ACA Part 2 for Extent of a Chemical Reaction

Name(s) with Lab section in Group

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Calculating the Equilibrium Constant for a Reaction

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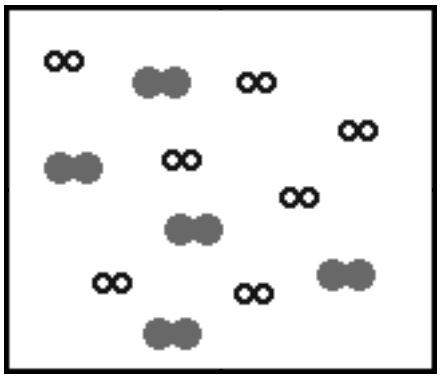
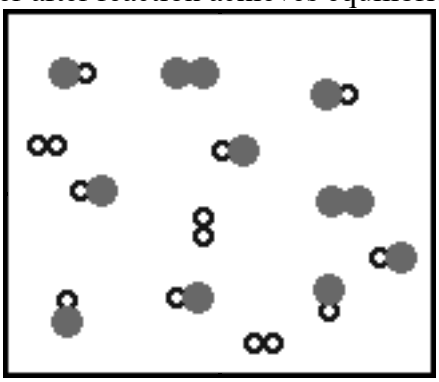
1. Below are listed three reactions. Associated with each reaction is a 1.0 L container with a particulate level representation of the reaction before the reaction has occurred. To the right is the 1.0 L container with a particulate level representation of the reaction after attaining equilibrium. In 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



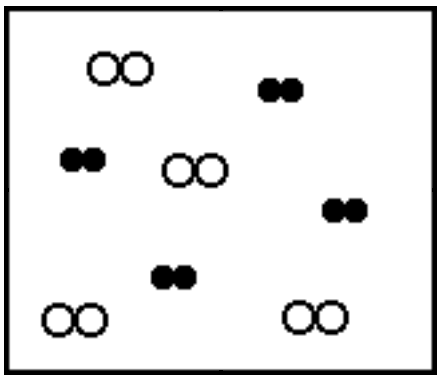
Container after reaction achieves equilibrium



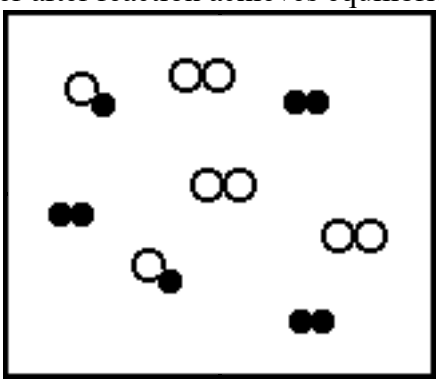
Is the equilibrium constant for the reaction greater than 1, less than 1 or equal to 1? Explain.

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

Container before reaction started



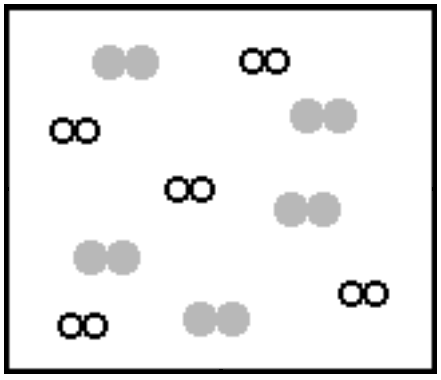
Container after reaction achieves equilibrium



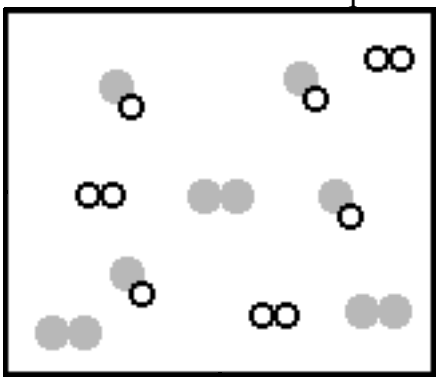
Is the equilibrium constant for the reaction greater than 1, less than 1 or equal to 1? Explain.

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

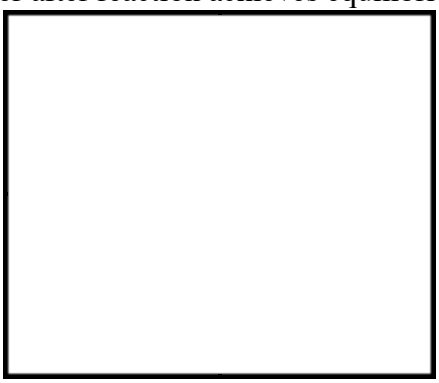


Is the equilibrium constant for the reaction greater than 1, less than 1 or equal to 1? Explain.

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 b, calculate the magnitude of the equilibrium constant for the following reactions at the same temperature.

   i) $2HI_{(g)} \rightleftharpoons H_{2(g)} + I_{2(g)}$

   ii) $\frac{1}{2} H_{2(g)} + \frac{1}{2} I_{2(g)} \rightleftharpoons HI_{(g)}$

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 0.393 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

   $$2NO_{(g)} + Br_{2(g)} \rightleftharpoons 2NOBr_{(g)}$$