ASSUMPTIONS WITH EQUILIBRIUM

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Example #1

At 2000°C, K_{eq} is 6.40×10^{-7} for the decomposition of CO_2 into CO and O_2. Calculate all equilibrium concentrations if 0.250 mol of CO_2 is placed in a 1.00 L container at the given temperature.

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Example #1

$$2\ CO_{2(g)} \Leftrightarrow 2\ CO_{(g)} + O_{2(g)}$$

I

C

E

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Look at the K_{eq} (which is 0.000000640)

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Example #1

$2CO_{2(g)} \Leftrightarrow 2CO_{(g)} + O_{2(g)}$

$$K_{eq} = \frac{[CO]^2[O_2]}{[CO_2]^2}$$

$$6.40 \times 10^{-7} = \frac{[2x]^2[x]}{[0.250-2x]^2}$$

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Calculate all equilibrium concentrations if 0.250 mol of CO_2 is placed in a 1.00 L container at the given temperature.

$$2CO_{2(g)} \Leftrightarrow 2CO_{(g)} + O_{2(g)}$$

	$2CO_{2(g)}$	$2CO_{(g)}$	$O_{2(g)}$
I	0.250	0	0
C	-2x	+2x	+x
E	0.250-2x	2x	x

$x = 2.15 \times 10^{-3}$

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How do I know if I can make an assumption?

You can also divide the initial concentration by k_{eq}. If the answer is AT LEAST 100, you can use the assumption!

$0.250/6.40 \times 10^{-7} = 3.91 \times 10^{5}$, which is MUCH bigger than 100

0.247 and 0.250 are very close

The difference is 1.2%. As long as the difference is less than 5%, you can use the assumption.

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Questions involving a lot of polynomial expansion is a good indication that an assumption should be used.

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In a study of halogen bond strengths, 0.50 mol of I_2 was heated in a 2.5L vessel, and the following reaction occurred: $I_2(g) \leftrightarrow 2I(g)$

Calculate $[I_2]$ and $[I]$ at equilibrium at 600K where $K_{eq} = 2.94 \times 10^{-10}$