G.C.E. A/L Examination March - 2018

Conducted by Field Work Centre, Thondaimanaru

In Collaboration with

Provincial Department of Education Northern Province.

Grade - 12 (2019)	Chemistry	Marking Scheme

M.C.Q

1)	5	6)	1	11)	1	16)	1	21)	1
2)	4	7)	2	12)	3	17)	2	22)	5
3)	3	8)	3	13)	2	18)	3	23)	2
4)	2	9)	4	14)	4	19)	4	24)	3
5)	1	10)	5	15)	2	20)	5 (b,c,d)	25)	4

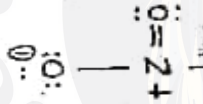
25x2 = 50 marks

Structured essay

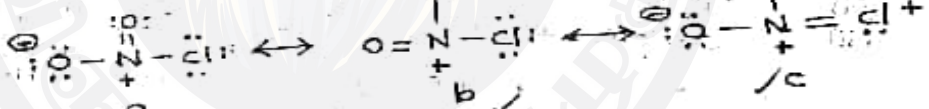
① (a) I) $Q = [N_A] - [N_{LP}] - \frac{1}{2}[N_{BP}]$

II) $Q = [6] - [0] - \frac{1}{2}[12] = [0]$

III) (i)



(ii)



b ✓ c

a ✓ ii

(iii)

+ charge on electro negative atom ✓
like charges on adjacent atoms ✓
high charge seperation ✓

IV)

N^5	C^4	C^7	O^9
4 ✓	4 ✓	4 ✓	4 ✓
Tetrahedral ✓	Tetrahedral ✓	Trigonal planar ✓	Tetrahedral ✓
4 ✓	4 ✓	3 ✓	4 ✓
Trigonal pyramidal ✓	Tetrahedral ✓	Trigonal planar ✓	angular ✓
sp^3 ✓	sp^3 ✓	sp^2 ✓	sp^3 ✓

V) N^3 sp^3 ✓ C^4 sp^3 ✓
C^4 sp^3 ✓ H^5 $1s$ ✓
C^4 sp^3 ✓ C^7 sp^2 ✓
C^2 sp^2 ✓ O^3 sp^3 ✓

(b) I ion-dipole attractive force, H-bond, London force.
II dipole-induced dipole forces, London force.
III ion-induced dipole force, London force.
Question-01 ×50 = 50marks

(2) (a) (i) A - Mg (01) B - Ca (01)
(ii) A - $1s^2\ 2s^2\ 2p^6\ 3s^2$ (01) B - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$ (01)
(iii) I Ca > Mg (01) II Ca > Mg (01)
II Mg > Ca (01) IV Mg > Ca (01)

(iv) $2Ca + O_2 \longrightarrow 2CaO$ (03)
$3Ca + N_2 \longrightarrow Ca_3N_2$ (02)

(v) $CaO + H_2O \longrightarrow Ca(OH)_{2(s)}\downarrow$ (03)

(vi) CO_2

(vii) $Ca(OH)_2 + CO_2 \longrightarrow \underset{\text{White}}{CaCO_3}\downarrow + H_2O$ (03)

$CaCO_{3(s)} + H_2O_{(l)} + CO_{2(g)} \longrightarrow Ca(HCO_3)_2$ (03)

(b) (i) I NaCl / HCl
II $AgNO_3$
III $Pb(NO_3)_2$
IV $AgNO_3$
V HCl
VI $Na_2S_2O_3$ / K_2SO_3
(06)

(ii) A - AgCl
B - AgCl
C - PbI_2
D - Ag_2O
E - S
F - K_2SO_3
(06)

(iii) $AgCl_{(s)} + 2NH_{3(aq)} \longrightarrow [Ag(NH_3)_2]^+ Cl^-_{(aq)}$ (05)

$PbI_{2(s)} \longrightarrow PbI_{2(aq)}$ / $Pb^{2+}_{(aq)} + 2I^-_{(aq)}$ (05)

$BaSO_{3(s)} + 2HCl_{(aq)} \longrightarrow BaCl_{2(aq)} + H_2O_{(l)} + SO_{2(g)}$ (05)

(3) (a) I $PV = nRT$ (03)

$n_{He} = \dfrac{2\times10^5\ pa \times 3\ m^3}{8.314\ J\,mol^{-1}K^{-1} \times 300K}$ (02)

$= 240.56\ mol.$ (02)

II $n_{N_2} = \dfrac{5\times10^5\ pa \times 3\ m^3}{8.314\ J\,mol^{-1}K^{-1} \times 300k}$ (03)

$= 601.39\ mol.$ (02)

Question-02 = 50 மார்க்ஸ்

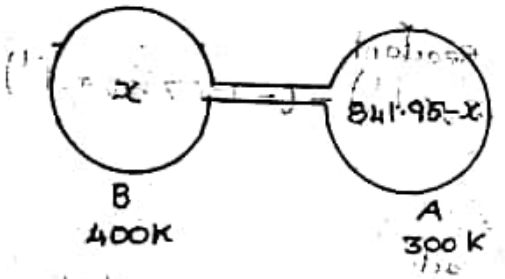
$n_{Total} = 240.56 + 601.39$ (02)

$= 841.95$ mol. (03)

$X_{N_2} = \frac{601.39 \text{ mol}}{841.95 \text{ mol}}$ (02)

$= 0.714.$ (02)

III)



$\frac{x \text{ mol} \times R \times 400K}{3m^3} = \frac{(841.95 - x) \times R \times 300K}{3m^3}$ (02)

$4x = 3(841.95 - x)$

$7x = 3 \times 841.95$

$x = \frac{2525.85}{7}$

$= 360.83$ (02)

$P = \frac{360.83 \text{ mol} \times 8.314 \text{ J mol}^{-1} K^{-1} \times 400K}{3m^3}$ (02)

$= 3.99 \times 10^5$ pa / 4×10^5 pa. (02)

Question 03 (a) **26 marks**

(b) $Mg + H_2SO_4 \longrightarrow MgSO_4 + H_2$ (03)

$x/24$ $x/24$ (02)

$2Al + 3H_2SO_4 \longrightarrow Al_2(SO_4)_3 + 3H_2$ (03)

$\frac{5-x}{27}$ $\frac{3}{2}\left(\frac{5-x}{27}\right)$ (02)

$n_{H_2} = \frac{5.59}{22.4}$ mol (04)

$\frac{x}{24} + \frac{3(5-x)}{2 \times 27} = \frac{5.59}{22.4}$ (02)

$\frac{x}{24} + \frac{15-3x}{54} = 0.249$

$\frac{54x + 24(15-3x)}{24 \times 54} = 0.249.$

$54x + 360 - 72x = 323.46$

$18x = 36.58$

$x = 2.03$ (02)

% of Mg $= \frac{2.03}{5} \times 100$ (02) $= 40.6\%$ (02)

Question 03 (b) **24 marks**

Question 3 **26+25 = 50 marks**

(4) (a)(i) Definition ✓
(ii) Definition ✓
(iii) Definition ✓

(b) I increases ✓
II increases ✓
III increases ✓
IV increases ✓
V decreases ✓

(c) (i) $\Delta H^{\theta} = \sum H^{\theta}_{products} - \sum H^{\theta}_{Reactants}$ ✓

$= (-635\ kJ\,mol^{-1} - 393\ kJ\,mol^{-1}) - (-1207\ kJ\,mol^{-1})$

$= +179\ kJ\,mol^{-1}$ ✓

(ii) $\Delta S^{\theta} = \sum S^{\theta}_{products} - \sum S^{\theta}_{Reactant}$ ✓

$= (38\ J\,mol^{-1}K^{-1} + 214\ J\,mol^{-1}K^{-1}) - (93\ J\,mol\,K)$ ✓

$= +159\ J\,mol^{-1}K^{-1}$ ✓

(iii) I $\Delta G = \Delta H - T\Delta S$ ✓

θ indicated - no marks

II. $\Delta G^{\theta} = \Delta H^{\theta} - T\Delta S^{\theta}$ ✓

$= 179\ kJ\,mol^{-1} - 298 \times \frac{159}{1000}\ kJ\,mol^{-1}$ ✓

$= 179\ kJ\,mol^{-1} - 298 \times 0.159\ kJ\,mol^{-1}$

$= 179\ kJ\,mol^{-1} - 47.382\ kJ\,mol^{-1}$

$= 131.618\ kJ\,mol^{-1}$ ✓

$\therefore$ $\Delta G = +ve$ ✓ non spontaneous ✓

IV when $\Delta G \leq 0$ $CaCO_3$ start to decompose

$= \Delta H - T\Delta S$ ✓

$T = \frac{\Delta H}{\Delta S} = \frac{179\ kJ\,mol^{-1}}{0.159\ kJ\,mol^{-1}K^{-1}}$

$= 1125K$

$= 852\ C$ ✓

V ΔS and ΔH had not changed with temperature ✓

Question 04 - 02x25 = 50 mark

Essay

⑤ (a) (i) Gases that obey all gas laws at all temperatures and pressures.

OR

Gases that obey the equation PV = nRT at all temperatures and pressures.

OR

Gases that obey Boyles law, charles law, Avogadro's laws.

OR

Gases that obey

OR

Gases that obey combined gas law. (05)

(ii) PV = nRT ✓ (05)

P - Pressure (01) V - volume (01)

n - number of moles (01) R - universal gas constant (01)

T - absolute temperature (01)

(iii) PV = nRT.

At constant temperature product nT for a fixed mass of gas is constant (03)

R - constant (03)

nRT - constant (03)

PV = K (03)

$P \propto \frac{1}{V}$ [m], [T] (03)

5a - 30 marks

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b) (i) $Na_2CO_{3(s)} + 2HCl_{(aq)} \longrightarrow 2NaCl_{(aq)} + CO_{2(g)} + H_2O_{(l)}$ ✓

$\Delta H = mS\theta$ ✓

$= 100g \times 10 Jg^{-1}K^{-1} \times 2.5K$ ✓

$= 2500 J = 2.5 KJ$ ✓

$\Delta H = \frac{2.5 KJ}{0.05 mol}$ ✓

$\Delta H_1 = -50 KJ mol^{-1}$

$2NaHCO_{3(s)} \longrightarrow Na_2CO_{3(s)} + H_2O_{(l)} + CO_{2(g)}$

$\Delta H_2 = \frac{20000 J}{0.5 mol}$ ✓

$= \frac{20 KJ}{0.5 mol}$

$= +40 KJ mol^{-1}$

(ii) $2NaHCO_{3(s)} + 2HCl_{(aq)} \xrightarrow{\Delta H} 2NaCl_{(aq)} + 2H_2O_{(l)} + 2CO_{2(g)}$

cycle ✓

$2 \times \Delta H_2$; ΔH_1

$Na_2CO_{3(s)} + 2H_2O_{(l)} + 2CO_{2(g)} + 2HCl_{(aq)}$

Using Hess' law ✓

$\Delta H = 2\Delta H_2 + \Delta H_1$ ✓

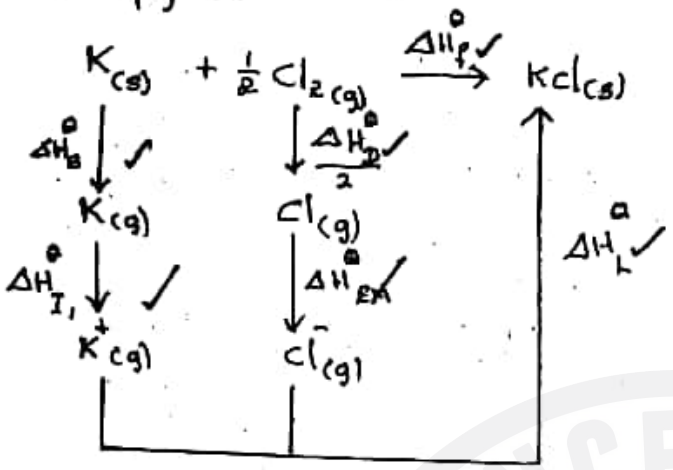
$= 2 \times 40\ kJ\ mol^{-1} + (-50\ kJ\ mol^{-1})$ ✓

$= +30\ kJ\ mol^{-1}$ ✓

56 − 05×14 = 70 marks

(iii) Enthalpy of solution of $NaHCO_{3(s)}$ is neglected.

c)(i)



cycle ✓

$\Delta H_L^\circ = \Delta H_f^\circ - \Delta H_S^\circ - \Delta H_{I_1}^\circ - \frac{1}{2}\Delta H_D^\circ - \Delta H_{EA}^\circ$ ✓

$= -437\ kJ\ mol^{-1} - 89\ kJ\ mol^{-1} - 418\ kJ\ mol^{-1} - \frac{1}{2}(-244\ kJ\ mol^{-1}) - (-349\ kJ\ mol^{-1})$ ✓

$= -437 - 89 - 418 + 122 + 349$

$= -473\ kJ\ mol^{-1}$ ✓

5c — 05×10 = 50 marks

Question 5 — 30 + 70 + 50 = 150 marks

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⑥ (a) $SrCO_3 + 2HCl \longrightarrow SrCl_2 + H_2O + CO_2$ (04)

$\frac{x}{148}$ (03)

$BaCO_3 + 2HCl \longrightarrow BaCl_2 + H_2O + CO_2$ (04)

$\frac{1.6-x}{197}$ (03)

$n_{HCl\ added} = \frac{0.8 \times 50}{1000} = 0.04\ mol$ (03)

n_{NaOH} required to react with the excess HCl $= \frac{0.5 \times 40}{1000}$ (03)

$= 0.02\ mol$ (03)

$n_{NaOH} : n_{HCl} = 1 : 1$ (02)

$n_{HCl\ reacted} = 0.04 - 002$

$= 0.02\ mol.$ (03)

$2\left(\frac{x}{148} + \frac{1.6-x}{197}\right) = 0.02$ (03)

$x = 1.117\ g$ (03)

$W_{SrCO_3} = 1.117\ g, \quad W_{BaCO_3} = 0.483\ g$ (03)

% of $SrCO_3$ = $\frac{1.117g}{1.6g} \times 100$ (03)

= 69.81 % (02)

% of $BaCO_3$ = $\frac{0.483g}{1.6g} \times 100$ (03)

= 30.18 % (03)

6a – 50marks

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b) (i) $5\left[Fe^{2+} \longrightarrow Fe^{3+} + e\right]$ (03)

$MnO_4^- + 8H^+ + 5e \longrightarrow Mn^{2+} + 4H_2O$ (03)

$5Fe^{2+} + MnO_4^- + 8H^+ \longrightarrow 5Fe^{3+} + Mn^{2+} + 4H_2O$ (04)

(ii) $5\left[2I^- \longrightarrow I_2 + 2e\right]$ (03)

$2IO_3^- + 12H^+ + 10e \longrightarrow 6H_2O + I_2$ (03)

$IO_3^- + 5I^- + 6H^+ \longrightarrow 3I_2 + 3H_2O$ (04)

(iii) $2\left[H_2S \longrightarrow S + 2H^+ + 2e\right]$ (03)

$4H^+ + H_2SO_3 + 4e \longrightarrow S + 3H_2O$ (03)

$H_2SO_3 + 2H_2S \longrightarrow 3S\downarrow + 3H_2O$ (04)

(iv) $H_2O_2 \longrightarrow O_2 + 2H^+ + 2e$ (03)

$Ag_2O + 2H^+ + 2e \longrightarrow 2Ag + H_2O$ (03)

$Ag_2O + H_2O_2 \longrightarrow 2Ag + H_2O + O_2$ (04)

(v) $2I^- \longrightarrow I_2 + 2e$ (03)

$H_2O_2 + 2H^+ + 2e \longrightarrow 2H_2O$ (03)

$H_2O_2 + 2I^- + 2H^+ \longrightarrow I_2 + 2H_2O$ (04)

6b – 50 marks

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c) $6\left[M^{n+} + H_2O \longrightarrow MO^{2+} + (4-n)e + 2H^+\right]$ ✓✓

$(4-n)\left[6e + 14H^+ + Cr_2O_7^{2-} \longrightarrow 2Cr^{3+} + 7H_2O\right]$ ✓✓

$\frac{n_{M^{n+}}}{n_{Cr_2O_7^{2-}}} = \frac{6}{4-n}$ ✓

no. of moles of $K_2Cr_2O_7$ = $\frac{0.1 \times 20}{1000}$ mol ✓

no. of moles of M^{n+} = 4×10^{-3} mol ✓

$\frac{n_{M^{n+}}}{n_{Cr_2O_7^{2-}}} = \frac{6}{4-n} = \frac{4 \times 10}{2 \times 16 \times 3}$

-8C - 05x10 = 50 marks

50+50+50 = 150 marks

(7) a) (i)

A - Li
B - $LiNO_3$
C - Li_2O
D - NO_2
E - O_2
F - H_2
G - LiOH

07x7 = 49

(ii) $2Li_{(s)} + 2H_2O_{(l)} \longrightarrow 2LiOH + H_{2(g)}$ (15)

(iii) burning splinter is dipped into the gas jar, it is extinguished with characteristic 'pop' sound (10) — 35 marks

(b) (i) $4LiNO_{3(s)} \longrightarrow 2Li_2O_{(s)} + 4NO_{2(g)} + O_{2(g)}$ (15)

(ii) $2NaNO_{3(s)} \longrightarrow 2NaNO_{2(s)} + O_{2(g)}$ (15)

(iii) $Li_2CO_{3(s)} \longrightarrow Li_2O_{(s)} + CO_{2(g)}$ (15)

(iv) $MgCO_{3(s)} \longrightarrow MgO_{(s)} + CO_{2(g)}$ (15)

(v) $CaCO_{3(s)} + H_2O_{(l)} + CO_{2(g)} \longrightarrow Ca(HCO_3)_{2(aq)}$ (15)

7b - 75 marks

Structure 150 marks

M.C.Q ⇒ 50 marks

(Part) II ⇒ 50 marks

100 marks

Structure 50x4 = 200

Essay 150x2 = 300

Part II ⇒ 500 = 50

10