ICE Questions:

We can do K_{eq} questions when more than just the final concentrations are given. By examining a combination of the initial concentrations, final concentrations and/or change in concentrations, we can solve for K_{eq}

1.00 mol of colourless hydrogen gas and 1.00 mol of violet iodine vapour are sealed in a 1.00 L flask and allowed to react at 450 degrees C. At equilibrium, 1.56 mol of colourless hydrogen iodide is present, together with some of the reactant gases. Calculate K_{eq} for the reaction.

$$H_{2\,(g)} + I_{2\,(g)} \longleftrightarrow 2\,HI_{\,(g)}$$

	H_2	I_2	HI
Initial	1.00 mol/L	1.00 mol/L	0
Change	0.78 mol/L	0.78 mol/L	1.56 mol/L ← reaction dependent.
Equilibrium ~~Final~~	0.22 mol/L	0.22 mol/L	1.56 mol/L → Keq

$\frac{1.56\,mol}{2}$

$$K_{eq} = \frac{[HI]^2}{[H_2][I_2]} = \frac{[1.56]^2}{[0.22][0.22]} = 50.3$$

1.0 mol of N_2O_4 was introduced into a 1.0L flask. After equilibrium was established, only 0.80 mol of N_2O_4. Calculate K_{eq}.

$$N_2O_{4\,(g)} \longleftrightarrow 2\,NO_{2\,(g)}$$

	N_2O_4	NO_2
I	1.0 mol/L	+0
C	0.20 mol	0.40 ← 0.20 × 2
E	0.80 mol/L	0.40

depends on moles in reaction →

Keq →

$$K_{eq} = \frac{[NO_2]^2}{[N_2O_4]} = \frac{[0.40]^2}{[0.80]} = 0.20$$

A 10.0 L bulb is filled with 4.0 mol of SO_2, 2.2 mol of O_2 and 5.6 mol of SO_3. After equilibrium of the formation reaction, there was 2.6 mol of SO_2. Calculate K_{eq}.

÷10 ÷10 ÷10 ÷10

$C = \frac{n}{V}$

$$2SO_{2\,(g)} + O_{2\,(g)} \longleftrightarrow 2SO_{3\,(g)}$$

	SO_2	O_2	SO_3
I	0.40 mol/L	0.22	0.56
C	0.14	0.07	0.14
E	0.26 mol/L	0.15	0.70

depends on moles from reaction →

0.14 / 2

← Keq

$$K_{eq} = \frac{[SO_3]^2}{[SO_2]^2[O_2]} = \frac{[0.70]^2}{[0.26]^2[0.15]} = 48$$

$[0.26]^2[0.15]$

A 5.0 L vessel contained 6.0 mol of SO_2, 2.5 mol of NO_2 and 1.0 mol of SO_3. At equilibrium the vessel was found to contain 3.0 mol of SO_3. Calculate K_{eq}.

÷5.0L ÷5.0L ÷5.0L

$$SO_{2\,(g)} + NO_{2\,(g)} \longleftrightarrow SO_{3\,(g)} + NO_{\,(g)}$$

$C = \frac{n}{V}$

	SO_2	NO_2	SO_3	NO
I	1.2 mol/L	0.50 mol/L	0.20 mol/L	0
C	−0.40	−0.40	+0.40 mol/L	+0.40
E	0.80	0.10	0.60 mol/L	0.40 ← Keq

moles from rxn.

$$K_{eq} = \frac{[SO_3][NO]}{[SO_2][NO_2]} = \frac{[0.60][0.40]}{[0.80][0.10]} = 3.0$$