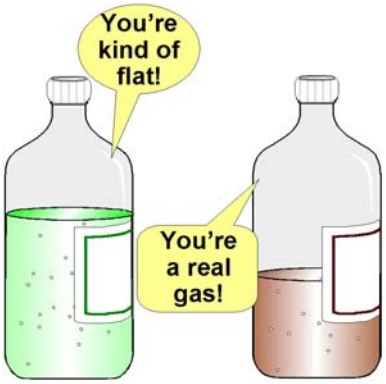
Are All Equilibria Created Equal?

Two bottles of soda are sitting in the refrigerator. One is almost full. The other is almost empty. Slowly, the sodas are going flat. This is because the dissolved carbon dioxide is coming out of solution and going into the air space above. Of course, if you keep the bottle closed tightly, the soda doesn't go flat as fast. If the gas can't escape, it soon reaches equilibrium with the solution below. But are all equilibria the same? Does the almost empty bottle retain as much carbonation as the almost full bottle? The soda with the larger air space has more room for the carbon dioxide gas to spread out. As a result the gas particles are under lower pressure and have a lower concentration. This makes it easier for them to come out of solution. When the almost empty bottle reaches equilibrium, it will have more carbon dioxide in the space above the liquid and less carbon dioxide dissolved than the almost full bottle has. It will be flat.

Equilibrium doesn't mean equal amounts of reactants and products. It means the reactants are turning into products at the same rate that the products are turning back to reactants. Many factors influence equilibrium. These include temperature, pressure, and concentration.



When sodas discuss solution equilibrium

Answer the questions below based on the reading above, and on your knowledge of chemistry.

1. A reversible reaction is at equilibrium. The forward reaction is exothermic.
   a. Is the reverse reaction exothermic or endothermic? _____
   b. Which has the higher activation energy, the forward reaction or the reverse? _____
   c. What affect does raising the temperature have on the speed of reaction for the forward reaction? Why? _
      _____
   d. What affect does raising the temperature have on the speed of reaction for the reverse reaction? Why? _
      _____
   e. Will the rate of the forward reaction and the reverse reaction be affected to the same extent by an increase in temperature? Explain. _____
      _____
      _____
      _____

Continue ☞

2. A reversible reaction is at equilibrium. More reactant is added.
   a. Will the reaction remain at equilibrium after adding more reactant? Explain. _____
   b. What happens to the probability of effective collisions on the reactant side when more reactant is added? _____
   c. If a new equilibrium is reached how will the amount of reactant and product compare to the amounts in the old equilibrium. Explain. _____
   d. In what direction does equilibrium shift when more reactants are added? _____
   e. What would happen if more product was added? Explain. _____

3. The following reversible reaction occurs in a closed chamber: $2A(g) + 3B(g) \rightleftharpoons 4C(g) + 6D(g)$
   a. How many moles of reactant are there to every mole of product? _____
   b. If the pressure in the chamber is increased, what affect, if any, will it have on the concentration of either the reactant or the product? _____
   c. Will the concentration of the reactants be affected to the same extent as the concentration of the products by an increase in pressure? Explain. _____
   d. Will the reaction remain at equilibrium after increasing the pressure? Explain. _____
   e. In what direction does equilibrium shift as a result of the increase in pressure? Explain. _____