CONCEPT: LE CHATELIER'S PRINCIPLE

Earlier you learned that _____ studied the rate at which our reactants changed into products.

In this chapter you will learn that _____ deals with the direction that a chemical reaction at equilibrium will shift.

_____ Principle states that once a system that is at equilibrium is disturbed it will do whatever it can to get back to equilibrium.

EXAMPLE: For the following endothermic reaction $K_c = 6.73 \times 10^3$. Predict in which direction the reaction will proceed.

$$4\ NH_3\ (g)\ +\ 3\ O_2\ (g) \rightleftharpoons 2\ N_2\ (g)\ +\ 6\ H_2O\ (g)$$

a) Addition of a catalyst

b) Decreasing the volume

c) Removing H_2O (g)

d) Increasing the Temperature

e) Addition of NH_3 (g)

f) Decreasing the pressure

g) Removing H_2O (l)

h) Addition of a precipitate

i) The addition of an inert gas at constant volume.

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PRACTICE: Consider the reaction below:

$$CH_4\,(g) + F_2\,(g) \rightleftharpoons CF_4\,(g) + HF\,(g) \quad \Delta H = +38.1\ KJ/mol$$

The following changes will shift the equilibrium to the **left** except one. Which one would not cause a shift to the **left**?

a) Add some CF_4.

b) Remove some F_2.

c) Decrease the Temperature.

d) Decrease the container volume.

e) Increase the partial pressure of HF.

PRACTICE: The following data was collected for the following reaction at equilibrium:

$$2\,A\,(g) + 3\,B\,(g) \rightleftharpoons C\,(g)$$

At 25°C, K is 5.2×10^{-4} and at 50°C K is 1.7×10^{-7}. Which of the following statements is true?

a) The reaction is exothermic

b) The reaction is endothermic

c) The enthalpy change, ΔH, is equal to zero

d) Not enough information is given

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PRACTICE: Which direction will the following reaction (in a 10.0 L flask) proceed if a catalyst is added to the system?

$$CaCO_3\,(s) \rightleftharpoons CaO\,(s) + CO_2\,(g) \qquad K_p = 3.2 \times 10^{-28}$$

a) To the right.

b) To the left.

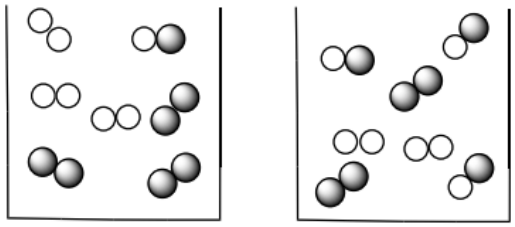
c) The equilibrium position will not change but the rate will increase.

d) The equilibrium position will not change but the concentrations of everything will increase.

PRACTICE: Consider the following gas reaction of A_2 (shaded spheres) and B_2 (unshaded spheres)

$$A2\,(g) + B2\,(g) \rightleftharpoons 2\,AB\,(g)$$

Which container proceeds more to completion?



A B