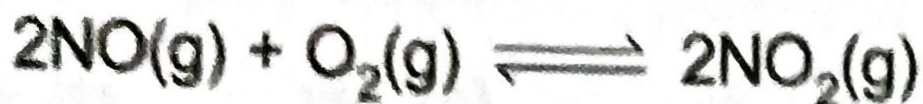


[JEE (Main)-2015]

263a. The following reaction is performed at 298 K.



The standard free energy of formation of  $\text{NO}(\text{g})$  is 86.6 kJ/mol at 298 K. What is the standard free energy of formation of  $\text{NO}_2(\text{g})$  at 298 K?

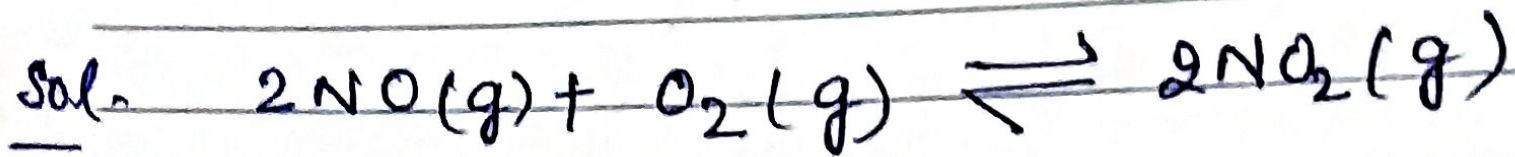
$$(K_p = 1.6 \times 10^{12})$$

(1)  $R(298) \ln(1.6 \times 10^{12}) - 86600$

(2)  $86600 + R(298) \ln(1.6 \times 10^{12})$

(3)  $86600 - \frac{\ln(1.6 \times 10^{12})}{R(298)}$

✓ (4)  $0.5 [2 \times 86,600 - R(298) \ln 1.6 \times 10^{12}]$



We are given  $K_p$ .

$$\text{So, } \Delta G_r^\circ = -RT \ln K_p.$$

$$\text{Also, } \Delta G_r^\circ = 2 \cdot \Delta G_{\text{NO}_2}^\circ - 2 \Delta G_{\text{NO}}^\circ$$

$$(\because \Delta G_{\text{O}_2}^\circ = 0)$$

$$\text{So, } -RT \ln K_p = 2 \Delta G_{\text{NO}_2}^\circ - 2 \times 86600$$

$$\therefore 2 \Delta G_{\text{NO}_2}^\circ = 2 \times 86600 - R \times 298 \ln(K_p)$$

$$\therefore \Delta G_{\text{NO}_2}^\circ = 0.5 \left\{ 2 \times 86600 - R \times 298 \times \ln(1.6 \times 10^2) \right\}.$$