations:

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Equation:

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- b) Hydrogen peroxide is added to acidified potassium manganate (VII) solution. (02½ marks)

Observations:

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Equation:

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- c) Ethyne is bubbled through ammoniacal silver nitrate solution. (01½ marks)

Obervations:

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d) Hydrogen sulphide is added to acidified sodium dichromate (VI) solution. (03 marks)

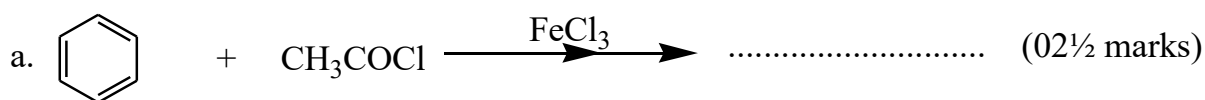
Observations:

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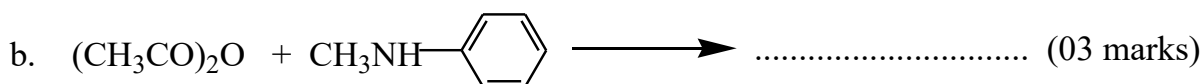
Equation:

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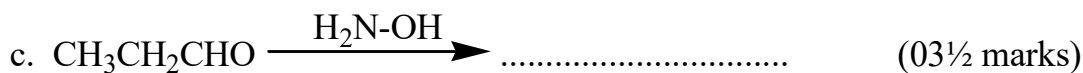
16. Complete the following equations and in each case, write an accepted mechanism for the reaction.



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17.20.0cm³ of 0.50M hydrochloric acid was added to 250.0cm³ of water.

a) Calculate the **p^H** of the resultant solution. (02 marks)

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b) Calculate the **mass** of ammonium chloride that should be added to 1dm³ of 0.1M ammonia solution at 25°C to give a solution whose **p^H** is 8.7.State any assumption made.(The base dissociation constant for ammonia solution, **K_b = 1.8 X 10⁻⁵mol/dm³** at 25°C) (05½ marks)

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c) Few drops of aqueous sodium hydroxide solution were added to solution in (b).

i. State what happened to the pH of the solution. (0½ mark)

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ii. Give a reason for your answer in c (i). (01 mark)

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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

♥ ===END===

SECTION A-46 MARKS

ATTEMPT ALL QUESTIONS IN THIS SECTION.

1. Uranium undergoes nuclear decay according to the following equation.



- a) Identify the species X, Y & Z. (03 marks)

X:

.....

Y:

.....

Z:

.....

- b) 10.0g of Uranium was left to decay to decay. Calculate the mass of Uranium that remained after 2.5×10^9 years. [Half-life of Uranium, $t_{\frac{1}{2}} = 4.5 \times 10^9$ years] (03 marks)

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2. Write for the reaction between aqueous sodium hydroxide solution and:

a) Beryllium oxide. (01½ marks)

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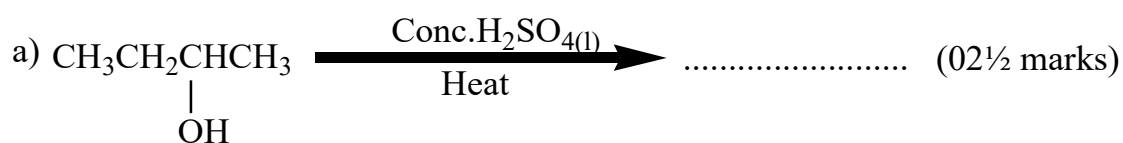
b) Chromium (III) oxide. (01½ marks)

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c) Sulphur (IV) oxide. (01½ marks)

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3. Complete the equations and write the accepted mechanism in each case.



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4.(a) State: (01 mark)

i. Raoult's law.

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ii. Two conditions under which the law is valid.

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b) The vapour pressures of heptane and octane are 473.2 and 139.8Pa at a temperature of 20°C. Calculate:

i. The vapour pressure of a mixture containing 0.5moles of heptane and 0.25moles of octane at the same

temperature. [Assume that the two liquids forms ideal solution] (02 marks)

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ii. The composition of the vapour. (02 marks)

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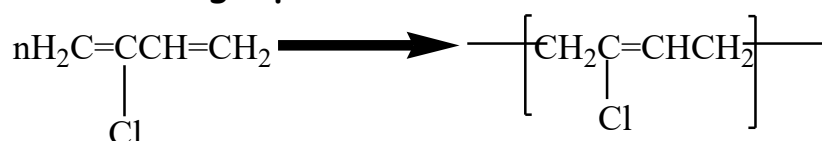
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5.(a) Synthetic rubber, neoprene is made by polymerization of 2-chlorobuta-1, 3-diene, $\text{CH}_2(\text{Cl})=\text{CCH}=\text{CH}_2$ according to the following equation.



i. State the conditions for the reaction. (01 mark)

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- ii. Name the type of polymerization leading to the formation of polyneoprene.

(0½ mark)

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- b) A solution containing 2.8% of polyneoprene was found to have an osmotic pressure of 7.0×10^{-4} atmospheres at room temperature. Calculate the:

- i. Molar mass of polyneoprene. (02 marks)

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- ii. Value of n. (01 mark)

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6. State what would be observed and write an equation that takes place when:

- a) Excess concentrated hydrochloric acid is added to aqueous copper (II) sulphate solution. (02½

marks)

Observation:

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....

Equation:

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- b) Solid sodium iodide is heated with concentrated sulphuric acid. (02 marks)

Observation:

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Equation:

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7. Compound, Q is a green solid. Q dissolves in water to form a pale green solution. The solution of Q formed a red precipitate when reacted with butanedioxime and a reddish brown solution when a few drops of iron (III) chloride is added to it. when Q was heated, propanone was formed.

- a) Identify compound, Q. (01 mark)

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- b) Write equation for the reaction that took place when compound, Q was heated. (01½ marks)

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- c) Write equation (s) for the reaction (s) that would take place when excess ammonia solution is added to a solution of compound, Q. (02 marks)

.....

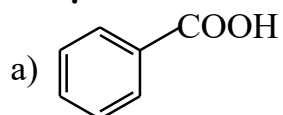
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8. Draw the structure and name the shape of the following species.

Species	Structure	Shape
NO_2^-		
SF_4		
H_3O^+		

9. Write the equation in each case to show how the following compounds can synthesized.



from

benzene

(02 marks)

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b) CH_3COCH_3 from prop-1-ene (03 marks)

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SECTION B-54 MARKS

ATTEMPT ANY SIX QUESTIONS IN THIS SECTION.

10. Name one reagent that can be used to distinguish between following pairs of compounds. In each case, state what would be observed if each member of the pair is separately treated with the reagent you have named. (@03 marks)

a) $(\text{CH}_3)_3\text{COH}$ and $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$.

Reagent:

Observation:

.....

b) $\text{CH}_3\text{CH}_2\text{CHO}$ and $\text{CH}_3\text{CH}_2\text{COCH}_2\text{CH}_3$.

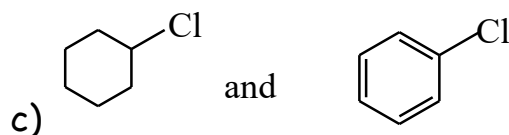
Reagent:

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Observation:

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Reagent:

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Observation:

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11.(a) Write the electronic configuration of chromium atom.

(01 mark)

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b) State why chromium is classified as a transition element.

(0½

mark)

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c) Write the formula of all possible isomers of chromium

(III) chloride-6-water $[\text{CrCl}_3 \cdot 6\text{H}_2\text{O}]$.

(03 marks)

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d) To an aqueous solution of chromium (III) chloride was added to concentrated ammonia solution drop wise until in excess.

(i) State what was observed. (01½ marks)

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(ii) Write equation (s) for the reaction (s) that took place. (03 marks)

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12. Compound, Y consists of 68.8% carbon, 4.92% hydrogen and the rest being oxygen. The vapour density of the compound is 61.

a) Determine the:

(i) Empirical formula of compound, Y. (02½ marks)

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(ii) Molecular formula of compound, Y. (01½ marks)

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(b) Compound, Y burns with a sooty flame and the pH of its aqueous solution is less than 7. Write the structural formula of compound, Y. (02½ marks)

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- c) Write the equation and indicate the mechanism for the reaction between compound, Y and ethanol in presence of concentrated sulphuric acid on heating. (04 marks)

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- 13.(a) Write the equation and state the condition (s) for the reaction leading to the formation of: (@02½ marks)

(i) Iron (II) chloride.

Equation:

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Condition (s):

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(ii) Iron (III) chloride.

Equation:

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Condition (s):

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b) Write equation for the reaction that takes place when iron (III) chloride is dissolved in water. (01½ marks)

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c) Magnesium ribbon was added to the solution in (b) above.
(i) State what was observed. (01 mark)

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(ii) Write equation for the reaction that took place. (01½ marks)

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14. State what would be observed and write equation for the reaction would take place if: (@02 marks)

a) Propene is bubbled through bromine water.
Observation (s):

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Equation:

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- b) A solution of iodine and sodium hydroxide solution is warmed with butanone.

Observation (s):

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Equation:

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- c) Sulphur (IV) oxide is bubbled through acidified potassium dichromate solution. (02½

marks)

Observation (s):

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Equation:

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- d) Chlorine gas is bubbled through potassium manganate (VII) solution.

(02½ marks)

Observation (s):

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Equation:

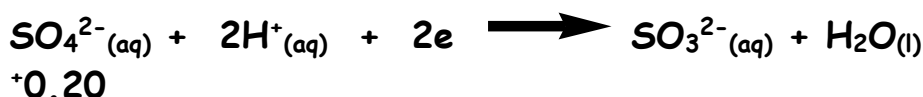
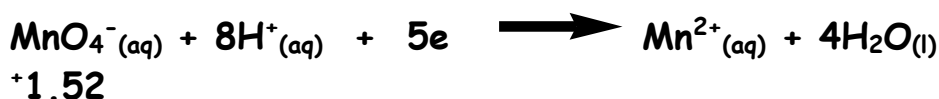
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15. The standard electrode potentials, $E^\ominus$ for some half-cell reactions are given below:

$E^\ominus/V$



a) Write the cell notation for the reaction between sulphite ions and acidified potassium manganate (VII) solution.

(01½

marks)

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b) Write the ionic equation for the overall cell reaction.

(01½

marks)

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- c) Calculate the e.m.f of the cell. (01½ marks)

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- d) State whether the reaction is feasible or not and give a reason for your answer. (01 mark)

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- e) Explain why hydrochloric acid is not used to acidify titrants in volumetric analysis involving potassium manganate (VII) solution. (02½ marks)

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f) State which of bromine and chlorine a stronger oxidizing agent is and give a reason for your answer. (01 mark)

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16.(a) Differentiate between soap and soapless detergents.(02 marks)

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- b) Write equations to show how a soapless detergent can be prepared from dodecanol. $[\text{CH}_3(\text{CH}_2)_{10}\text{CH}_2\text{OH}]$. (02 marks)

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- c) Explain the cleansing action of soap. (02 marks)

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- d) State the merits and demerits of using a soapless detergent instead of soap in washing. (@0 $\frac{1}{2}$ mark)

Advantage:

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Disadvantage:

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e) Explain why aluminium utensils should not be washed with soap.

(02 marks)

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17.(a) Differentiate between order of a reaction and molecularity.
(02 marks)

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b) The data in the table below was obtained for the reaction.

$3C \longrightarrow \text{Products.}$

Time (minutes)	0	60	120	180	240	320
$\log_{10}[C]$	-0.62	-0.80	-1.00	-1.14	-1.34	-1.47

Plot a graph of $\log_{10}[C]$ against time. (03 marks)

c) From the graph determine the order of the reaction.

(01 mark)

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d) Calculate:

(i) The rate constant for the reaction. (02 marks)

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(ii) The half-life of the reaction. (01 mark)

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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

♥ ===END===

SECTION A-46 MARKS

ATTEMPT ALL QUESTIONS IN THIS SECTION.

1. The elements **tin** and **lead** belong to **group (IV)** of the periodic table.
a) Write **equation** for the preparation of the **tetra chlorides** of the elements: (@01 mark)

✓ Tin

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✓ Lead

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- b) **Tin (IV) chloride fumes in moist air. Explain this observation.**
(03 marks)

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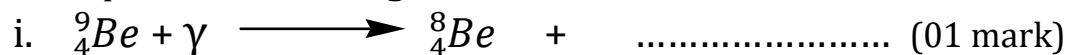
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- 2.a) Complete **the following nuclear reactions.**



- b) It takes **5 days** for **0.025mg** of bismuth-**214** to disintegrate in to **0.0125mg** of bismuth-**210**. Calculate the **time** required for **0.016mg** bismuth-**214** to change in to **0.001mg** bismuth-**210**. (03 marks)

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- 3.a) At **25°C**, **0.1M** solution of ethylamine is **7.3%** ionized.

Write an **equation** for the **ionization** of ethylamine in water.

(01 mark)

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- b) Calculate the **concentration** of hydroxide ions at equilibrium.

(01 mark)

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c) **$1.0 \times 10^{-2} \text{ mol}$** of ethylamine hydrochloride was added to **1 dm^3** of ethylamine solution in **(a)**. Calculate the hydroxide ion concentration of the resultant solution. State **any assumption** made. (04 marks)

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4.a) Draw a **structure** and **name the shape** of the followings **anion**. (03 marks)

Anions	Shapes	Names
SO_3^{2-}		
SO_4^{2-}		
$\text{S}_2\text{O}_3^{2-}$		

b) Name a reagent (s) which can be used to distinguish between SO_3^{2-} and SO_4^{2-} ions, State what would be observed.
 Regent (s): (01 mark)

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.....
Observation(s): (01 mark)
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5. (a). (i). State the **condition (s)** under which chlorine gas reacts with sulphur dioxide gas. (01 mark)

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(ii). Write **equation** for the reaction. (01 mark)

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(b). Chlorine gas was bubbled through sodium thiosulphate and lead (II) nitrate solution added to the resultant solution.

(i). State what **was observed**. (01 mark)

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(ii). Write **equation (s)** for the **reaction (s)** that took place. (02 marks)

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6.a) **Phenol** was added to **bromine water**.

i. State what **was observed**. (01 mark)

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ii. Write **an equation for the reaction**. (01 mark)

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- (b) Name a **reagent** which can be used to distinguish between phenol and cyclohexanol. State what would be **observed** if the reagent is treated with each compound.

Reagent: (01 mark)

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Observations: (01 mark)

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- (c) Write equation show how phenol may be prepared from benzene diazonium chloride. (01 mark)

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7. (a) Write equation for the reaction between sodium hydroxide solution:
i. Aluminium oxide. (01 mark)

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- ii. Chlorine gas. (01 mark)

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- (b). Sodium hydroxide solution was added to nickel (II) sulphate solution.

- i. State what was observed. (01 mark)

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- ii. Write equation for the reaction. (01 mark)

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8. (a). State **Graham's law** of gaseous diffusion. (01 mark)

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- (b) A mixture of carbon monoxide and carbon dioxide gas diffuses through a porous partition in half the time taken for the same

volume of bromine vapour. Calculate the **percentage** of carbon dioxide gas in the gas mixture. (04 marks)

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9. The atomic number of **element T** is 32.

a) Write down the **electronic configuration of element T**. (01 mark)

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b) Write the **formula** of the: (@0½ mark)

i. **Hydride** of T.

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ii. **Chloride** of T.

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c) Water was added to the **chloride of T**. State whether the **resultant solution** was **neutral, acidic or alkaline**. **Explain your answer** giving an **equation for the reaction**. (03 marks)

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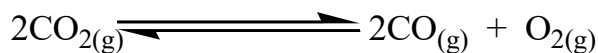
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SECTION B-54 MARKS

ATTEMPT ANY SIX QUESTIONS IN THIS SECTION.

10. When heated, carbon dioxide gas decomposes according to the equation below.



If at a certain temperature and **1 atmospheric pressure**, **60%** of the original carbon dioxide **gas remained undissociated**.

- a) Calculate the **equilibrium constant, K_p** for the reaction. (05 marks)

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- b) State and explain the effect of:

- i. Increasing the pressure to **2 atmospheres** on the equilibrium concentration of oxygen gas. (02 marks)

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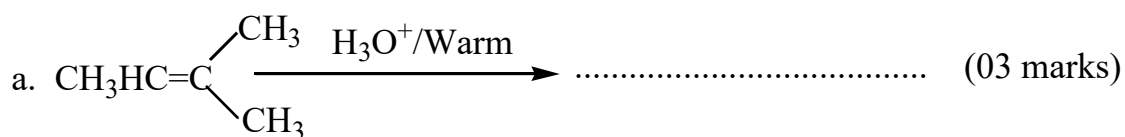
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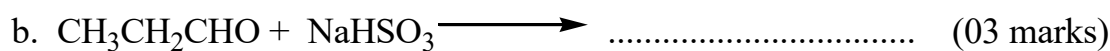
ii. Carrying out the decomposition at a lower temperature on the value of the equilibrium constant, K_p . (02 marks)

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11. Complete the following equations and write suggested mechanism for the reaction:

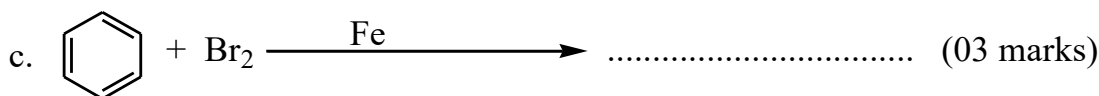


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12.(a). Define the following terms: (01 mark)

i.Lattice energy.

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ii.Standard heat of formation of a substance.

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b. The standard heat of formation of phosphorus trichloride is - **306KJ/mol**. The bond dissociation energy and enthalpy of atomization of chlorine and phosphorus are **314 & 242KJ/mol** respectively.

i. Draw a **Born-Haber** cycle for the formation of phosphorus trichloride. (02 marks)

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- ii. Use your cycle to **calculate** the P-Cl **bond energy**. (02 marks)

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- a. Calculate the standard heat of formation of ethane if the standard heats of combustion of graphite, hydrogen and ethane are **403,285** and **1395 KJ/mol** respectively. (03 marks)

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13.(a).Silver chromate is sparingly soluble in water. Write:

- i. An **equation for the solubility of silver chromate in water**. (01 mark)

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- ii. Write **an expression of the solubility product constant**, K_{sp} for silver chromate. (01 mark)

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- b. The solubility of silver chromate is **$6.64 \times 10^{-4} \text{g}/100\text{g}$** of water at a certain temperature. Calculate the **solubility product** of silver chromate. (04 marks)

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- c. Calculate the **solubility of silver chromate in 1.0dm³ of 1.0M** silver nitrate. (03 marks)

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- 14.(a). Explain what is meant by the term order of a reaction. (03 marks)

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- b) The following kinetics data was obtained for the reaction between an alkylhalide **S** and aqueous sodium hydroxide.

[S](mol/dm ³)	[OH ⁻](mol/dm ³)	Initial rate (mol/dm ³ s ⁻¹)
0.100	0.50	2.0 X 10 ⁻³
0.050	0.25	1.0 X 10 ⁻³
0.100	0.25	2.0 X 10 ⁻³
0.075	0.25	1.5 X 10 ⁻³

- i. Determine the **order of the reaction** with **respect to S** and sodium hydroxide solution. Give a reason for your answer. (03 marks)

Order with respect to **S**:.....

Reason:

.....

Order with respect to **OH⁻**:.....

Reason:

.....

- ii. Write **an equation** for the **rate of reaction**. (01 mark)

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- iii. Calculate the **rate constant** and **give its units**. (01 mark)

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- iv. Write the **general structure** of **S**. (01 mark)

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15.(a).Write the name and formula of one ore from which aluminium can be extracted. (@0½ mark)

Name:

Formula of the ore:

d) (i). Describe how the ore is purified. (04 marks)

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(ii).Describe the reaction of aluminium metal with acids. (04 marks)

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16.Compound **F** contains **62.1%** carbon, **10.3%** hydrogen, the rest being oxygen.

a) Calculate the **empirical formula of F**. (03 marks)

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b) **F** distils in steam at **98°C** and **1.01 X 10⁵Nm²**. If the vapour pressure of water at **98°C** is **9.5 X 10⁴Nm²**.

i. Calculate the **molecular mass of F** if the distillate contained **16.67%** by mass of **F**. (02 marks)

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ii. Determine the **molecular formula of F**. (01 mark)

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c) **F** formed a grey precipitate when treated with ammoniacal silver nitrate. Write **equation** and **outlines a mechanism** for the reaction between **F** and **sodium hydrogen sulphite solution**. (03 marks)

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17. To 25.0cm^3 of 0.1M zinc sulphate solution was added 25.0cm^3 of 1.7M aminomethane. The resultant solution was shaken with trichloromethane and left to settle. 10.0cm^3 of the aqueous layer required 16.5cm^3 of 0.5M nitric acid. If the partition coefficient for the distribution of aminomethane between water and trichloromethane is 25 at 25°C .

- a) Calculate the concentration of aminomethane in the organic layer. (04 marks)

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- b) The concentration of aminomethane that formed a complex with zinc ions. (03 marks)

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- c) Use your answer in (b) to write an equation for the reaction between aminomethane and zinc ions. (02 marks)

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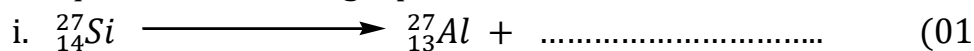
THE PERIODIC TABLE

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

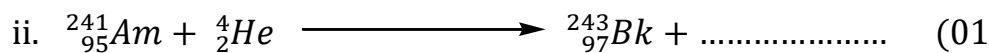
SECTION A-46 MARKS

ATTEMPT ALL QUESTIONS IN THIS SECTION.

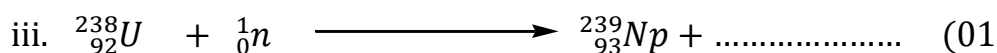
1. (a). Complete the following equations for the nuclear reactions.



mark)



mark)



mark)

(b). In an experiment, the rate of radioactive decay of bromine decreased by **25%** in **96** minutes. Calculate the **half-life** of bromine. (02 marks)

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2. An alkene **R**, diffuses through a porous partition in **2** minutes. Under similar conditions, the same volume of oxygen gas diffuses in **1.75** minutes.

a) (i). Calculate the **formula mass** of **R**. (01½ marks)

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(ii). Determine the **molecular formula** of **R**. (02 marks)

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b) Write equations to show how **R** can be **synthesized** from **propanone**. (02 marks)

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3. In the manufacture of sulphuric acid, sulphur trioxide is **not** dissolved in water, but another solvent.
- a) (i). State why water is **not** used as a solvent. (01 mark)

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(ii).Write equation(s) to show the formation of sulphuric acid from sulphur trioxide gas.
(03 marks)

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b) Write equation for the reaction between sulphuric acid and hydrogen bromide. (01½ marks)

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4. (a) State **one** colligative property of a dilute solution other than depression of freezing point or elevation of boiling point of a solvent. (01 mark)

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(b) Ethane-1, 2-diol $\text{HOCH}_2\text{CH}_2\text{OH}$, is used as an antifreeze for water in car radiators. **Calculate** the **mass of ethane-1, 2-diol** that should be added to **1kg** of water to prevent it from freezing at **-10°C**. (03 marks)

[Freezing point depression constant for water = $1.86^\circ\text{Ckgmol}^{-1}$]

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Nylon-6, 6, $\left[\overset{\overset{H}{|}}{N} - (CH_2)_6 - \overset{\overset{O}{||}}{C} - (CH_2)_4 - C \right]_n$ is a synthetic polymer formed by condensation polymerisation.

5. (a). State what is meant by the term **condensation polymerization**.

(01 mark)

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(b). Write the **structural formulae** of the monomers of **nylon-6, 6**.
(01 mark)

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(c).Name:

i. **One natural polymer** that is formed by condensation polymerization.
(01 mark)

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ii. The **monomers** of the polymer in (c) (i). (0½ mark)

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(d).State **one** use of the polymer you have named in (c) (i). (0½ mark)

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6. (a). State two properties in which chromium behaves as a transition element. (01 mark)

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(b). Write the equation for the reaction that takes place when chromium (III) sulphate is dissolved in water. (01½ marks)

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(c). Magnesium ribbon was added to a solution of chromium (III) sulphate.

i. State what was observed. (01 mark)

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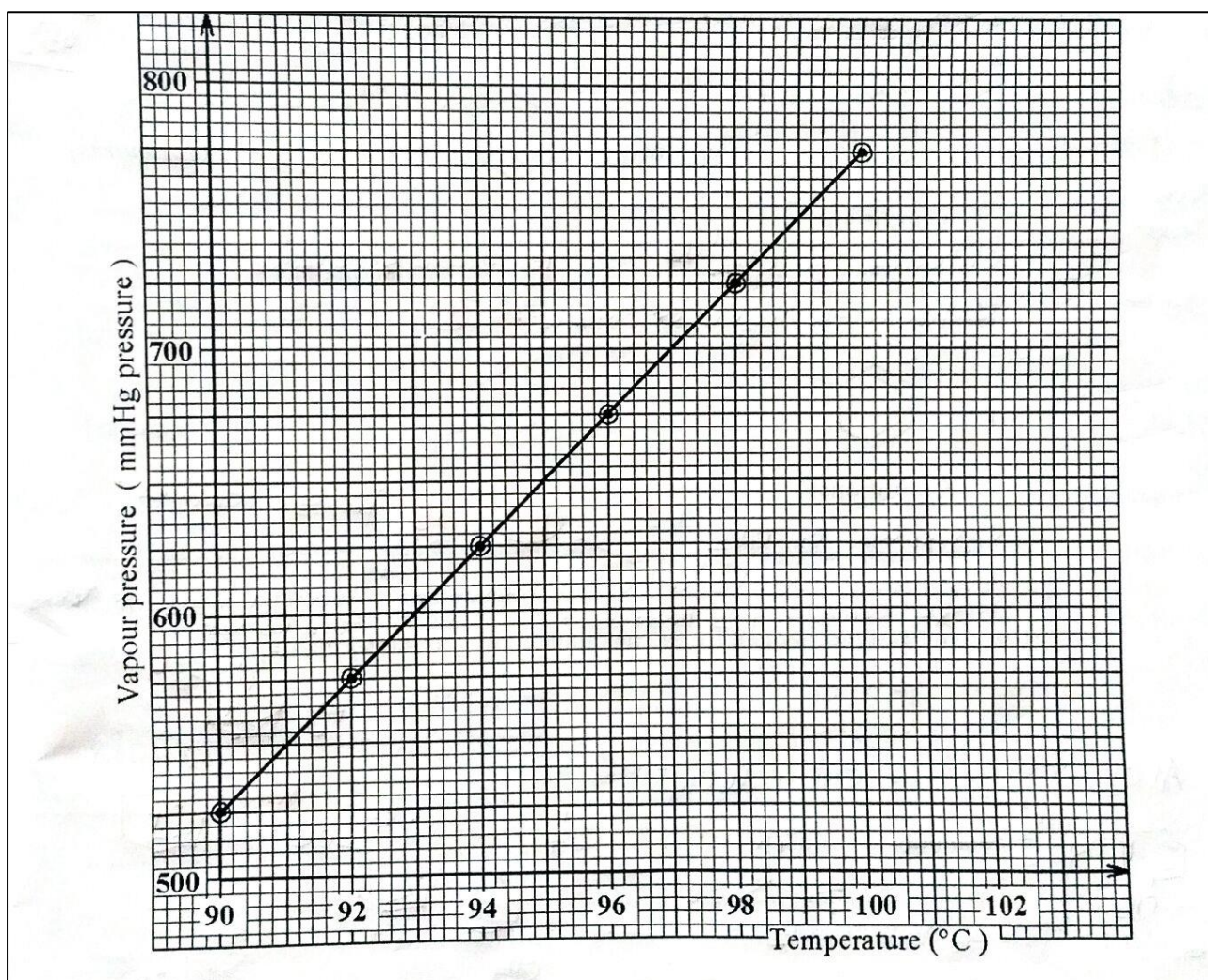
- ii. Write equation for the reaction that took place. (01½ marks)

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7. The graph below shows how the total vapour pressure of a mixture of water and nitrobenzene varies with temperature.



- a) State the temperature at which the mixture boils at **760mmHg** pressure. (01 mark)

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- b) The partial vapour pressure of nitrobenzene at the boiling point of the mixture is **20mmHg**.

Calculate the **percentage of nitrobenzene by mass** that will be obtained when the mixture is steam distilled at normal atmospheric pressure. (H = 1, C = 12, N = 14, O = 16)
(04 marks)

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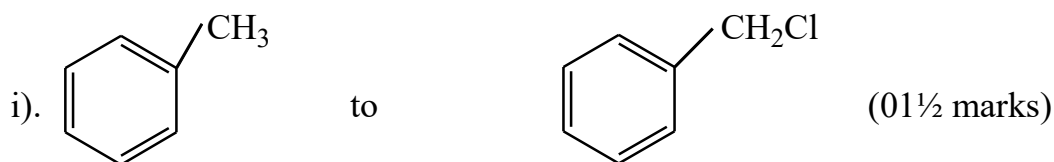
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8. (a). State the condition(s) under which the following conversions can be effected.

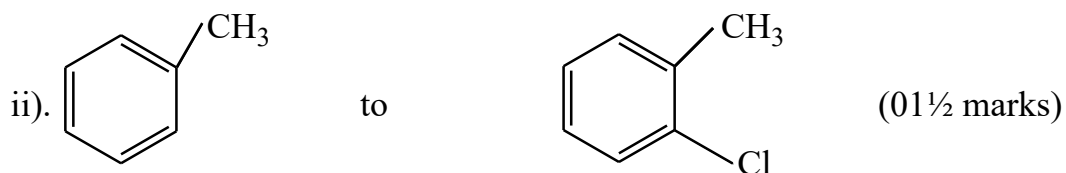


Conditions:

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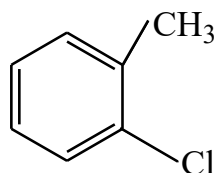
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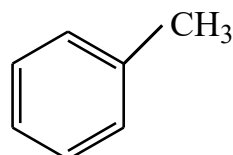
Conditions:

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(b). Write a mechanism for the reaction leading to the formation of:



From



(02 marks)

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9. Explain the following observations.

- a) Silicon (IV) chloride is **hydrolyzed** by **water** while carbon tetrachloride is **not**. (03½ marks)

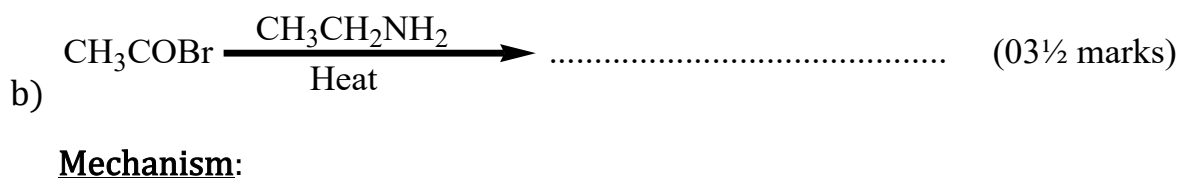
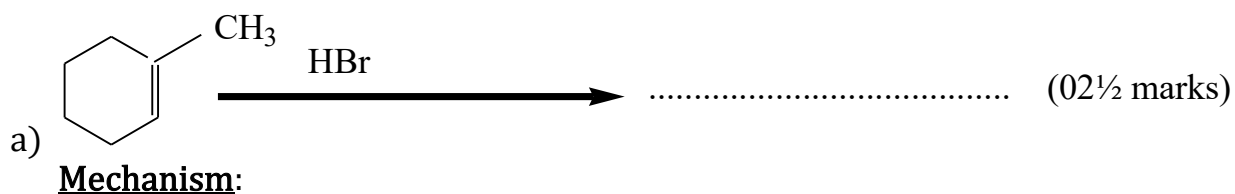
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- b) Lead (IV) chloride **exists** but lead (IV) bromide **does not**. (02 marks)

SECTION B-54 MARKS

ATTEMPT ANY SIX QUESTIONS IN THIS SECTION.

10. Complete each of the following equations and write the suggested mechanism for the reaction.





Mechanism:

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 11.(a). State what is meant by the term **buffer solution**. (01 mark)

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(b). Calculate the **pH** of the solution formed when **0.61g** of benzoic acid is dissolved in **1dm³** of a **0.02M** sodium benzoate. (02½ marks)

(**K_a** of benzoic acid = **6.3 x 10⁻⁵ moldm⁻³**)

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(c). Explain what would happen to the **pH of the solution in (b)** if a few drops of the following reagents were added:

i. Potassium hydroxide solution. (03 marks)

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ii. Hydrochloric acid. (02½ marks)

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12.(a). When **0.1g** of aluminium chloride was vaporized at **350°C** and pressure of **1atmosphere**, **19.2cm³** of vapour was formed.

i. Calculate the **relative molecular mass** of aluminium chloride.

(02 marks)

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ii. Write the **molecular formula** of aluminium chloride in the gaseous state at **350°C**. (Al = 27, Cl = 35.5)
(01 mark)

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(b). Aluminium chloride is normally contaminated by traces of iron
(III) chloride.

i. Name **one reagent** that can be used to detect the presence of iron (III) ion in a contaminated solution of aluminium chloride.
(01 mark)

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ii. State what would be observed if the contaminated aluminium chloride solution was treated with the named reagent in (b) (i).
(0½ mark)

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- iii. Write equation for the reaction leading to the observation you have stated in (b) (ii). (01½ marks)

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- (c). Water was added drop wise to aluminium chloride.

- i. State what was observed. (01 mark)

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- ii. Write equation for the reaction that took place. (01½ marks)

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- (d). State **one use** of aluminium chloride in organic synthesis. (0½ mark)

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- 13.(a). Draw the structure and name the shape of each of the species in the table below. (04½ marks)

Species	Structure	Shape
BF_3		
SnCl_2		
ClO_3^-		

(b). Write equation for the reaction between:

i. Boron trifluoride and ammonia. (01½ marks)

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ii. Tin (II) chloride and iron (III) ions. (01½ marks)

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iii. Acidified potassium iodide solution and aqueous sodium chlorate (V) solution. (01½ marks)

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14.(a). Write:

i.Equation for the **ionization** of methanoic acid in water.

(01½

marks)

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ii.The **expression** for the acid dissociation constant K_a , for methanoic acid.

(01

mark)

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(b). The molar conductivities of some electrolytes at infinite dilute at **25°C** are given in the table below.

Electrolyte	molar conductivity at infinite dilution ($S\text{cm}^2/\text{mol}$)
Sodium chloride	113.0
Sodium methanoate	101.0
Sodium hydroxide	225.2
Hydrochloric acid	397.8

Calculate the **molar conductivity** of methanoic acid at infinite dilution.

(03

marks)

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- (c). The molar conductivity of a **0.05M** methanoic acid solution is **24.328Scm²/mol** at **25°C**.

Calculate the:

- i. Degree of **ionization** of methanoic acid at **25°C**. (01½ marks)

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- ii. Dissociation constant **K_a** of methanoic acid at **25°C**. (02 marks)

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15. Name **one functional group** that can be identified using each of the following reagents. In each case state what would be **observed** and write **equation** for the reaction that would take place:

- a) Bromine water:

Functional group. (01 mark)

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.....
.....

Observation. (01 mark)

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Equation. (01
mark)

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.....

b) 2, 4-dinitrophenyl hydrazine.
Functional group. (01
mark)

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Observation. (01
mark)

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Equation. (01
mark)

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c) Sodium carbonate.
Functional group. (01
mark)

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Observation. (01
mark)

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Equation. (01
mark)

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16. During the extraction of copper from copper pyrites, copper pyrites is crushed and agitated with water/oil mixture. Compressed air is bubbled through the mixture which is then filtered, roasted and finally impure molten copper is obtained.

a) State the role of:

i. Oil. (01
mark)

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ii. Compressed air. (01
mark)

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- b) Write equation for the reaction that occurs when copper pyrites is roasted. (01½ marks)

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- c) Explain briefly how impure copper can be refined. (04 marks)

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- d) Explain why it is advantageous to have a sulphuric acid manufacturing plant near a copper extraction plant. (01½ marks)

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17.(a). State what is meant by the term:

- i. Order of a reaction.
(mark)

(01

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- ii. Half-life of a reaction. (01 mark)

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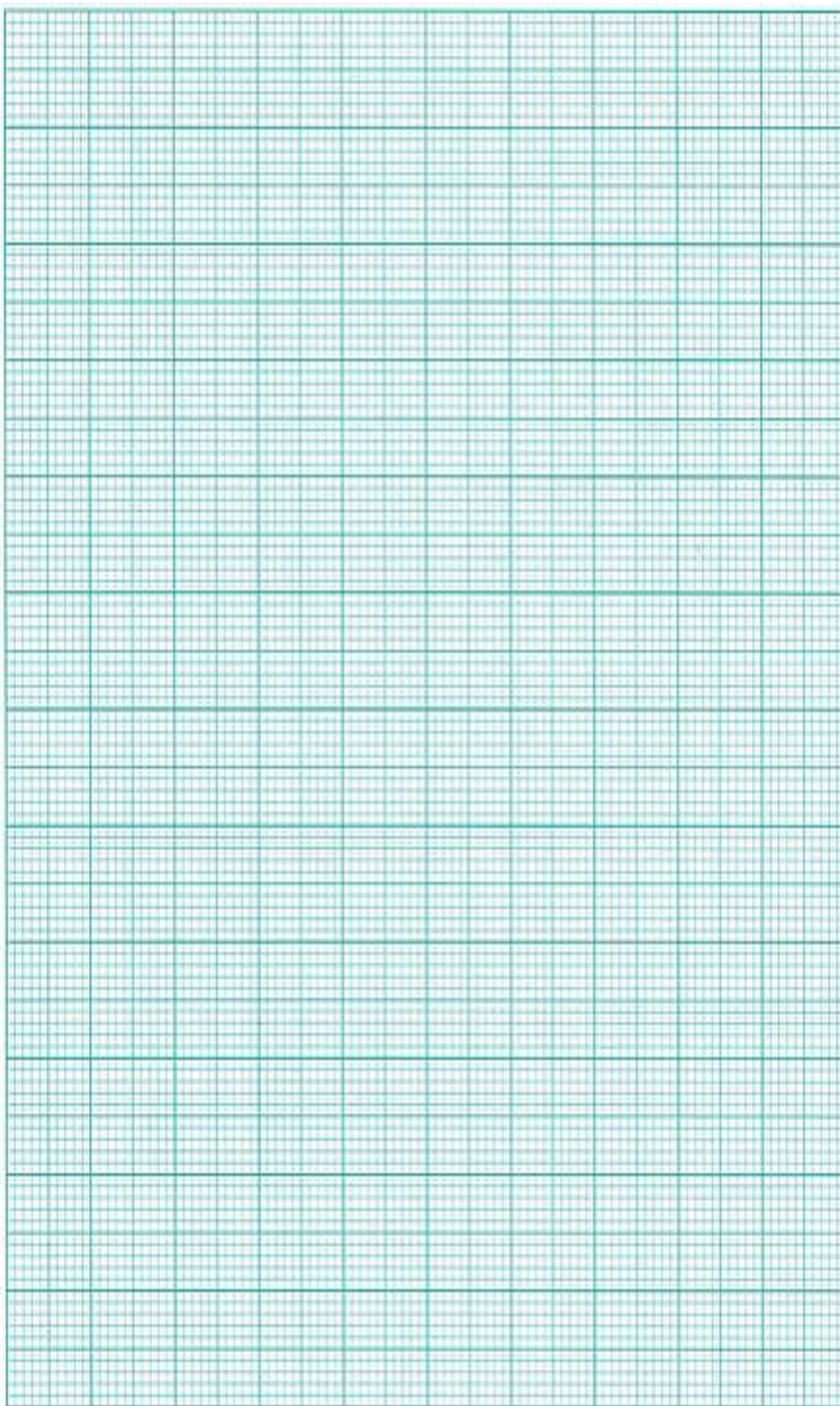
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(b). The table below shows the kinetic data obtained for the hydrolysis of methyl ethanoate in acidic media.

$[\text{CH}_3\text{COOCH}_3](\text{mol/dm}^3)$	0.241	0.161	0.109	0.073	0.046	0.034
Time (minutes)	0	60	120	180	240	320

Plot a graph of **concentration** of methyl ethanoate **against time**.

(03arks
)



(c).Use the graph in (b) above to determine the:

- i. Half-life of the reaction.

(01½ marks)

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- ii. Order of the reaction with respect to $\text{CH}_3\text{COOCH}_3$. Give a reason for your answer. (01 mark)

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- (d). Calculate the **rate constant** and indicate its **units**. (01½ marks)

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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



===END===

SECTION A (46 Marks)

Answer all questions from this section A

1. (a) Write:

(i) equation for ionization of methanoic acid in water.

(1 $\frac{1}{2}$ marks)

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(ii) the expression for the acid constant K_a , for methanoic acid.

($\frac{1}{2}$ mark)

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(b) The molar conductivity of 0.1M methanoic acid solution at 25°C is $16.2 \text{ scm}^2 \text{ mol}^{-1}$. Calculate the:

(i) Degree of ionisation of methanoic acid at 25°C (molar conductivity of methanoic acid at infinite dilution at 25°C is $40 \text{ scm}^2 \text{ mol}^{-1}$)

(1 $\frac{1}{2}$ marks)

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(ii) Ionization constant, K_a for methanoic acid at 25°C. (1 $\frac{1}{2}$ marks)

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

(1 $\frac{1}{2}$ marks each)

(a) Chromium (III) oxide.

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(b) Beryllium oxide

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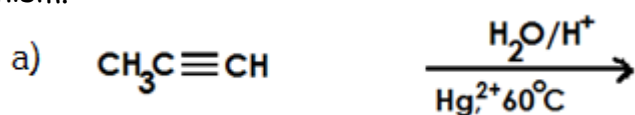
(c) Lead (II) oxide

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3. Complete the following reaction equations and write the accepted mechanism.



(3marks)

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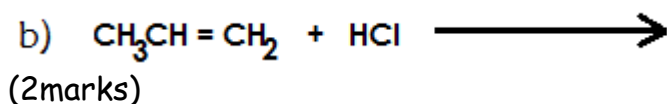
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4. (a) State what is meant by the term **diagonal relationship**?

(1mark)

(b) State three reasons why lithium and magnesium resemble.

(1 $\frac{1}{2}$ marks)

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

(3marks)

5. 20cm^3 of a gaseous hydrocarbon, X was exploded with 100cm^3 of oxygen. After explosion, the volume and cooling of the residual gas was found to

be 90cm^3 . On addition of concentrated potassium hydroxide, the volume reduced to 50cm^3 .

(a) Determine the molecular formula of X.
(2marks)

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(b) X reacts with ammoniacal copper (I) chloride solution.

(i) State what is observed
(1mark)

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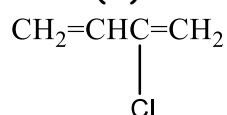
(ii) Write equation for the reaction that takes place.
(1mark)

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6. (a) Synthetic rubber (Z) was made from monomers with structure.



(i) State the conditions for the reaction.
(1mark)

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(ii) Write the equation leading the formation of Z (1mark)

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(iii) Name the type of reaction in a(ii)

($\frac{1}{2}$ mark)

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.....

(b) A solution containing 5.0g of Z in 200cm³ of benzene is found to have an osmotic pressure of 34KPa at 17°C. Calculate

(i) the molar mass of Z
marks)

(2 $\frac{1}{2}$

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(ii) the number of monomers (n)
marks)

(1 $\frac{1}{2}$

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7. (a) State **Raoult's law** of relative lowering of vapour pressure. (1marks)

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(b)(i) Calculate the vapour pressure of a solution containing 18g of glucose (C₆H₁₂O₆) in 50g of water at 60°C is 150mmHg.

(2 $\frac{1}{2}$ marks)

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(ii) State any three assumptions made in b(i)
marks)

(1 $\frac{1}{2}$

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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 propanoate 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 propanoate?
(2marks)

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9. (a) One of the properties of transition metals is complex ion formation

(i) Define the term **complex ion**
(1mark)

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(ii) Explain why transition metals form many complexes (1
 $\frac{1}{2}$ marks)

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(b) Complete the table below.
 (2marks)

Complex ion	Oxidation state of metal ion	Name of complex ion
(i) $\text{Fe}(\text{CN})_6^{3-}$		
(ii) CuCl_4^{2-}		

SECTION B (54 MARKS)

Answer six questions from this section

10. a) When red lead oxide, Pb_3O_4 was heated with dilute nitric acid, a solid was formed. Write equation for the reaction.
 (2marks)

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(b) The mixture from (a) was filtered and the residue warmed with concentrated hydrochloric acid.

(i) State what was observed.
 (1mark)

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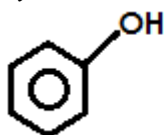
(ii) Write equation for the reaction (1
 $\frac{1}{2}$ marks)

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- (c) The filtrate from (b) was divided into two portions.
(i) To the first portion was added aqueous potassium iodide. State what was observed and write equation for the reaction.
(2marks)

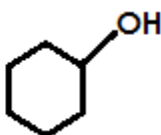
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- (ii) The second portion evaporated to dryness and then heated strongly. State what was observed and write equation for the reaction.
(2 $\frac{1}{2}$ marks)
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11. Name reagent(s) that can be used to distinguish between the following pairs of compounds and in each case state what is observed.
(3marks)

a)



and



Reagent

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Observations

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(b) Ethanoic acid and chloroethanoic acid

Reagent

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Observations.

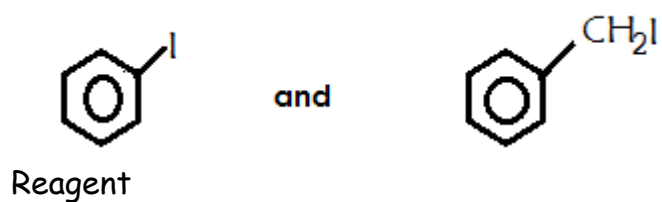
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(c)



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Observations

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12. (a) State three properties in which manganese differs from magnesium.

(1 $\frac{1}{2}$ marks)

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(b) Write equation to show the reduction of manganate (VII) ion in

(i) Acidic medium (1 $\frac{1}{2}$ marks)

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(ii) Alkaline medium (1 $\frac{1}{2}$ marks)

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(c) State what is observed when drops of acidified potassium manganate (VII) solution are added to each of the following solutions. In each case, write the equation of reaction.

(i) Hydrogen peroxide
(2marks)

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(ii) Hot sodium oxalate solution.
(2marks)

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.....
(d) State one reason why potassium manganate (VII) is not a good primary standard in volumetric analysis

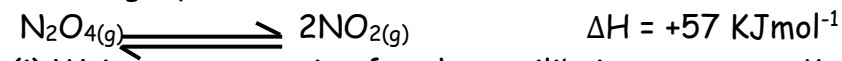
($\frac{1}{2}$ mark)

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13. (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 ($\frac{1}{2}$ mark)

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

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(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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14. Write equations to show how the following compounds can be synthesized and in each case indicate the conditions of reaction.

(a) $\text{CH}_2 = \text{CH}_2$ from $\text{CH}_3\text{CH}_2\text{COOH}$

(3marks)

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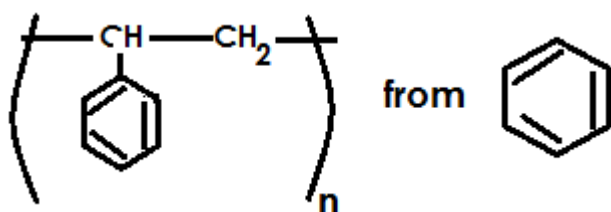
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(b)

(3marks)



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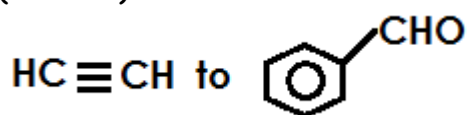
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(c)
(3marks)



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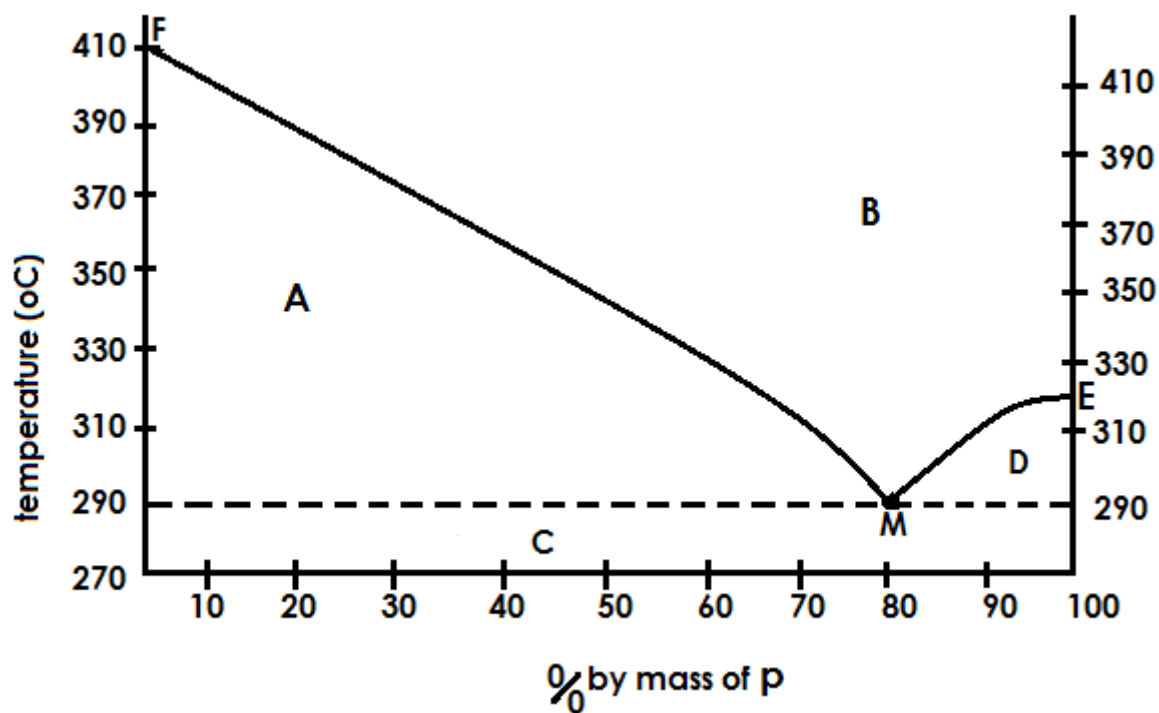
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15. The phase diagram for a mixture of metals **P** and **Q** is shown below.



(a) Identify the regions A, B, C and D
(2marks)

(i) A

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(ii) B

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.....

(iii) C

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.....

(iv) D

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.....

(b) State what point M represents.
(1mark)

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(c) Using the diagram, estimate the melting point of;
(1mark)

(i) P

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.....

(ii) Q

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.....

(d) Describe what would happen if a mixture containing 50% by mass of P
and Q is cooled from 410°C to 270°C.

(3marks)

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(e) State one difference and one similarity between the substance at
point M and a pure compound

(i) difference
(1mark)

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.....
.....

(ii) similarity
(1mark)

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.....
.....

16. (a) Compound Y contains by mass 22.86% oxygen, 8.57% hydrogen and the
rest carbon.

(i) Calculate the empirical formula of Y (2
 $\frac{1}{2}$ marks)

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(ii) When 0.30g of Y is vapourised at 80°C and 700mmHg pressure, it occupied a volume of 134.77cm³. Determine the molecular formula of Y.
(3 $\frac{1}{2}$ marks)

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(b) Y forms a yellow precipitate with 2,4-dinitrophenyl hydrazine and does not react with Tollen's reagent. Identify Y.
Identify Y.
(1mark)

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(c) Write equation for the formation of the yellow precipitate in (b) above.(2marks)

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17. Explain the following observations

(a) phenylamine is a weaker base than ethyl amine

(3marks)

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(b) The PH of a 0.1M phenol is 6.5 while that of cyclohexanol is 7

(3marks)

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(c) Hydrofluoric acid is a weaker acid than hydrobromic acid. (3marks)

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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

♥ ===END===

SECTION A-46 MARKS
ATTEMPT ALL QUESTIONS IN THIS SECTION.

1. Various concentrations of X and Y were reacted at a constant temperature. The table below shows the initial concentrations of X and Y, and their initial rates for the reaction.

Experiments	[X] mol/dm ³	[Y] mol/dm ³	Initial rate (mol/s)
1	0.2	0.2	3.5×10^{-4}
2	0.4	0.4	1.4×10^{-3}
3	0.8	0.4	5.6×10^{-3}

- a) State the order of reaction with respect to X and Y. (@0½ marks)
- i. X:
- ii. Y:
- b) Give **reasons** for your answers in (a) above. (02 marks)
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-
-
-
- c) Determine the **overall order** of the reaction. (0½ marks)
-
-
- d) Calculate the **value for the rate constant** of the reaction. (01½ marks)
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-
2. A solid **Q** contains **9.37%** by mass magnesium, **10.39%** nitrogen, **42.18%** water and the rest is oxygen.

a) (i). Calculate the empirical formula of solid **Q**. (02 marks)

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(ii). Determine the molecular formula of **Q**. (01 mark)

(RFM of **Q** = 256)

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- b) Solution of **Q** reacts with **freshly prepared iron (II) sulphate** in the **presence of concentrated sulphuric acid** to form a **brown ring**. Identify **Q**. (0½ mark)

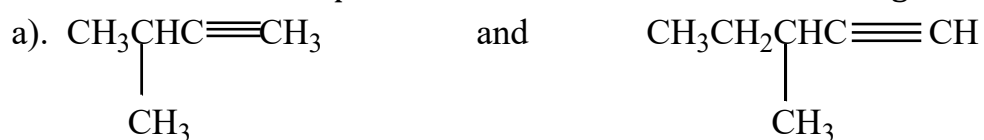
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- c) Write **equation for the reaction** that would take place if **Q** was heated. (01½ marks)

.....

3. Name a **reagent** that can be used to **distinguish** between the following pairs of compounds and in each case, **state what would be observed** if each members of the pair was treated with the named reagent.

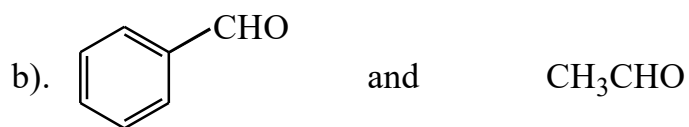


Reagent (01 mark)

.....

Observations (02 marks)

.....



Reagent (01 mark)

.....

Observations
marks)

(02

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4. Write equation for the reaction between aqueous sodium hydroxide solution and: (@01½ marks)

a) Chromium (III) oxide.

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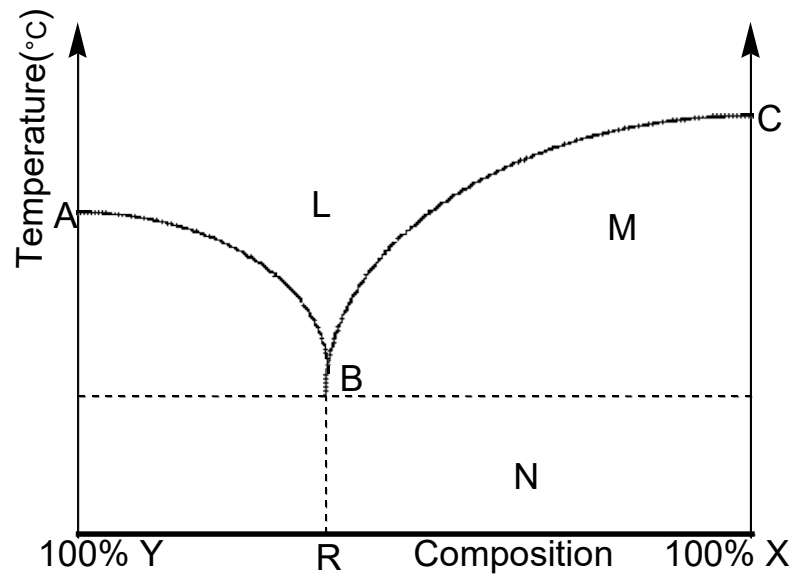
b) Beryllium oxide.

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c) Tin (II) oxide.

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5. The **temperature-composition diagram** for a system containing two components **X** and **Y** is shown below.



a) State what the following represents. (@0½ mark)

i. Regions: L:

.....

M:

.....

N:

.....

ii. Points: A:

.....

B:

.....

C:

.....

iii. Curves: AB:

.....

BC:

.....

b) State what would happen when a mixture of composition R is heated.

(0½ mark)

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6. Complete the following equations and in each case, write a mechanism for the reaction.

a). $(\text{CH}_3)_2\text{C}=\text{CHCH}_3 \xrightarrow{\text{HBr}}$ (02½ marks)

Mechanism:

.....

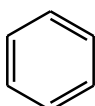
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b).  + $\text{CH}_3\text{CH}_2\text{COCl} \xrightarrow[50^\circ\text{C}]{\text{AlCl}_3}$ (02½ marks)

Mechanism:

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7. When a current of **0.65A** was passed through copper (II) sulphate solution using platinum electrodes for **35 minutes**, **0.0143g** of hydrogen and **0.113g** of oxygen gases were evolved.

a) Write **equation for the reaction** that took place at the: (@01 mark)

i. Anode.

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ii. Cathode.

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b) Determine **the quantity of electricity** required to evolve **1mole** of gas at each electrode.

i. At the anode. (02 marks)

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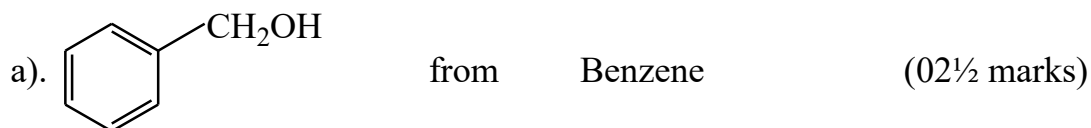
ii. At the cathode. (01 mark)

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8. Write equation in each case show how the following conversions can be effected.



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9. State what would be observed and write equations for the reaction that would take place when: (02½ marks)

a) Excess concentrated hydrochloric acid was added to lead (II) oxide.

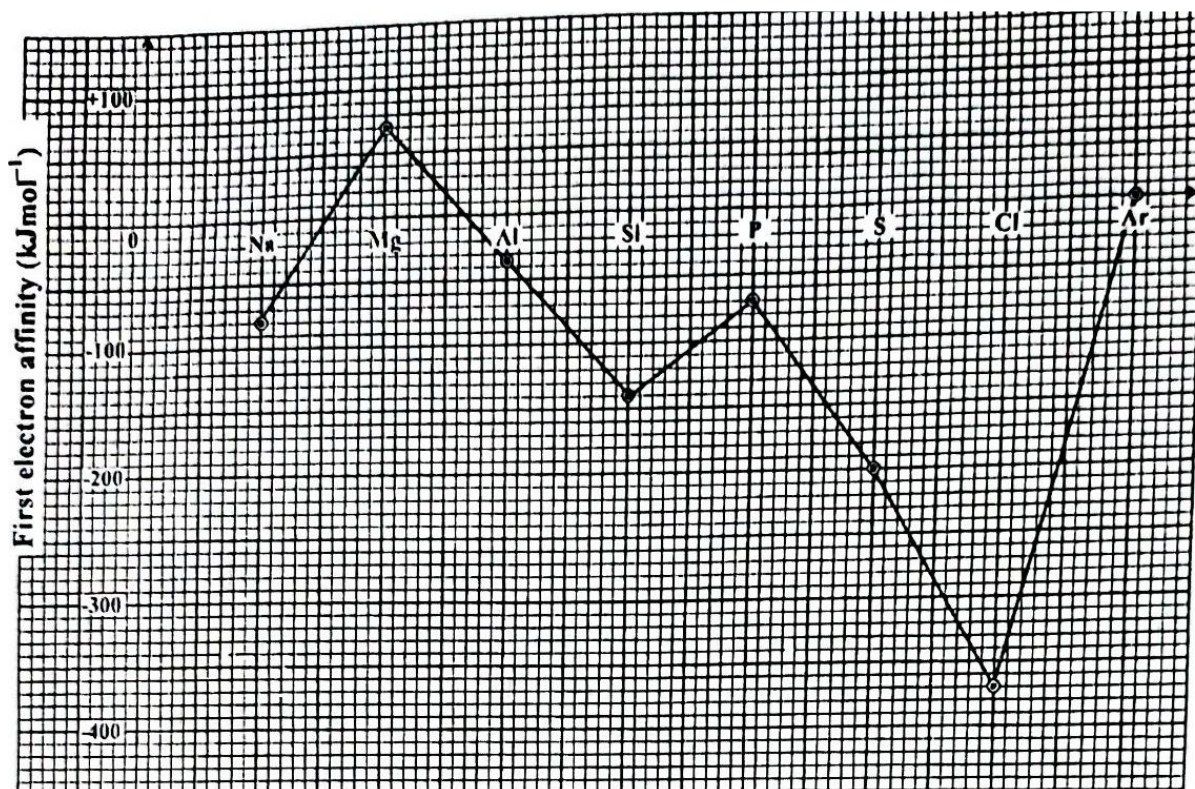
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b) Potassium iodide was added to copper (II) sulphate solution.

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SECTION B-54 MARKS
ATTEMPT ALL QUESTIONS IN THIS SECTION.

10. The figure below shows the variation of the 1st electron affinity of the elements in Period 3 of the Periodic table.



Explain each of the following observations.

a) There is a general increase in the 1st electron affinity from sodium to argon. (01½ marks)

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b) The **1st electron affinity** of magnesium is higher than that aluminium.

(04 marks)

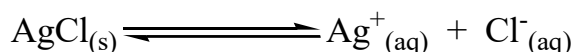
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c) The **1st electron affinity** of phosphorous is less than that of sulphur.

(03½ marks)

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11. Silver chloride dissolves in water according to the following equations.



a) Write the expression for the solubility product, K_{sp} of silver chloride.

(01 mark)

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- b) The electrolytic conductivity of a saturated solution of silver chloride in water at 25°C is $3.41 \times 10^{-6} \Omega^{-1} \text{cm}^{-1}$ and that of pure water is $1.60 \times 10^{-6} \Omega^{-1} \text{cm}^{-1}$. Calculate the **solubility product** of a saturated solution of silver chloride at 25°C.

(04½ marks)

(The molar conductivities at infinite dilution of silver nitrate, potassium nitrate and potassium chloride are 133.4, 145.0 and $149.9 \Omega^{-1} \text{cm}^2 \text{mol}^{-1}$ respectively at 25°C).

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- c) Ammonia solution was added to a solution containing silver chloride.

i. State how the **solubility** of silver chloride was affected. (01 mark)

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ii. Explain your answer in (c)(i) above. (02½ marks)

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12. Manganese is a **d-block element** in the Periodic Table.

a) Define the term **d-block element**. (01 mark)

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b) (i). Write the electronic configuration of manganese. (0½ mark)

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...

(ii). State the **common oxidation states** exhibited by manganese in its compounds. (01½ marks)

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(iii). Write the **formulae of oxides** of manganese in each of the oxidation states you have stated in (b) (ii) above. (01½ marks)

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c) A **black oxide**, Y of manganese was fused with a mixture of potassium hydroxide and potassium nitrate to give a compound which when

treated with water gives a **green solution**. The **green solution** turned **purple** when acidified with sulphuric acid.

Identify:

- i. Y (01 mark)

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- ii. The ion that gives the green solution its colour. (01 mark)

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- iii. The ion that gives the purple solution its colour. (01 mark)

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- d) Write ionic equation for the reaction leading to the formation of the purple solution. (01½ marks)

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13. Compound **T**, $\text{C}_3\text{H}_6\text{O}$ reacts with **2, 4-dinitrophenylhydrazine** to form a **yellow precipitate**.

- a) Write the **names** and the **structural formulae** of all possible isomers of **T**. (03 marks)

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- b) **T** reacts with ammoniacal silver nitrate solution to form silver.
Identify **T**.
(01 Mark)

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- c) Write equation and indicate a mechanism for the reaction between **T** and 2, 4-dinitrophenylhydrazine under acidic condition. (05 marks)

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- 14.(a). (i). Sketch a graph to show the pH change when hydrochloric acid is titrated with ammonia solution.
(01½ marks)

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(ii). Explain the **shape of your sketch graph** in (a) (i). (03½ marks)

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(b). Calculate the **pH** of a resultant solution formed when **10cm³** of a **0.1M** sodium hydroxide solution is added to **25cm³** of a **0.1M** ethanoic acid at **25°C**. (04 marks)

(Dissociation constant of ethanoic acid at **25°C** = **1.8 x 10⁻⁵ moldm⁻³**)

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15. Beryllium, magnesium, calcium and barium are some of the elements that belong to Group (II) of the Periodic Table.

- a) State how the elements react with sulphuric acid and give the conditions for the reactions. (03 marks)

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- b) (i). State how the solubilities of the sulphates of Group (II) elements vary down the group. (01 mark)

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- (ii). Explain your answer in (b) (i). (02 marks)

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c) Write equation for the reaction of:

i. Beryllium with sodium hydroxide solution. (01½ marks)

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ii. Calcium carbide with water. (01½ marks)

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16. In the manufacture of ammonia, nitrogen gas is catalytically hydrogenated to give ammonia according to the following equation.



a) (i). Name the catalyst used in the reaction. (0½ mark)

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(ii). Write the expression for the equilibrium constant, K_p for the reaction.

(01 mark)

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- b) State what would happen to the position of the equilibrium if:
i. Pressure was increased. (01 mark)

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- ii. Temperature was increased. (01 mark)

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- c) When **3 moles** of hydrogen and **1 mole** of nitrogen were mixed and allowed to attain equilibrium at **100 atms** and **400°C**, the equilibrium mixture contained **25%** of ammonia by volume. Calculate the:

- i. Number of moles of nitrogen and hydrogen at equilibrium.

(03 marks)

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- ii. Value of the equilibrium constant, K_p at 400°C. (02½ marks)

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17.(a).Differentiate between addition and condensation polymers. (02 marks)

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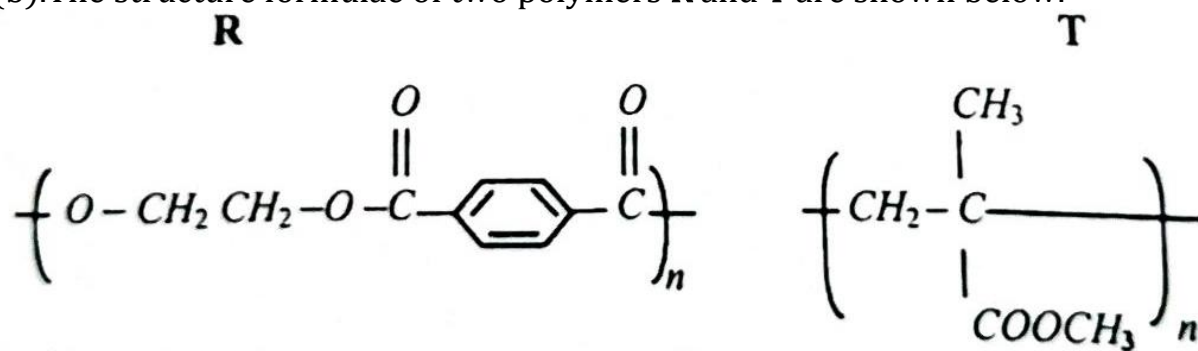
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(b).The structure formulae of two polymers R and T are shown below.



Name the polymer.
(1 mark)

i. R:

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ii. T:

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(c).Write the structural formula (e) of monomer(s) of the polymers R and T respectively. (03 marks)

(d). Give one use of: (@01 mark)

i. R:

.....

ii. T:

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♥ ===END===

SECTION A-46 MARKS
ATTEMPT ALL QUESTIONS IN THIS SECTION.

18.(a).Define the following terms. (01 mark)

i. Bond energy.

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ii. Heat of formation.

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b)Given the following bond energies.

Bond	Bond energy [KJ/mol]
C-C	337
C-H	414
C-O	360
O-H	123

Calculate the heat of conversion of gaseous methoxymethane to gaseous ethanol. (02 marks)

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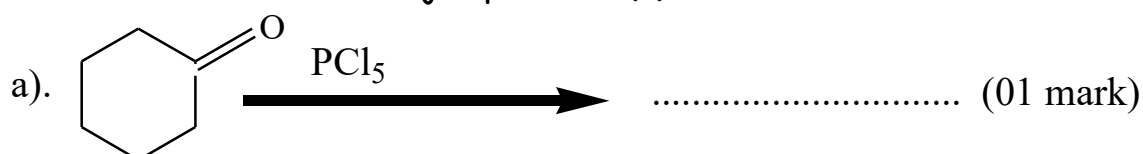
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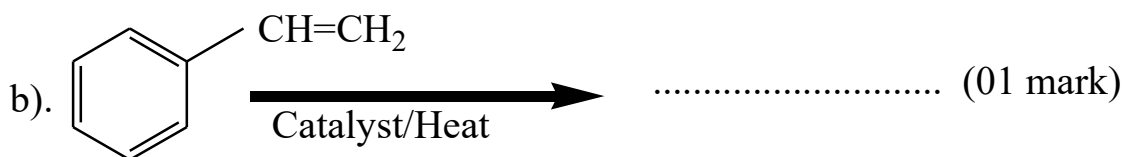
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19. Complete each of the following organic reactions and give the IUPAC names for the major product (s).



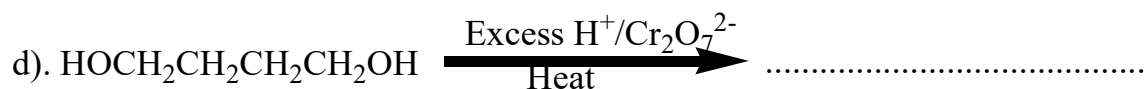
Name of product: (0½ mark)



Name of product (s): (0½ mark)



Name of product (s): (0½ mark)



Name of product (s): (0½ mark)

3.(a) An alkyne, Q has molecular formula C_4H_6 . Write the names and structural formulae of all possible isomers of alkyne, Q.

(02 marks)

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b). Alkyne, Q react with ammoniacal silver nitrate solution.

- i. State what is observed. (0 $\frac{1}{2}$ mark)

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- ii. Write the equation for the reaction in b (i) above. (01 $\frac{1}{2}$ marks)

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c) Write equations to show how alkyne, Q can be synthesized from ethane.
(04 marks)

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4. Name a **reagent** that can be used to **distinguish** between the following pairs of compounds and in each case, **state what would be observed** if each members of the pair was treated with the named reagent.

(@02 marks)

a) $\text{CH}_3\text{CH}_2\text{OH}$

and

CH_3OH

Reagent

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Observations

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b) HCOOH

and

CH_3COOH

Reagent

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Observations

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5.(a) Explain briefly why chlorine is a stronger oxidizing agent than bromine. (02 marks)

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d) Phosphorus.

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6. (a). Compare the reactivity of the following elements with water.

(@0½ mark)

i. Fluorine

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ii. Chlorine

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iii. Iodine

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(b).Write equation for the reaction between fluorine and: (01½ marks)

i. Cold dilute sodium hydroxide solution.

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ii. Hot concentrated sodium hydroxide solution.

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7. (a).Define the term **Freezing point constant** of a substance. (01 mark)

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(b).A solution containing **1.54g** of compound, T [Molar mass, $M_{rT} = 128$] in **18g** of camphor freezes at **148.3°C**.Calculate the **freezing point constant** of camphor.
(03½ marks)

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8. **50cm³** of a vapourized alcohol, Q [$C_nH_{2n+1}OH$] diffused through a small hole in **119.85s**.Under the same conditions, the same volume of hydrogen diffused via the hole in **21.85s**.

c) (i). Calculate the molecular mass of alcohol, Q. (01½ marks)

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- ii. Determine the molecular formula of alcohol, Q. (01 mark)

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- d) (i). Write the **structural formulae** and **IUPAC names** of all the possible isomers of alcohol, Q. (02 marks)

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- ii. Alcohol, Q reacts with aqueous sodium hydroxide solution and iodine solution to give a yellow precipitate. Identify alcohol, Q. (0½ mark)

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9. Below are some bond energies for selected bonds.

Bond	H-H	C-H	C=C	C-C
Bond energy (Kj/mol)	436	412	615	348

- a) Define the term **bond energy**. (01 mark)

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- b) Use the values in the table to calculate the enthalpy change for the following reaction. (03 marks)

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SECTION B-54 MARKS
ATTEMPT ALL QUESTIONS IN THIS SECTION.

10.State what would be observed and write equations for reactions which would occur when:

- a) Dilute hydrochloric acid is added to sodium thiosulphate solution.

(02 marks)

Observation:

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Equation:

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- b) Concentrated hydrochloric acid is added to manganese (IV) oxide and the mixture heated. (02½ marks)

Observation:

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Equation:

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- c) Mixture of potassium manganate (VII) and oxalic acid is heated in the presence of dilute sulphuric acid. (03 marks)

Observation:

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Equation:

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- d) Water is added to tin (IV) chloride. (01½ marks)

Observation:

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Equation:

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11. Write mechanism to show how the following conversions can be effected.

(a). Butan-2-ol to But-2-ene. (03 marks)

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(b) Propene to propan-2-ol. (03 marks)

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(c) Ethene to 2-chloroethanol. (03 marks)

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12.(a).Draw the structures and name of shapes of the following molecules/ions. (@01½ marks)

Species	Structures	Name of shapes
SiF ₄		
NO ₃ ⁻		
SO ₃ ²⁻		
(CH ₃) ₃ N		

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b) Briefly explain why the following molecule/ion adopt the structure drawn in (a) above. (01½ marks)

d) SO_3^{2-} .

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e) SiF_4 .

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13.(a).State what is meant by the term **melting point**? (01 mark)

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(b).The table below shows the melting points of some of the period (III) elements of the periodic table.

Elements	Na	Mg	Al	Si	P	S	Cl
Mpt(°C)	371	923	933	1,680	317	392	172

Explain why:

- i. The melting point of magnesium is higher than that of sodium.

(01½ marks)

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- ii. Silicon has a very high melting point. (01 mark)

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- iii. Melting point of sulphur is higher than that of phosphorus. (01½ marks)

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f) Write equation for the reaction between:

i. Heated magnesium and steam. (01 mark)

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ii. Chlorine and warm concentrated sodium hydroxide solution.

(01½ marks)

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iii. Sulphur and hot concentrated nitric acid. (01½ marks)

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14. Write equations to show the following compounds can be synthesized.

Indicate the condition (s) for each reaction (s). (@03 marks)

d) Ethanal from 1,2-dichloroethane.

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e) Ethanoic acid from iodomethane.

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f) Ethylethanoate from bromoethane.

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15. An organic compound, **R** contains carbon, hydrogen, and oxygen atoms only. On complete combustion, **0.463g** of organic compound, **R** gave **1.100g** of carbon dioxide gas and **0.563g** of water.

e) Determine the empirical formula of organic compound, **R**. (03 marks)

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f) When vapourized, **0.1g** of organic compound, **R** occupies a volume of **54.5cm³** at a temperature of **208°C** and pressure of **98.3kPa**.

(02½ marks)

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- g) An organic compound, R reacts with sodium metal evolution of a gas. Write the structural formula of all the possible isomers of organic compound, R. (02 marks)

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- h) An organic compound, R reacts with a mixture of anhydrous zinc chloride and concentrated hydrochloric acid to give a cloudy solution in about 10 minutes.

- i. Identify an organic compound, R. (0½ mark)

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- ii. Show how an organic compound, R can be synthesized from but-2-ene. (01 mark)

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16.(a).State what is meant by the term Lattice energy?
(mark)

(01

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b). Thermochemical data for some processes are shown in the table below.

Process	Energy (kJ/mol)
Atomization of calcium	+178
First ionization energy	+590
Second ionization energy	+1,146
Formation of calcium fluoride	-1,220
Electron affinity of fluorine	-328
Bond dissociation energy of fluorine	+243

i. Use the values above to construct a Born-Haber cycle for the formation of calcium fluoride.
(03 Marks)

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ii. Calculate the lattice energy of calcium fluoride.
(marks)

(02

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- iii. Determine the enthalpy of solution of calcium fluoride.
[Enthalpies of hydration of calcium ions and fluoride ions are -1,587
& -515kJ/mol] (01½
marks)

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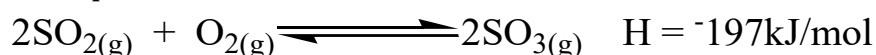
- c) (i).State the effect of temperature on the solubility of calcium
fluoride.
(01 mark)

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- (ii).Give a reason for your answer. (0½
mark)

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17. In the manufacture of sulphuric acid by the contact process, sulphur dioxide gas is catalytically oxidized to sulphur trioxide gas according to the equation below.



The sulphur trioxide gas is then absorbed in a substance, T.

- a) Name two major sources of sulphur dioxide gas in the contact process.
(01 mark)

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- b) State the industrial conditions used to obtain maximum yield of sulphur trioxide gas. (01½ marks)

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- c) Identify substance, T. (0½ mark)

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- (ii). Write equation to show what happens when sulphur trioxide gas is absorbed in substance, T. (01½ marks)

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- d) State the conditions and write equation for the reaction between carbon and sulphuric acid. (02½ marks)

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- e) Sulphuric acid is used in the manufacture of calcium dihydrogensulphate from calcium phosphate.
i. Write equation for the reaction leading to the formation of calcium dihydrogenphosphate. (01 mark)

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- ii. State two uses of dihydrogenphosphate. (01 mark)

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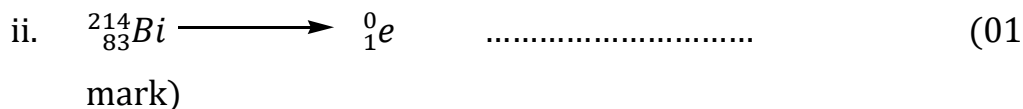
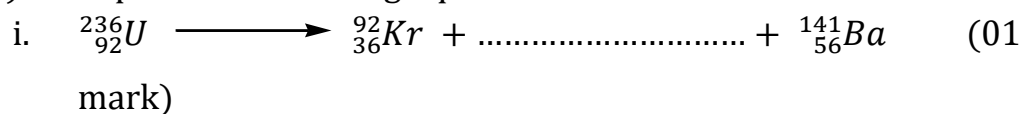
THE PERIODIC TABLE

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

♥ ===END===

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** form Bismuth to decay by **75%**.
 (02½ marks)

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2. (a) (i) Write the **electronic configuration** of phosphorous. (01 mark)

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(ii) State the **common oxidation states** exhibited by phosphorous in its compounds. (01 mark)

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...

(b) Draw the **structure** and **name the shape** of phosphorous trichloride molecule.
 (01 mark)

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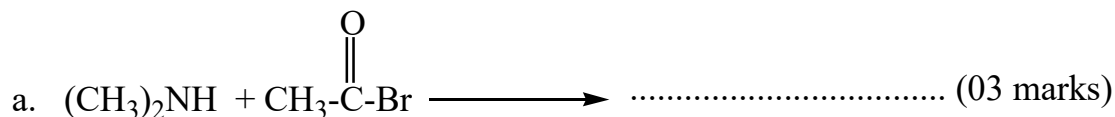
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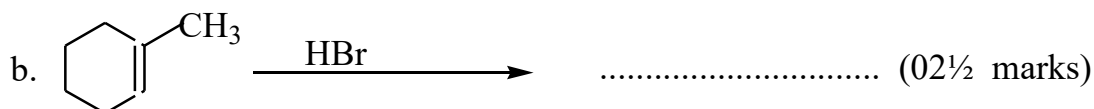
- (c) The enthalpy of formation of phosphorous trichloride is -
306kJmol⁻¹ and enthalpies of atomization of phosphorous and
 chlorine are **+314kJmol⁻¹** and **+242kJmol⁻¹** respectively.
 Calculate the **average bond energy** of the P-Cl bond. (02½
 marks)

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3. Complete the following equations and in each case outline the accepted
 mechanism for the reaction.



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4. A sample of methylamine was placed at one **end A** of a **0.8metre** glass tube held horizontally. At the other **end B** of the tube was placed a sample of hydrochloric acid and both ends of the tube closed. When the tube was left for some time, a **white ring** was formed inside the tube.

a) Write **equation** for the reaction leading to the formation of the **white ring**.
(01 mark)

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b) Calculate the **distance between end B** and the **white ring**. (03 marks)

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5. Name **one reagent** that can be used to distinguish between each of the following pairs of ions and in each case, state what would be observed if each member of the pair is treated with the reagent you have named.

a. $\text{Cl}^-_{(\text{aq})}$ and $\text{I}^-_{(\text{aq})}$ (03 marks)

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$$\text{---CH}_2\text{---CH---}$$

Cl

---_n

[illegible]

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Observation:

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Equation:

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- ii. 3-phenylpropene was added to a solution of bromine in tetrachloromethane. (01½ marks)
Observation:

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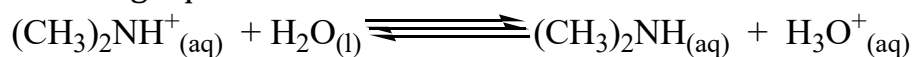
Equation:

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- (b) Give a **reason** for your observation in a (i) above. (01 mark)

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8. Dimethyl ammonium chloride undergoes hydrolysis in water according to the following equation:



- a) Write the **expression for the hydrolysis constant, K_h** of dimethyl ammonium chloride. (01 mark)

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b) When **4.0mol/dm³** of dimethyl ammonium chloride was hydrolysed **25.0cm³** of the resulting solution required **7.5cm³** of **0.01mol/dm³** of sodium hydroxide for complete neutralization.

i. pH of the solution. (02 marks)

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ii. hydrolysis constant K_h and any assumptions made.

(02½ marks)

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9. Write equation for the reaction (s) between:

a) Lead (IV) oxide and concentrated hydrochloric acid on warming.

(01½ marks)

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b) Aqueous lead (II) nitrate and excess sodium hydroxide solution.

(03 marks)

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c) Tin (II) chloride and water.
marks)

(01½

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SECTION B-56 MARKS

ATTEMPT ALL QUESTIONS IN THIS SECTION.

10. **Beryllium** is in **Group (II)** of the periodic Table but it shows some similarities with **aluminium** which is in group **(III)** of the Periodic table.

a) Give a reason why aluminium shows some similarities in properties with beryllium.

(01 mark)

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b) Write equation for the reaction between water and:

i. Beryllium carbide.

(01½

marks)

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.....

ii. Calcium carbide.

(01½

marks)

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- c) Thallium and aluminium are both in group (III) of the Periodic Table. State one difference between aluminium oxide and thallium oxide.

(01 mark)

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- d) Write equation for the reaction between sodium hydroxide and:
 i. Aluminium. (02 marks)

.....

- ii. Beryllium. (02 marks)

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11. (a). State the effect on the vapour pressure of water and the total vapour pressure of the system when small amounts of the following substances are separately added to water at 25°C. (03 marks)

Substance added to H ₂ O	Effect on	
	Vapour pressure of H ₂ O	Total vapour Pressure of the system
Sodium chloride		
Propanone		
Tetrachloromethane		

- (b). Explain your answer(s) in (a) (ii) and (a) (iii). (04 marks)

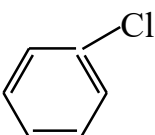
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- (c). An organic compound **X** was steam distilled at **95°C** at **760mmHg** pressure. If the distillate contained **0.8g** of water by mass. Calculate the relative molecular mass of **X**.

(02 marks)

(The saturated vapour pressure of water at **95°C** is **732.7mmHg**)

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

- (a).  and $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$ (03 marks)

Reagent:

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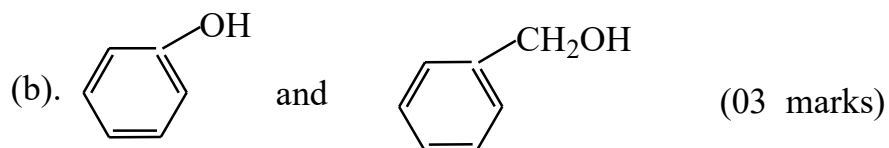
Observation:

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Reagent:

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Observation:

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Reagent:

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Observation:

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13. Write equations to show how the following compounds can be synthesized. Indicate the condition (s) for the reaction(s).

a) But-2-yne from butan-2-ol. (03½ marks)

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b) Ethylamine from ethanol. (03½ marks)

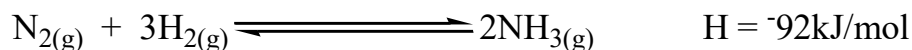
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c) Propanone from propene. (02 marks)

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14. Nitrogen reacts with hydrogen gas to form ammonia according to the following equation:



a) State the conditions for the reaction which would give maximum yield of ammonia. (01½ marks)

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b) Write equations for the reactions that take place during the manufacture of nitric acid from ammonia. (04½ marks)

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c) Write equations for the reaction between copper and:
i. Dilute nitric acid. (01½ marks)

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- ii. Concentrated nitric acid. (01½ marks)

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15. Hydrogen and iodine react to form hydrogen iodide according to the following equation.



- a) (i) Write the expression for the **equilibrium constant, K_c** for the reaction. (01 mark)

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- (ii) **1 mole** of hydrogen and $\frac{1}{3}$ **mole** of iodine were heated together at **450°C** until equilibrium was obtained. Calculate the number of moles of hydrogen iodide present in the equilibrium mixture at **450°C**. (The equilibrium constant, **K_c** for the reaction between hydrogen and iodine is **50**) (04 marks)

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- b) Briefly describe how the concentration of iodine in the equilibrium mixture can be determined. (04 marks)

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16. A compound R contains 40% carbon and 6.67% hydrogen, the rest being oxygen.

- a) Calculate the **empirical formula** of R. (01½ marks)

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- b) A solution containing 28.145g of R in 250g of water froze at -3.490°C.
i. Determine the **molecular formula** of R.

(The freezing point constant, K_f of water $1.86^\circ\text{C/mol/1000g}$)
(03 marks)

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- ii. Write the structural formula and **I.U.P.A.C names** of all the possible isomers of **R**.
(02 marks)

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- c) **R** reacted with **sodium carbonate** with **effervescence**.

- i. Identify **R**. (01 mark)

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- ii. Write equations to show how **R** can be **synthesized** from ethene.

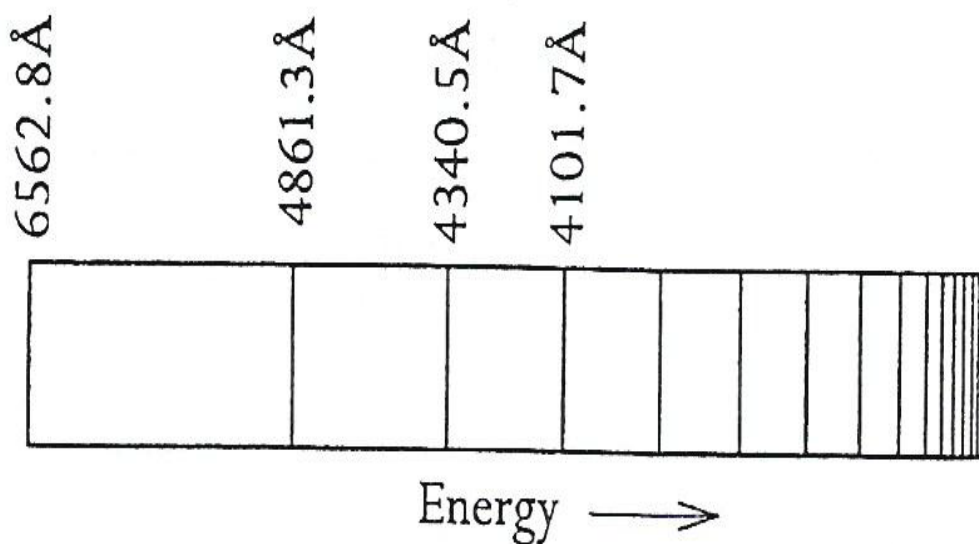
(01½ marks)

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17. The diagram below shows part of the atomic emission spectrum of hydrogen.



a) State:

- i. The information that can be obtained from the separate lines about the electronic structure of the hydrogen atom. (01½ marks)

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- ii. How an emission line arises. (01½ marks)

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b) Briefly, explain why the emission lines get closer together. (03½ marks)

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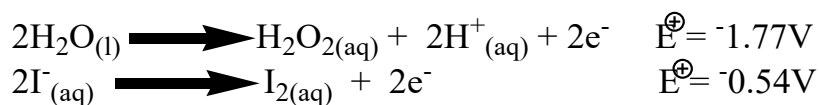
c) State what is meant by term '**principal quantum number**'. (01½ marks)

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♥ ===END===

SECTION A-46 MARKS
ATTEMPT ALL QUESTIONS IN THIS SECTION.

4. The standard electrode potentials for some half-cell reactions are given below:



c) Write the:

(i) Cell notation for the reaction that takes place when the two half cells are connected. (01½ marks)

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(ii) Equation for overall reaction. (01½ marks)

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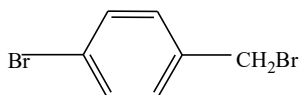
d)(i) Calculate the $E^\ominus$ for the cell in (a) above. (01 mark)

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(ii) Comment on the feasibility of the reaction. (01 mark)

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5. Compound, E has a molecular structure of:



a) Name the functional group present in compound, E. (0½ mark)

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b) Write the mechanism for the reaction between compound, E and hot aqueous sodium hydroxide solution. (01½ marks)

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(ii) Name the type of reaction mechanism in b(i) above.

(01 mark)

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c) 2.5g of compound, E was heated with 25.0cm³ of 1M aqueous sodium hydroxide solution. Calculate the volume of 0.25M sulphuric acid needed to neutralize the mixture after the reaction. (03 marks)

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6. Draw the structure and name the shape of the following molecules. (04 marks)

Ions/Anions	Structure	Name of shape
SO_2		
SO_3		
SOCl_2		

SO_2Cl_2		

b) Write equation to show the reaction between:

(i) SO_2 gas and acidified potassium dichromate (VI) solution.

(01 mark)

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(ii) SOCl_2 and propanoic acid.

(01

mark)

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7. Write equation for the reaction between hot concentrated sodium hydroxide solution and:

(@01

mark)

(i) Aluminium.

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(ii) Phosphorous.

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b) Write equation for the reaction between dilute sulphuric acid and:

(@01 mark)

(i) Copper (I) oxide.

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(ii) Sodium benzoate solution.

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5. Potassium ethanoate undergoes hydrolysis when dissolved in water according to the equation below.

If the hydrolysis constant, K_h for potassium ethanoate at room temperature is 5.6×10^{-10} . Calculate the:

a) pH of 0.1M solution of potassium ethanoate. (03 marks)

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b) Percentage hydrolysis of 0.1M solution of potassium ethanoate. (02 marks)

6. Carbon monoxide gas diffuses 2.646 times faster than carbonyl of iron with the formula $\text{Fe}(\text{CO})_n$:

a) Determine the:

(i) Relative formula mass of the carbonyl of iron.

(02½

marks)

(ii) Value of n. (01½ marks)

(ii) Value of n. (01½ marks)

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Oxidation state:

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Oxidation state:

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Oxidation state:

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b) Write equation for the reaction between the solution R in water and:

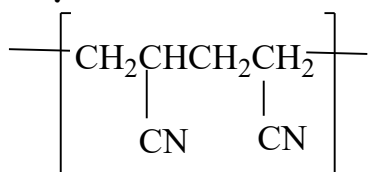
(i) Excess concentrated hydrochloric acid. (01½ marks)

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(ii) Potassium iodide solution. (01½ marks)

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8. Polymer, Z has the following structure:



a) Write the structure and name of the monomer of polymer, Z.

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b) The osmotic pressure of a solution containing 2g/dm³ of a polymer, Z is 0.155mmHg at room temperature. Calculate the number of monomers in a polymer, Z. (03½ marks)

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9. Write equation(s) to show how the following conversions can be effected.

a) Propane-1,2-diol from propan-1-ol.
marks)

(02½

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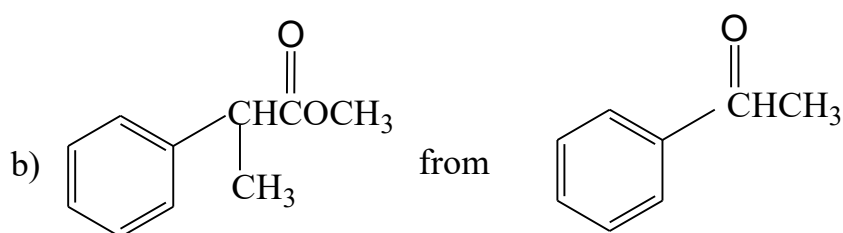
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SECTION B-54 MARKS

ATTEMPT ANY SIX QUESTIONS IN THIS SECTION.

10.(a) Write:

- (i) The name and formula of one ore from which zinc can be extracted. (01 mark)**

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- (ii) Name the method by which the ore can be concentrated. (01 mark)**

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- b) During the concentration process, the ore is crushed and mixed with water, oil and compressed air is bubbled through the mixture. The ore rises up the froth and it's skimmed off and the acid is added. State the role of:**

- (i) Oil. (01½ marks)**

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(ii) Compressed air. (01½ marks)

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(iii) Acid. (01 mark)

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c) The concentrated ore in (b) above can be converted to zinc oxide:

(i) State how the conversion can be carried out. (01 mark)

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(ii) Write the equation for the reaction that leads to the formation of zinc oxide. (01 mark)

(iii) Write equation to show how zinc oxide can be converted to zinc.

(01 mark)

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11. State what would be observed and write equation for the reaction that would take place when:

a) Hydrogen sulphide gas is bubbled through acidified potassium dichromate (VI) solution.

(02½ marks)

Observation (s):

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Equation:

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b) Iodine solution and sodium hydroxide solution is added to butanone and the mixture warmed. (02 marks)

Observation (s):

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Equation:

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c) Concentrated nitric acid followed by lead (IV) oxide is added to manganese (II) sulphate solution and the mixture warmed.

(02 marks)

Observation (s):

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Equation:

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d) Dilute hydrochloric acid is added to sodium thiosulphate solution.

(02½

marks)

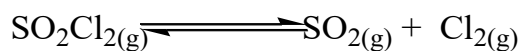
Observation (s):

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Equation:

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12. Sulphur dichloride dioxide decomposes at high temperature according to the equation below:



When 13.5g of Sulphur dichloride dioxide was placed in a 2 litres vessel and heated at a pressure of 2 atmospheres, 1.5g of chlorine was formed at equilibrium.

a) Write the expression for the equilibrium constant, K_p .

(01

mark)

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b) Calculate the value of equilibrium constant, K_p for the reaction and state its S.I unit.

(05

marks)

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c) State what would happen to the position of equilibrium when:

(@0½ mark)

(i) Pressure of the system is reduced.

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(ii) Sulphur dioxide gas is removed from the equilibrium mixture.

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(iii) Chlorine gas is added to the equilibrium mixture.

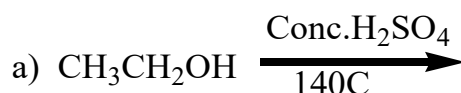
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d) Explain your answer in c (iii) above.
marks)

(01½

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13. Complete the following equations and write the mechanism for the reaction in each case:



(03½ marks)

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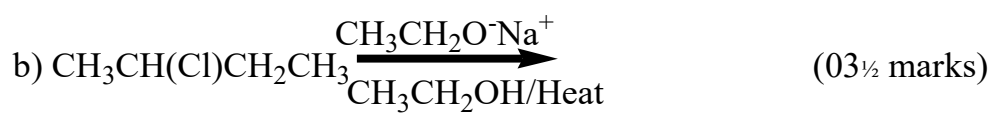
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14. Lead (II) chloride is sparingly soluble in water:

a) Write the:

(i) Equation for the solubility of lead (II) chloride in water.

(01½ marks)

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(ii) Expression for the solubility product, K_{sp} of lead (II) chloride.

(0½

mark)

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b) 5.0g of lead (II) chloride was shaken with 1 litre of distilled water. Determine the percentage of lead (II) chloride that dissolved. [Solubility constant for lead (II)

chloride, $K_{sp} = 1.6 \times 10^{-5} \text{ mol}^3/\text{dm}^9$ at 25°C]

(03½ marks)

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c) If 0.05M hydrochloride acid was used instead of water in (b) above, Calculate the percentage of lead (II) chloride that dissolved and state the assumption made.

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15. Complete combustion of a hydrocarbon, Q in excess air produced 7.04g of carbon dioxide gas and 1.08g of water.

a) Calculate the empirical formula of hydrocarbon, Q.

(03 marks)

b) Hydrocarbon, Q has a density of $4.5536 \times 10^{-3} \text{ g/cm}^3$ at s.t.p. Determine the molecular formula of hydrocarbon, Q. (01 $\frac{1}{2}$ marks)

c) Hydrocarbon, Q burns with a sooty flame and forms a red precipitate when treated with a solution of copper (I) chloride in excess ammonia solution.

(i) Identify hydrocarbon, Q.
(01 mark)

(0½)

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(ii) Write equation for the reaction leading to the formation of red precipitate.
(01 mark)

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d) Write equation to show how hydrocarbon, Q can be prepared from an alcohol.
(03 marks)

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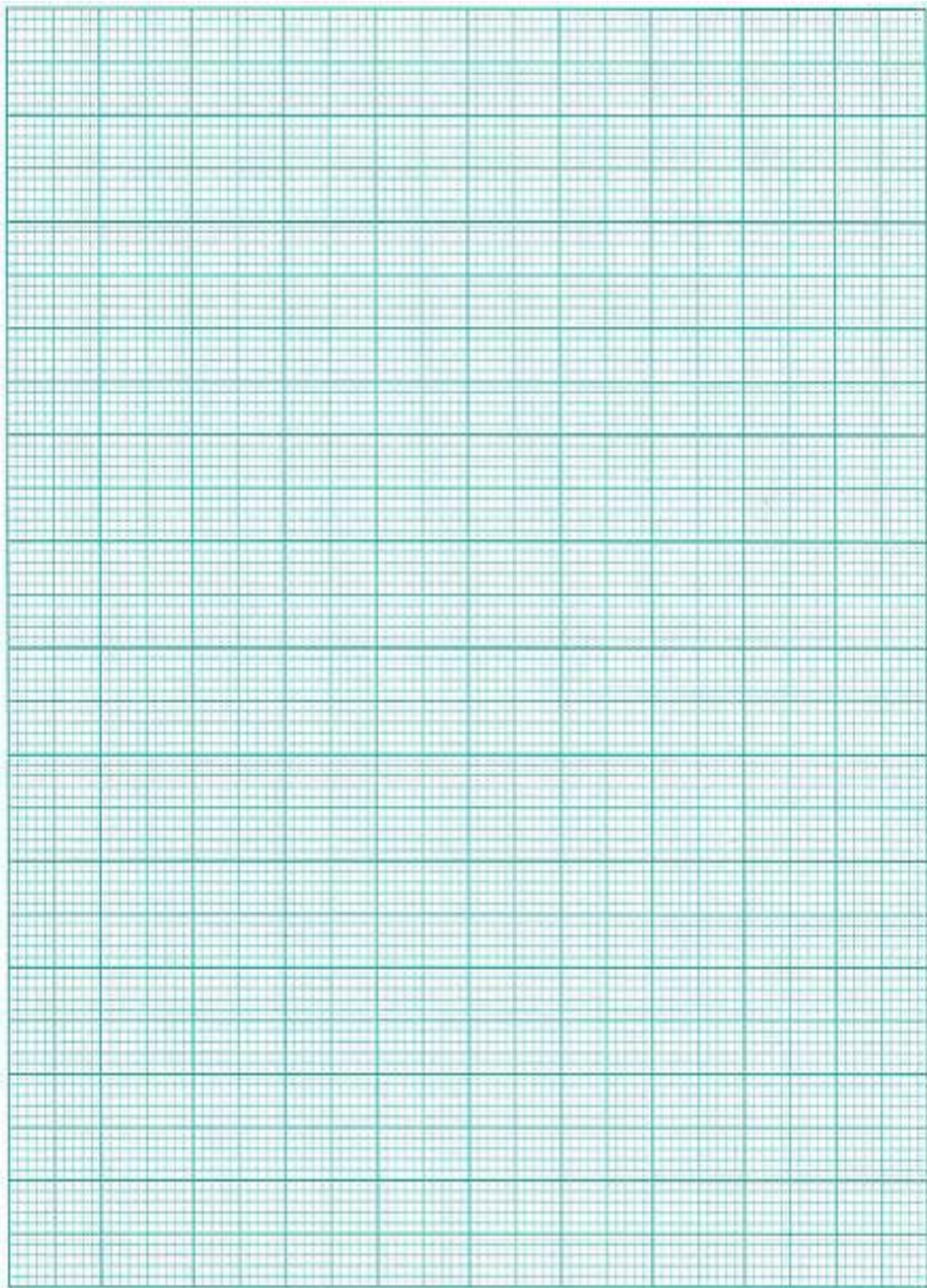
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16. The products of pressure and volume, PV for 21.1g of gas, W at different temperatures are shown below:

PV (atm/dm ³)	0.016	0.032	0.048	0.065	0.080	0.096
Temperature (K)	299	300	301	302	303	304

(i) Plot a graph of PV against temperature.
(03 marks)

(03)



(ii) Use the graph to determine the molecular mass of gas W.

(03 marks)

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b) Gas, W consists of 25.93% by mass of nitrogen atom and the rest being oxygen atom. Determine the molecular formula of gas, W.

(03 marks)

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17.(a) What is vegetable oil?

(01

mark)

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b)Describe briefly how soap can be prepared from a nut.

(03 marks)

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c)Write the general equation for the:

(i)Formula of soap. (01 mark)

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(ii) Reaction between soap solution and hard water. (01 mark)

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d) In an experiment, 9.85g of soap was prepared from a vegetable oil containing an ester of hexadecanoic acid, $C_{15}H_{35}COOH$. Calculate the mass of the vegetable oil used in the experiment. (03 marks)

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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

♥ ===END===