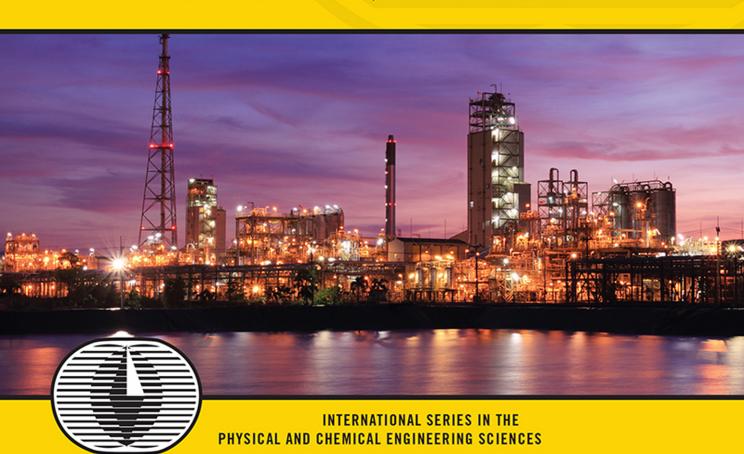


BASIC PRINCIPLES AND CALCULATIONS IN CHEMICAL ENGINEERING

EIGHTH EDITION

DAVID M. HIMMELBLAU • JAMES B. RIGGS



Basic Principles and Calculations in Chemical Engineering

Eighth Edition

Basic Principles and Calculations in Chemical Engineering

Table of Contents

Cover

Half Title

Title Page

Copyright Page

CONTENTS

PREFACE

READ ME

ACKNOWLEDGMENTS

ABOUT THE AUTHORS

PART I: INTRODUCTION

CHAPTER 1 WHAT ARE CHEMICAL ENGINEERING AND BIOENGINEERING?

- 1.1 Introduction
- 1.2 A Brief History of Chemical Engineering
- 1.3 Where Do Chemical and Bioengineers Work?
- 1.4 Future Contributions of Chemical and Bioengineering
- 1.5 Conclusion

CHAPTER 2 INTRODUCTORY CONCEPTS

- 2.1 Systems of Units
- 2.2 Conversion of Units
- 2.3 Dimensional Consistency
- 2.4 Significant Figures
- 2.5 Validation of Results
- 2.6 The Mole and Molecular Weight



- 2.7 Choosing a Basis
- 2.8 Density and Specific Gravity
- 2.9 Concentration
- 2.10 Temperature
- 2.11 Pressure and Hydrostatic Head
- 2.12 Flow Rate

PART II: MATERIAL BALANCES

CHAPTER 3 MATERIAL BALANCES

- 3.1 Introduction to Material Balances
- 3.2 A General Strategy for Solving Material Balance Problems

CHAPTER 4 MATERIAL BALANCES WITHOUT REACTION CHAPTER 5 MATERIAL BALANCES INVOLVING REACTIONS

- 5.1 Stoichiometry
- 5.2 Terminology for Reaction Systems
- 5.3 Species Mole Balances
- 5.4 Element Material Balances
- 5.5 Material Balances for Combustion Systems

CHAPTER 6 MATERIAL BALANCES FOR MULTI-UNIT SYSTEMS

- 6.1 Primary Concepts
- 6.2 Sequential Multi-Unit Systems
- 6.3 Recycle Systems
- 6.4 Bypass and Purge
- 6.5 The Industrial Application of Material Balances

PART III: GASES, VAPORS, AND LIQUIDS

CHAPTER 7 IDEAL AND REAL GASES

- 7.1 Ideal Gases
- 7.2 Real Gases: Equations of State
- 7.3 Real Gases: Compressibility Charts
- 7.4 Real Gas Mixtures

CHAPTER 8 MULTIPHASE EQUILIBRIUM



- 8.1 Introduction
- 8.2 Phase Diagrams and the Phase Rule
- 8.3 Single Component Two-Phase Systems (Vapor Pressure)
- 8.4 Two-Component Gas/Single-Component Liquid Systems
- 8.5 Two Component Gas/Two Component Liquid Systems
- 8.6 Multicomponent Vapor-Liquid Equilibrium

PART IV: ENERGY

CHAPTER 9 ENERGY BALANCES

- 9.1 Terminology Associated with Energy Balances
- 9.2 Types of Energy to Be Included in Energy Balances
- 9.3 Energy Balances without Reaction

CHAPTER 10 ENERGY BALANCES: HOW TO ACCOUNT FOR CHEMICAL REACTION

- 10.1 The Standard Heat (Enthalpy) of Formation
- 10.2 The Heat (Enthalpy) of Reaction
- 10.3 Integration of Heat of Formation and Sensible Heat
- 10.4 The Heat (Enthalpy) of Combustion

CHAPTER 11 HUMIDITY (PSYCHROMETRIC) CHARTS AND THEIR USE

- 11.1 Terminology
- 11.2 The Humidity (Psychrometric) Chart
- 11.3 Applications of the Humidity Chart

PART V: SUPPLEMENTARY MATERIAL

CHAPTER 12 ANALYSIS OF THE DEGREES OF FREEDOM IN STEADY-STATE PROCESSES

CHAPTER 13 HEATS OF SOLUTION AND MIXING

CHAPTER 14 THE MECHANICAL ENERGY BALANCE

CHAPTER 15 LIQUIDS AND GASES IN EQUILIBRIUM WITH SOLIDS

CHAPTER 16 SOLVING MATERIAL AND ENERGY BALANCES USING PROCESS SIMULATORS (FLOWSHEETING CODES)

CHAPTER 17 UNSTEADY-STATE MATERIAL AND ENERGY BALANCES



APPENDIXES

- A: ANSWERS TO SUPPLEMENTAL QUESTIONS AND PROBLEMS
- **B: ATOMIC WEIGHTS AND NUMBERS**
- C: TABLE OF THE PITZER Z[sup(0)] AND Z[sup(1)] FACTORS
- D: HEATS OF FORMATION AND COMBUSTION
- E: ANSWERS TO SELECTED PROBLEMS
- F: PHYSICAL PROPERTIES OF VARIOUS ORGANIC AND INORGANIC SUBSTANCES
- G: HEAT CAPACITY EQUATIONS
- H: VAPOR PRESSURES
- I: HEATS OF SOLUTION AND DILUTION
- J: ENTHALPY-CONCENTRATION DATA
- K: THERMODYNAMIC CHARTS
- L: PHYSICAL PROPERTIES OF PETROLEUM FRACTIONS
- M: SOLUTION OF SETS OF EQUATIONS
- N: FITTING FUNCTIONS TO DATA

INDEX

PROBLEMS WORKBOOK INDEX

- Α
- В
- C
- D
- Ε
- F
- G
- Н
- Ι
- K



L

М

Ν

0

Р

R

S

Т

U

٧

W