

Chemistry 12  
**Equilibrium V**

Name:  
 Date:  
 Block:

1. ICE Tables (cont'd)
2. Trial  $K_{eq}$

**ICE Tables**

**Determining Initial Concentrations from  $K_{eq}$  and the Equilibrium Concentrations**

**(1)** Some  $\text{CH}_3\text{OH}$  was injected into a flask where it established equilibrium with a  $[\text{CO}] = 0.15\text{M}$ . What was the initial concentration of  $\text{CH}_3\text{OH}$ ?



	___ $\text{CH}_3\text{OH}_{(g)}$	$\rightleftharpoons$	___ $\text{H}_2(g)$	+	___ $\text{CO}_{(g)}$
<b>I</b>					
<b>C</b>					
<b>E</b>					

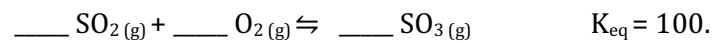
**(2)**  $\text{NiS}$  reacted with  $\text{O}_2$  in a 2.0L flask. When equilibrium was achieved, 0.36 mol of  $\text{SO}_2$  were found in the flask. What was the original  $[\text{O}_2]$  in the flask?  $K_{eq} = 0.30$

	___ $\text{NiS}_{(s)}$	+	___ $\text{O}_2(g)$	$\rightleftharpoons$	___ $\text{SO}_2(g)$	+	___ $\text{NiO}_{(s)}$
<b>Initial</b>							
<b>Change</b>							
<b>Equilibrium</b>							

**(3)** Some HI is pumped into a flask. At equilibrium, the  $[HI] = 0.60 \text{ mol/L}$ . What is the initial  $[HI]$ ?



**(4)** Some  $SO_2$  and  $O_2$  are injected into a flask. At equilibrium, the  $[SO_2] = 0.050M$  and the  $[O_2] = 0.040 M$ . What was the initial  $[O_2]$ ?



## Trial $K_{eq}$

With any given values of the concentration of product or reactant, a trial  $K_{eq}$  can be found. From this value, it can be predicted whether the reaction will proceed to the left or right to reach equilibrium.

Trial  $K_{eq}$  is also called the reaction quotient,  $Q$ .

$$\text{Trial } K_{eq} = \frac{[\text{products}]}{[\text{reactants}]} @ \text{ any time}$$

Remember...

The [reactants] and [products] will shift in order to reach equilibrium.

### Comparing trial $K_{eq}$ and actual $K_{eq}$ ...

#### 1. If trial $K_{eq}$ is greater than actual $K_{eq}$ ...

$$\text{Trial } K_{eq} = \frac{[\text{products}]}{[\text{reactants}]}$$

$$K_{eq} = \frac{[\text{products}]}{[\text{reactants}]}$$

- More \_\_\_\_\_ will need to be formed.
- The reaction will shift \_\_\_\_\_.

#### 2. If trial $K_{eq}$ is less than actual $K_{eq}$ ...

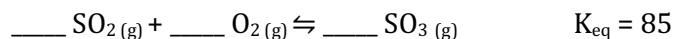
$$\text{Trial } K_{eq} = \frac{[\text{products}]}{[\text{reactants}]}$$

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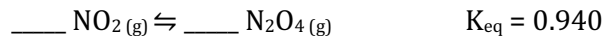
- More \_\_\_\_\_ will need to be formed.
- The reaction will shift \_\_\_\_\_.

#### Example:

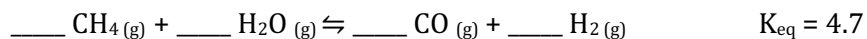
**(1)** The following gases are introduced into a closed flask: 0.057M  $\text{SO}_2$ , 0.057M  $\text{O}_2$  and 0.12M  $\text{SO}_3$ . In which direction will the reaction proceed to establish equilibrium?



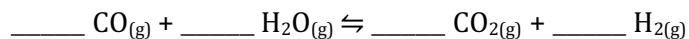
**(2)** The following gases are introduced into a closed 1.50 L flask: 1.5 mol of NO<sub>2</sub> and 4.0 mol N<sub>2</sub>O<sub>4</sub>. In which direction will the reaction proceed to achieve equilibrium?



**(3)** A mixture contains 0.025M CH<sub>4</sub>, 0.045M H<sub>2</sub>O, 0.10M CO and 0.30M H<sub>2</sub>. In which direction will the reaction proceed to reach equilibrium?



**(4)** At a certain temperature the reaction:



has a  $K_{\text{eq}} = 0.400$ . Exactly 1.00 mol of each gas was placed in a 100. L vessel and the mixture was allowed to react. Find the equilibrium concentration of each gas.