Daily Tutorial Sheet-2	JEE Main (Archive)

16.(A) **(A)** $N_2 + 3H_2 \longrightarrow 2NH_3$

Since number of gaseous moles are decreasing hence entropy change $\Delta S = S_{products} - S_{reactants}$ is negative

(B) $\underset{(s)}{CaSO_4} \longrightarrow \underset{(s)}{CaO} + \underset{(g)}{SO_3}$

ΔS : positive, as number of gas moles increases

(C) $CO_2(s) \longrightarrow CO_2(g)$

ΔS : positive, as number of gaseous moles are increasing

(D) $I_2(s) \longrightarrow I_2(aq)$

ΔS : positive, as randomness of the system has increased

17.(D) Heat released by one block at T_2 = Heat absorbed by block at T_1

$-ms(T - T_2) = ms(T - T_1)$ (where $T_2 > T_1$); T is equilibrium temperature

$(T_2 - T) = (T - T_1), T = \frac{T_1 + T_2}{2}$

$\Delta S = C_p \ln\frac{T}{T_1} + C_p \ln\frac{T}{T_2} = C_p \ln\left(\frac{T}{T_1} \times \frac{T}{T_2}\right) \quad \Rightarrow \quad \Delta S = C_p \ln\frac{T^2}{T_1T_2}$

$\Delta S = C_p \ln\frac{(T_1 + T_2)^2}{4T_1T_2}$

18.(C) $C_v = \frac{f}{2}R$

$C_P = \left(\frac{f}{2} + 1\right)R$ Where f = degree of freedom at normal temperature.

At normal temperature f = 5 for diatomic gas.

At higher temperature vibrational degree of freedom also becomes active, so the value of f in both C_v and C_P will shot up after a particular temperature. Hence graph (C) is incorrect.

19.(A) For the process to be spontaneous ΔG: – ve

$\Delta G = \Delta H - \Delta(TS)$

At a particular Temperature $\Delta G = \Delta H - T\Delta S$

For spontaneity $\Delta G < 0$

$\Delta H - T\Delta S < 0$

$T\Delta S > \Delta H$

T(40) > 200 T = 5K ⇒ T > 5

20.(D) $\Delta G^0 = \Delta H^0 - T\Delta S^0$

$A = \Delta H^0$

$B = \Delta S^0$

For endothermic Reaction $\Delta H > 0$

21.(A) The reaction

$MgO(s) + C(s) \longrightarrow Mg(s) + CO(g)$

$\Delta_r H = +4941.1 kJ/mol$

$\Delta_r S = +198.0\,J\,K^{-1}\,mol^{-1}$

$\Delta G = 0$ at equilibrium

$$T = \frac{\Delta H}{\Delta S} = \frac{491.1\times10^3}{198.0} = 2480.3\,K$$

22.(A) For spontaneous process

$\Delta G = (\Delta H - T\Delta S)$ should be negative

$\therefore \quad \Delta G < 0$

23.(C) q & w are path functions.

Option (C) is correct

24.(D) Maltose is a disaccharide made up two D-glucose units. On treatment with dil. HCl is undergoes hydrolysis to give two D-glucose units. (Monosaccharide)

25.(D) $$\Delta H = \int nC_P dT = 3\int_{300}^{1000}(23+0.01T)\,dT = 3\left[23T + \frac{0.01T^2}{2}\right]_{300}^{1000}$$

$$= 3\left[23000 + \frac{0.01}{2}(1000)^2 - 23(300) - \frac{0.01(300)^2}{2}\right]$$

$$= 3[23000+5000-6900-450] = 61950\,J \simeq 62\,kJ$$

26.(B) According to first law of thermodynamics : $\Delta U = q + w$

For adiabatic process, $q = 0$

Hence, $\Delta U = w$

27.(A) $\Delta U = q + W$

$\Delta U = (-2) + 10 = 8\,kJ$

28.(A) $$\Delta U = nC_v\Delta T = \frac{5\times28\times100}{1000} = 14\,kJ$$

$$\Delta(pV) = nR\Delta T = \frac{5\times8\times100}{1000} = 4\,kJ$$

29.(6.25) $\Delta U = nC_v\Delta T$

$500 = 4\times C_v\times(500-300)$

$$C_v = \frac{5000}{4\times200} = 6.25JK^{-1}mol^{-1}$$

30.(D) $$\Delta S = \int\frac{dq}{T}\;;\quad S = \int_0^T \frac{nCdT}{T}$$

31.(48.00) Work done = Area under the curve $= \frac{1}{2}(6+10)\times6 = 48\,J$

32.(–2.70) $A(\ell) \longrightarrow 2B(g)$

$\Delta U = 2.1\,kcal,\ \Delta S = 20\,cal/k,\ T = 300K$

$\Delta G = \Delta H - T\Delta S$

$\Delta H = \Delta U + \Delta ng\,RT \qquad \Delta ng = 2$

$\Delta G = 3300 - (300)(20) = 3300 - 6000 = -2700\,cal = -2.7\,kcal$