



**INDIAN SCHOOL MUSCAT**  
**CLASS XI**  
**CHEMISTRY WORK SHEET**  
**THERMODYNAMICS**

1	Define (i) Heat capacity (ii) Molar heat capacity (iii) Enthalpy of a reaction (iv) Entropy (v) Gibb's free energy (vi) Residual entropy
2	State i. Hess's law of constant heat summation ii. Second law of thermodynamics iii. Third law of thermodynamics
3	Derive the relation $\Delta H = \Delta U + \Delta n_g RT$
4	Discuss the role of temperature in determining the spontaneity of a process
5	Calculate heat change at constant pressure if heat change at constant volume for the reaction $\text{NH}_2\text{CN(g)} + \frac{3}{2} \text{O}_2\text{(g)} \rightarrow \text{N}_2\text{(g)} + \text{CO}_2\text{(g)} + \text{H}_2\text{O(l)}$ at 298K is -742 kJ/mole.
6	The mean bond enthalpies of N≡N and H-H are 946 and 436 kJ/mole respectively. If heat of formation of ammonia is -46kJ/mole, calculate the mean BE in ammonia.
7	Calculate the $\Delta H_f^0$ of benzene if $\Delta H_{\text{comb}}$ of benzene, carbon and hydrogen are 3267, 393 and 286 kJ/mole respectively.
8	Define $C_v$ and $C_p$ for an ideal gas. Derive a relationship between $C_v$ and $C_p$ .
9	Differentiate between a) closed system and an isolated system b) heat of formation and heat of reaction c) heat of hydration and heat of solution
10	For the reaction $2\text{NO(g)} + \text{O}_2\text{(g)} \rightleftharpoons 2\text{NO}_2\text{(g)}$ , calculate the $\Delta G$ at 600 K if enthalpy and entropy changes are -110kJ/mole and 150 J/Kmole.
11	For the equilibrium $\text{PCl}_5 \rightleftharpoons \text{PCl}_3 + \text{Cl}_2$ at $25^\circ\text{C}$ , $K = 1.8 \times 10^{-7}$ . Calculate $\Delta G^\circ$ of reaction.
12	Calculate the $K_c$ at 298 K for the reaction $\text{H}_2 + \text{I}_2 \rightleftharpoons 2\text{HI}$ , if $\Delta G_f^\circ(\text{HI}) = 1.3\text{kJ/mole}$ .
13	What will be the sign of entropy change for the following changes? a) In an isolated system, two identical gases are allowed to mix under identical conditions. b) $\text{I}_2\text{(g)} \rightarrow \text{I}_2\text{(s)}$ c) $\text{H}_2\text{(g)} + \text{I}_2\text{(g)} \rightarrow 2\text{HI(g)}$ d) Dissolution of sugar in water contained in a thermos flask.
14	$\Delta H$ and $\Delta S$ for the reaction $\text{Ag}_2\text{O} \rightleftharpoons 2\text{Ag} + \frac{1}{2} \text{O}_2$ are 30.56 KJ/mole and 60 J/K respectively. Calculate the temperature at which the free energy change for this reaction will be zero. Predict whether the forward reaction will be favoured above/below this T.
15	Explain the formation of NaBr using Born-Haber cycle.
16	Comment on the following statements (i) An exothermic reaction is always thermodynamically spontaneous. (ii) The entropy of a substance increases when going from liquid state to vapour state at any temperature. (iii) A reaction with $\Delta G^\circ > 0$ always has an equilibrium constant greater than one



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	(iv) Dissolution of ammonium chloride in water is endothermic yet it is a spontaneous process
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