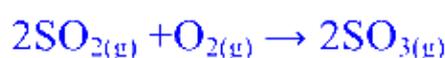
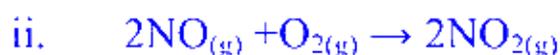


# Chemical Equilibrium

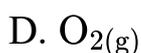
## Question1

Identify the reaction intermediate of following reaction.



## MHT CET 2023 12th May Evening Shift

Options:



**Answer: B**

**Solution:**

Intermediate should not be present in overall reaction.  $\text{NO}_{(g)}$  is the only species in the above reaction mechanism that is absent in overall reaction and hence, it is an intermediate.

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## Question2

Weak acid HX has dissociation constant  $1 \times 10^{-5}$ . Calculate the percent dissociation in its 0.1M solution.



## MHT CET 2023 10th May Evening Shift

Options:

A. 2.2%

B. 3.5%

C. 4.2%

D. 1.0%

**Answer: D**

**Solution:**

$$K_a = 1 \times 10^{-5}, c = 0.1M$$

$$K_a = \alpha^2 c$$

$$\therefore \alpha = \sqrt{\frac{K_a}{c}} = \sqrt{\frac{1 \times 10^{-5}}{0.1}} = \sqrt{1 \times 10^{-4}} = 0.01$$

$$\alpha = \frac{\text{Percent dissociation}}{100}$$

$$\text{Percent dissociation} = \alpha \times 100$$

$$= 0.01 \times 100 = 1.0\%$$

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## Question3

**What is molar concentration of weak monobasic acid if dissociation constant is  $5 \times 10^{-8}$  and undergoes 0.5% dissociation?**

## MHT CET 2021 20th September Evening Shift

Options:

A. 0.03 M

B. 0.002 M

C. 0.001 M

D. 0.005 M

**Answer: B**

**Solution:**

$$K_a = 5 \times 10^{-8}, \alpha = 0.5\% = \frac{0.5}{100} = 5 \times 10^{-3}$$

$$K_a = \alpha^2 c$$

$$\begin{aligned} \therefore c &= \frac{K_a}{\alpha^2} = \frac{5 \times 10^{-8}}{(5 \times 10^{-3})^2} = \frac{5 \times 10^{-8}}{25 \times 10^{-6}} \\ &= 0.002\text{M} \end{aligned}$$

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## Question4

**Equilibrium constant for a reaction is 20. What is the value of  $\Delta G^\circ$  at 300 K? ( $R = 8 \times 10^{-3} \text{ kJ}$ )**

**MHT CET 2020 16th October Evening Shift**

**Options:**

A.  $-7.191 \text{ kJ mol}^{-1}$

B.  $-5.527 \text{ kJ mol}^{-1}$

C.  $-2.763 \text{ kJ mol}^{-1}$

D.  $-1.663 \text{ kJ mol}^{-1}$

**Answer: A**

**Solution:**

Given:

Equilibrium constant,  $K_{\text{eq}} = 20$

Temperature,  $T = 300 \text{ K}$

Gas constant,  $R = 8 \times 10^{-3} \text{ kJ} \cdot \text{mol}^{-1} \cdot \text{K}^{-1}$

To find the standard Gibbs free energy change ( $\Delta G^\circ$ ), use the following equation:

$$\Delta G^\circ = -2.303 \times R \times T \times \log K_{\text{eq}}$$

Substituting the given values:

$$\begin{aligned}\Delta G^\circ &= -2.303 \times 8 \times 10^{-3} \times 300 \times \log 20 \\ &\text{(given } \log 20 = 1.301\text{)} \\ &= -2.303 \times 8 \times 10^{-3} \times 300 \times 1.301 \\ &= -7.191 \text{ kJ} \cdot \text{mol}^{-1}\end{aligned}$$

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