

Daily Tutorial Sheet-9

Level-2

106.(ACD) Absolute value of heat content, internal energy and Gibbs energy of the system can not be calculated. Absolute value of entropy can be calculated.

107.(ACD) $\text{H}_2\text{O}(\text{s}) \longrightarrow \text{H}_2\text{O}(\text{l})$ [spontaneous process because $\Delta G < 0$; $\Delta S < 0$]

108.(A) $\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \longrightarrow \text{H}_2\text{O}(\text{g}) \quad \Delta_r H_{298\text{K}}^\circ = -241 \text{ kJ / mol}^{-1}$

$$\Delta_r H_{373\text{K}}^\circ = \Delta_r H_{298\text{K}}^\circ + \Delta C_P(T_2 - T_1) = -241.8 + \left[(C_P)_{\text{H}_2\text{O}} - (C_P)_{\text{H}_2} - \frac{1}{2}(C_P)_{\text{O}_2} \right] (373 - 298)$$

$$= -241.8 + [33.6 - 28.8 - \frac{1}{2} \times 29.4] \times (373 - 298) \times 10^{-3} = -242.6 \text{ kJ / mol}$$

109.(D) Larger the molecule, more is the entropy. Also, Entropy of a molecule is larger in gaseous state than in solid state.

$$\Rightarrow S_{\text{C}_2\text{H}_2} < S_{\text{C}_2\text{H}_6}; S_{\text{CO}_2} > S_{\text{CO}}; S_{\text{I}_2(\text{s})} < S_{\text{I}_2(\text{g})}$$

110.(A) $\text{Protein}_A(\text{s}) \rightleftharpoons \text{Protein}_A(\text{l}) \quad \Delta_r H_A = 2.73 \text{ kcal / mol}$

$\text{Protein}_B(\text{s}) \rightleftharpoons \text{Protein}_B(\text{l}) \quad \Delta_r H_B = 3.0 \text{ kcal / mol}$

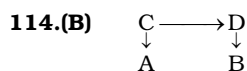
$$\Delta S_A = \frac{\Delta_r H_A}{T_A} = \frac{2.73}{273} \times 10^3 = 10 \text{ Jmol}^{-1} \text{ K}^{-1} \text{ and } \Delta S_B = \frac{\Delta_r H_B}{T_B} = \frac{3.03}{303} \times 10^3 = 10 \text{ Jmol}^{-1} \text{ K}^{-1}$$

111.(A) Using : $-\Delta_r G^\circ = RT \ln K_{\text{eq}} \Rightarrow -\Delta_r G^\circ = 8.314 \times 298 \ln 10^{-14} = 7.99 \times 10^4 \text{ J}$

112.(B) $\Delta G = \Delta H - T\Delta S$ At equilibrium, $\Delta G = 0$

For a reaction to be spontaneous ΔG should be negative, so T should be greater than T_e .

113.(B) Standard Gibb's energy of formation (ΔG_f°) of a substance is defined as the Gibb's energy change when mole of the substance is formed from its elements in their standard states. The following reaction define ΔG_f° , $\frac{1}{2}\text{H}_2(\text{g}) + \frac{1}{2}\text{F}_2(\text{g}) \longrightarrow \text{HF}(\text{g})$



Given, $\Delta S_{(\text{A} \rightarrow \text{C})} = 50 \text{ eu}$

$$\Delta S_{(\text{C} \rightarrow \text{D})} = 30 \text{ eu} ; \quad \Delta S_{(\text{B} \rightarrow \text{D})} = 20 \text{ eu}$$

Where, eu is entropy unit

Therefore, $\Delta S_{(\text{A} \rightarrow \text{B})} = \Delta S_{(\text{A} \rightarrow \text{C})} + \Delta S_{(\text{C} \rightarrow \text{D})} + \Delta S_{(\text{D} \rightarrow \text{B})}$

$$= \Delta S_{(\text{A} \rightarrow \text{C})} + \Delta S_{(\text{C} \rightarrow \text{D})} - \Delta S_{(\text{B} \rightarrow \text{D})} = 50 + 30 - 20 = 60 \text{ eu}$$

115.(D) Variation of K_{eq} with temperature t is given by van't Hoff equation $\ln K_{\text{eq}} = -\frac{\Delta H^\circ}{R} \cdot \frac{1}{T} + \frac{\Delta S^\circ}{R}$

Slope of the given line is positive indicating that term A is positive thus ΔH° is negative. Thus, reaction is exothermic.