

DAT General Chemistry Equation Sheet

General Concepts

Density: $(d = m/v)$

Dilutions: $M_1V_1 = M_2V_2$ (or $C_1V_1 = C_2V_2$)

% Error Calculations

$$\% \text{ Error} = \frac{\text{Actual} - \text{theoretical}}{\text{theoretical}} \times 100$$

Spectrophotometer: $Abs = \epsilon cl$

Abs = Absorbance

ϵ = molar extinction coefficient (molar absorptivity)

l = path length

Atomic Structure

Absorption/Emission Line Spectra: $\Delta E = E_{\text{photon}}$

Energy of a photon: $E_{\text{photon}} = hf = \frac{hc}{\lambda}$

$$c = 3.0 \times 10^8 \text{ m/s}$$

$$h = 6.63 \times 10^{-34} \text{ J} \cdot \text{s}$$

Photoelectric Effect: $KE_{\text{electron}} = E_{\text{photon}} - \phi$

ϕ = work function (minimum energy to ionize electron)

Chemical Kinetics and Equilibrium

General Rate Law: $\text{rate} = k[A]^m[B]^n$

Arrhenius Equation: $k = Ae^{-E_a/RT}$ E_a = activation energy

$R = 0.0821 \text{ L atm/mol K}$

Equilibrium Constant:

$$K_c = \frac{[\text{products}]}{[\text{reactants}]} \quad K_p = \frac{P_{\text{products}}}{P_{\text{reactants}}}$$

Solutions

Concentration

$$\text{Molarity (M)} = \frac{\text{moles}_{\text{solute}}}{L_{\text{solution}}}$$

$$\text{molality (m)} = \frac{\text{moles}_{\text{solute}}}{kg_{\text{solvent}}}$$

Henry's Law: $P_A = k_H[A]$

Colligative Properties

Freezing Point Depression:

$$\Delta T_f = -iK_f m$$

Boiling Point Elevation:

$$\Delta T_b = iK_b m$$

Raoult's Law (* = pure):

$$P_A = X_A P_A^*$$

Osmotic Pressure:

$$\pi = iMRT$$

K_f/K_b = F.P./B.P. depression/elevation constant

X_A = mole fraction of A

i = van't Hoff Factor

$R = 0.0821 \text{ L atm/mol K}$

M = molarity, m = molality

Gases/Gas Laws

Pressure: $P = \text{Force/Area}$

Average Kinetic Energy:

$K.E._{avg} = \frac{3}{2} RT$ (per mole of gas)

Root-mean-square speed: $v = \sqrt{\frac{3RT}{M_m}}$

Gas Laws

Ideal Gas Law:

$$PV = nRT$$

Boyle's Law:

$$P \propto \frac{1}{V}$$

Charles' Law:

$$V \propto T$$

Avogadro's Law:

$$V \propto n$$

Combined Gas Law:

$$\frac{P_1 V_1}{n_1 T_1} = \frac{P_2 V_2}{n_2 T_2}$$

Dalton's Law of Partial Pressures:

$$P_{\text{Tot}} = P_A + P_B + \dots$$

$$P_A = X_A \cdot P_{\text{Tot}}$$

$$X_A = \text{mol fraction } A$$

$R = 0.0821 \text{ L atm/mol K}$

n = moles

M_m = molar mass

r = rate of effusion

a and b are constants specific to a given gas.

Grahams Law of Effusion:

$$\frac{r_1}{r_2} = \sqrt{\frac{M_{m2}}{M_{m1}}}$$

Acid-Base

pH Scale

$$pH = -\log[H^+]$$

$$[H^+] = 10^{-pH}$$

$$pOH = -\log[OH^-]$$

$$[OH^-] = 10^{-pOH}$$

$$pH + pOH = 14$$

$$[H^+][OH^-] = 1 \times 10^{-14}$$

Weak Acids:

$$K_a = \frac{[H_3O^+][A^-]}{[HA]}$$

$$[H^+] = \sqrt{K_a[HA]}$$

Weak Bases:

$$K_b = \frac{[OH^-][HA]}{[A^-]}$$

$$[OH^-] = \sqrt{K_b[B]}$$

$$K_a \cdot K_b = K_w$$

Buffer: $pH = pK_a + \log \frac{[A^-]}{[HA]}$

Titration/Neutralization: $n_a M_a V_a = n_b M_b V_b$

Chemical Engineering Formula Sheet

Helmut J. Fischbeck, Kurt Fischbeck



Chemical Engineering Formula Sheet

Formulas, Facts, and Constants H. J. Fischbeck, K. H. Fischbeck, 2012-12-06 The material presented in this book has been compiled for the convenience of the reader. The aim of the book is to provide a handy source of formulas, conversion factors, and constants for everyday use. The formulas and tables are amended by examples in all of those cases where their use is not self-explanatory. The material has been selected to be helpful whenever it is inconvenient or not possible to consult tables available at the library. Section 1 provides the fundamental tools of mathematics needed in all areas of the physical sciences. Section 2 summarizes the SI system, lists conversion factors, and provides precise values of fundamental constants. Sections 3 and 4 review the basic terms of spectroscopy, atomic structure, and wave mechanics. These sections serve as a guide to the interpretation of modern literature. Section 5 is a resource for work in the laboratory. Data and formulas are given to be of assistance in the use of frequently encountered equipment such as vacuum systems and electronic devices. Material constants and other data are listed for information and as an aid for estimates or problem solving. The assistance of the Springer Verlag during the various stages of the development of this book is gratefully acknowledged. The authors like to thank Dr. F. L. Boschke for his many helpful suggestions. Helmut J. Fischbeck, Kurt H. Fischbeck. Contents: Basic mathematical facts and figures.

Chemical Engineering Design Gavin Towler, Ray Sinnott, 2012-01-25 Chemical Engineering Design, Second Edition, deals with the application of chemical engineering principles to the design of chemical processes and equipment. Revised throughout, this edition has been specifically developed for the U.S. market. It provides the latest U.S. codes and standards, including API, ASME, and ISA design codes and ANSI standards. It contains new discussions of conceptual plant design, flowsheet development, and revamp design, extended coverage of capital cost estimation, process costing, and economics, and new chapters on equipment selection, reactor design, and solids handling processes. A rigorous pedagogy assists learning with detailed worked examples, end-of-chapter exercises, plus supporting data and Excel spreadsheet calculations, plus over 150 Patent References for downloading from the companion website. Extensive instructor resources, including 1170 lecture slides and a fully worked solutions manual, are available to adopting instructors. This text is designed for chemical and biochemical engineering students, senior undergraduate year, plus appropriate for capstone design courses where taken plus graduates and lecturers, tutors, and professionals in industry, chemical process, biochemical, pharmaceutical, petrochemical sectors. New to this edition: Revised organization into Part I: Process Design and Part II: Plant Design. The broad themes of Part I are flowsheet development, economic analysis, safety, and environmental impact and optimization. Part II contains chapters on equipment design and selection that can be used as supplements to a lecture course or as essential references for students or practicing engineers working on design projects. New discussion of conceptual plant design, flowsheet development, and revamp design. Significantly increased coverage of capital cost estimation, process costing, and economics. New chapters on equipment selection, reactor design, and solids handling processes. New sections on fermentation, adsorption, membrane separations, ion exchange, and chromatography. Increased coverage of batch processing, food, pharmaceutical, and biological processes. All equipment chapters in Part II revised and updated with current information. Updated throughout for latest U.S. codes and standards, including API, ASME, and ISA design codes and ANSI standards. Additional worked examples and homework problems. The most complete and up-to-date coverage of equipment selection. 108 realistic commercial design projects from diverse industries. A rigorous pedagogy assists learning with detailed worked examples, end-of-chapter exercises, plus supporting data and Excel spreadsheet calculations, plus over 150 Patent References for downloading from the companion website. Extensive instructor resources, 1170 lecture slides, plus fully worked solutions manual, available to adopting instructors.

Handbook of Chemical Engineering Calculations Nicholas P. Chohey, 1994 A compilation of the calculation procedures needed every day on the job by chemical engineers Tables of Contents Physical and Chemical Properties Stoichiometry Phase Equilibrium Chemical Reaction Equilibrium Reaction Kinetics and Reactor Design Flow of Fluids and Solids Heat Transfer Distillation Extraction and Leaching Crystallization Filtration Liquid Agitation Size Reduction Drying Evaporation Environmental Engineering in the Plant Illustrations Index

Formulas, Facts, and Constants for Students and Professionals in Engineering, Chemistry, and Physics Helmut J. Fischbeck, Kurt Fischbeck, 1982

Short Handbook of Mathematical Formulas for Chemical Engineers Muhammad Rashid Usman, 2017-09-20 This book is a collection of physical constants conversion factors mathematical formulas and some essential MATLAB commands many of which are required on daily basis by chemical engineers The book is intended to save vital time of the students instructors researchers and people in the process industry which they have to spend in searching the material available in this book

Rules of Thumb for Chemical Engineers Carl Branam, 2002 Fractionators separators and accumulators cooling towers gas treating blending troubleshooting field cases gas solubility and density of irregular solids Hundreds of common sense techniques shortcuts and calculations

Chemical Engineering Calculations Ernest J. Henley, Herman Bieber, 1959

Chemical Engineering Fluid Mechanics Ron Darby, Raj P. Chhabra, 2016-11-30 This book provides readers with the most current accurate and practical fluid mechanics related applications that the practicing BS level engineer needs today in the chemical and related industries in addition to a fundamental understanding of these applications based upon sound fundamental basic scientific principles The emphasis remains on problem solving and the new edition includes many more examples

The AIChE Pocket Handbook American Institute of Chemical Engineers, 1985

Conservation Equations And Modeling Of Chemical And Biochemical Processes Said S.E.H. Elnashaie, Parag Garhyan, 2003-03-26 Presenting strategies in control policies this text uses a systems theory approach to predict simulate and streamline plant operation conserve fuel and resources and increase workplace safety in the manufacturing chemical petrochemical petroleum biochemical and energy industries Topics of discussion include system theory and chemical biochemical engineering systems steady state unsteady state and thermodynamic equilibrium modeling of systems fundamental laws governing the processes in terms of the state variables different classifications of physical models the story of chemical engineering in relation to system theory and mathematical modeling overall heat balance with single and multiple chemical reactions and single and multiple reactions

Henley's Formulas, Recipes and Processes Various,2023-12-12 Henley s Formulas Recipes and Processes is a compilation of ten thousand selected household and workshop formulas recipes processes and money saving methods for the practical use of manufacturers mechanics housekeepers and home workers Each recipe from this book is to be regarded as a basis of experiment to be modified to suit the particular purpose in hand or the peculiar conditions which may affect the experimenter Chemicals are not always of uniform relative purity and strength heat or cold may markedly influence the result obtained and lack of skill in the handling of utensils and instruments may sometimes cause failure In some instances a series of formulas is given which apparently differ but slightly in their ingredients This has been done on the principle that one or more may be chosen for the purpose in hand Apart from the modern methods and formulas old recipes and so called trade secrets which have proven their value by long use are also included in this useful edition

Handbook Mattias Alveteg,2013

Chemistry 2e Paul Flowers,Richard Langely,William R. Robinson,Klaus Hellmut Theopold,2019-02-14 Chemistry 2e is designed to meet the scope and sequence requirements of the two semester general chemistry course The textbook provides an important opportunity for students to learn the core concepts of chemistry and understand how those concepts apply to their lives and the world around them The book also includes a number of innovative features including interactive exercises and real world applications designed to enhance student learning The second edition has been revised to incorporate clearer more current and more dynamic explanations while maintaining the same organization as the first edition Substantial improvements have been made in the figures illustrations and example exercises that support the text narrative Changes made in Chemistry 2e are described in the preface to help instructors transition to the second edition

Chemical Engineering Catalog ,1919

The Chemist's Handbook ,1922

Analysis, Synthesis and Design of Chemical Processes Richard Turton, Richard C. Bailie, Wallace B. Whiting, Joseph A. Shaeiwitz, 2008-12-24
The Leading Integrated Chemical Process Design Guide Now with New Problems New Projects and More More than ever effective design is the focal point of sound chemical engineering Analysis Synthesis and Design of Chemical Processes Third Edition presents design as a creative process that integrates both the big picture and the small details and knows which to stress when and why Realistic from start to finish this book moves readers beyond classroom exercises into open ended real world process problem solving The authors introduce integrated techniques for every facet of the discipline from finance to operations new plant design to existing process optimization This fully updated Third Edition presents entirely new problems at the end of every chapter It also adds extensive coverage of batch process design including realistic examples of equipment sizing for batch sequencing batch scheduling for multi product plants improving production via intermediate storage and parallel equipment and new optimization techniques specifically for batch processes Coverage includes Conceptualizing and analyzing chemical processes flow diagrams tracing process conditions and more Chemical process economics analyzing capital and manufacturing costs and predicting or assessing profitability Synthesizing and optimizing chemical processing experience based principles BFD PFD simulations and more Analyzing process performance via I O models performance curves and other tools Process troubleshooting and debottlenecking Chemical engineering design and society ethics professionalism health safety and new green engineering techniques Participating successfully in chemical engineering design teams Analysis Synthesis and Design of Chemical Processes Third Edition draws on nearly 35 years of innovative chemical engineering instruction at West Virginia University It includes suggested curricula for both single semester and year long design courses case studies and design projects with practical applications and appendixes with current equipment cost data and preliminary design information for eleven chemical processes including seven brand new to this edition

Spreadsheets in Science and Engineering Gordon Filby, 2013-12-18 Spreadsheets in Science and Engineering shows scientists and engineers at all levels how to analyze validate and calculate data and how the analytical and graphic capabilities of spreadsheet programs ExcelR can solve these tasks in their daily work The examples on the CD ROM accompanying the book include material of undergraduate to current research level in disciplines ranging from chemistry and chemical engineering to molecular biology and geology

Handbook of Chemical and Environmental Engineering Calculations Joseph Reynolds, John S. Jeris, Louis Theodore, 2007-02-09
Because of the ubiquitous nature of environmental problems a variety of scientific disciplines are involved in the development of environmental solutions The Handbook of Chemical and Environmental Engineering Calculations provides approximately 600 real world practical solutions to environmental problems that involve chemical engineering enabling engineers and applied scientists to meet the professional challenges they face day to day The scientific and mathematical crossover between chemical and environmental engineering is the key to solving a host of environmental problems Many problems included in the Handbook are intended to demonstrate this crossover as well as the integration of engineering with current regulations and environmental media such as air soil and water Solutions to the problems are presented in a programmed instructional format Each problem contains a title problem statement data and solution with the more difficult problems located near the end of each problem set The Handbook offers material not only to individuals with limited technical background but also to those with extensive industrial experience Chapter titles include Chemical Engineering Fundamentals Chemical Engineering Principles Air Pollution Control Equipment Solid Waste Water Quality and Wastewater Treatment Pollution Prevention Health Safety and Accident Management Ideal for students at the graduate and undergraduate levels the Handbook of Chemical and Environmental Engineering Calculations is also a comprehensive reference for all plant and environmental engineers particularly those who work with air drinking water wastewater hazardous materials and solid waste

Basic Principles and Calculations in Chemical Engineering David M. Himmelblau, James B. Riggs, 2012-05-31 The Number One Guide to Chemical Engineering Principles Techniques Calculations and Applications Now Even More Current Efficient and Practical Basic Principles and Calculations in Chemical Engineering Eighth Edition goes far beyond traditional introductory chemical engineering topics presenting applications that reflect the full scope of contemporary chemical petroleum and environmental engineering Celebrating its fiftieth Anniversary as the field's leading practical introduction it has been extensively updated and reorganized to cover today's principles and calculations more efficiently and to present far more coverage of bioengineering nanoengineering and green engineering Offering a strong foundation of skills and knowledge for successful study and practice it guides students through formulating and solving material and energy balance problems as well as describing gases liquids and vapors Throughout the authors introduce efficient consistent student friendly methods for solving problems analyzing data and gaining a conceptual application based understanding of modern chemical engineering processes This edition's improvements include many new problems examples and homework assignments Coverage includes Modular chapters designed to support introductory chemical engineering courses of any length Thorough introductions to unit conversions basis selection and process measurements Consistent sound strategies for solving material and energy balance problems Clear introductions to key concepts ranging from stoichiometry to enthalpy Behavior of gases liquids and solids ideal real gases single component two phase systems gas liquid systems and more Self assessment questions to help readers identify areas they don't fully understand Thought discussion and homework problems in every chapter New biotech and bioengineering problems throughout New examples and homework on nanotechnology environmental engineering and green engineering Extensive tables charts and glossaries in each chapter Many new student projects Reference appendices presenting atomic weights and numbers Pitzer Z factors heats of formation and combustion and more Practical readable and exceptionally easy to use Basic Principles and Calculations in Chemical Engineering Eighth Edition is the definitive chemical engineering introduction for students license candidates practicing engineers and scientists This is the digital version of the print title Access to the CD content that accompanies the print title is available through product registration See the instructions in back pages of your digital edition CD ROM INCLUDES The latest Polymath trial software for solving linear nonlinear and differential equations and regression problems Point and click physical property database containing 700 compounds Supplemental Problems Workbook containing 100 solved problems Descriptions and animations of modern process equipment Chapters on degrees of freedom process simulation and unsteady state material balances Expert advice for beginners on problem solving in chemical engineering

Henley's Twentieth Century Formulas, Recipes and Processes Various, 2022-05-28 This is a guide book that were used in the late 19th and early 20th century containing ten thousand selected household and workshop formulas recipes processes and money making methods for practical use by manufacturers mechanics housekeepers and home workers The value of this great monument to human ingenuity is in the nostalgia of looking back at the actual situation more than 100 years ago which gives the readers an understanding of what our society went through to get to what we have today

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