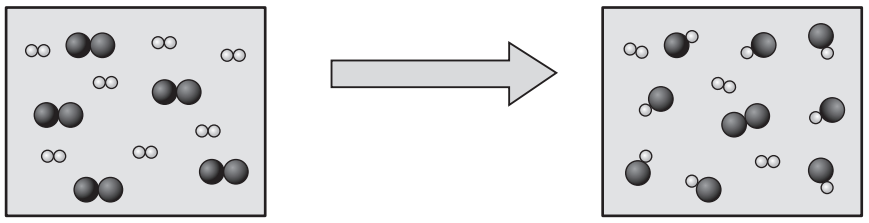
# CALCULATING THE EQUILIBRIUM CONSTANT FOR A REACTION

NAME _____ SECTION _____

1. Below are listed three reactions. Associated with each reaction is a 1.0 L container with a particulate level representation of the reaction before the reaction has occurred. To the right is the 1.0 L container with a particulate level representation of the reaction after attaining equilibrium. In each case indicate whether you think the equilibrium constant for the reaction is greater than 1, less than 1, or equal to 1. In each case support your answer with a brief explanation.

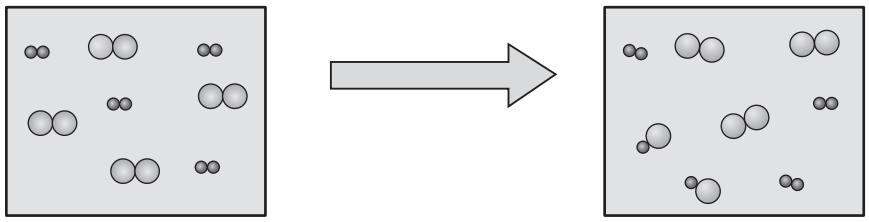
   a. Reaction I : $A_2(g) + B_2(g) \rightleftharpoons 2AB(g)$ (where  is $A_2$ and  is $B_2$)



**Container Before Reaction Started** **Container After Reaction Achieves Equilibrium**

   Is the equilibrium constant for the reaction greater than 1, less than 1, or equal to 1? Explain.

b. Reaction II : $C_2(g) + D_2(g) \rightleftharpoons 2CD(g)$ (where  is $C_2$ and  is $D_2$)

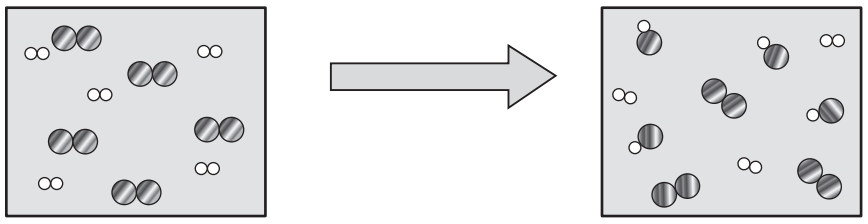


**Container Before Reaction Started**

**Container After Reaction Achieves Equilibrium**

Is the equilibrium constant for the reaction greater than 1, less than 1, or equal to 1? Explain.

c. Reaction III : $X_2(g) + Y_2(g) \rightleftharpoons 2XY(g)$ (where  is $C_2$ and  is $D_2$)

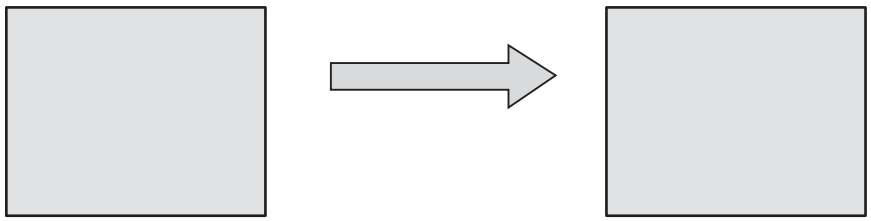


**Container Before Reaction Started**

**Container After Reaction Achieves Equilibrium**

Is the equilibrium constant for the reaction greater than 1, less than 1, or equal to 1? Explain.

d. If any of the cases (K > 1, K < 1, or K = 1) did not appear in the three examples above, use the space below to draw the before container, and the equilibrium container for the missing case.



**Container Before Reaction Started**

**Container After Reaction Achieves Equilibrium**

Explain how your model properly represents the particular case.

2. The following reaction is at equilibrium at a particular temperature

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$

and the $[H_2]_{eq}$ = 0.012 M, $[I_2]_{eq}$ = 0.15 M, and $[HI]_{eq}$ = 0.30 M. Calculate the magnitude of $K_c$ for the reaction.

3. Using the equilibrium constant calculated in 2, calculate the magnitude of the equilibrium constant for the following reactions at the same temperature.

   a. $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$

   b. $\frac{1}{2}H_2(g) + \frac{1}{2}I_2(g) \rightleftharpoons HI(g)$

4. The initial concentration of both $H_2$ and $I_2$ is 0.250 M. The reaction occurs as shown below,

   $$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$

   When equilibrium is achieved the concentration of HI is 0.390 M. Calculate the magnitude of $K_c$ for the reaction.

5. A vessel initially has a partial pressure of NO equal to 0.526 atm and a partial pressure of $Br_2$ equal to 0.329 atm. At equilibrium the partial pressure of $Br_2$ is 0.203 atm. Calculate $K_p$ for the reaction

   $$2NO(g) + Br_2(g) \rightleftharpoons 2NOBr(g)$$