An 8.00 L reaction vessel at 3900C is charged with 0.850 mol of nitrogen and oxygen gases. Find the concentration of NO at equilibrium.

$$N_2(g) + O_2(g) \rightleftharpoons 2NO(g) \quad K_c = 0.0123$$

$$K_c = \frac{[NO]^2}{[N_2][O_2]} = 0.0123$$

We'll start by making a chart to relate these concentrations to each other.

Species	[Initial]	Δ	[Equilibrium]
N_2	$\frac{0.850\ mol}{8.00\ L} = 0.10625$	$-x$	$0.10625 - x$
O_2	$\frac{0.850\ mol}{8.00\ L} = 0.10625$	$-x$	$0.10625 - x$
NO	0	$+2x$	$2x$

Let "x" equal the change in nitrogen gas concentration

Plug back into the equilibrium expression:

$$\frac{(2x)^2}{(0.10625-x)(0.10625-x)} = 0.0123$$

$$\frac{(2x)^2}{(0.10625-x)(0.10625-x)} = 0.0123$$

$$\frac{(2x)^2}{(0.10625-x)^2} = 0.0123$$

We could solve this problem by using the quadratic equation, but there might be a simpler way we can do it. Notice that the entire left hand side of the equation is a squared term.

Species	[Equilibrium]
N_2	$0.10625-x$
O_2	$0.10625-x$
NO	$2x$

$$\sqrt{\frac{(2x)^2}{(0.10625-x)^2}} = \sqrt{0.0123}$$

$$\frac{2x}{0.10625-x} = 0.110905365$$

$$2x = 0.110905365(0.10625-x)$$

$$2x = 0.011783695 - 0.110905365x$$

$$2.110905365x = 0.011783695$$

$$x = 0.005582294$$

$$[NO] = 2x = \boxed{0.01112\ M\ NO}$$