FBISE
WE WORK FOR EXCELLENCE

Federal Board HSSC – I Examination
Chemistry – Mark Scheme

SECTION A

Q.1

i.	D	ii.	C	iii.	A
iv.	C	v.	A	vi.	D
vii.	C	viii.	C	ix.	D
x.	C	xi.	C	xii.	B
xiii.	D	xiv.	A	xv.	D
xvi.	D	xvii.	D		

(17x1=17)

SECTION B

Q.2 **(5)**

$2NH_3 + 5F_2 \longrightarrow N_2F_4 + 6HF$

i. moles of $NH_3 = \frac{4}{17} = 0.235$ (½ mark)

moles of $F_2 = \frac{14}{38} = 0.368$ (½ mark)

mass of $N_2F_4 = 7.654g$ (1 mark)

ii. Ammonia (½ mark)

moles of ammonia used = 0.147 (1 mark)

mole in excess = 0.235 – 0.147 = 0.088 mol (½ mark)

$V = n\,V_m$

$= 0.088 \times 22.414$

$= 1.97dm^3$ (1 mark)

(OR)

i. C : H

$\frac{85.7}{12}$: $\frac{14.3}{1.008}$ (1 mark)

7.142 : 14.187 (1 mark)

1 : 2

CH_2

ii. a. $V = n\,V_m$

$n = \frac{V}{V_m} = \frac{100}{22414} = 4.16 \times 10^{-3}$ mol (1 mark)

relative molecular mass = $\frac{mass}{mole}$

$= \frac{0.25}{4.46\times10^{-3}} = 56$ (1 mark)

b. $n = \frac{molecular\ formula\,mass}{empirical\ formula\,mass}$

$= \frac{56}{14} = 4$ (½ mark)

Molecular formula = n (empirical formula)

= 4 (CH_2)

= C_4H_8 (½ mark)

Q.3 **(3)**

a. $V = \frac{C}{\lambda}$

$= \frac{3\times10^{8}}{589\times10^{-10}} = 5.09 \times 10^{1J}\ S^{-1}$ (1 mark)

b. $E = h\upsilon$

Per photon $= 6.626 \times 10^{-34} \times 5.09 \times 10^{15}$

$= 3.37 \times 10^{-18}$J (1 mark)

Per mole $= \frac{3.37\times10^{-18}}{1000}\times6.022\times10^{23}$

= 2029 KJ/mol (1 mark)

Q.4 **(4)**

i. A and C (1 mark)

ii. B (1 mark)

iii. Relative solubility of different solute present in the mixture (1 mark)

Solute having lower R_f value is less soluble than solute having higher R_f value in the same solvent (1 mark)

Q.5 **(3)**

$\rightleftharpoons$

i. $I_2 + I^{-1}_{(aq)}$ $I^{-3}_{(aq)}$ (1 mark)

ii. Distribution law or partition law (1 mark)

iii. $K = \frac{[I_{2(CCl_4)}]}{[I_2\ as\ I^{-1}_{3(aq)}]}$ (1 mark)

(OR)

a. When n = 3 the possible value of l will n – 1 which is l = 2 so l = 3 is not allowed. (1 mark)

b. When m = -1

s = -½, +½ not -1

clock wise or anti clock wise direction (1 mark)

c. When l = 1 then m = -l, 0, +l not m = -2 (1 mark)

the value of m varies from -l to +l

Q.6 **(5)**

a. Low temperature (½ mark)

High pressure (½ mark)

b. Molecules come close to each other attractive forces between them increase. (1 mark)

Gaseous particles are converted into liquid state. (1 mark)

c. Lesser than NH_3 (1 mark)

N_2 molecules have weak Vander Waal forces while stronger forces (hydrogen bonding) exist in NH_3 molecules. (1 mark)

Q.7 **(3)**

i. Both have weak intermolecular forces therefore less amount of energy is required to break these forces. (1 mark)

ii. Propanol molecules have stronger intermolecular forces than the others. (1 mark)

Hydrogen bonding (1 mark)

Q.8 **(4)**

i. $\mu = q \times r$ (1 mark)

Unit = Debye or Coulomb meter. (1 mark)

ii. H_2O is polar while CO_2 is non-polar (1 mark)

$\overset{\longleftarrow\!\!\!+}{O = C} \overset{+\!\!\!\longrightarrow}{= O}$

In CO_2 dipole moment of C = O cancel the effect of each other. (1 mark)

(OR)

i. Variation in period (1 mark)

	Reason	(½ mark)
	Variation in group	(1 mark)
	Reason	(½ mark)
ii.	$K^+ Cl^- = 131 + 181 = 312$Pm	(1 mark)

Q.9 **(5)**

a. When an electrode is in contact with one molar solution of its own ions at 298k, is standard electrode potential. (1 mark)

b. i. Copper electrode (1 mark)

ii. Copper to silver (1 mark)

c. $Cu \longrightarrow Cu^{2+} + 2\bar{e}$

$Ag^+ + \bar{e} \longrightarrow Ag$ (2 marks)

Q.10 **(3)**

i. +ive electrode (1 mark)

ii. –ive electrode (1 mark)

iii. +ive electrode (1 mark)

(OR)

i. from anode to cathode (1 mark)

ii. 4 (1 mark)

iii. $Zn + 20H^- \longrightarrow Zn(OH)_2 + 2\bar{e}$ ——— at anode (1 mark)

Q.11 **(3)**

Concentration = 5g/dm^3

$$Conc_{mol/dm3} = \frac{Conc.g\,dm^{-3}}{molar\,mass}$$

$$= \frac{5}{104} = 0.0305\text{mol/dm}^3$$ (1 mark)

$Ca(NO_3)_2 \rightleftharpoons Ca^{2+} + 2\,NO_3^{-1}$

Conc. of Ca^{2+} = 0.0305M

Conc. of $NO_3^{-1} = 2 \times 0.0305 = 0.061$M (2 marks)

Q.12 **(4)**

a. That resists change in pH when acid or alkali added to it. (1 mark)

b. $CH_3COOH + H_2O \rightleftharpoons CH_3COO^- + H_3O^+$

$CH_3COO^-Na^+ \rightleftharpoons CH_3COO^- + Na^+$

When a base or OH^- ions are added to above buffer system, OH^- react with H_3O^+ to give back H_2O and pH of solution remain unchanged.

Common ion effect is applied in buffer solution. (3 mark)

SECTION C

Q.13 **(13)**

a. i. $C_2H_2 + 5/2O_2 \longrightarrow 2CO_2 + H_2O$ $\Delta H = ?$

(a) $C + O_2 \longrightarrow CO_2$ $\Delta H = -393.5KJ/mol$

(b) $H_2 + 1/2\ O_2 \longrightarrow H_2O$ $\Delta H = -285.7KJ/mol$

(c) $2C + H_2 \longrightarrow C_2H_2$ $\Delta H = 226KJ/mol$

Multiply equation (a) by (2) then add the product to equation (b) we get:

(d) $2C + \frac{5}{2}O_2 + H_2 \longrightarrow 2CO_2 + H_2O$ $\Delta H = -1072.7KJ$

Subtract equation (c) from equation (d)

$2C + H_2 \longrightarrow C_2H_2$ $\Delta H = -226$

$C_2H_2 + 5/2O_2 \longrightarrow 2C_2 + H_2O$ $\Delta H = -1298.7KJ/mol$

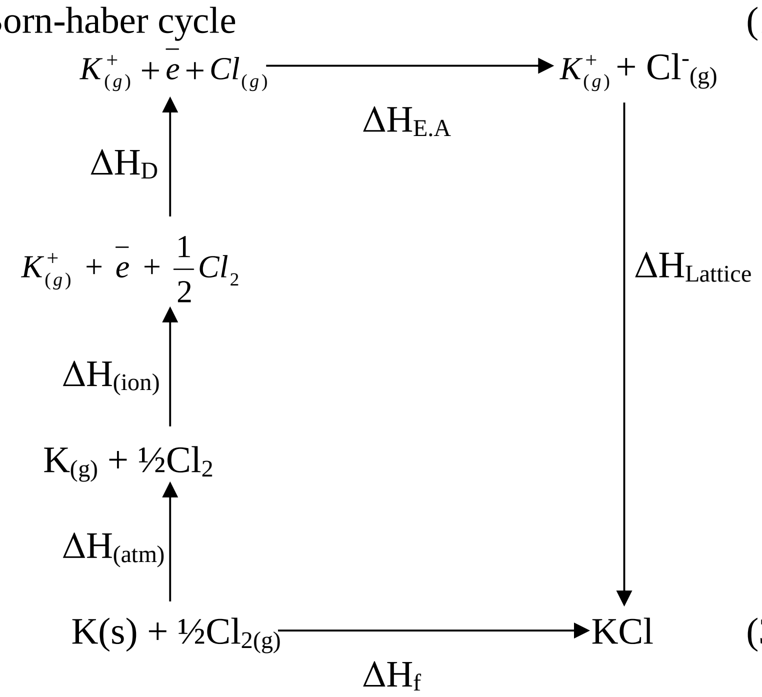
(3 marks)

ii. Hess's Law: overall energy change is the same, regardless of the route applied. (2 marks)

b. i. Lattice energy is the enthalpy of formation of one mole of the ionic compound from gaseous ions under standard conditions. (1 mark)

ii. Born-haber cycle (1 mark)

iii.



(3 marks)

c. i. System move towards backward direction. (1 mark)

ii. System move towards backward direction. (1 mark)

iii. Towards forward direction. (1 mark)

Q.14 **(13)**

a. i. The relative lowering of vapour pressure is equal to mole fraction of solute. (1 mark)

ii. $P_A = P_A^\circ X_A$ (1 mark)

$P_B = P_B^\circ X_B$

$P_t = P_A + P_B = P_A^\circ X_A + P_B^\circ X_B$

$X_A + X_B = 1$

$X_A = 1 - X_B$ (1 mark)

$P_t = P_A^\circ (1 - X_B) + P_B^\circ X_B$

$P_t = (P_B^\circ - P_A^\circ) X_B + P_A^\circ$ (1 mark)

b. i. 210g of solution contain 110g of KNO_3 (1 mark)

ii. $1g = \frac{110}{210} g\ of\ KNO_3$ (1 mark)

$525g = \frac{110}{210} \times 525 g\ of\ KNO_3$

$= 275g$ of KNO_3 (1 mark)

This is saturated solution. (1 mark)

c. Positive deviation

negative deviation (2 marks)

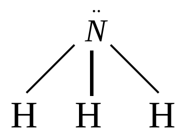
In case of positive deviation total pressure increases. (1 mark)

In case of negative deviation total pressure decreases. (1 mark)

Diagram for both deviation. (1 mark)

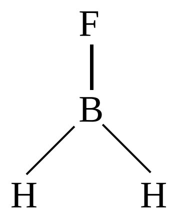
Q.15 **(13)**

a. i.



(1 mark)

Bond angle = 107° (½ mark)

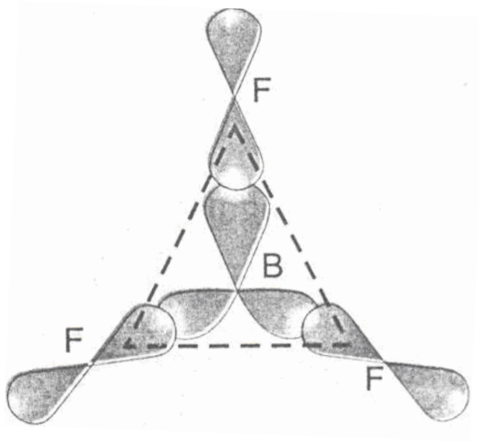


(1 mark)

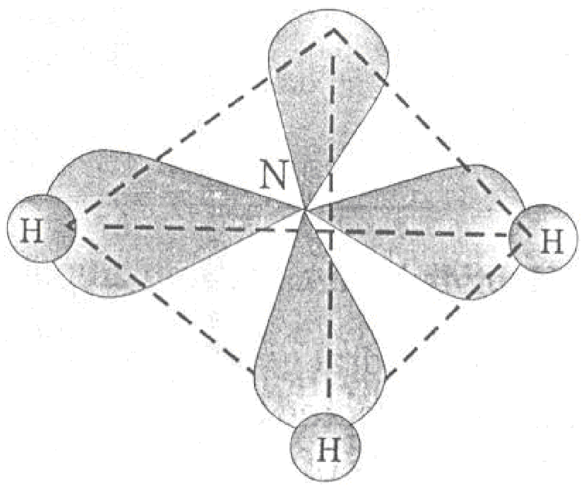
Bond angle = 120° (½ mark)

ii. In $NH_3 = SP^3$ hybridization (½ mark)

In $BF_3 = SP^2$ hybridization (½ mark)



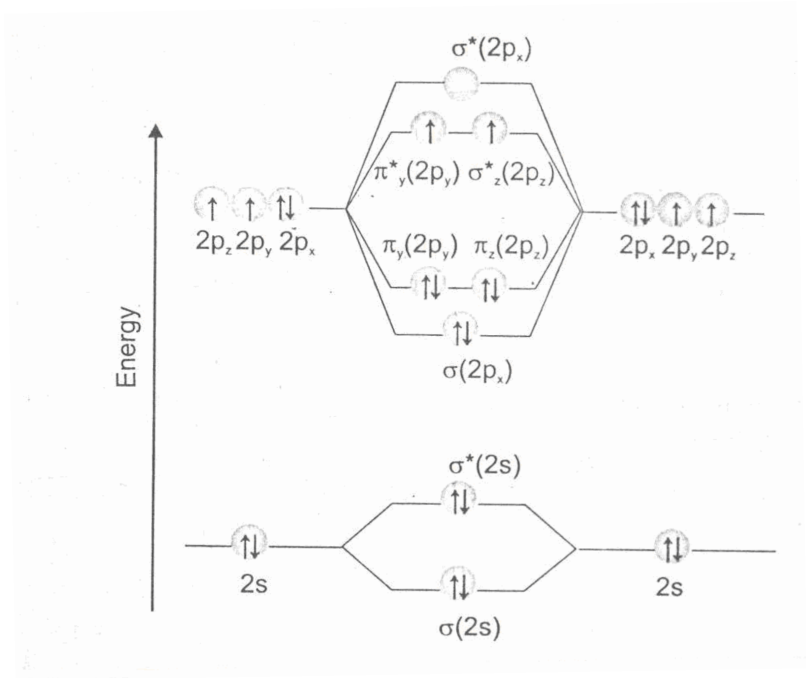
(1 mark)



(1 mark)

iii. In NH_3 $\mu \neq O$ (1 mark)
while in BF_3 $\mu = O$ (1 mark)
due to their structure.

b. i. O_2



Due to un-paired electron in $\overset{*}{\pi}$ orbital O_2 show paramagnetic behaviour. (2 marks)

While O_2^{2-} is diamagnetic because it has no un-paired electron in $\overset{*}{\pi}$ orbital. (2 marks)

ii. Bond order = ½[10 – 6]
= ½[4]
= 2 (1 mark)