The following reaction is at equilibrium: ← EXOTHERMIC

$C(s) + 2Cl_2(g) \leftrightarrow CCl_4(g) + energy$

The reaction will shift NO WHERE when I add C (s) b/c solid doesn't affect equilibrium.

The reaction will shift LEFT when I increase the temperature

- Add Cl_2 → right
- Remove CCl_4 → right
- decrease Volume → right
- decrease pressure ← left (same as ↑V)

Add inert gas (doesn't act in rxn)

↓ constant Volume
[container is same size; more gas doesn't change partial pressure]

↓ constant pressure
[must allow increase in volume; shift to side w/ more gas molecules]

WORKSHEET

PART ONE

① $K = \frac{[CH_3COO^-][H_3O^+]}{[CH_3COOH]}$

$H_2O(l)$ has mass action expression of one

K_a = acid K_{sp} = sparingly soluble salt

② $K = 1.8 \times 10^{-5}$

$K > 1$: products
$K < 1$: reactants

Favors Reactants

③ $\Delta G = -RT \ln K$

always + in K

$\ln(1.8 \times 10^{-5}) = -$

$- \cdot - = +$

$\Delta G > 0$

④ 0.2M concentration of CH_3COOH expect to have a higher concentration of CH_3COOH at equilibrium b/c it's reactant favored

⑤ $K_a = 1.85E{-}5 = \frac{[x][x]}{.2} = 1.85 \times 10^{-5} = \frac{x^2}{.2}$

$x = .00189$

concentration of product

*safe to ignore x and approximate answer when $K \leq 1 \times 10^{-3}$ (part 1)

continuation of part one

- increase H_3O^+, the concentration of CH_3COOH will INCREASE
- increase CH_3COO, it will DECREASE

- strong bases disassociate to form a cation and the Hydroxide ion (capable of accepting a proton)
- weak acids do not completely disassociate

	$HCl\ (aq)$	+ $H_2O\ (l)$	⟶ $Cl^-\ (aq)$	+ $H_3O^+\ (aq)$
R				
I	0.2 M		∅	∅
C	$-x\ (0.2)$		$+x$	$+x$
E	~~$0.2-x$~~ ∅ (ionizes completely)		x	x

①What is the assumed concentration of HCl in a 0.2 M aq solution of HCl at equilibrium? → HCl ionizes completely to H^+, Cl^- and has a 0.2 M concentration

↕ switch answers

Hydronium ion concentration? assumed concentration is 0; $K \sim \infty$ assumes 100% products

- whenever you have a strong acid or base, we assume it ionizes 100%

Brain Dumb: Acids & Bases

- acids have pH from 1-7
- bases have pH from 8-14
- acids = H^+; proton donor
- base = OH^-; proton acceptor
- bases are bitter; acids are sour
- mix together to form water + salt (neutralization)

According to Brønsted Lowry
- acid is PROTON DONOR
- base is a PROTON ACCEPTOR

$\overset{\text{acid}}{CH_3COOH\,(aq)} + \overset{\text{base}}{H_2O\,(l)} \leftrightarrow \overset{\text{conj. base}}{CH_3COO^-\,(aq)} + \overset{\text{conj. acid}}{H_3O^+\,(aq)}$

$\overset{\text{acid}}{HCl\,(aq)} + \overset{\text{base}}{H_2O\,(l)} \longrightarrow Cl^-\,(aq) + H_3O^+\,(aq)$

$\overset{\text{base}}{NH_3\,(aq)} + \overset{\text{acid}}{H_2O\,(l)} \longleftrightarrow NH_4^+ + OH^-$

$\overset{\text{base}}{CH_3COO^-} + \overset{\text{acid}}{H_2O} \longleftrightarrow CH_3COOH + OH^-$