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G.C.E. (A/L) Examination
Chemistry - 2005

M.C.Q. Answers

(1)	4	(16)	1	(31)	all	(46)	5
(2)	3	(17)	3	(32)	3	(47)	2
(3)	4	(18)	4	(33)	4	(48)	5
(4)	2	(19)	4	(34)	4	(49)	4
(5)	2	(20)	3	(35)	2	(50)	3
(6)	3	(21)	3, 5	(36)	1	(51)	3
(7)	5	(22)	4	(37)	2	(52)	3
(8)	1	(23)	5	(38)	3	(53)	3
(9)	4	(24)	2	(39)	3	(54)	5
(10)	5	(25)	3	(40)	4	(55)	3
(11)	2	(26)	4	(41)	4	(56)	1
(12)	3	(27)	5	(42)	5	(57)	3,5
(13)	5	(28)	5	(43)	5	(58)	5
(14)	4	(29)	4	(44)	4	(59)	5
(15)	2	(30)	3	(45)	5	(60)	1

PART A - STRUCTURED ESSAY

Answer all four questions. Each question carries **10 marks**

01. (a) (i) Cl_2O_7 (ii) HCl/HI
(iii) SiO_2 (iv) HF
(v) BCl_3 (vi) Cl_2O_7 (6 x 6 = 36)

(b) (i) Mg/Magnesium (24)

(ii) $2Mg + O_2 \rightarrow 2MgO$ (5)
$3Mg + N_2 \rightarrow Mg_3N_2$ (5)

(b = 34 marks)

(c) (i) V (15)
(ii) VIII/O (15)

(c = 30 marks)

02. (a) (i)

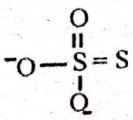
Na	S	H	O
$\frac{18.5}{23}$	$\frac{25.8}{32}$	$\frac{4.0}{1.0}$	$\frac{51.7}{16}$
1	1	5	4

(5 x 4)

$NaSH_5O_4$ (5)

(ii) Empirical mass = 124 (3)
∴ Molecular formula = $Na_2S_2O_8H_{10}$ (3)

(iii)

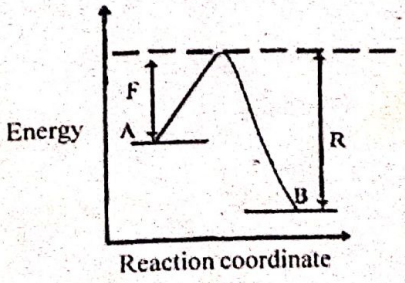


(10)

(iv) Hypo ; Sodium thiosulphate (03)

(v) In photography (03)
As a fungicide (03)

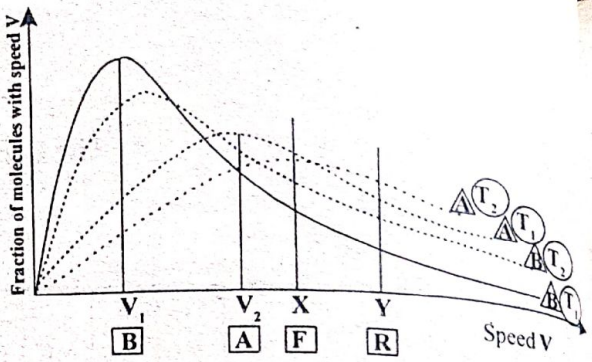
(b) (i)



(2 x 4 = 08)

Figure I

(b)



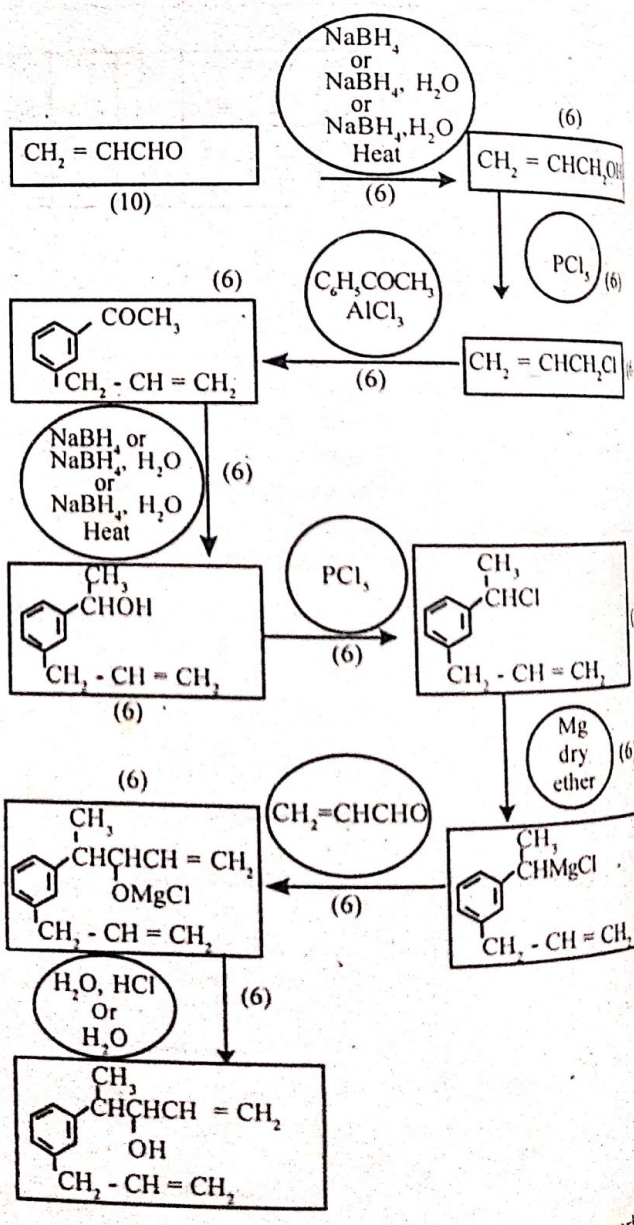
Delete words; (02 x 12 = 24)

(ii) endothermic, positive (3 + 3)

(vi) greater, (3) smaller, (3) decreases, (3) decreases (3)

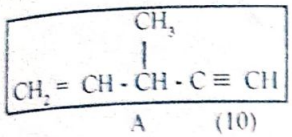
(b = 50 marks)

03.

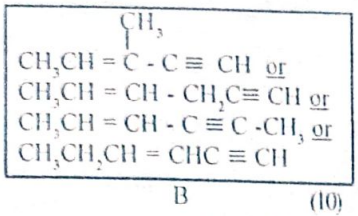


(3) = 100 marks

04. (a)



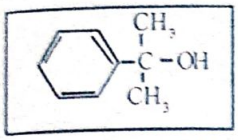
A (10)



B (10)

(a) = 20 marks

(b)



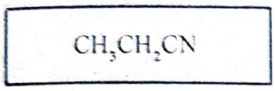
X (16)

Hydrogen (or H_2)

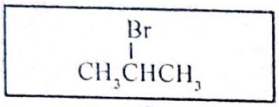
Y (04)

(b) = 20 marks

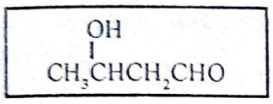
(b) (i)



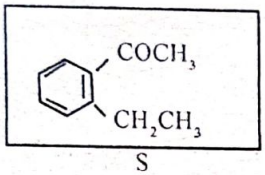
P



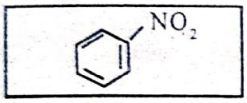
Q



R



S



T

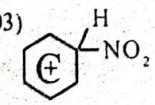
(4 x 5 = 20)

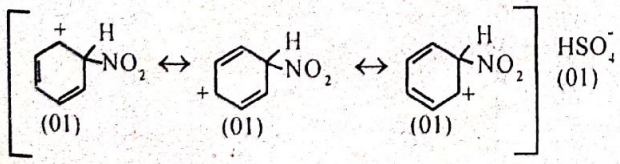
(ii)

Reaction number	Mechanism - type (A_E, S_E, A_N, S_N or M_O)	Electrophile (in electrophilic reactions)	Nucleophile (in nucleophilic reactions)
I	S_N		CN^-
II	A_E	H^+	
III	A_N		$-CH_2CHO$
IV	M_O		
V	S_E	NO_2^+	

(4 x 9 = 36)

(iii)

(03)  (01) HSO_4^- OR



(01) (01) (01) HSO_4^- (01)

05. (a) (i) $K_p = \frac{P_B P_D}{[P_A]^a}$ (02)

$K_c = \frac{C_B C_D}{[C_A]^a}$ (02)

$pV = nRT$ (02)

$P = CRT$ (02)

$K_p = \frac{C_B C_D}{[C_A]^a} (RT)^{(2-a)}$ (02)

$(RT)^{(2-a)} = 1$ (02)

$(2 - a) = 0,\ a = 2$ (02)

Total for (i) = 14 marks

Alternative answer for question 5 (a) (i) :

	$aA(g)$	=	$B(g)$	+	$D(g)$
initial	a mol		0 mol		0 mol
Concentration	$a(1-\alpha)$ mol		α mol		α mol
at equilibrium	$a(1-\alpha)/v$		α/v		α/v
Partial Pressure	$\frac{a(1-\alpha)p}{a+(2-a)\alpha}$		$\frac{\alpha p}{a+(2-a)\alpha}$		$\frac{\alpha p}{a+(2-a)\alpha}$

(3 x 01)

(3 x 01)

$\therefore K_p = K_c$

$$\frac{\left(\frac{\alpha p}{a+(2-a)\alpha}\right)^2}{\left(\frac{a(1-\alpha)p}{a+(2-a)\alpha}\right)^a} = \frac{\left(\frac{\alpha}{v}\right)^2}{\left(\frac{a(1-\alpha)}{v}\right)^a}$$ (02)

$$\frac{p^{(2-a)}}{[a+(2-a)\alpha]^{(2-a)}} = \frac{1}{v^{(2-a)}}$$ (02)

$$\left(\frac{pv}{a+(2-a)\alpha}\right)^{(2-a)} = 1$$ (02)

$2 - a = 0, \quad a = 2$ (02)

(ii) $K_p = \frac{8 \times 10^5 Pa \times 2 \times 10^5 Pa}{(2 \times 10^5 Pa)^2}$ (1 + 1 for units)

$= 4$ (02)

Total for (ii) = 04 marks

(iii) $P_B = P_D = Z$ (02)

$P_A = Y - 2Z$ (02)

$4 = \frac{Z^2}{(Y - 2Z)^2}$ (02)

$2 = \frac{Z}{(Y - 2Z)}$ (02)

$2Y = 5Z$ (02)

$Y = \frac{5Z}{2}$ (02)

Assume ideal gas behaviour (02)

For the reaction $\Delta n = 0$ (01)

Total moles at 27°C = Total s of 500 K (01

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$ (02)

$\frac{X}{300} = \frac{Y}{500}$ (02)

$\frac{Y}{X} = \frac{5}{3}$ (02)

If $Y = 8 \times 10^5$ Pa (02)

$Z = \frac{2}{5} \times 8 \times 10^5$ Pa (02)

$= 3.2 \times 10^5$ Pa (02)

$X = \frac{3}{5} \times 8 \times 10^5$ Pa (02)

$= 4.8 \times 10^5$ Pa (02)

Total for (iii) = 30 marks

(iv) No of moles at equilibrium in (iii) = n_1

$n_1 = \frac{8 \times 10^5 \text{ Pa} \times 4.157 \text{ m}^3}{8.314 \text{ Jk}^{-1} \text{ mol}^{-1} \times 500 \text{ K}}$ (2 + 2)

$= 800$ mol

No. of moles after addition of A is n_2 (02)

$\frac{n_1}{n_2} = \frac{P_1}{P_2}$ (02)

$\frac{800}{n_2} = \frac{8 \times 10^5}{2.5 \times 10^6}$ (02)

$n_2 = 2500$ mol (02)

No of moles of A added = 2500 - 800 = 1700 mol (02)

Let the no. of moles of B at equilibrium in (iv) be n_B

$$4 = \frac{\left[\frac{n_B}{2500 \text{ mol}}\right]^2 \left[2.5 \times 10^6 P_a\right]^2}{\left[\frac{2500 \text{ mol} - 2n_B}{2500 \text{ mol}}\right]^2 \left[2.5 \times 10^6 P_a\right]^2}$$ (1 + 1 for units)

$2 = \frac{n_B}{2500 - 2n_B}$ (02)

$5n_B = 5000$ mol (02)

$n_B = n_D = 1000$ mol (02)

$n_A = 500$ mol (02)

$P_A = \frac{500 \times 2.5 \times 10^6 \text{Pa}}{2500}$ (02)

$= 5 \times 10^5$Pa (02)

$P_B = P_D = \frac{2.5 \times 10^6 - 5 \times 10^5 \text{Pa}}{2}$ (02)

$= 10^6$Pa (02)

Total for (iv) = 32 marks

Total for (a) = 80 marks

(b) (i) $Br_{(g)} + e \rightarrow Br^-_{(g)}$

(ii) $Mg_{(s)} + Cl_{2(g)} \rightarrow MgCl_{2(s)}$

(iii) $C_{17}H_{35}COOH_{(s)} + 26O_{2(g)} \rightarrow 18CO_{2(g)} + 18H_2O(l)$

(iv) $Mg_{(g)} \rightarrow Mg^+_{(g)} + e$

$Mg^+_{(g)} \rightarrow Mg^{2+}_{(g)} + e$

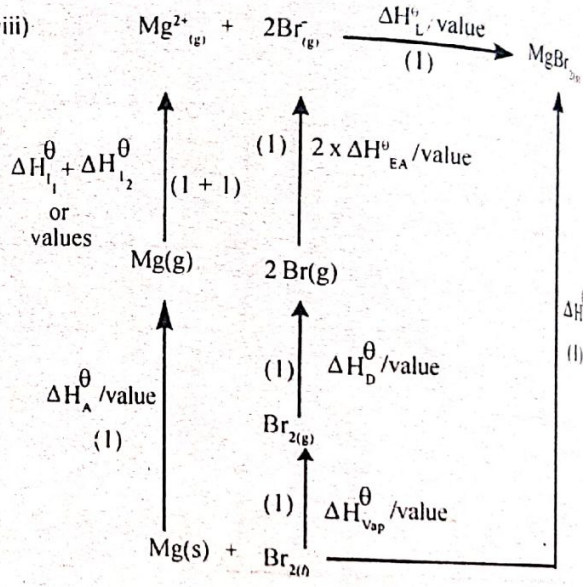
(v) $Mg_{(s)} \rightarrow Mg_{(g)}$

(vi) $Mg^{2+}_{(g)} + 2Br^-_{(g)} \rightarrow MgBr_{2(s)}$

(vii) $Br_{2(g)} \rightarrow 2Br_{(g)}$

(8 x 4 = 32 marks)

(viii)



(8 x 1 = 8 marks)

$\Delta H^\theta_f = \Delta H^\theta_{A(Mg)} + (\Delta H^\theta_{I_1} + \Delta H^\theta_{I_2})_{Mg} + \Delta H^\theta_{vap(Br_2)} + 2\Delta H^\theta_{D(Br_2)} + 2\Delta H^\theta_{EA(Br)} + \Delta H^\theta_{L(MgBr_2)}$ (

$= 148.0 + (737.0 + 1451.0) + 15.0 + 193.0 + (2 \times -328.$
$+ (-2440.0)$ KJ mol^{-1} (

$= -552.0$ KJ mol^{-1} (02 + 02

Total for (viii) = 26 marks

(ix) $\Delta H^\theta_f = \Delta H^\theta_{f(MgCl_2)} + \Delta H^\theta_{f(Br_2)} - \Delta H^\theta_{f(MgBr_2)} - \Delta H^\theta_{f(Cl_2)}$ (

$= -641.0 + 0 - (-552.0) - 0$ (

$= -89.0$ KJ mol^{-1} (2 +

Total for (ix) = 12 marks

Total for (b) = 70 marks

(c) (i) $N_A = a/b$ (3)

(ii) $q = 2b$ (3)

(iii) $C = 3a$ (3)

(iv) Total moles = $6b$ (3)

$X_A = 1/6$ (3)

$X_B = 1/3$ (3)

$X_C = 1/2$ (3)

(v) $P_B = \frac{H}{2} \times \frac{1}{3}$ (0

$= H/6$ (0

(vi) $\frac{H}{6} = \frac{bH}{T}$ (3)

$T = 6b$ (3)

(vii) $Y_B = b/6b$ (3)

$= 1/6$ (3)

$n_A(\text{vapour}) = \frac{a}{3} \times \frac{1}{N_A}$ (3)

$= \frac{a}{3} \times \frac{b}{a} = \frac{b}{3}$ (3)

$Y_A = \frac{b}{3} \times \frac{1}{6b} = \frac{1}{18}$ (3)

$Y_C = 1 - \frac{1}{6} - \frac{1}{18}$ (3)

$= \frac{7}{9}$ (3)

(viii) $P_A = H/18, \quad P_C = 7H/9$ (3 + 3)

(ix) $G = \frac{6bRQ}{H}$ (5)

(x) $\bar{C}^2 = \frac{3RQ}{L}$ (5)

Total for (c) = 70 marks

06. (a) (i) From I,

X content in ether layer = 40.0 mg x 1000 cm^3 /100 cm^3 (2)

= 400 ppm (2)

Original X content of 500.0 cm^3 of water = 45.0 mg (2)

X content of aqueous layer = 5.0 mg x 1000 cm^3/500 cm^3 (2)

= 10.0 ppm (2)

K = 400/10 (2)

= 40 (2)

From II

X content of ether layer = 43.2mg x 1000 cm^3/100cm^3 (2)

= 432.0 ppm (2)

X content of water layer = 432/40 (2)

= 10.8 ppm (2)

Original X content of well water = (43.2 + 10.8) ppm (2)

= 54 ppm (2)

From III

X content of ether layer = 6.0mg x 1000 cm^3 / 100 cm^3 (2)

= 60.0 ppm (2)

X content of aqueous layer = (60/40) ppm (2)

= 1.5 ppm (2)

Original X content in brick treated water = (1.5 + 6.0) ppm (2)

= 7.5 ppm (2)

Alternate answer for question 6 (a) (i)

From I. $$K = \frac{40.0\text{ mg}}{0.100\text{ dm}^3}$$

$$\frac{}{\left[\frac{90.0\text{ mg}}{\text{dm}^3} \times 0.500\text{ dm}^3\right] - 40.0\text{ mg}}$$

$$0.500\text{ dm}^3$$

(06)

$= \frac{400}{10}$ (06)

$= 40.0$ (02)

From II.

$$K = 40 = \frac{43.20\text{ mg}}{0.100\text{ dm}^3}$$

$$\frac{}{\left[X\ \frac{\text{mg}}{\text{dm}^3} \times 1.00\text{ dm}^3\right] - 43.2\text{ mg}}$$

$$1.00\text{ dm}^3$$

(6)

$40.0 = \frac{432}{X - 43.2}$ (2)

$40.0\ X - (40.0 \times 43.2) = 43.2 \times 10$ (2)

$X = \frac{43.2 \times 50}{40.0} = \frac{432}{8}$ (2)

$= 54.0$ ppm (2)

From III,

$$K = 40.0 = \frac{6.0\text{ mg}}{0.100\text{ dm}^3}$$

$$\frac{}{\left[X\ \frac{\text{mg}}{\text{dm}^3} \times 1.00\text{ dm}^3\right] - 6.0\text{ mg}}$$

$$1.00\text{ dm}^3$$

(6)

$40.0\ (X - 6.0) = 6.0 \times 10$ (2)

$X = \frac{6.0 \times 50}{40}$ (2)

$= \frac{30}{4}$ (2)

$= 7.5$ ppm (2)

(i) X content of well water = 54.0 mg dm^{-3} (2)

= 54.0 x 10^{-3} / 125 mol dm^{-3} (2)

= 4.32 x 10^{-4} mol dm^{-3}

X content of reacted water = 7.5 ppm (2)

= 7.5 x 10^{-3} / 125 mol dm^{-3} (2)

6.0 x 10^{-5} mol dm^{-3} (2)

(ii) Treatment with brick powder reduces X content due to adsorption / uptake / retention (5)

(iii) Repeat readings at each site

Take readings at different sites

Take readings under different conditions of rainfall /weather

Take readings on different dates .

any three (3 x 5) = 15

(iv) Filter through brick particles (5)

Filter to remove brick particles (5)

(Total for (a) = 80 marks)

(b) $2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$ (2)

$Mg + 2HCl \rightarrow MgCl_2 + H_2$ (2)

$Zn + 2HCl \rightarrow ZnCl_2 + H_2$ (2)

1.0 g of mixture	Moles of metal			Moles of H_2
	Al	Zn	Mg	
P	0.008	0.002	0.02725	0.04125
Q	0.010	0.008	0.00875	0.03175
R	0.012	0.010	0.00108	0.02908

12 x 3 = 36

The three mixtures give different volumes of H_2 on complete reaction with HCl (04)

Place 1.0 g of each mixture seperately in bottles. (04)

Add excess HCl to each and fit a balloon over the mouth of each bottle (04)

After complete reaction (04)

Balloon with largest volume corresponds to P. (04)

Balloon with smallest volume corresponds to R (04)

The other is Q (04)

(Total for (b) = 70 marks)

(07) (a) (i) Solution A

$K_{sp} = [Ag^+_{(aq)}][Cl^-_{(aq)}]$ (02)

No marks if (aq) is not given

$= [Ag^+_{(aq)}]^2$ (02)

$[Ag^+_{(aq)}]^2 = 1 \times 10^{-10}\ mol^2dm^{-6}$ (02)

$[Ag^+_{(aq)}] = 1 \times 10^{-5}\ mol\ dm^{-3}$ (02)

∴ Solubility of AgCl $= 1 \times 10^{-5}\ mol\ dm^{-3}$ (02)

$142.5 \times 10^{-5}\ g\ dm^{-3}$ (02)

$= 1.425\ mg\ dm^{-3}$ (02)

Solution B

$1 \times 10^{-10}\ mol^2dm^{-6} = [Ag^+_{(aq)}][0.1\ mol\ dm^{-3}]$ (02)

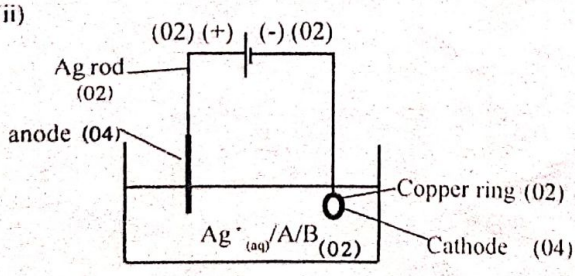
$[Ag^+_{(aq)}] = 1 \times 10^{-9}\ mol\ dm^{-3}$ (02)

Solubility of AgCl $= 1 \times 10^{-9}\ mol\ dm^{-3}$ (02)

$= 142.5 \times 10^{-9}\ g\ dm^{-3}$ (02)

$(=1.425 \times 10^{-4}\ mg\ dm^{-3})$ (02)

(ii)



(iii) Rate of reaction α concentration (02)

Rate of deposition α concentration (02)

$[Ag^+]$ in B < $[Ag^+]$ in A (02)

rate of deposition is lower for B (02)

Select B (02)

(iv) Complex very stable

$[Ag^+]$ much lower in KCN than in aq solution

Better metal coating

∴ Select KCN solution

K is very small

(v) In Tollens test $Ag^+_{(aq)} + e \rightarrow Ag_{(s)}$

To obtain a shiny mirror, rate of deposition to be low.

Ag- ammonia complex is very stable.

∴ very low free $[Ag^+]$

∴ Better mirror than with aqueous solution.

(vi) Q = 0.15 x 60 x 40C Coulombs

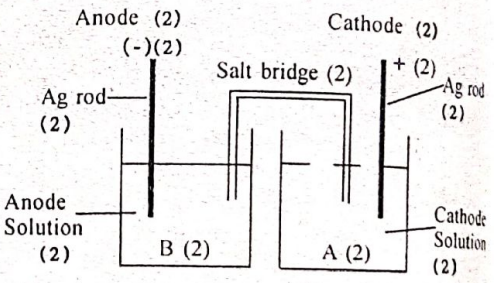
∴ The no. of moles deposited = $\frac{0.15 \times 60 \times 40}{96540\ Cmol^{-1}}$

Mass of Ag deposited $= \frac{0.15 \times 60 \times 40 \times}{96540}$

$= 0.3994$ g

∴ increase in mass $= 0.3994$ g

(vii)



Total for (a) = 100 marks

07. (b) Final Solution.

$[OH^-(aq)] = 1 \times 10^{-5}\ mol\ dm^{-3}$ (1+2 (aq), answer

$[Ba^{2+}(aq)] = 5 \times 10^{-6}\ mol\ dm^{-3}$ (1+2

$[Cd^{2+}(aq)] = 1.25 \times 10^{-5}\ mol\ dm^{-3}$ (1+2

$[SO_4^{2-}(aq)] = 1.25 \times 10^{-5}\ mol\ dm^{-3}$ (1+2

$[Ba^{2+}(aq)][SO_4^{2-}(aq)] = 5 \times 10^{-6} \times 1.25 \times 10^{-5}\ mol^2dm^{-6}$ (1+2

$= 6.25 \times 10^{-11}\ mol^2dm^{-6}$ (2+2)

$< K_{sp}(BaSO_4)$ (4)

∴ Does not precipitate (4)

$[Cd^{2+}_{(aq)}][OH^-_{(aq)}]^2 = 1.25 \times 10^{-5} \times 1 \times 10^{-10}\ mol^3\ dm^{-9}$ (1+2

$= 1.25 \times 10^{-15}\ mol^3dm^{-9}$ (02+0

$< K_{sp}[Cd(OH)_2]$ (04)

∴ Does not precipitate (4)

∴ No ppt formed (02)

Total for (b) = 50 mark

08. (a) (i) (A) Ti / Titanium (10)

(B) $1s^2 2S^2 2P^6 3S^2 3P^6 4S^2 3d^2$ or $1s^2 2S^2 2P^6 3S^2 3P^6 3d^2 4S^2$ (10)

(C) M - Rocket / aircraft/ spacecraft parts/ alloy (05)

MO_2 - As a (white) pigment in paints/ As a photocatalyst (05)

(ii) Cr^{3+} and Cu^{2+} (or Chromic & Cupric) (10 + 10)

Test (B) - yellow colour due to CrO_4^{2-} (05)

Test (C) - yellow colour due to $[CuCl_4]^{2-}$ (05)

$Cr^{3+} + 8OH^- \rightarrow CrO_4^{2-} + 4H_2O + 3e$

OR $3H_2O_2 + 10\ OH^- + 2Cr^{3+} \rightarrow 2CrO_4^{2-} + 8H_2O$ (05)

$Cu^{2+} + 4Cl^- \rightarrow [CuCl_4]^{2-}$ (05)

Filterate from (B) turns **Orange** on acidification (05)

$2CrO_4^{2-} + 2H^+ \rightarrow Cr_2O_7^{2-} + H_2O$ (05)

08. (b) (i) Source of N_2 - Air (04)

Source of H_2 - Petrolium/ Synthesis gas (reaction of CH_4 or C_7H_{16} with steam) (04)

(ii) Temperature - about 400 - 500 °C (04)

Pressure - > 200 atm (04)

Catalyst - Fe/iron Oxide (04)

(iii) Effect of Catalyst on

- rate of forward reaction : increases (04)
- rate of reverse reaction : increases (04)
- equilibrium constant (04)

(iv) Ostwald process/ manufacture of nitric acid (04)

Conditions : Temperature : about 850°C (04)

Pressure : near atmospheric (04)

Catalyst : Pt, Pt/Rh (04)

(v) Disinfectant / cleaning agent (02)

(vi) $2NH_3 + 3CuO \rightarrow 3Cu + N_2 + 3H_2O$ (03)

Passing ammonia over **hot** CuO (or heat) (01)

$NH_3 + 3I_2 \rightarrow NI_3 + 3HI$ (03)

Excess iodine / low PH (01)

$2NH_3 + 2Na \rightarrow 2NaNH_2 + H_2$ (03)

Liquid ammonia / gaseous ammonia (01)

(vii) Uses of ammonia :

Fertilizer industry - $(NH_4)_2SO_4$, NH_4NO_3, $(NH_4)_3PO_4$ (02)

As a source of nitrogen (02)

In rubber industry : NH_4OH/ aq ammonia (02)

To stabilize latex / to prevent coagulation (02)

09. (a) (i) CO_2 - by burning limestone ($CaCO_3$) (5 + 5)

Brine from Sea water (5 + 5)

(ii) By products : CaO, NH_4Cl, $CaCl_2$ (any two) (5 + 5)

(iii) Reactions : Production Process

$CaCO_3 \rightarrow CaO + CO_2$

$NH_3 + H_2O \rightarrow NH_4OH$

$2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$

OR

$NH_3 + H_2O + CO_2 \rightarrow NH_4HCO_3$

$NH_4HCO_3 + NaCl \rightarrow NaHCO_3 + NH_4Cl$

$NaCl + NH_4OH + CO_2 \rightarrow NaHCO_3 + NH_4Cl$

Recycling of by products :

$2NH_4Cl + CaO \rightarrow CaCl_2 + 2NH_3 + H_2O$ (5 x 2 = 10)

(iv) Low temperature increases the solubility of gases (CO_2 & NH_3)

Decreases the solubility of $NaHCO_3$ (5 +5)

(v) Availability of limestone deposits / ammonia, Closer to sea (to get brine). Climatic conditions, pollution of the environment (by ammonia, CO_2), heat generation, disposal of by - products etc.

Any 3 factors (3 x 05 = 15)

(vi) Uses : Na_2CO_3 : for washing clothes / cleaning articles/ water saftening/ glass industry (05)

$NaHCO_3$: as baking powder, in fire extinguishers, medical uses (05)

Total for g (a) = (75)

9. (b) (i) 1 drop of $AgNO_3$ corresponds to 12.5mg of Cl^- in 1 litre of water

∴ 12 drops of $AgNO_3$ correspond to 12 x 12.5 mg of Cl^- /litre = 150 mg (05)

(ii) Concentration of Cl^- ions = $\frac{150}{1000 \times 35.5}$ moldm^{-3}

= 0.0042 moldm^{-3} (05)

(iii) No. of drops of $AgNO_3$ required if 6.0cm^3 of the water sample is used = $\frac{12 \times 6}{24} = 3$ (05)

1 drop of $AgNO_3$ now corresponds to = $\frac{12.5mg \times 24}{6}$

= 50 mg Cl^- / litre (5 + 5)

(OR 150 mgl^{-1}/3 drops = 50 mg/1 litre)

(iv) 1 drop of $AgNO_3$ corresponds to 12.5 mg of Cl^- / litre of water sample

The amount of Cl^- ions equivalent to Ag^+ ions in 1 drop of $AgNO_3$ = $\frac{12.5\ mg \times 24}{1000}$ = 0.30 mg (05)

= $\frac{0.3 \times 10^{-3}}{35.5}$ mol (05)

∴ Amount of Ag^+ ions in 1 drop of $AgNO_3$ = $\frac{0.3 \times 10^{-3}}{35.5}$ mol

(20 drops = 1 cm^3)

∴ The concentration of $AgNO_3$ solution

= $\frac{0.3 \times 10^{-3} \times 20 \times 1000\ moldm^{-3}}{35.5}$

= 0.169 moldm^{-3}

Total for 9 (b) = (40)

(c) (i) $-CH(C_6H_5) - CH_2 -$, $-CH(Cl) - CH_2 -$

$-CH_2 - C(CH_3) = CH - CH_2 -$ (Cis)

Cis structure must be shown / indicated) (3 x 5 = 15)

(ii) $C_6H_5CH = CH_2$; $ClCH = CH_2$; $CH_2=C(CH_3)-CH=CH_2$

(3 x 5 = 15)

(iii) Test : On heating PVC softens (03)

On heating bakelite does not soften / decomposes (02)

(Total for 9 (c) = 35)

10. (a) The compound that dissolves in water / leaves no residue on heating is $(NH_4)_2CO_3$ (05)

$(NH_4)_2CO_3 \rightarrow 2NH_3 + CO_2 + H_2O$

OR $(NH_4)_2CO_{3(s)} \rightarrow 2NH^+_4(aq) + CO_3^{2-}(aq)$ (05)

Heat the compounds strongly. The residue that dissolves in `water is produced by $BaCO_3$ (05)

$BaCO_3 \rightarrow BaO + CO_2$ (05)

$BaO + H_2O \rightarrow Ba(OH)_2$ [OR $Ba^{2+}(aq) + 2OH^-(aq)$] (05)

$ZnCO_3 \rightarrow ZnO + CO_2$ (05)

$MgCO_3 \rightarrow MgO + CO_2$ (05)

Add a small amount of the other two residues separately to portions of solution formed by dissolving the soluble resi due in water.

The residue that dissolves in the above solution is formed from $ZnCO_3$ (05)

$ZnO + Ba(OH)_2 \rightarrow BaZnO_2 + H_2O$ (05) } or

{(OR the residue that becomes yellow when hot is ZnO;) (10)}

The other residue (which does not dissolve) is formed from $MgCO_3$ (05)

(OR the other residue (or the residue that does not become yellow when hot) is MgO; (05)

(Total for 10 (a) = 50)

(b) (i) SO_2, Na_2SO_3, H_2SO_3 any one compound (05)

HOCl, NaOCl, bleaching powder or $[Ca(OCl)_2]$ (05)

Bleaching action : Bleaching occurs by **reduction** of the materials by suplphur containing compounds. (05)

$SO_2 + H_2O \rightarrow SO_3 + 2H^+ + 2e$

OR $(SO_3^{2-} + H_2O \rightarrow SO_4^{2-} + 2H^+ + 2e)$ (05)

Bleaching occurs by **oxidation** of the materials by chlorine containing compounds. (05)

NaOCl or $Ca(OCl)_2$ on acidification produces HOCl.

$2HOCl \rightarrow H_2O + Cl_2 + 'O'$ (03)

$'O' + 2e \rightarrow O^{2-}$ (or explanation) (02)

Preparation :

SO_2	Burning sulphur, roasting sulphides	
Na_2SO_3	Dissolve SO_2 in NaOH	
H_2SO_3	Dissolve SO_2 in water	
		Any One (05)
NaOCl	Dissolve Cl_2 in NaOH (low/room temp)	
$Ca(OCl)_2$	Dissolve Cl_2 in $Ca(OH)_2$ (low/room temp)	
HOCl	Dissolve Cl_2 in water (low/room temp)	
		Any One (03 +2)

(03 for method / equation. 02 for low/room temp)

(Total for 10 (6) = 40)

(c) (i) PH of the gastric solution

Amount of HCl in gastric solution = $0.365 g/100 cm^3$

Amount of HCl 1 dm^3 gastric solution = $\frac{0.365\ g \times 1000\ cm^3}{100\ cm^3 \times 36.5\ g}$

= 0.1 mol

$\therefore [H^+]$ = 0.1 mol dm^{-3}

$P^H = -\log[H^+]$ = 1.0

(ii) Each tablet contains 0.520 g of $Mg_2Si_3O_8$ and 0.087 g of $Mg(OH)_2$

1 mol $Mg_2Si_3O_8$ reacts with 4 mol of HCl (reaction gi

1 mol $Mg(OH)_2$ reacts with 2 mol of HCl

$Mg_2Si_3O_8$ = 260, $Mg(OH)_2$ = 58

Amount of HCl reacting with 0.520 g of $Mg_2Si_3O_8$ = $\frac{4 \times 0.520\ mol}{260}$

= 0.008 mol

Amount of HCl reacting with 0.087 g of $Mg(OH)_2$ = $\frac{2 \times 0.087\ mol}{58}$

= 0.003mol

Amount of HCl reacting with 1 tablet = 0.008 + 0.003

= 0.011 mol

Amount of HCl reacting with 2 tablets = 0.011 x 2

= 0.022 mol

Volume of gastric solution = 500 cm^3

Amount of HCl in 500 cm^3 of gastric soln = 0.05 mol (See i)

$\therefore$ Amount of HCl remaining (in 500 cm^3) = 0.05 - 0.022 mol

= 0.028 mol

$\therefore$ Amount of HCl remaining in 1 dm^3 = $\frac{0.028\ mol \times 1000}{500\ cm^3}$

= 0.056 mol

$\therefore [H^+]$ = 0.056 mol dm^3

The pH of the gastric solution after taking 2 tablets = -log (0.056)

= 1.25

(Total for 10 (