

Daily Tutorial Sheet-2 JEE M	ain (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

$$\begin{array}{ccc} \textbf{(B)} & \text{CaSO}_4 & \longrightarrow & \text{CaO} + \text{SO}_3 \\ & \text{(s)} & & \text{(g)} \end{array}$$

 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

$$\left(T_{2}-T\right)=\left(T-T_{1}\right),T=\frac{T_{1}+T_{2}}{2}$$

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

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

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 \Rightarrow $T > 5$$

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

$$A = \Delta H^0$$

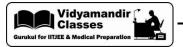
$$B = \Delta S^0$$

For endothermic Reaction $\Delta H > 0$

21.(A) The reaction

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

$$\Delta_{\rm r}H = +4941.1 \,\mathrm{kJ/mol}$$



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

 $\Delta G = 0$ at equilibrium

$$T = \frac{\Delta H}{\Delta S} = \frac{491.1 \times 10^3}{198.0} = 2480.3 \,\text{K}$$

22.(A) For spontaneous process

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

$$\Delta G < 0$$

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)
$$\Delta H = \int nC_P dT = 3 \int_{300}^{1000} (23 + 0.01T) dT = 3 \left[23T + \frac{0.01T^2}{2} \right]_{300}^{1000}$$
$$= 3 \left[23000 + \frac{0.01}{2} (1000)^2 - 23(300) - \frac{0.01(300)^2}{2} \right]$$
$$= 3 [23000 + 5000 - 6900 - 450] = 61950 J \approx 62 \text{ kJ}$$

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

For adiabatic process, q = 0

Hence, $\Delta U = w$

27.(A)
$$\Delta U = q + W$$
 $\Delta U = (-2) + 10 = 8 \text{ kJ}$

28.(A)
$$\Delta U = nC_v \Delta T = \frac{5 \times 28 \times 100}{1000} = 14 \text{ kJ}$$

$$\Delta (pV) = nR\Delta T = \frac{5 \times 8 \times 100}{1000} = 4 \text{ kJ}$$

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

$$500 = 4 \times C_{\rm v} \times (500 - 300)$$

$$C_v = \frac{5000}{4 \times 200} = 6.25 J K^{-1} mol^{-1}$$

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)×6 = 48 J

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

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

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

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

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

VMC | Chemistry 60 Thermodynamics