

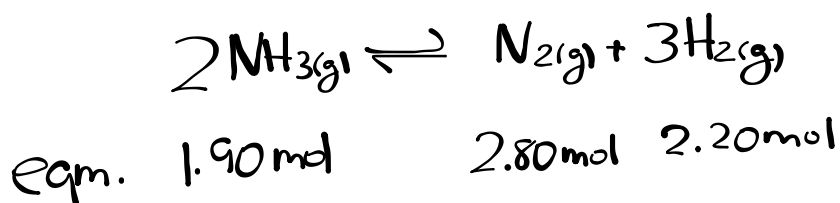
# Warm Up

Ammonia gas ( $\text{NH}_3$ ) decomposes into nitrogen and hydrogen gases in a 3.00 L reaction vessel, creating an equilibrium. Determine the equilibrium constant if there are 1.90 mol of  $\text{NH}_3$ , 2.80 mol of  $\text{N}_2$ , and 2.20 mol of  $\text{H}_2$  present at equilibrium. Is the reaction products-favoured or reactants-favoured?

$$T = 448^\circ\text{C}$$

$$P =$$

$$V = 3.00\text{ L}$$



$$C = \frac{n}{V}$$

0.633 mol/L      0.933 mol/L    0.733 mol/L

$$K = \frac{[\text{N}_2(\text{g})][\text{H}_2(\text{g})]^3}{[\text{NH}_3(\text{g})]^2}$$

$$K = \frac{[0.933][0.733]^3}{[0.633]^2}$$

$$K = 0.917$$

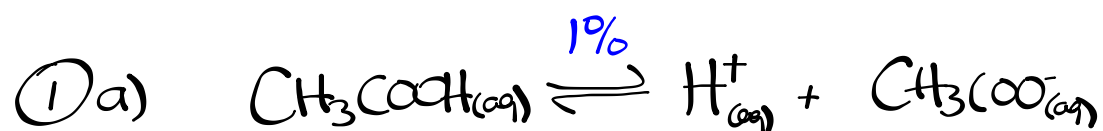
REACTANTS - FAVOURED

## Eqm Law Worksheet



- Ⓐ  $8.5 \times 10^{-17}$    Ⓑ  $1.7 \times 10^{-1}$    Ⓒ  $1.0 \times 10^0$    Ⓓ  $2.0 \times 10^4$

## Eqm Law Worksheet



SAMPLE DOUBLE REPLACEMENT (b) & (c)



## 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

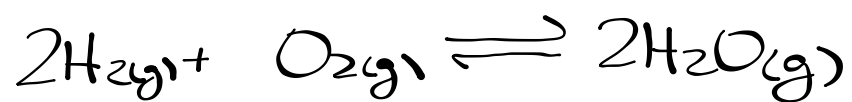
If a stress is applied to a system in dynamic equilibrium, the system changes in a way that **relieves the stress**, to **re-achieve equilibrium**.

- 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**

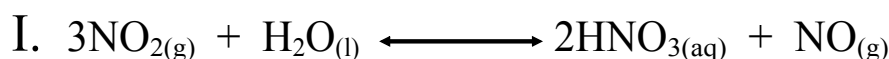


equilibrium

equal rates

Conc. constant

## Concentration



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

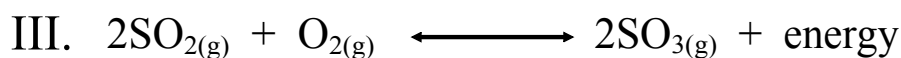
$\Rightarrow$  add  $\text{HNO}_{3(\text{aq})}$       shift left

## Temperature



$\Rightarrow$  heat system

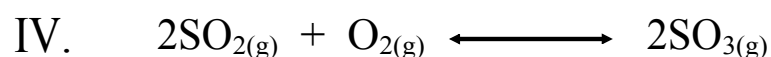
\*think of energy as an entity in the equation



$\Rightarrow$  cool system (low T)

## Pressure / Volume

$\Rightarrow$  look at gaseous entities



$\Rightarrow$  decrease volume (increase pressure)

$\Rightarrow$  increase volume (decrease pressure)