General Chemistry with Dr. Mattson

~~Feb 9~~ Today Wednesday 2/8 — Section 14.6–14.8

Thursday 2/9 — Lab Quiz ("take home")
Bring Laptops
Wake-up calls → tell lab partner
Expt 4 Equilibrium
Prelab

Friday 2/10 — Finish chap 14
Hmwk quiz

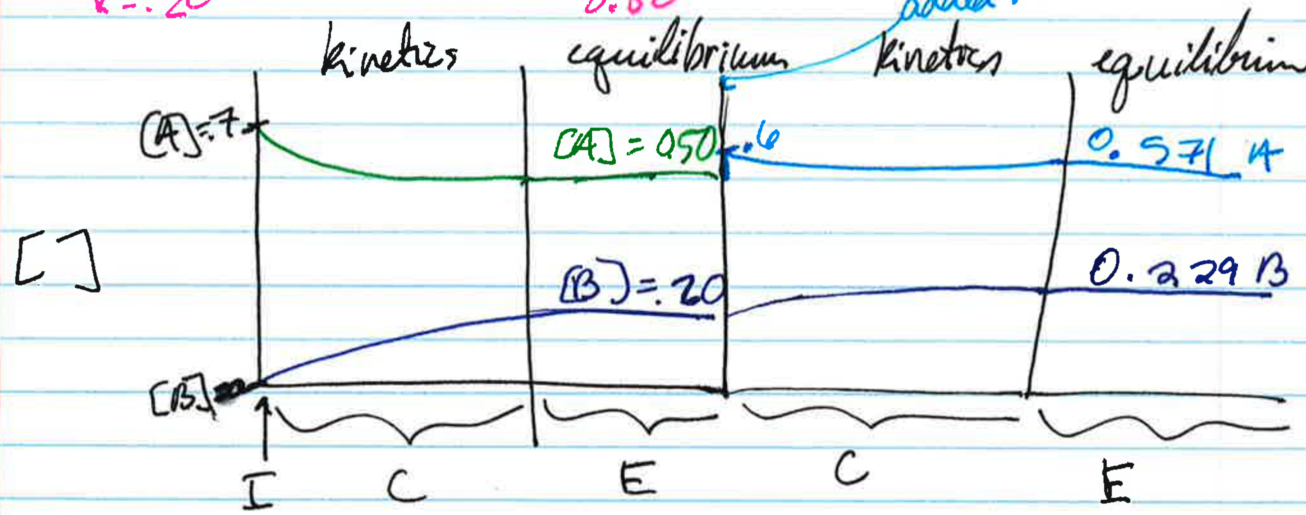
M	A	⇌	B
I	0.70		0
C	−x		+x
E	0.50		x

$\Rightarrow K_c$?

$.70 - x = .50$

$x = .20$

$K_c = \frac{0.20}{0.50} = 0.40$



$Q_c = \frac{[B]}{[A]} = \frac{.2}{.6} = .33 < .4 = K_c$

↳ so shift Right

Added 0.10 M A

I	0.60	0.20
C	−x	+x
E	.60−x	.20−x

⟹ A = 0.571 B = 0.229

$K_c = \frac{[B]}{[A]} = \frac{0.20+x}{0.60-x} = 0.4$

$x = 0.029$

Both A and B are greater than they were before adding more A

Le Chatlier's Principle

If you add or remove a component you are not at equilibrium. To get back to eq, shift in the direction that minimizes the change.

$N_{2(g)} + 3H_2 \rightleftharpoons 2NH_{3(g)}$ K_c

$PV = nRT$ $P \propto \frac{1}{V}$ $PV = \text{constant}$

$V \propto 1/P$

Eg. ~~If you half the pressure, you~~

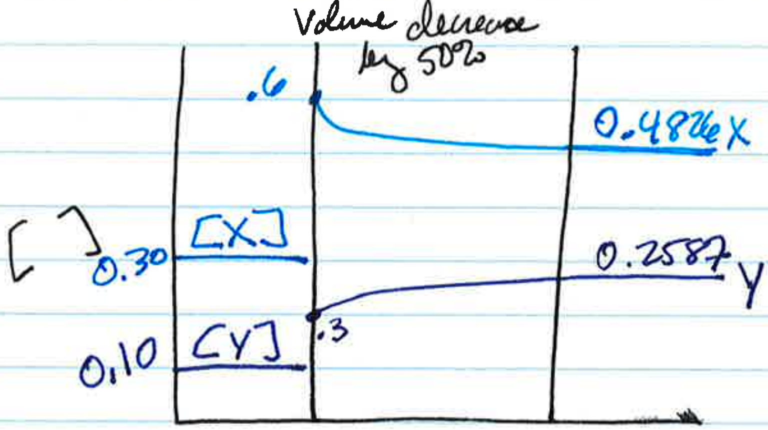
If you halve the pressure, you increase volume by 2.

$K_c = \frac{[B]}{[A]}$ ← n_B / vol

← n_A / vol

M $2X \rightleftharpoons Y$ $K_c = \frac{0.10}{0.30^2} = 1.111$

E 0.30 0.10



$K_c = 1.111$

Kc is always the same

after volume decrease

I 0.60 0.20 ⟵ $Q_c = \frac{0.20}{.60^2} = 0.56$

C −2x +x

E 0.60−x 0.20+x $Q_c < K_c$ ∴ Shift right

$K_c = 1.111 = \frac{0.20+x}{(0.60-2x)^2}$ → quadratic → $x = 0.0587$

E 0.60−2×0.0587 0.20+0.0587

0.4826 0.2587

If volume decreases, to get back to equilibrium, shift towards the side with fewest total # of moles

M $A \rightleftharpoons B$

E 0.50 0.20 increase volume by 100%

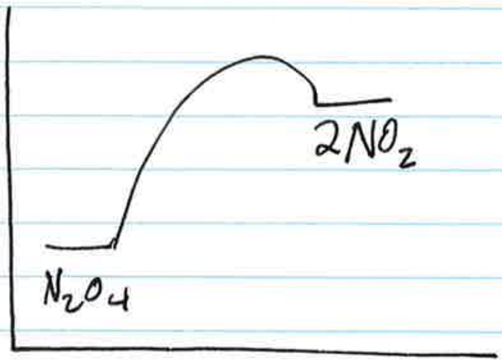
I 0.25 0.10 ⟵

C −x +x $Q_c = \frac{.10}{.25} = .4 = K_c$

E 0.25 0.10

NO change

Increasing the temperature always favors the endothermic direction. and K_c increases



$$K_c = \frac{[NO_2]^2}{[N_2O_4]}$$

$N_2O_4 \rightleftharpoons 2\ NO_2$ $\Delta H = +58\ kJ$

colorless Red brown

temp increase