

02/27/02

➤ **Exam #2:** *2 weeks from today!*

- Exam #2 info page now online
- Old Exam #2 questions coming later today

➤ **Chapter 16:** assigned problems now online

➤ **Premed?**

➤ Demo today . . . Quiz on Friday

1

Effect of Adding an Inert Gas

- Suppose we add some *Argon* to a system at equilibrium . . . Will that change the position of equilibrium?
- **The Simple Answer: *No!***
 - ✓ The partial pressures of the reactants and products are not affected ($Q = K$)
- **The Real Answer: *It Depends!***
 - ✓ Constant Volume or Constant Pressure?

2

Added Inert Gas: *Constant Volume*

- If *volume* is unchanged upon addition of gas, then P_{total} must *increase*:

Before: $P_{\text{total}} = P_{\text{reactants}} + P_{\text{products}}$

After: $P_{\text{total}} = P_{\text{reactants}} + P_{\text{products}} + P_{\text{gas}}$

- Partial Pressures of reactants and products are unchanged:

No Shift

3

Added Inert Gas: *Constant Pressure*

- If *pressure* is unchanged upon addition of gas, then ***volume*** must increase.

Before: $P_{\text{total}} = P_{\text{reactants}} + P_{\text{products}}$

After: $P_{\text{total}} = P_{\text{reactants}} + P_{\text{products}} + P_{\text{gas}}$

BUT: P_{total} (before) = P_{total} (after)

- Partial pressures of reactants and products must *decrease* in order to keep total pressure constant

Reaction Can Shift

4

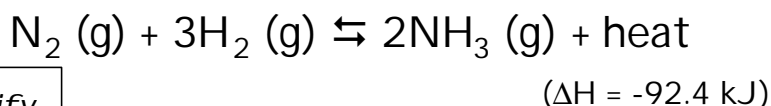
Effect of Temperature

➤ Treat *heat* as a:

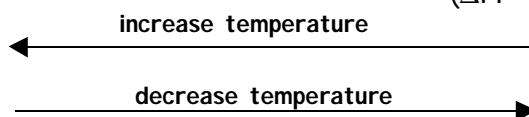
Product (for exothermic process)

Reactant (for endothermic process)

Example:



Quantify
using van't
Hoff
equation!

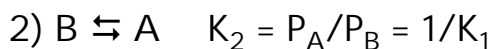


5

Manipulating K's and Equilibria

➤ What happens to K when we
add/subtract/reverse equilibria?

Reverse Reaction:

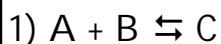


✓ Reverse Reaction
= **INVERSE of K**

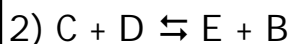
6

Adding Equilibria

Let's add these two reactions:



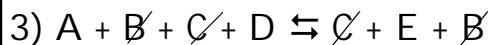
$$K_1 = \frac{P_C}{P_A P_B}$$



$$K_2 = \frac{P_E P_B}{P_C P_D}$$

✓ Add Rxns =
Multiply K's

✓ Subtract Rxns
= Divide K's



$$K_3 = K_1 K_2 = \frac{P_C P_E P_B}{P_A P_B P_C P_D} = \frac{P_E}{P_A P_D}$$

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K_p versus K_c

➤ What if gas amounts are expressed as **concentrations (mol/L)**?

- K_p = thermodynamic K (atm)
- K_c = *concentration* -based equilib constant

Ideal Gas Law: $P = (n/V)RT$

It can be shown that:

$$K_p = K_c (RT)^{\Delta n}$$

Change in #mol gas

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