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Units kp and kc

Kp and Kc are the balance constant of an ideal gaseous mixture. Kp is a balance constant that is used when equilibrium concentrations are expressed in atmospheric pressure and Kc is a balance constant used when equilibrium concentrations are expressed in molarity. For many general chemical reactions aA + bB ⇋ cC + dD Where a mole B-spleen mole of b c mole reagent product C d mole of product D Consider an example 2A(g)+B(g) ⇋ 2C(g) All in the gas phase. The Kp is given by ——— {2}P_ P_ {2} P_(K_ 1) Ideal gas equation each of these ideal gas molecules behaves similarly. So for each of them, PV - nRT In the reorganization we get- (P -frac-n-V-RT) Substitution of these in equation (1) ('Rightarrow K_'p'frac'') Substitution of these in equation (1) ('Rightarrow K_'p'frac' left [C to the right], {2} (RT , right), left {2} [A , right], {2}, left (RT, right), {2} , left [B , right], A , {2} , left (RT , right) {2} left [B , right], (left (RT ?right)) ? ('Rightarrow''K_''p'frac'left [C 'right]'{2}'left [A 'right]'{2}'left [B 'right]''hours'{2} {2}' replacing the K_, c, frac and left [C, right], {2} left [A , right], {2}, left [B , right], you get K_ K_- (RT) or (K_,p-K_,c,left (RT, right), in general, in general, in general , in the place of K_ p, K_ , c, etc. (RT, right), Delta n) in place, N represents the change in the number of moles of gas molecules. [That's product – reagent in moles only for gas molecules] When the change in the number of gas molecule moles is zero, i.e. 0 ⇒ Kp-Kc In general, for any chemical reaction of gas molecules, the ratio between Kp and Kc is((K_, p, K_, etc., RT (RT) and Delta no.o) (K_ c) Physics-related topics of K_.p, left (RT, right), delta n Etc. Physics Related Topics: Boyle Law Pressure Unit Ideal Zero Gas Laws Keep an eye out for BYJU'S for more interesting items. Plus, sign up for BYJU'S-The Learning App for tons of interactive and engaging physics-related videos and unlimited academic support. Different disciplines and different textbooks treat K units differently, and you have to be very careful to find out what their conventions are. Conventions often change within a textbook, and often this is not explicitly indicated. Examples where balance constants are clearly treated as dimensionless are Kw 10e-14, expressions involving ln(K) or -log(K), and once concentrations are changed to activities, or from partial pressure to fleeting. Examples which the balance constant is clearly treated as having dimensions is by the Kd dissociation constant used in biochemistry, or in the conversion from Kc to Kp. The way to make balance constant without dimensions is to use measures of concentrations without dimensions in your definition. The best way is to use activities because then you get accurate results. When that's not possible, possible, concentrations without dimensions dividing the concentration by the respective standard state (given in the same dimension) so that the dimensions are canceled. The common standard state for solutes is a concentration of 1 M, while the common standard state for solvents is pure liquid (that's why we usually leave out the solvent of a equilibrium expression). Note that unless you are using activities, all your calculations are estimates that become accurate only when working with infinitely diluted solutions. Also, if you want to have a dimensionless version of the Kp and Kc conversion, you would use (RT M/atm) in the formula instead of (RT) if your agreed standard states for Kc is 1 M and for Kp is 1 atm. (i) Consider a reaction of type A(g) + B(g) C(g) + D(g). It is noted that for such a balance, there is a balance constant, K, which is given as, K - This implies that regardless of the substance we start with (i.e. A&B or C&D or A+B+C or A+B+D or A+C+D or B+C+D or A+B+B+C+D) and how much of these we start with, the ratio is a fixed amount to a given temperature when the reaction reaches. For example, if we assume that the K to 10 for this balance, then no matter what we take initially and regardless of how long we take, once the balance is established the ratio will always be equal to 10. This certainly seems surprising. Well, the answer is in the actual understanding of the term balance. In balance, the forward reaction rate is equal to the reverse reaction rate. I mean, forward reaction rate - kf [A] [B] (where kf is the forward reaction rate constant) reverse reaction rate to kr [C] [D] (where kr is the reverse reaction rate constant) In balance, ∴ kf [B] to kr [C] [D] ∴ As kf and kr are constant at a given temperature, therefore their ratio (kf/kr) would also be constant. Therefore, the relationship is also constant called Keq. ∴ Since, this expression implies all variable terms, so the proportion of would also be constant called Kc. [When the concentration ratio of reagents and products is taken into account, The equilibrium constant is called Kc] ∴Kc - Assuming these gases behave ideally, we can apply the ideal gas equation PV - nRT P - CRT C - ∴ [C] , [D] , [A] , [B] - ∴Kc - where and PB are the partial pressures of C, D, A and B respectively. Since LHS is a constant, therefore, the ratio of partial product pressures to reagents would also be a constant called Kp. ∴Kp - For this balance, Kp - Kc, but for other balances, this may not be the case. (ii) consider the reaction of type A(s) + B(g) C(soln.) + D(g) Its balance constant, Keq would be Keq - Concentration of C is the number of C moles per unit of solution volume. The concentration of D is the number of D moles per unit volume the container (we can assume that the volume of the solution is negligibly small compared to the volume of the container and therefore the volume occupied by the gas is equal to the volume of the container). The concentration of A is the number of moles of A per solid volume unit, A. The concentration of all pure solids and pure liquids is a constant. This is because if we initially take w gm of A, then the moles of A are w/M. The volume of A is w/d where d is the density of A. Therefore, the initial concentration of A is . Therefore, it is clear that in balance also the concentration of A remains as d/M (d and M are constant). In fact, even if A were a pure liquid, its concentration would have remained constant. Therefore, here the concentration of A does not change over time while the concentration of B, C and D varies over time. Therefore, we bring all the constant terms on the one hand and we get Keq[A] - This relationship that is a constant and that implies only the concentration terms that are variable is called Kc. ∴KC - Keq [A] [Note: The distinction between Kc and Keq is that in Keq expression all substances are involved while in Kc's expression there are only solutions and gases involved. Kc's expression lacks pure components such as pure solids and pure liquids since its concentrations are constant] (iii) Consider another reversible reaction of type x1A(g) + x2B(g) y1C(g) + y2D(g) The expression of the balance constant would be ∴Keq - Since in this expression all terms are variable, so the ratio would also be constant called Kc. ∴Kc - As we know, the concentration of a gas is given by P/RT. Therefore, [C] , [D] , [A] , [B] , ∴Kc , ∴Kc LHS of this equation being a constant since T is fixed and R and Kc are constant. Therefore, RHS of the equation would also be constant. Therefore, for this balance the ratio of high partial pressures to the power of the appropriate estechiometric coefficients is also a constant called Kp. ∴Kp - Now suppose that A is pure solid or pure liquid. For such a balance, Kc's expression would be Kc and following the sequence given above of derivation, Kp would be Kp - Now if we assume that A was a solute present in a solution, then Kc's expression would remain the same, that is, KC. However, if we try to express concentrations in terms of partial pressures, we would not do so for A, as it is not possible to express the concentration of a solution in terms of its vapour pressure or pressure and constants. Therefore[A] remains as such ∴KC - KC The R.H.S. of the previous expression is a constant that implies that the L.H.S is also a constant. This new expression cannot be called as KC or KP, as terms of concentration and terms of pressure. We call it KPC. We can also see that if we take [A] to the R.H.S. the L.H.S. contains only terms, but then it is not a constant since [A] is a variable. Therefore, we can conclude that Kp exists for those balances that meet the conditions given. (i) You must have at least one gas in the reagents or products and (ii) you must not have any components in the solution phase. Relationship between Kp and Kc In general, the relationship between Kp and Kc for a reversible reaction Kp - where number of moles of gaseous products - number of moles of gaseous reagents R - Constant gas and T - Absolute temperature [Remember that the value of R will be used in atm liter units per mole per Kelvin]. (i) If n to 0, then Kp to Kc, for example N2(g) + O2(g) 2NO(g) (ii)Si > 0, then Kp > Kc, for example PCl5(g) PCl3(g) + Cl2(g), where n to 2 x 1 (iii) If < 0, then Kc > Kp, For example N2(g) + 3H2)(g) 2NH2(g), where the Kc unit would be. Similarly, when pressure is expressed in atmospheres, Kp's unit would be. [Note: The given Kp or Kc unit for a balance in a problem means that if the value of the balance constant is given for balance in the forward direction or in the reverse direction]. address].

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