

CHEMICAL EQUILIBRIUM



EQUILIBRIUM CONSTANT 'K'.

For a General Reaction $aA + bB \rightleftharpoons pP + qQ$

The equilibrium constant expression is

$$K_c = \frac{[P]^p [Q]^q}{[A]^a [B]^b}$$

where K_c is the **Equilibrium Constant** (or K_p if they are all gases)

RELATION BETWEEN K_p AND K_c

For the Reaction $aA + bB \rightleftharpoons cC + dD$

$$K_p = \frac{[P_c]^c \times [P_D]^d}{[P_A]^a \times [P_B]^b} = \frac{[C]^c [D]^d}{[A]^a [B]^b} \frac{(RT)^{c+d}}{(RT)^{a+b}}$$

$$K_p = K_c (RT)^{\Delta n_g}$$

$$\text{if } \Delta n_g = 0 \implies K_p = K_c$$

Where, $\Delta n_g = (c+d) - (a+b)$

= no. of moles of gaseous products - no. of moles of gaseous Reactants

WHAT DOES THE VALUE OF 'K' MEAN ?

(a) $K \gg 1$

Reactants



Products

If $K \gg 1$, the reaction is product-favoured; product predominates at Equilibrium.

(a) $K \ll 1$

Reactants



Products

If $K \ll 1$, the reaction is reactant-favoured; reactant predominates at Equilibrium.

(a) $K = 1$

The reaction lies in the middle (mix of reactants and products)

MAGNITUDE OF 'K'

Small ($K < 10^{-3}$)



Reactants



Products

Mostly Reactants

Intermediate ($10^{-3} \leq K \leq 10^3$)



Reactants



Products

Significant amounts of reactants and products

Large ($K > 10^3$)



Reactants



Products

Mostly Products

Phase Equilibrium Concept Review Answers Chapter 1

section 4

Oxtoby



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Applied Mechanics Reviews, 1974 *Chemistry*³ Andrew Burrows, Andrew Parsons, Gwen Pilling, Gareth Price, 2013-03-21 New to this Edition Material Balances for Chemical Reacting Systems R.L. Cerro, B.G. Higgins, S. Whitaker, 2022-12-05 Written for use in the first course of a typical chemical engineering program *Material Balances for Chemical Reacting Systems* introduces and teaches students a rigorous approach to solving the types of macroscopic balance problems they will encounter as chemical engineers This first course is generally taken after students have completed their studies of calculus and vector analysis and these subjects are employed throughout this text Since courses on ordinary differential equations and linear algebra are often taken simultaneously with the first chemical engineering course these subjects are introduced as needed Teaches readers the fundamental concepts associated with macroscopic balance analysis of multicomponent reacting systems Offers a novel and scientifically correct approach to handling chemical reactions Includes an introductory approach to chemical kinetics Features many worked out problems beginning with those that can be solved by hand and ending with those that benefit from the use of computer software This textbook is aimed at undergraduate chemical engineering students but can be used as a reference for graduate students and professional chemical engineers as well as readers from environmental engineering and bioengineering The text features a solutions manual with detailed solutions for all problems as well as PowerPoint lecture slides available to adopting professors

Fundamentals of Vibrations Leonard Meirovitch, 2010-06-17 *Fundamentals of Vibrations* provides a comprehensive coverage of mechanical vibrations theory and applications Suitable as a textbook for courses ranging from introductory to graduate level it can also serve as a reference for practicing engineers Written by a leading authority in the field this volume features a clear and precise presentation of the material and is supported by an abundance of physical explanations many worked out examples and numerous homework problems The modern approach to vibrations emphasizes analytical and computational solutions that are enhanced by the use of MATLAB The text covers single degree of freedom systems two degree of freedom systems elements of analytical dynamics multi degree of freedom systems exact methods for distributed parameter systems approximate methods for distributed parameter systems including the finite element method nonlinear oscillations and random vibrations Three appendices provide pertinent material from Fourier series Laplace transformation and linear algebra *Concepts in Biology* 2007 Ed. 2007 Edition , *MATLAB-based Computations of Chemical Engineering Principles* Kamal I. M. Al-Malah, 2025-06-17 Explore chemical engineering principles using MATLAB for data analysis visualization and solving intricate problems *MATLAB based Computations of Chemical Engineering Principles* is an in depth textbook that enables readers to transform classical chemical engineering principles and calculations into MATLAB based calculations Throughout the text problems are solved through two methods manually i.e. classical and via implementing MATLAB code i.e. digital or software assisted with a focus on the latter when solving problems involving multiple steps or

complex solutions or when working with large databases such as dealing with physical properties of compounds Seven appendices contain large size MATLAB codes In general small size MATLAB code is kept within the relevant chapter section All codes have been verified using the MATLAB platform End of chapter problems reinforce learning by students The textbook includes problems and solutions related to concepts including System units and measurement process variables measurement and measurement variations and uncertainty Types of errors involved in measurements and energy balance applications for closed and open flow systems Total and component material balances chemical reaction stoichiometry conversion yield selectivity and chemical equilibrium Properties of pure substances and mixtures as well as vapor liquid equilibrium for single and multi component mixtures Equations of state for gases Comprehensive in scope with a plethora of helpful learning aids included throughout this is a perfect textbook for sophomore courses titled Chemical Engineering Principles Chemical Engineering Stoichiometric Calculations Fundamentals of Chemical Engineering Introduction to Chemical Engineering or Essentials of Chemical Engineering **Scientific and Technical Aerospace Reports** ,1994 Lists citations with abstracts for aerospace related reports obtained from world wide sources and announces documents that have recently been entered into the NASA Scientific and Technical Information Database **Resources in Education** ,1980

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