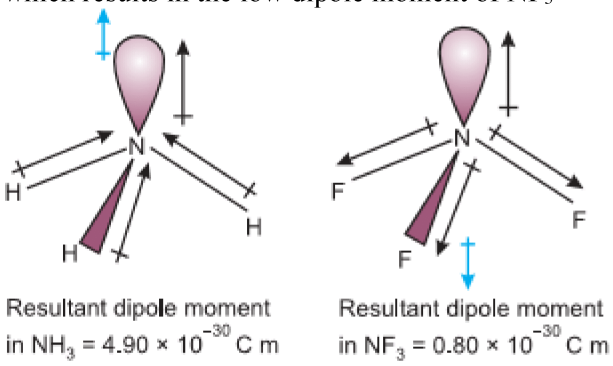
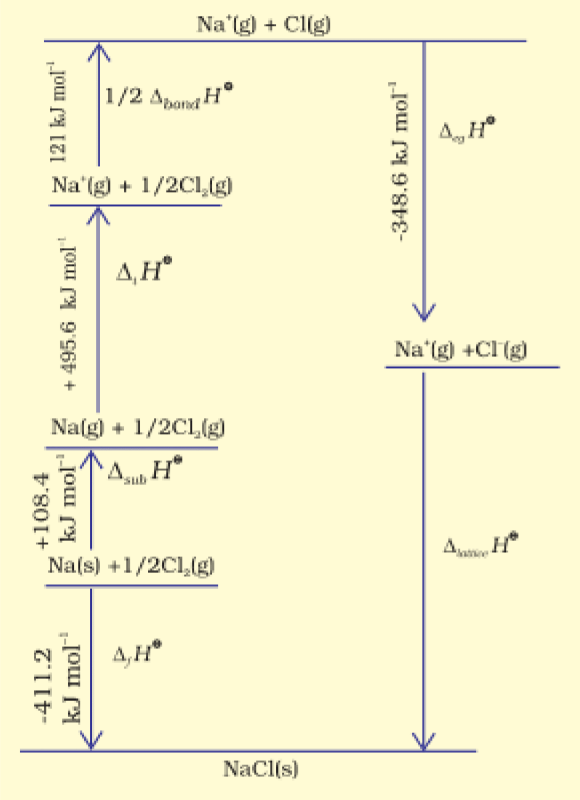
HSE I **Answer key** **SET –A**

Chemistry

Qn No.	Scoring Indicators	Detailed Score	Score
1	H_2O	1	1
2	CO and H_2	1	1
3	Kp = 46.4	1	1
4	d) 0.2000	1	1
5	electron	1	1
6	Li^+	1	1
7	Boyle's Law Statement of law	1 1	2
8	% composition of C= $\frac{12\times100}{44}$ =27.27% % composition of O= $\frac{32\times100}{44}$ =72.72%	1 1	2
9	(a) There is no force of attraction between the molecules of a gas. (b) Volume of the molecules of a gas is negligibly small in comparison to the space occupied by the gas	1 1	2
10	molarity (M)= No. of moles of solute /Volume of solution in litres No. of moles of solute = molarity (M) x Volume of solution in litres = 0.5M x 0.5L = 0.25 mol/L Mass of NaOH required = 0.25 x 40=10g	1 1 1	3
11	The production of dihydrogen is increased by reacting carbon monoxide of syngas mixtures with steam in the presence of iron chromate as catalyst $CO(g)+H_2O(g)\xrightarrow[\text{catalyst}]{673K}CO_2(g)+H_2(g)$	1 1	2
12	For differentiating extensive and intensive properties For examples	1 1	2
13	The blue colour of the solution is due to the ammoniated electron which absorbs energy in the visible region of light and thus imparts blue colour to the solution $M+(x+y)NH_3\rightarrow[M(NH_3)_x]^+ +[e(NH_3)_y]^-$	1 1	2
14	Statement of the law Explanation using any one example	1 1	2
15	The amount of HCl required to completely react with 100g of $CaCO_3$ according to the equation = 73g Therefore the amount of HCl required to completely react with 200g of $CaCO_3$ = $\frac{73\times200}{100}$ = 146g	1 1	2
16	Surface tension explanation	1 1	2

17	$M = \frac{dRT}{P}$ $= \frac{5.5g/L \times 0.083barL/k/mol \times 298K}{2bar}$ = 68g/mol	½ 1 ½	2
18	a) pH = – log [H+] = - log(1x10^{-2}) = 2 b) A mixture of weak acid and one of its salt with strong base One example	1 ½ 1 ½	3
19	a) Increasing the temperature shift the equilibrium in the forward direction as it is endothermic. b) increase of pressure shift the equilibrium towards left (backward direction) where the no.of particles is less. C) If the volume is kept constant and an inert gas such as argon is added which does not take part in the reaction, the equilibrium remains undisturbed. It is because the addition of an inert gas at constant volume does not change the partial pressures or the molar concentrations of the substance involved in the reaction.	1 1 1	3
20	a) 4.9 x 10^{-30} C m b) in case of NH_3 the orbital dipole due to lone pair is in the same direction as the resultant dipole moment of the N - H bonds, whereas in NF_3 the orbital dipole is in the direction opposite to the resultant dipole moment of the three N-F bonds. The orbital dipole because of lone pair decreases the effect of the resultant N - F bond moments, which results in the low dipole moment of NF_3  Resultant dipole moment in NH_3 = 4.90 × 10^{-30} C m Resultant dipole moment in NF_3 = 0.80 × 10^{-30} C m	1 1 1	3

21	 For each step 1/2 score	3	3
22	For definition For derivation	1 2	3
23	For the correct calculation of oxidation state of each atom For balanced equation	1½ 1½	3
24	a)$Ag^{+}/Ag<Hg^{2+}/Hg < Cr^{3+}/Cr < Mg^{2+}/Mg$ b)$NO_3^{-} > NO_2, > NO_2^{-}$, N_2H_4.	1	3
25	I) There is no time lag between the striking of light beam and the ejection of electrons from the metal surface. (ii) The number of electrons ejected is proportional to the intensity or brightness of light. (iii) For each metal, there is a characteristic minimum frequency, ν 0 (also known as threshold frequency) below which photoelectric effect is not observed	1 1 1	3
26	Shapes of 5 3d orbitals Angular nodes , *l*=2	2½ ½	3
27	a) $1s^2 2s^2 2p^6 3s^2 3p^1$, group - 13 b) A_2O_3	2 1	3
28	Ionisation enthalpy decreases with increase in atomic number Any two factors- Nuclear charge, atomic size, shielding effect etc.	1 2	3
29	$AgCN \rightarrow Ag^{+} + CN^{-}$ $K_{sp} = [Ag^{+}][CN^{-}] = 6x\ 10^{-17}$ $Ni(OH)_2 \rightarrow Ni^{2+} + 2OH^{-}$ $K_{sp} = [Ni^{2+}][OH^{-}]^2 = 2x\ 10^{-15}$ Let $[Ag^{+}] = S_1$, then $[CN^{-}] = S_1$ Let $[Ni^{2+}] = S_2$, then $[OH^{-}] = 2S_2$ $S_1^2 = 6x\ 10^{-17}$, $S_1 = 7.8 \times 10^{-9}$	 ½ ½ 1	4

	$(S_2)(2S_2)^2 = 2x\ 10^{-15}$, $S_2 = 0.58 \times 10^{-4}$ $Ni(OH)_2$ is more soluble than AgCN.	 1 1	
30	a) detailed explanation of sp^3 b) detailed explanation of sp^2	2 2	4
31	Explanation of hydrogen bonding Explanation of intra molecular hydrogen bonding in o-nitrophenol Explanation of inter molecular hydrogen bonding in HF	1 1½ 1½	4
32	a) For explanation of principal, azimuthal and magnetic quantum numbers b) (i) 2p (ii) 4s	1+1+1=3 ½ + ½=1	4