Ap chemistry notes flashcard

The equilibrium constant K is where the partial pressures in atmospheres, is a constant, independent of the original composition, the volume of he container, or the total pressure. 12. 2 The Equilibrium Constant Expression An equilibrium constant expression can be written for every gaseous chemical system and it states that the conditions that must be attained at equilibrium. Partial pressures must be expressed in atmospheres.

The equilibrium partial pressures of products appear in the numerator. The equilibrium trial pressures of reactants appear in the denominator.

Each partial pressure is raised to a power equal to its coefficient in the balanced equation. This constant is usually symbolized by Kip to how that it involves partial pressures. Kc is used to symbolize that concentration is used.

Kip= Kc(ART)change in n. The expression for K depends on the form of the chemical equation written to describe the equilibrium system. The coefficient rule states that if the coefficients in a balanced equation are multiplied by a factor n, the equilibrium constant is raised to the nth power (K'= Ink).

The reciprocal rule states that the equilibrium constants for forward and reverse reactions are the reciprocals of each other (Ink= ASK). The rule of multiple equilibrium states that if a reaction can be expressed as the sum of two or more reactions, K for the overall reaction is the product of the equilibrium constants of the individual reactions {K(reaction 3)= K(reaction l)x K(reaction 2)}.

The equilibrium systems so far have been homogeneous. In certain reactions, at least one of the substances involved is a pure liquid or solid' the others are gases. Such a system is heterogeneous, because more than one phase is present.

The position of the equilibrium is independent of the amount of solid or liquid, as long as some is present. The terms for pure liquids or solids need not appear in the expression for K. Gases enter as their partial pressures in ATM.

Pure liquids or solids do not appear' neither does the solvent for a reaction in dilute solution. Species (ions or molecules) in water solution enter as their molar concentrations. 12. 3 Determination of K Numerical values of equilibrium constants can be calculated if the partial pressures of products and reactants at equilibrium are known.

As a system approaches equilibrium, changes in partial pressures of reactants and produces-like changes in molar amounts-are related to one another through the coefficients of the balanced equation. 12. 4 Applications of the Equilibrium Constant Sometimes, knowing only the magnitude of the equilibrium constant, it is possible to decide on the feasibility of a reaction. If K is a very small number, the equilibrium mixture will contain mostly unrelated starting material; for all practical purposes, the toward reaction does not go. A large K implied a reaction that products should b formed in high yield.

K frequently has an intermediate value, in which case you must make quantitative calculations concerning the direction or extent of reaction. The arm of the expression for Q, known as the reaction quotient, is the same as that for the equilibrium constant, K. The difference is that the partial pressures that appear in Q are those that apply at a particular moment, not necessarily when the system is at equilibrium. By comparing the numerical value of Q with that of K, it is possible to decide in which direction the system will move to achieve equilibrium.

The equilibrium constant for a chemical system can be used to calculate the partial pressures of the species present at equilibrium. 12.

5 Effect of Changes in Conditions n an Equilibrium System Once a system has attained equilibrium, it is possible to change the ratio of products to reactants by changing the external conditions. To disturb chemical equilibrium you can add or remove a gaseous reactant or product, compressing or expanding the system, and changing the temperature.

You can deduce the direction in which an equilibrium will shift when one of these changes is made by applying the following principle: if a system at equilibrium is disturbed by a change in concentration, pressure, or temperature, the system will, if possible, shift o partially counteract the change. This is commonly referred to as Eel Chatterer’s principle. If a chemical system at equilibrium is disturbed by adding a gaseous species (reactant or product), the reaction will proceed in such a direction as to consume part of the added species.

Conversely, if a gaseous species is removed, the system shifts to restore part of that species.

The change in concentration is brought about by adding or removing a gaseous species is partially counteracted when equilibrium is restored.

Adding a pure liquid or solid has no effect on a system at equilibrium. The rule is a simple one: for a species to shift the position of an equilibrium, it must appear in the expression for K. When the system is compressed, thereby increasing the total pressure, reaction takes place in the direction that decreases the total number of moles of gas. When the system is expanded, thereby decreasing the total pressure, reaction takes place in the direction that increases the total number of moles of gas.