Topic :- THERMODYNAMICS

1 **(b)**
By eq. (ii) – (i),
$$C_G \longrightarrow C_D; \qquad \Delta H = +1.5 \text{ kJ}$$

2 **(a)**
This is derived formula.

3 **(a)**
$$W = 2.303 \, nRT \log \frac{p_2}{p_1}$$
$$= 2.303 \times 1 \times 2 \times 300 \log \frac{10}{2} = 965.84$$
At constant temperature, $\Delta E = 0$
$$\Delta E = q + W;$$
$$q = -W = -965.84 \text{ cal}$$

4 **(a)**
$$H_2(g) + (1/2)O_2(g) \longrightarrow H_2O(g)$$
$\Delta n = -1/2$ and thus, ΔS decreases or –ve

5 **(d)**
$$\Delta G = \Delta H + T\left[\frac{\partial \Delta G}{\partial T}\right]_P \text{ (Gibbs-Helmholtz equation)}$$
Also, $\Delta G = \Delta H - T\Delta S$; and $-\Delta G = nF \cdot E$
$$\therefore \qquad \Delta G - \Delta H = -T\Delta S$$
$$\text{or } -T\Delta S = T\left[\frac{\partial \Delta G}{\partial T}\right]_P = T\left(\frac{-nF\partial E}{\partial T}\right)_P$$
or $\left[\frac{\partial E}{\partial T}\right]_P = \frac{\partial S}{nF}$; similarly derive for other values .

6 **(a)**
Internal energy of 1 mole of gas $= \frac{3}{2}RT$

8 **(c)**
$$C_D \longrightarrow C_G; \ \Delta H = -453.5 \text{ cal},$$
i.e., Energy of C_G is less and thus, more stable.

10   **(c)**
At equilibrium $\Delta G = 0$.

11   **(c)**
$\Delta S = 16\,\text{J mol}^{-1}\text{K}^{-1}$

$T_{\text{b.p}} = \dfrac{\Delta H_{\text{vapour}}}{\Delta S_{\text{vapour}}} = \dfrac{6 \times 1000}{16}$

$= 375\text{K}$

12   **(a)**

$\Delta S = \dfrac{\Delta H}{T} = \dfrac{1.435 \times 10^3}{273} = 5.260\,\text{cal mole}^{-1}\text{K}^{-1}$

13   **(b)**
Endothermic reactions are those in which heat energy is absorbed.

14   **(b)**
The melting of ice at $-15°C$ is not an spontaneous process.

15   **(c)**
Mixing of gases increases the entropy

16   **(c)**
Current flows from higher potential to lower one.

17   **(a)**
$-W_{\text{irr.}} = P_{\text{ext.}}(V_2 - V_1)$

$= 1 \times (15 - 3) = 12$ litre atm

$= \dfrac{12 \times 1.987 \times 4.184}{0.0821}$

$= 1.215 \times 10^3\text{J}$

18   **(c)**
ΔH for combustion of 56 litre $H_2 = \dfrac{-24.1 \times 56}{22.4}$

ΔH for combustion of 56 litre $CO = \dfrac{-263 \times 56}{22.4}$

$\therefore$ Total $\Delta H = -1312\text{ kJ}$

19   **(b)**
This is the derived formula for W_{rev} in adiabatic process.

20   **(a)**
$\dfrac{1}{2}\,H_2 + \dfrac{1}{2}\,Cl_2 \rightarrow HCl; \qquad \Delta H = -90\text{kJ}$

$\therefore \qquad \Delta H = \dfrac{1}{2}\,e_{H-H} + \dfrac{1}{2}\,e_{Cl-Cl}$

or $\quad -90 = \dfrac{1}{2}\text{x } 430 + \dfrac{1}{2}\text{x } 240 - e_{H-Cl}$

$\therefore \quad e_{H-Cl} = 425\text{ kJ mol}^{-1}$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	B	A	A	A	D	A	B	C	D	C
Q.	11	12	13	14	15	16	17	18	19	20
A.	C	A	B	B	C	C	A	C	B	A