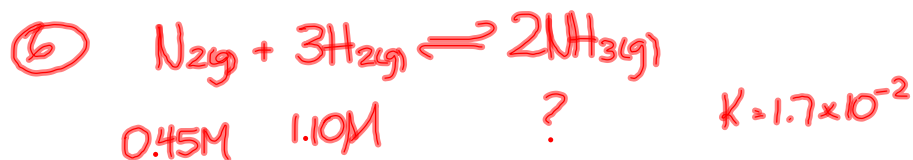


$$K = \frac{[\text{H}_{2(g)}][\text{I}_{2(g)}]}{[\text{HI}_{(g)}]^2}$$

$$K = \frac{[7.5 \times 10^{-3}][4.3 \times 10^{-5}]}{[4.0 \times 10^{-3}]^2}$$

$$K = 0.020$$



$$K = \frac{[\text{NH}_{3(g)}]^2}{[\text{N}_{2(g)}][\text{H}_{2(g)}]^3}$$

$$[\text{NH}_{3(g)}] = \sqrt{K[\text{N}_{2(g)}][\text{H}_{2(g)}]^3}$$

$$[\text{NH}_{3(g)}] = \sqrt{(1.7 \times 10^{-2})(0.45)[1.10]^3}$$

$$[\text{NH}_{3(g)}] = 0.10 \text{M}$$

## Change in Equilibrium Conditions

A complete description of an equilibrium state of a system must indicate temperature, pressure, composition and concentrations of all entities.

(A percent reaction or equilibrium constant may be part of the the description.)

\*There are as many states of equilibrium of a chemical system as there are combinations of properties.\*

### Le Chatelier's Principle

If a stress is applied to a system in dynamic equilibrium, the system changes in a way that relieves the stress, to re-achieve equilibrium.

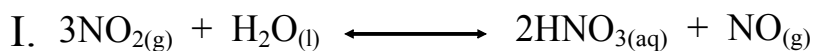
- is a method of predicting in which direction an equilibrium will shift if the factors describing an equilibrium state (temperature, pressure, concentration) are changed.

- is useful in order to choose conditions which maximize the production of the desired product.

\***catalysts** speed up the time to reach equilibrium but do not affect the final position of an equilibrium\*

**Summary p. 492: Variables Affecting Chemical Equilibria**

## Concentration



$\Rightarrow$  remove  $\text{NO}_{(g)}$

shift right

$\Rightarrow$  add  $\text{NO}_{2(g)}$

shift right



## Temperature

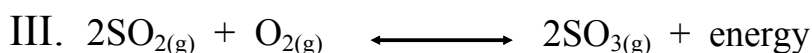


$\Rightarrow$  heat system

shift right

(increase T)

\*think of energy as an entity in the equation



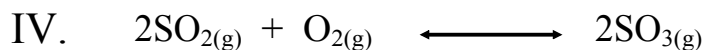
$\Rightarrow$  cool system (low T)  $\longrightarrow$

$\Rightarrow$  heat system  $\longleftarrow$

$$pV = nRT \quad p = \frac{nRT}{V}$$

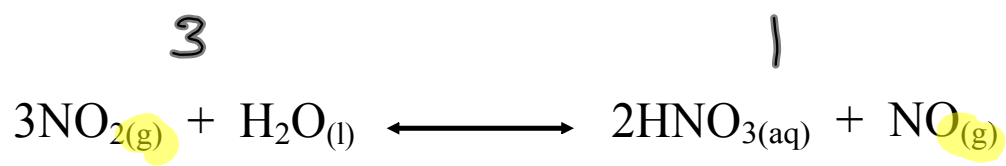
## Pressure / Volume

$\Rightarrow$  look at gaseous entities



$\Rightarrow$  decrease volume (increase pressure)  $\longrightarrow$

$\Rightarrow$  increase volume (decrease pressure)  $\longleftarrow$



increase volume  
(decrease pressure)



Exercise #6 p. 555

Worksheet