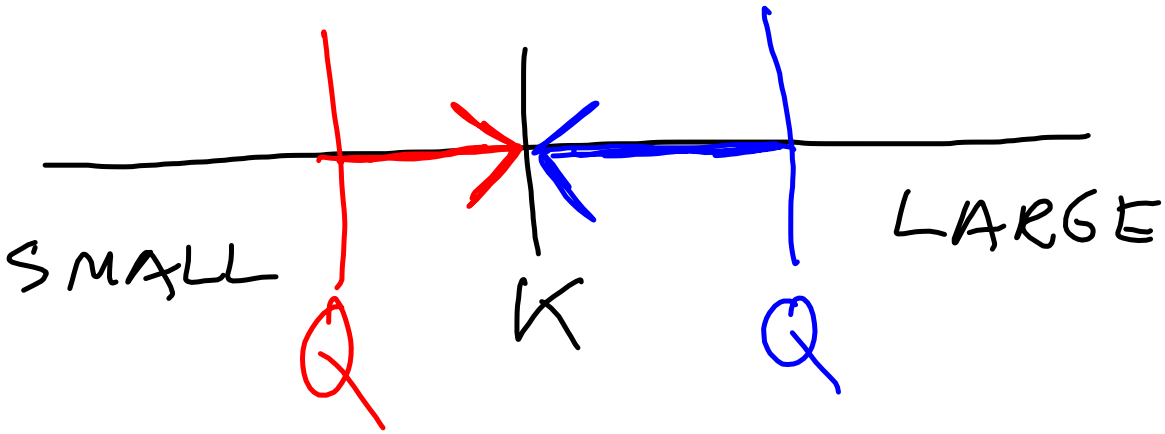
$Q > K$ left

$K < Q$

$Q < K$ right

$K > Q$



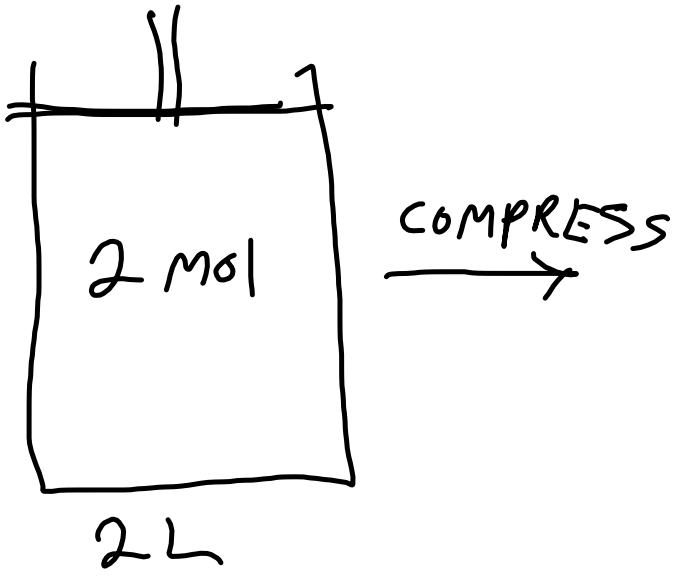
$$a\,A(s) + b\,B(aq) \rightleftarrows c\,C(g) + d\,D(\ell)$$

$$K_c' = \frac{[C]_{eq}^{c}\,[D]_{eq}^{d}}{[A]_{eq}^{a}\,[B]_{eq}^{b}}$$

$$\frac{[A]_{eq}^{a}}{[D]_{eq}^{d}} \cdot K_c' = \frac{[C]_{eq}^{c}\,\cancel{[D]_{eq}^{d}}}{\cancel{[A]_{eq}^{a}}\,[B]_{eq}^{b}} \cdot \frac{\cancel{[A]_{eq}^{a}}}{\cancel{[D]_{eq}^{d}}}$$

$$\downarrow$$

$$K_c = \frac{[C]_{eq}^{c}}{[B]_{eq}^{b}}$$



$$[gas] = \frac{2\,mol}{2L} = 1\,\frac{mol}{L}$$

$$[gas] = \frac{2\,mol}{1L} = 2\,\frac{mol}{L}$$

$$1.00 \frac{\cancel{g}}{\cancel{mL}} \left(\frac{1000 \cancel{mL}}{1 L} \right) \left(\frac{1 \text{ mol}}{18.016 \cancel{g}} \right)$$

$$= 55.5 \frac{\text{mol}}{L}$$

$$2A(g) \rightleftarrows B(g) + C(g)$$

$[A] = 1.00 \quad [B] = 0.50 \quad [C] = 0.50$

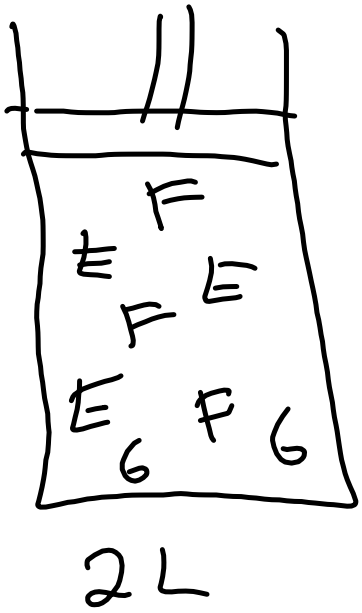
$$K_C = \frac{[B]_e[C]_e}{[A]_e^2} = 1.0$$

$$Q_C = \frac{[B][C]}{[A]} = \frac{(0.50)(0.50)}{(1.00)^2}$$

$$= 0.25$$

	[A]	[B]	[C]
I	1.00	0.50	0.50
C	$-2X$	$+X$	$+X$
E	$1.00-2X$	$0.50+X$	$0.50+X$

$$K_c = \frac{[B]_{eq}[C]_{eq}}{[A]_{eq}^2} = \frac{(0.50+x)(0.50+x)}{(1.00-2x)^2} = 1.0$$



2 L

$$E(g) + F(g) \rightleftarrows G(g)$$

$[E]_e = 0.75\ M \quad [F]_e = 0.25\ M$

$[G]_e = 0.50\ M$

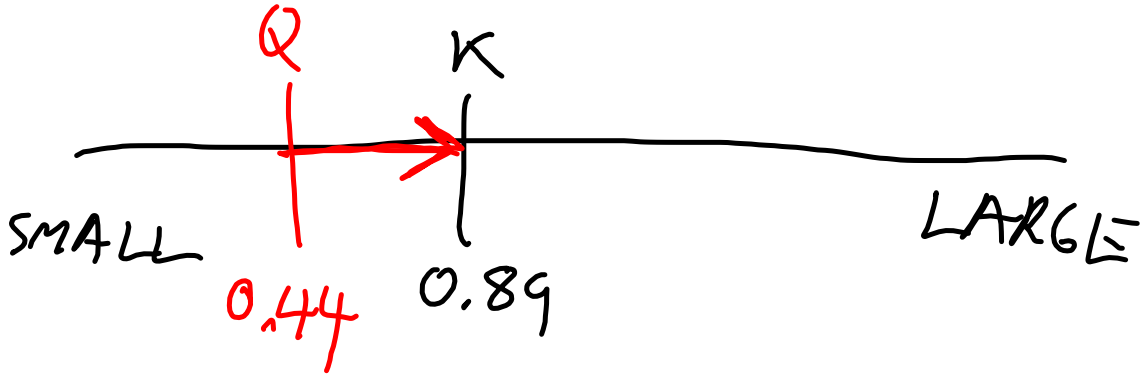
$$K_c = \frac{[G]_e}{[E]_e[F]_e}$$

$$= \frac{(0.50)}{(0.75)(0.75)}$$

$$= 0.89$$

$$Q_c = \frac{[G]}{[E][F]} = \frac{(1.00)}{(1.50)(1.50)}$$

$$= 0.44$$



ACID / BASE EQUILIBRIA

An ACID is a substance that produces H_3O^+ ions when dissolved in H_2O (Arrhenius)

A ACID is a proton donor (Bronsted/Lowry)

A BASE is a substance that produces OH^- ions when dissolved in H_2O (Arrhenius)

A BASE is a proton acceptor (Bronsted/Lowry)

$$HCl(aq) + H_2O(l) \xrightarrow{100\%} H_3O^+(aq) + Cl^-(aq)$$

STRONG ACID

$$HC_2H_3O_2(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + C_2H_3O_2^-(aq)$$

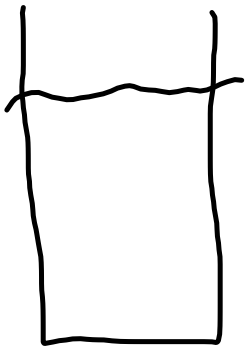
weak acid

$$NaOH(s) \xrightarrow[100\%]{H_2O} Na^+(aq) + OH^-(aq)$$

STRONG BASE

$$NH_3(aq) + H_2O(l) \rightleftharpoons NH_4^+(aq) + OH^-(aq)$$

weak base



H_2O

$$2H_2O(\ell) \rightleftarrows H_3O^+(aq) + OH^-(aq)$$

	H_3O^+	OH^-
I	0	0
C	$+x$	$+x$
E	x	x

$$K_w = [H_3O^+]_e [OH^-]_e$$

$$= (x) \cdot (x) = x^2$$

1.0×10^{-14} at 25°C

$$x^2 = 1.0 \times 10^{-14}$$

$$x = 1.0 \times 10^{-7}$$

$$x = [H_3O^+]_e = [OH^-]_e = 0.0000001,$$

$$pH = -\log[H_3O^+]$$

$$pOH = -\log[OH^-]$$

$$p\text{anything} = -\log(\text{anything})$$

$$K_w = [H_3O^+][OH^-]$$

$$\log K_w = \log([H_3O^+][OH^-])$$

$$\log K_w = \log[H_3O^+] + \log[OH^-]$$

$$-\log K_w = -\log[H_3O^+] + (-\log[OH^-])$$

$$pK_w = pH + pOH$$

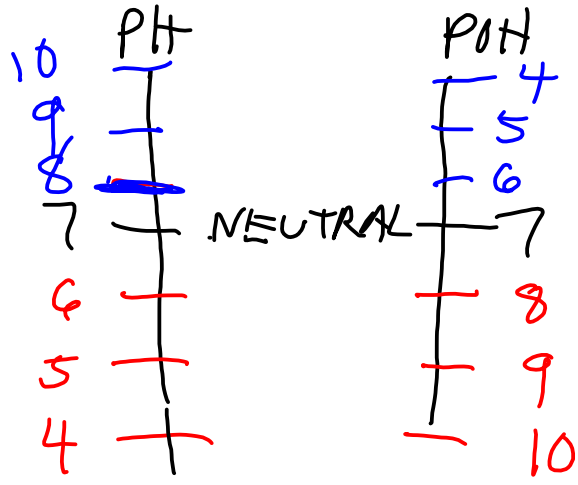
$25^\circ C \quad K_w = 1.0 \times 10^{-14}$

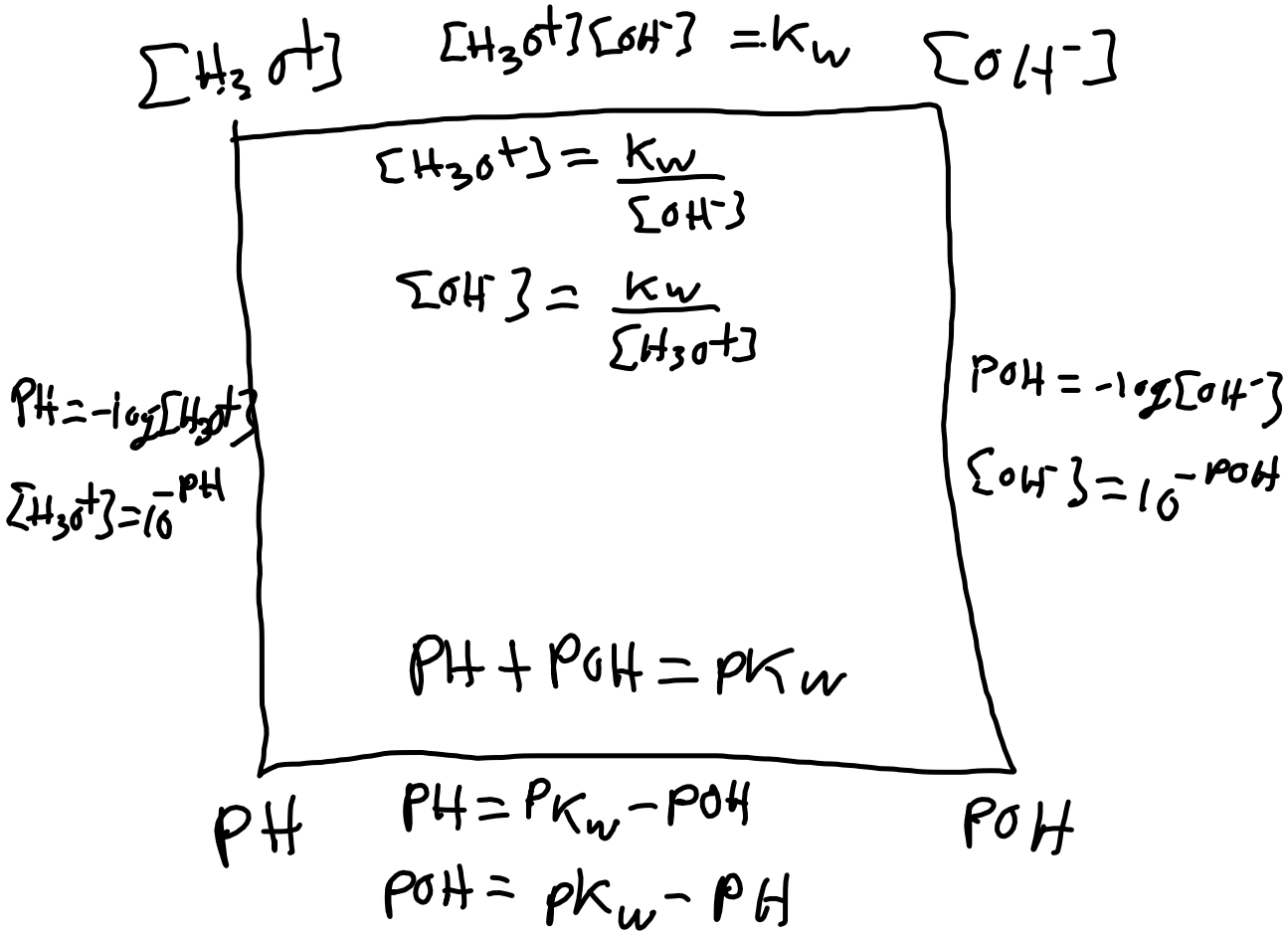
$25^\circ C \quad pK_w = -\log K_w = -\log(1.0 \times 10^{-14})$

$$= -(-14.00)$$

$$= +14.00$$

$25^\circ C \quad pH + pOH = 14.00$




[H3O+]
[H3O+][OH-] = Kw
[OH-]
[H3O+] = Kw / [OH-]
[OH-] = Kw / [H3O+]
pH = -log[H3O+]
[H3O+] = 10^-pH
pOH = -log[OH-]
[OH-] = 10^-pOH
pH + pOH = pKw
pH
pH = pKw - pOH
pOH = pKw - pH
pOH