FWC

தேசிய வெளிக்கள நிலையம் தொண்டைமானாறு
மூன்றாம் தவணைப் பரீட்சை - 2024
National Field Work Centre, Thondaimanaru
3rd Term Examination - 2024

இரசாயனவியல்
Chemistry

Gr. 12 (2024)

புள்ளித்திட்டம்

பகுதி - I

01)	**3**	14)	**5**
02)	**2**	15)	**2**
03)	**2**	16)	**4**
04)	**5**	17)	**3**
05)	**3**	18)	**2**
06)	**4**	19)	**5**
07)	**1**	20)	**1**
08)	**4**	21)	**1**
09)	**1**	22)	**4**
10)	**2**	23)	**3**
11)	**4**	24)	**5**
12)	**3**	25)	**3**
13)	**5**		

Part - I $25 \times 2 = 50$

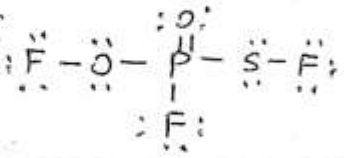
Par - I $50 + \frac{\text{Part II}}{700} \times 50 = 100$

CHEMISTRY | 3rd Term Exam (A/L 2024)

Part A

① a. I S II Mg III Al IV Si V P VI Ar

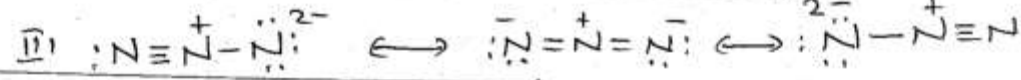
03 × 6 = 18

b) 

06 marks

I P +5 S O O O

01 × 3 = 03

II 

03 × 3 = 09

IV

N_1	O^2	C^3	N^4
3	4	4	2
trigonal planar	tetra-hedral	tetra-hedral	linear
Angular	Angular	tetra hedral	linear
sp^2	sp^3	sp^3	sp
118°	105°	109°	180°

01 × 20 = 20

V

O 2p/sp^2	N^1 sp^2
N^1 sp^2	O^2 sp^3
O^2 sp^3	C^3 sp^3
C^3 sp^3	N^4 sp
N^4 sp	C 2p/sp

01 × 10 = 10

VI $C^3 < N^2 < N^4 < O^2$

04

(c) (1)

I $CH_4 < CF_4 < CO_3^{2-} < O_2$

II $MgI_2 < MgBr_2 < MgCl_2 < MgF_2$

III $Si < S < P < Cl$

IV $F < O < N < S < Cl$

V $NH_3 < N_2H_4 < N_2O_2 < NO_2F$

$03 \times 5 = 15$

C (2) I ion – dipole II hydrogen bond

III dipole – induced dipole IV ion – induced dipole

V London dipposals

$03 \times 05 = 15$

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(2) A – Cu^{2+} B – Ni^{2+} C – Ag^{+} D – Zn^{2+} $02 \times 4 = 08$

P_1 – $Cu(OH)_2$	P_2 – $[Cu(NH_3)_4]^{2+}$	P_3 – $[CuCl_4]^{2-}$
P_4 – $Ni(OH)_2$	P_5 – $[Ni(NH_3)_6]^{2+}$	P_6 – $[NiCl_4]^{2-}$
P_7 – Ag_2O	P_8 – $[Ag(NH_3)_2]^{+}$	P_9 – $AgCl$
P_{10} – $Zn(OH)_2$	P_{11} – $[Zn(NH_3)_4]^{2+}$	P_{12} – $[ZnCl_4]^{2-}$

$01 \times 12 = 20$

$Cu^{2+} + 2NH_3 + 2H_2O \longrightarrow Cu(OH)_2 + 2NH_4^{+}$ 02

OR

$Cu^{2+} + 2NH_4OH \longrightarrow Cu(OH)_2 + 2NH_4^{+}$

$Cu(OH)_2 + 4NH_3 \longrightarrow [Cu(NH_3)_4](OH)_2$ 02

OR $Cu(OH)_2 + 4NH_4OH \longrightarrow [Cu(NH_3)_4]OH + 4H_2O$

white priciptate disolved in NH_3 solution 02

$AgCl + 2NH_3 \longrightarrow [Ag(NH_3)_2]Cl$ 02

P_2 – $[Cu(NH_3)_4]^{2+}$ tetraammine copper(II) ion

P_6 – $[NiCl_4]^{2-}$ tetrachloridonickelate(II) ion $03 \times 2 = 06$

b) M - Pb | M_2O_3 - $PbO.PbO_2$ Pb_2O_3 | MCl_2 - $PbCl_2$

02 × 3 = 06

$PbO_2 + 4HCl \longrightarrow PbCl_2 + Cl_2 + 2H_2O$

c) 03

U - $Na_2S_2O_3$ W - KNO_2 X - KNO_3 Y - $NaHCO_3$

Z - Na_2SO_3

03 × 5 = 15

$Na_2S_2O_3 + 2HCl \longrightarrow 2NaCl + SO_2 + S + H_2O$

$KNO_2 + 2HCl \longrightarrow 2KCl + NO_2 + NO + H_2O$

$NaHCO_3 + HCl \longrightarrow NaCl + CO_2 + H_2O$

$Na_2SO_3 + 2HCl \longrightarrow 2NaCl + SO_2 + H_2O$

03 × 4 = 12

	R CO_2	S SO_2
$Ca(OH)_2$	turs milky continued passing become colourless	turns milky continues passing become colourless
$H^+/K_2Cr_2O_7$	no change	Orange colour solution becomes green colour
H^+/Cu^{2+}	no change	blue colour becomes colourless
blue litmus	blue turns red	blue turns red continues passing become colourless

03 × 8 = 24

(vi) $3SO_2 + Cr_2O_7^{2-} + 2H^+ \longrightarrow 3SO_4^{2-} + 2Cr^{3+} + H_2O$

(vii) $SO_2 + 2Cu^{2+} + 2H_2O \longrightarrow SO_4^{2-} + 2Cu^+ + 4H^+$

03 × 2 = 06

3) a

I $P_1V_1 = P_2V_2$

$2\times10^5\ Pa \times 10\ dm^3 = P_2 \times 15\ dm^3$ — 4+1

$P_2 = 1.33\times10^5\ Pa$ — 4+1

II $P_1V_1 = P_2V_2$

$3\times10^5 \times 5 = P_2 \times 15$ — 4+1

$P_2 = 1\times10^5\ Pa$ — 4+1

III $P_A + P_B = P_T$ — (5)

$P_T = 2.33\times10^5\ Pa$ — 4+1

IV $\frac{P_1}{T_1} = \frac{P_2}{T_2}$ — (5)

$\frac{2.33\times10^5\ Pa}{300\ K} = \frac{P_2}{400\ K}$

$P_2 = 3.11\times10^5\ Pa$ — (5)

V $PV = nRT$

$n = \frac{2\times10^5 \times 10\times10^{-3}\ Pa\ m^3}{8.314\ J\ mol^{-1}K^{-1}\times300K} = 0.8\ mol$ — (5)

molecular mass of A = $\frac{20}{0.8} = 25\ g\ mol^{-1}$ — (5)

VI • Entropy will be increased — (5)

b) (I)

I $m = d \cdot V$
$= 1.08\ g\,cm^{-3} \times 100\ cm^3$
$= 108\ g$ 04

II mass of water $= 108 - 9 = 99\ g$
mole of H_2O $= \frac{99}{18} = 5.5\ mol$ 04
mole of urea $= \frac{9}{60} = 0.15\ mol$ 04

III $X_{urea} = \frac{0.15}{5.65} = \frac{3}{113}$ 04

IV molarity of urea $= \frac{0.15\ mol}{100 \times 10^{-3}\ dm^3}$
$= 1.5\ mol\,dm^{-3}$ 04

V $CO(NH_2)_2 + 2NaOH \longrightarrow Na_2CO_3 + 2NH_3$ 04

(2) I mole amount of $Na_2CO_3 = 0.15\ mol$ 04

II $Na_2CO_3 + CaCl_2 \longrightarrow CaCO_3 \downarrow + 2NaCl$ 04
mole amount of $CaCl_2 = 0.15\ mol$ 04
contration of $CaCl_2$ $= \frac{0.15\ mol}{50 \times 10^{-3}\ dm^3} = 3\ mol\,dm^{-3}$ 04

III mass of $CaCO_3$ $= 0.15\ mol \times 100\ g\,mol^{-1}$
$= 15\ g$ 5

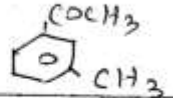
A – $CH_3-CH=CH-CH_2-CH_3$	B – $CH_2=CH-CH_2-CH_2-CH_3$
C – $CH_2=\underset{CH_3}{C}-CH_2-CH_3$	D – $CH_2=CH-\underset{CH_3}{CH}-CH_3$
E $CH_3-CH=\underset{CH_3}{C}-CH_3$	$08 \times 5 = 40$

A ⇒ 2-Pentene C ⇒ 2-methyl-1-butene E ⇒ 2-methyl-2-butene
$03 \times 3 = 09$

B

I $CH_3CH_2CH_3$

II $CH_3-\overset{O}{\overset{\|}{C}}-CH_3$

III 

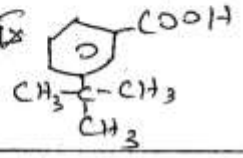
IV $CH_3-\overset{OH}{\underset{}{CH}}-CH_2-CHO$

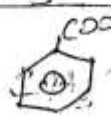
V $CH_3-C\equiv C^-Na^+$

VI 

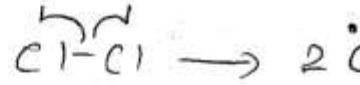
VII $CH_3-\overset{CH_3}{\underset{CH_3}{\overset{|}{\underset{|}{C}}}}-CH_3$ (omgBr)

VIII $\begin{matrix} CH_2-COOH \\ | \\ CH_2-CH_2OH \end{matrix}$

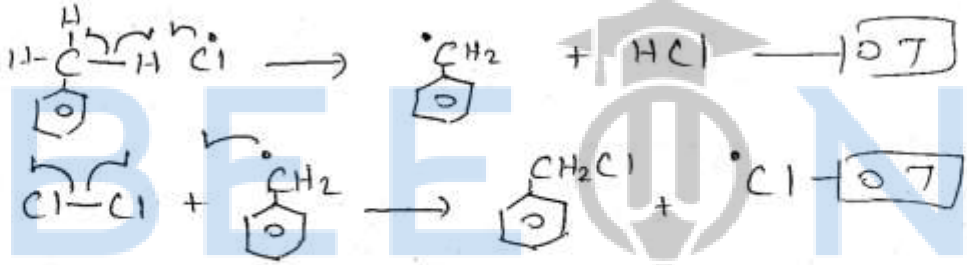
IX 

X 

03 × 10 = 30



07



07

07

Essay

(1) a)

I $\frac{1}{2}N_{2(g)} + \frac{3}{2}H_{2(g)} \longrightarrow NH_{3(g)}$ — (5)

$\Delta H_f^\circ = \Delta H^\circ_{\text{bonds broken}} - \Delta H^\circ_{\text{bonds formed}}$

$= \left[\left(\frac{1}{2}\times 950\right) + \frac{3}{2}\times 431\right] - [3\times 390]\ kJmol^{-1}$ — (5)

$= -48.5\ kJmol^{-1}$ — (4+1)

II $\Delta S^\circ = \Sigma S^\circ_{products} - \Sigma S^\circ_{Reagents}$ — (5)

$= 193 - \left[\frac{1}{2}\times 192 + \frac{3}{2}\times 131\right] Jmol^{-1}K^{-1}$ — (5)

$= -99.5\ Jmol^{-1}K^{-1}$ — (4+1)

III $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$ — (5)

$= -48.5\ kJmol^{-1} - 298\ K \times (-99.5\times 10^{-3}\ kJmol^{-1})$ — (5)

$= -18.849\ kJmol^{-1}$ 4+1

IV this reaction will take place at 25°C — (5)

when increasing temprature $T\Delta S$ become more positive therefore spontaneous decrease because ΔG become more positive — (5)

V $4NH_{3(g)} + 5O_{2(g)} \longrightarrow 4NO_{(g)} + 6H_2O_{(g)}$ —(5)

$\Delta H_R^\circ = \Sigma \Delta H_{f\,products}^\circ - \Sigma \Delta H_{f\,reagents}^\circ$

$= [4 \times 90\,kJmol^{-1} + 6 \times -242\,kJmol^{-1}] - [4 \times -48.5 + 5 \times 0]\,kJmol^{-1}$ —(4+1)

$= -898\,kJmol^{-1}$ —(4+1)

$4NH_{3(g)} + 5O_{2(g)} \longrightarrow 4NO_{(g)} + 6H_2O_{(g)} \quad \Delta H_R^\circ = -898\,kJmol^{-1}$

$6H_2O_{(l)} \longrightarrow 6H_2O_{(g)} \quad \Delta H^\circ = 6 \times 44 = 264\,kJmol^{-1}$

① − ② $4NH_{3(g)} + 5O_{2(g)} \longrightarrow 4NO_{(g)} + 6H_2O_{(l)} \quad \Delta H_R^\circ = -898 - 264$ (5)

$= -1162\,kJmol^{-1}$ (4+1)

(5)

5a ⇒ 80 marks

b) I As the temperature at and above which the vapour of the substance cannot be liquefied, no matter how much pressure is applied —(5)

II CO_2 has heigher critical temprature —(5)

more intermolecular forcees presence in CO_2 than O_2 (5)

III I $P_{CO_2} = \frac{40}{100} \times 1 \times 10^5 = 4 \times 10^4\,Pa$ —(10)

$P_{O_2} = \frac{60}{100} \times 1 \times 10^5 = 6 \times 10^4\,Pa$ —(10)

II $\frac{60}{100} \times 32 + \frac{40}{100} \times 44$ —(5)

$= 36.8$ —(5)

III $P = \frac{dRT}{M} \Rightarrow d = \frac{1 \times 10^5\,Pa \times 36.8 \times 10^{-3}\,kg\,mol^{-1}}{8314\,Jmol^{-1}K^{-1} \times 300K}$ (5) (5)

$= 1.475\,kgm^{-3}$ —(5)

OR $\Rightarrow d = \frac{1 \times 10^5\,Pa \times 36.8\,g\,mol^{-1}}{8.314\,Jmol^{-1}K^{-1} \times 300K}$ —(5)

$= 1475\,gm^{-3}$ —(5)

5b ⇒ 70 marks

(6) (i) I $CO_2 : H_2O = 1:1$

$\therefore C : H = 1:2$

$\therefore$ empirical formula CH_2 — (5)

II $(CH_2)_n = 56$

$(12+2)n = 56$

$n = 4$

$\therefore$ molecular formula $= C_4H_8$ — 5

III $CH_2=CH-CH_2-CH_3$ $CH_3-CH=CH-CH_3$

$CH_2=C(CH_3)-CH_3$

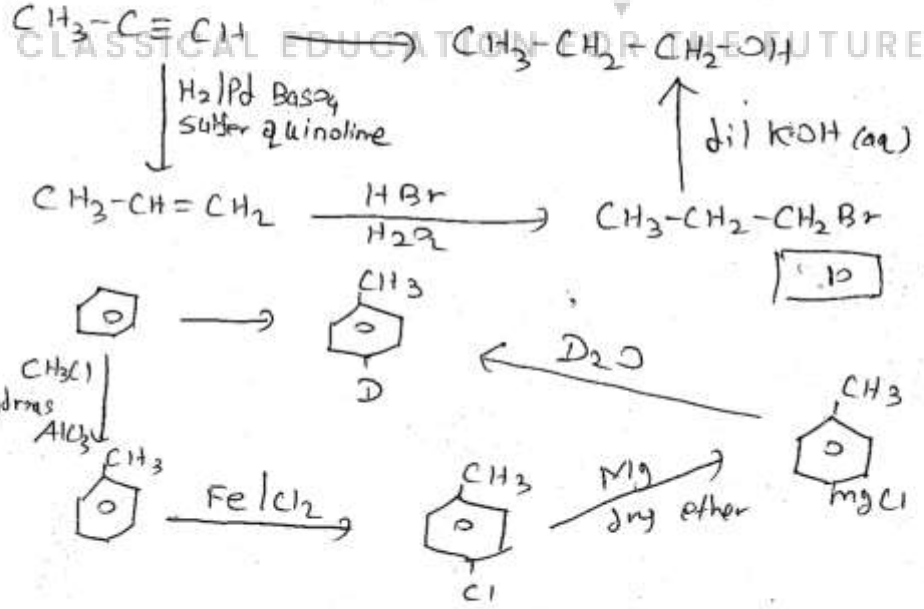
05 x 3 = 15

IV $Y \rightarrow HC\equiv C-CH_2-CH_3$ $Z \rightarrow Na^+ \bar{C}\equiv C-CH_2-CH_3$

05 x 3 = 15

(b) (2) $\therefore X \rightarrow CH_2=CH-CH_2-CH_3$

(1)

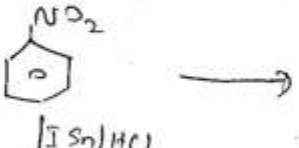


10

(ii)

10

(iii) $CH_3-CH_2CHO \xrightarrow{NaBH_4, methanol} CH_3CH_2-CH_2OH \xrightarrow[\Delta]{Al_2O_3} CH_3CH=CH_2 \xrightarrow{dil\ H_2SO_4} CH_3-\underset{OH}{CH}-CH_3 \xrightarrow{PCC} CH_3-\overset{O}{\overset{\|}{C}}-CH_3$

(iv) 

10

10

b) P → $CH_3\underset{Br}{CH}-CH_2Br$ Q → $CH_3C\equiv CH$ 6A ⇒ 80 marks

R → $CH_3-C\equiv C^-Na^+$ S → $CH_2=CH_2$

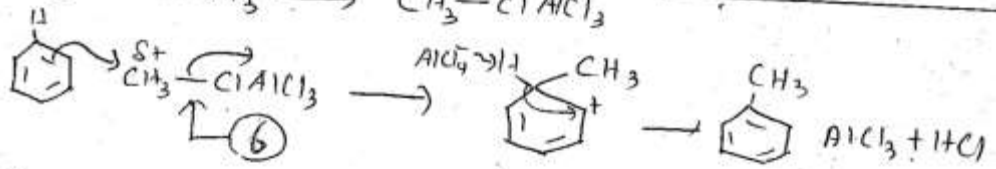
T → CH_3-CH_2Cl U → $CH_3-C\equiv C-CH_2-CH_3$ 6×4=24

A → $Br_2(CCl_4)$ B → alc KOH C → Na D → $H_2/Pd\ BaSO_4$

E → HCl F → $HgSO_4$ / dil H_2SO_4 6×4 = 24

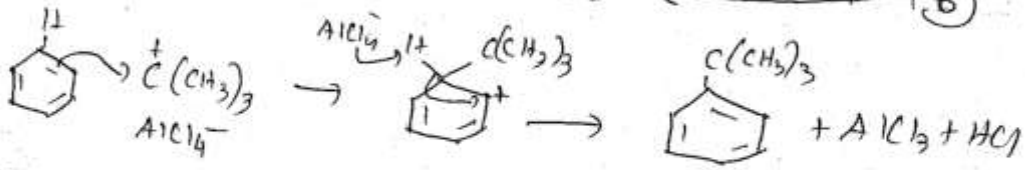
.6b ⇒ 48 marks

c) $CH_3Cl + AlCl_3 \longrightarrow \overset{\delta+}{CH_3}-\overset{\delta-}{Cl}\ \overset{\delta+}{AlCl_3}$



6

$(CH_3)CCl + AlCl_3 \longrightarrow (CH_3)_3C^+ + AlCl_4^-$ 6



$CH_3^+ < (CH_3)_3C^+$ — 10

methyl carbo cation < tertiary carbo cation more stable

6c ⇒ 22 marks

(3) a

A - Cu B - M C - $Cu^{2+}_{(aq)}$ / $Cu(NO_3)_2$ D - Mg^{2+} / $Mg(NO_3)_2$

E - NO_2 F - H_2O G - $[Cu(NH_3)_4]^{2+}$ H - $[CuCl_4]^{2-}$

I - $Cu_2[Fe(CN)_6]$ J - $Cu(OH)_2$ K - $K_4[Fe(CN)_6]$

L - $Mg(OH)_2$

03 × 12 = 36

04 × 2 = 08

II Cu - $1s^2\ 2s^2 2p^6\ 3s^2 3p^6 3d^{10}\ 4s^1$

Mg - $1s^2\ 2s^2 2p^6\ 3s^2$

III yes but $NO_{(g)}$ will be obtained instead of $NO_{2(g)}$ — 03

IV To make duralumin alloy — 03

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b) I oxidising Agent MnO_4^-

& Reducing Agent Fe^{2+} and $C_2O_4^{2-}$ — 05 / 05 × 2 = 10

II $MnO_4^- + 8H^+ + 5e \longrightarrow Mn^{2+} + 4H_2O$ — (1)

$Fe^{2+} \longrightarrow Fe^{3+} + e$ — (2)

$C_2O_4^{2-} \longrightarrow 2CO_2 + 2e$ — (3)

(2) + (3) $FeC_2O_4 \longrightarrow Fe^{3+} + 2CO_2 + 3e$ — (4)

(1) × 3 + (2) × 5

$3MnO_4^- + 5FeC_2O_4 + 24H^+ \longrightarrow 3Mn^{2+} + 5Fe^{3+} + 10CO_2 + 12H_2O$ — 15

III mole amount of $KMnO_4 = 0.1 \times 60 \times 10^{-3}$ mol

$= 6 \times 10^{-3}$ mol — 15

Mole amount of $FeC_2O_4 = 6 \times 10^{-3} \times \frac{5}{3}$ — 15

$= 10 \times 10^{-3}$ mol — 15

∴ mass of $FeC_2O_4 = 10 \times 10^{-3}$ mol × 144 g mol^{-1} — 15

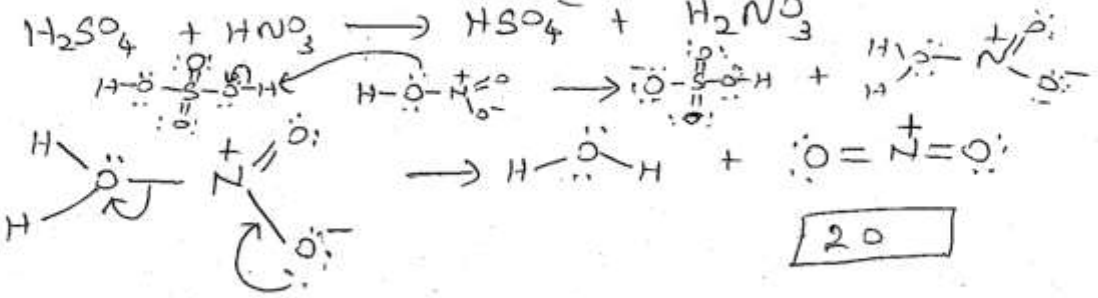
$= 1.44$ g — 15

∴ Mass percentage of $FeC_2O_4 = \frac{1.44}{2} \times 100$

$= 72\%$ — 15

c) P - H_2SO_4 Q - HNO_3 $10 \times 2 = 20$

$H_2SO_4 + HNO_3 \longrightarrow HSO_4^- + H_2NO_3^+$



20

$H_2NO_3 \longrightarrow H_2O + NO_2^+$