

Saturation refers to any Gas - Vapor Combination. While -  
 • Humidity refers only Air - Water Vapor System.

Absolute Humidity It is defined as the weight of Water Vapour present in a unit weight of dry (Non - condensable) gas.

$$H = \frac{\text{kg of water Vapour}}{\text{kg of dry Air}}$$

$$\begin{array}{l} \text{Vapor} = \text{Condensed} \\ \text{gas} = \text{Liquified} \end{array}$$

⇒ Molal Humidity (Molal Saturation) It is defined as the ratio of Mole of Vapour [Condensable] to the Mole of dry (Non - condensable) gas.

$$H_m = \frac{\text{kmol of Vapor}}{\text{kmol of dry gas}}$$

for air - water vapor system

$$H = H_m \left( \frac{18}{29} \right) = 0.6207 H_m$$

In Vapor - gas Mixture

$$P = P_A + P_B$$

$$PV = nRT \Rightarrow \left. \begin{array}{l} P_A = \frac{n_A}{n_A + n_B} P \\ P_B = \frac{n_B}{n_A + n_B} P \end{array} \right\}$$

$P$  = total / Barometric pr.

$P_A$  = Partial pr. of Vapor

$P_B$  = Partial pr. of ~~gas~~ gas

$$\Rightarrow \left[ \frac{P_A}{P_B} = \frac{n_A}{n_B} \right]$$

then

$$H_m = \frac{P_B}{P_B} = \frac{P_A}{P - P_A} \Rightarrow$$

$$H = 0.6207 \frac{P_A}{P - P_A}$$

# Process Calculation Chemical Engineering

**T. David Griffith**



## **Process Calculation Chemical Engineering:**

**Process Calculations** V. Venkataramani, N. Anantharaman, K. M. Meera Sheriffa Begum, 2011 This compact and highly readable text now in its second edition continues to provide a thorough introduction to the basic chemical engineering principles and calculations to enable the students to evaluate the material and energy balances in various units of a process plant Unless a chemical engineer is conversant with the energy conservation techniques at every stage of the process economy cannot be achieved in the design of process equipment The text lucidly explains the techniques involved in analyzing different chemical processes and the underlying theories by making a generous use of appropriate worked examples The examples are simple and concrete to make the book useful for self instruction In this new edition besides worked examples several exercises are included to aid students in testing their knowledge of the material contained in each chapter The book is primarily intended for undergraduate students of Chemical Engineering It would also be useful to undergraduate students of Petroleum Technology Pharmaceutical Technology and other allied branches of Chemical Engineering **KEY FEATURES** Exposes the reader to background information on different systems of units dimensions and behaviour of gases liquids and solids Provides several examples with detailed solutions to explain the concepts discussed Includes chapter end exercises with answers to enhance learning Chemical Process Calculations K. Asokan, 2007

**STOICHIOMETRY AND PROCESS CALCULATIONS** K. V. NARAYANAN, B. LAKSHMIKUTTY, 2006-01-01 This textbook is designed for undergraduate courses in chemical engineering and related disciplines such as biotechnology polymer technology petrochemical engineering electrochemical engineering environmental engineering safety engineering and industrial chemistry The chief objective of this text is to prepare students to make analysis of chemical processes through calculations and also to develop in them systematic problem solving skills The students are introduced not only to the application of law of combining proportions to chemical reactions as the word stoichiometry implies but also to formulating and solving material and energy balances in processes with and without chemical reactions The book presents the fundamentals of chemical engineering operations and processes in an accessible style to help the students gain a thorough understanding of chemical process calculations It also covers in detail the background materials such as units and conversions dimensional analysis and dimensionless groups property estimation P V T behaviour of fluids vapour pressure and phase equilibrium relationships humidity and saturation With the help of examples the book explains the construction and use of reference substance plots equilibrium diagrams psychrometric charts steam tables and enthalpy composition diagrams It also elaborates on thermophysics and thermochemistry to acquaint the students with the thermodynamic principles of energy balance calculations **Key Features** SI units are used throughout the book Presents a thorough introduction to basic chemical engineering principles Provides many worked out examples and exercise problems with answers Objective type questions included at the end of the book serve as useful review material and also assist the students

in preparing for competitive examinations such as GATE **Introduction to Process Calculations Stoichiometry** KA. Gavhane, 2012 **CHEMICAL PROCESS CALCULATIONS** D. C. SIKDAR, 2013-05-22 Keeping the importance of basic tools of process calculations material balance and energy balance in mind the text prepares the students to formulate material and energy balance theory on chemical process systems It also demonstrates how to solve the main process related problems that crop up in chemical engineering practice The chapters are organized in a way that enables the students to acquire an in depth understanding of the subject The emphasis is given to the units and conversions basic concepts of calculations material balance with and without chemical reactions and combustion of fuels and energy balances Apart from numerous illustrations the book contains numerous solved problems and exercises which bridge the gap between theoretical learning and practical implementation All the numerical problems are solved with block diagrams to reinforce the understanding of the concepts Primarily intended as a text for the undergraduate students of chemical engineering it will also be useful for other allied branches of chemical engineering such as polymer science and engineering and petroleum engineering **KEY FEATURES** Methods of calculation for stoichiometric proportions with practical examples from the Industry Simplified method of solving numerical problems under material balance with and without chemical reactions Conversions of chemical engineering equations from one unit to another Solution of fuel and combustion and energy balance problems using tabular column

**Basic Principles and Calculations in Chemical Engineering** David Mautner Himmelblau, James B. Riggs, 2012 Best selling introductory chemical engineering book now updated with far more coverage of biotech nanotech and green engineering Thoroughly covers material balances gases liquids and energy balances Contains new biotech and bioengineering problems throughout **CHEMICAL PROCESS CALCULATIONS** PRASAD, RAM, 2022-04-13 The present textbook is written for undergraduate students of chemical engineering as per the syllabus framed by AICTE curriculum It explains the basic chemical process principles in a lucid manner SI units chemical stoichiometry and measures of composition behaviour of gases vapour pressure of pure substances and humidity and saturation are covered in detail In addition mass and energy balances of chemical processes have also been described Chemical processes without chemical reactions include fluid flow mixing evaporation distillation absorption and stripping liquid liquid extraction leaching and washing adsorption drying crystallization and membrane separation process **SALIENT FEATURES** Description of all concepts and principles with a rich pedagogy for easy understanding Correct use of SI units Over 270 solved examples for understanding the basic concepts Answers to all chapter end numerical problems for checking the accuracy of calculations **TARGET AUDIENCE** BE B Tech Chemical Engineering **Process Calculations for Chemical Engineers** Ch Durgaprasada Rao, D V S Murthy, 1980-02-01 This book presents an introduction to chemical engineering calculations along with the techniques of writing mass and energy balances for chemical nuclear biochemical electrochemical and other less conventional processes Both undergraduate students of **Stoichiometry and Process Calculations** Mr. Rohit

Manglik,2024-01-22 EduGorilla Publication is a trusted name in the education sector committed to empowering learners with high quality study materials and resources Specializing in competitive exams and academic support EduGorilla provides comprehensive and well structured content tailored to meet the needs of students across various streams and levels

Basic Principles and Calculations in Process Technology T. David Griffith,2015-09-02 A Practical Guide to Physical and Chemical Principles and Calculations for Today s Process Control Operators In Basic Principles and Calculations in Process Technology author T David Griffith walks process technologists through the basic principles that govern their operations helping them collaborate with chemical engineers to improve both safety and productivity He shows process operators how to go beyond memorizing rules and formulas to understand the underlying science and physical laws so they can accurately interpret anomalies and respond appropriately when exact rules or calculation methods don t exist Using simple algebra and non technical analogies Griffith explains each idea and technique without calculus He introduces each topic by explaining why it matters to process technologists and offers numerous examples that show how key principles are applied and calculations are performed For end of chapter problems he provides the solutions in plain English discussions of how and why they work Chapter appendixes provide more advanced information for further exploration Basic Principles and Calculations in Process Technology is an indispensable practical resource for every process technologist who wants to know what the numbers mean so they can control their systems and processes more efficiently safely and reliably T David Griffith received his B S in chemical engineering from The University of Texas at Austin and his Ph D from the University of Wisconsin Madison then top ranked in the discipline After working in research on enhanced oil recovery EOR he cofounded a small chemical company and later in his career he developed a record setting Electronic Data Interchange EDI software package He currently instructs in the hydrocarbon processing industry Coverage includes Preparing to solve problems by carefully organizing them and establishing consistent sets of measures Calculating areas and volumes including complex objects and interpolation Understanding Boyle s Law Charles s Law and the Ideal Gas Law Predicting the behavior of gases under extreme conditions Applying thermodynamic laws to calculate work and changes in gas enthalpy and to recognize operational problems Explaining phase equilibria for distillation and fractionalization Estimating chemical reaction speed to optimize control Balancing material or energy as they cross system boundaries Using material balance calculations to confirm quality control and prevent major problems Calculating energy balances and using them to troubleshoot poor throughput Understanding fluid flow including shear viscosity laminar and turbulent flows vectors and tensors Characterizing the operation of devices that transport heat energy for heating or cooling Analyzing mass transfer in separation processes for materials purification *Handbook of Chemical Engineering Calculations* Nicholas Chohey,2004 Provides detailed procedures for performing hundreds of chemical engineering calculations along with fully worked out examples **Handbook of Chemical Engineering Calculations, Fourth Edition** Tyler Hicks,Nicholas

Chopey,2012-07-10 Solve chemical engineering problems quickly and accurately Fully revised throughout with new procedures Handbook of Chemical Engineering Calculations Fourth Edition shows how to solve the main process related problems that often arise in chemical engineering practice New calculations reflect the latest green technologies and environmental engineering standards Featuring contributions from global experts this comprehensive guide is packed with worked out numerical procedures Practical techniques help you to solve problems manually or by using computer based methods By following the calculations presented in this book you will be able to achieve accurate results with minimal time and effort Coverage includes Physical and chemical properties Stoichiometry Phase equilibrium Chemical reaction equilibrium Reaction kinetics reactor design and system thermodynamics Flow of fluids and solids Heat transfer Distillation Extraction and leaching Crystallization Absorption and stripping Liquid agitation Size reduction Filtration Air pollution control Water pollution control Biotechnology Cost engineering

*Material Balance and Process Calculations: A Book for Chemical Engineers and Chemists* Kingsley Augustine,2018-10-07 This textbook Material Balance and Process Calculations has been carefully written to teach you important topics in material balance and process calculations by explaining them with a mindset to fully equip you in the topics Whether you want this book for general studies of these topics or you want this book to study for an exam you will find it a very useful tool This textbook is a mass balance teacher which is suitable for students in universities and students in colleges It will also serve as a useful tool for direct entry students who are preparing for entrance examinations into colleges and universities This book is not only for engineering students but also for chemistry students or any student who is offering a course in chemistry The step by step explanations presented in the worked examples are easy to understand since care was taken to sufficiently explain salient points and process ideas Efforts have been made to achieve a complete and simplified explanation of every example given in this textbook Many worked examples have been included in each topic in order to fully cover every complexity the topic might contain This book will boost your level of understanding of material balance and process calculations Numerous exercises at the end of each chapter are intended to test students understanding of the topic Therefore students are thus presented with an effective means of self assessment whereby they can determine their individual strengths and revision needs The topics covered in this eBook include

**Basic Principles and Calculations in Process Technology** T. David Griffith,2016 Chemical Engineering Design Project Martyn S Ray,2020-08-12 This new edition follows the original format which combines a detailed case study the production of phthalic anhydride with practical advice and comprehensive background information Guiding the reader through all major aspects of a chemical engineering design the text includes both the initial technical and economic feasibility study as well as the detailed design stages Each aspect of the design is illustrated with material from an award winning student design project The book embodies the learning by doing approach to design The student is directed to appropriate information sources and is encouraged to make decisions at each stage of the design process rather than simply

following a design method Thoroughly revised updated and expanded the accompanying text includes developments in important areas and many new references      **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 US 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 US 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      ELEMENTARY PRINCIPLES OF CHEMICAL PROCESSES, 3RD ED (With CD ) Richard M. Felder, Ronald W. Rousseau, 2008-02 Market\_Desc Engineers Special Features Revised to increase clarification and contains hundreds of new problems and case studies of real industrial processes Gain a better understanding of chemical processes Material is presented in a very clear and accessible manner Frequent use of examples Case studies based on commercial processes CD ROM with instructional tutorials a powerful equation solver and a visual

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**Chemical Process Engineering** Harry Silla,2003-08-08 This illustrative reference presents a systematic approach to solving design problems by listing the needed equations calculating degrees of freedom developing calculation procedures to generate process specifications and sizing equipment Containing over thirty detailed examples of calculation procedures the book tabulates numerous easy to follow calculation procedures as well as the relationships needed for sizing commonly used equipment Chemical Process Engineering emphasizes the evaluation and selection of equipment by considering its mechanical design and encouraging the selection of standard size equipment offered by manufacturers to lower costs

**Introduction to Chemical Engineering Computing** Bruce A. Finlayson,2006-02-10 An innovative introduction to chemical engineering computing As chemical engineering technology advances so does the complexity of the problems that arise The problemsthat chemical engineers and chemical engineering students face today can no longer be answered with programs written on a case by case basis Introduction to Chemical Engineering Computing teaches professionalsand students the kinds of problems they will have to solve the types of computer programs needed to solve these problems and how to ensure that the problems have been solved correctly Each chapter in Introduction to Chemical Engineering Computing contains a description of the physicalproblem in general terms and in a mathematical context thorough step by step instructions numerous examples and comprehensive explanations for each problem and program This indispensable text features Excel MATLAB r Aspen PlusTM and FEMLAB programs and acquaints readers with the advantages of each Perfect for students and professionals Introduction to Chemical Engineering Computing gives readers the professional tools they need to solve real world problems involving Equations of state Vapor liquid and chemical reaction equilibria Mass balances



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