```html

## Chemical Equilibrium - Finding Equilibrium Pressure

### Given:

- Reaction: **$2\ NO(g) \leftrightarrow 2\ NO(g) + O_2(g)$**
- $K_p = 1.11 \times 10^{-5}$ at 200°C
- Volume of the vessel: 2.50 L
- Initial pressure of NO: 4.00 atm

### Objective:

To find the pressure of NO at equilibrium.

### 1. Introduction and Setup:

The balanced chemical equation for the reaction is given, and the equilibrium constant in terms of pressure ( $K_p$) is provided. The task involves determining the equilibrium pressure of NO gas when the system reaches equilibrium.

### 2. Determine Changes in Pressure:

Let $x$ be the change in the pressure of NO as the system comes to equilibrium.
The initial pressures are:
• Initial $P_{NO} = 4.00$ atm
• $P_{O_2} = 0$ atm

The changes in pressure at equilibrium will be:
• $P_{NO}$ decreases by $2x$
• $P_{O_2}$ increases by $x$

The equilibrium pressures will be:
• $P_{NO} = 4.00 - 2x$
• $P_{O_2} = x$

### 3. Express $K_p$ in Terms of Equilibrium Pressures:

The expression for $K_p$ for the equilibrium reaction:
$K_p = (P_{NO_2})^2 (P_{O_2}) / (P_{NO})^2$

Substituting the equilibrium pressures:
$K_p = x (4.00 - 2x)^2 / (4.00 - 2x)^2$

Simplify:
$K_p = x (4.00 - 2x)^2$

### 4. Solve the Equilibrium Equation:

Set up the quadratic equation:
$1.11 \times 10^{-5} = x (4.00 - 2x)^2$

### 5. Solve for $x$:

Simplify the equation carefully to avoid errors:
$1.11 \times 10^{-5} = x (16 - 16x + 4x^2)$

### 6. Calculate Equilibrium Pressure:

Once $x$ is determined, calculate the equilibrium pressure of NO:
$P_{NO} = 4.00 - 2x$

### 7. Final Solution:

The equilibrium pressure $P_{NO} = 4.00 - 2x$ atm.

```