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

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

a. $(CH_3)_3CBr \xrightarrow[Heat]{OH^-_{(aq)}}$ ..... (02½ mark)

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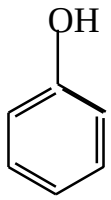
b.  + $CH_3COCl \xrightarrow[Heat]{NaOH_{(aq)}}$ ..... (03 marks)

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2. Thorium decays according to the following equation.

$^{232}_{90}Th + \alpha \longrightarrow \mathbf{X} + \beta \longrightarrow \mathbf{Y} + \beta \longrightarrow \mathbf{Z}$

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

X: .....

Y: .....

Z: .....

b) The **half-life** of Thorium-232 is **234 days**. Determine the t**ime 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. **50.0cm^3** 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.

$Fe^{3+}_{(aq)}$, $Fe^{2+}_{(aq)}/Pt_{(s)}$: $^{+}0.77V$	$Sn^{4+}_{(aq)}$, $Sn^{2+}_{(aq)}/Pt_{(s)}$: $^{+}0.15V$

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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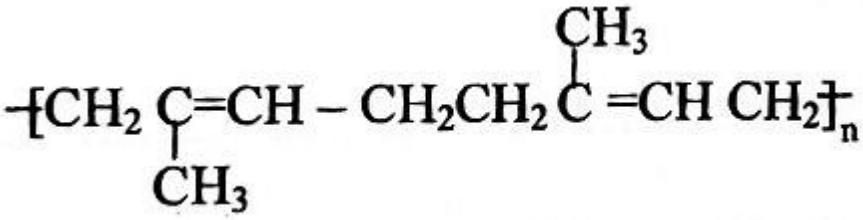
7. Natural rubber has the following structure.



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^{-4}moles** of natura; 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^{-3}g** 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, Kf of benzene=$5.12^0C\ mol^{-1}kg^{-1}$)

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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. $CH_3CH_2CO_2H$ from Propene (03 marks)

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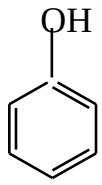
b.  from Benzene (03 marks)

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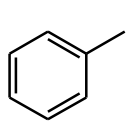
c.  from Phenylmethanol (03 marks)

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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 indepent ionic conductivity f ions. (02 marks)

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

$(CH_3COO)_2Cu$: Λ_m° $=195\ ohm^{-1}cm^2mol^{-1}$

$CuCl_2$: Λ_m° $=266\ ohm^{-1}cm^2mol^{-1}$

HCl : Λ_m° $=426.2\ ohm^{-1}cm^2mol^{-1}$

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

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(c).The ionic radii and ionic mobilities at infinite dilution of some ion 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.

a.  + CH_3COCl $\xrightarrow{FeCl_3}$ ..... (02½ marks)

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b. $(CH_3CO)_2O$ + CH_3NH  ⟶ ..... (03 marks)

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c. $CH_3CH_2CHO \xrightarrow{H_2N\text{-}OH}$ ..... (03½ marks)

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17. **20.0cm³** of **0.50M** hydrochloric acid was added to **250.0cm³** of water.

a) Calculate the **pH** 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 **pH** is **8.7**.State any assumption made.(The base dissociation constant for ammonia solution, $\mathbf{K_b = 1.8\ X\ 10^{5}mol/dm^3}$ 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 **p^{H}** 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 TI 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===

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