613.013 =

# Medical Dosage Calculations



# A Dimensional Analysis Approach



Olsen · Giangrasso · Shrimpton

Edition

610.013



# Medical Dosage Calculations

# A Dimensional Analysis Approach

#### June L. Olsen, MS, RN

Professor of Nursing (Emeritus) College of Staten Island Staten Island, NY

#### **Anthony Patrick Giangrasso, PhD**

Professor of Mathematics LaGuardia Community College Long Island City, NY

## **Dolores M. Shrimpton, MA, RN**

Professor of Nursing Department of Nursing Kingsborough Community College Brooklyn, NY

Universitat Medicinà si Farmacie SL3 «Nicolae Testemitanu» Eiblioteca Științifică Medicală

#### Pearson

Boston Columbus Indianapolis New York San Francisco Upper Saddle River Amsterdam Cape Town Dubai London Madrid Milan Munich Paris Montréal Toronto Delhi Mexico City São Paulo Sydney Hong Kong Seoul Singapore Taipei Tokyo

# Contents

# Unit 1

# Basic Calculation Skills and Introduction to Medication Administration 1

## Chapter 1 Review of Arithmetic for Medical Dosage Calculations 2

Diagnostic Test of Arithmetic 3 Changing Decimal Numbers and Whole Numbers to Fractions 5 Calculator 6 Ratios 7 Changing Fractions to Decimal Numbers 8 Rounding Decimal Numbers 10 Rounding Off 10 Rounding Down 10 Adding Decimal Numbers 11 Subtracting Decimal Numbers 11 Multiplying Decimal Numbers 12 Dividing Decimal Numbers 13 Estimating Answers 14 Multiplying Fractions 15 **Dividing Fractions** 16 Complex Fractions 17 Addition and Subtraction of Fractions 19 Same Denominators 19 Different Denominators 20 Percentages 21 Percent of Change 23 Summary 24 Practice Sets 24

## Chapter 2 Safe and Accurate Drug Administration 28

The Drug Administration Process 29 Preventing Medication Errors 29 Six Rights of Medication Administration 29 The Right Drug 30 The Right Dose 31 The Right Route 33 The Right Time 35

The Right Patient 36 The Right Documentation 36 Drug Prescriptions 38 Medication Orders 41 Types of Medication Orders 42 Components of a Medication Order 42 Medication Administration Records 45 Technology in the Medication Administration Process -50 Drug Labels 52 Combination Drugs 56 Controlled Substances 57 Drug Information 58 Prescription Drug Package Inserts 58 Over-the-Counter (OTC) Labels 58 Summary 62 Practice Sets 63

#### Chapter 3 Dimensional Analysis 75

Introduction to Dimensional Analysis 76

The Mathematical Foundation for Dimensional Analysis 76

Changing a Single Unit of Measurement to Another Single Unit of Measurement 78

Simple (One-Step) Problems with Single Units of Measurement 78
Complex (Multi-Step) Problems with Single Units of Measurement 82

Changing One Rate to Another Rate 85

Simple (One-Step) Problems with Rates 85
Complex (Multi-Step) Problems with Rates 87

Summary 89
Practice Sets 90

# Unit 2 Systems of Measurement 93

#### Chapter 4 The Household and Metric Systems 94

The Household System 95 Liquid Volume in the Household System 95 Weight in the Household System 96 Length in the Household System -97 Decimal-Based Systems 98 The Metric System 99 Liquid Volume in the Metric System 100 Weight in the Metric System 102 Length in the Metric System 105 Summary 106 Practice Sets 107 Cumulative Review Exercises 111

## Chapter 5 Converting from One System of Measurement to Another 113

Equivalents of Common Units of Measurement 114 Metric-Household Conversions 115 Summary 120 Practice Sets 120 Cumulative Review Exercises 125

## Unit 3 Oral and Parenteral Medications 127

#### **Chapter 6**

#### Oral Medication Doses 128

Simple (One-Step) Problems 129 Medication in Solid Form 129 Medication in Liquid Form 132 Medications Measured in Milliequivalents 136
Complex (Multi-Step) Problems 137
Calculating Dosage by Body Weight 143
Calculating Dosage by Body Surface Area 145 BSA Formulas 145 Nomograms 147
Summary 151

#### CASE STUDY 6.1 152

Practice Reading Labels 154 Practice Sets 160 Cumulative Review Exercises 167

#### Chapter 7 Syringes 169

Parts of a Syringe 170 Needles 170 Types of Syringes 171 Measuring Insulin Doses 178 Measuring a Single Dose of Insulin in an Insulin Syringe 178 Measuring Insulin with an Insulin Pen 179 Insulin Pumps 180 Measuring Two Types of Insulin in One Syringe 183 Measuring Premixed Insulin 185 Insulin Coverage/Sliding Scale Calculations 185 Prefilled Syringes 186 Safety Syringes 187 Needleless Syringes 188 Dosing Errors with Syringes 189 Summary 189 CASE STUDY 7.1 190

Practice Sets 194 Cumulative Review Exercises 205

#### Chapter 8 Preparation of Solutions 207

Determining the Strength of a Solution 208 Strengths of Solutions as Ratios, Fractions, and Percents 208 Liquid Solutes 210 Dry Solutes 212
Determining the Amount of Solute in a Given Amount of Solution 214
Determining the Amount of Solution That Contains a Given Amount of Solute 217
Irrigating Solutions, Soaks, and Oral Feedings 220
Summary 222
CASE STUDY 8.1 222

Practice Sets 224 Cumulative Review Exercises 229

#### Chapter 9 Parenteral Medications 230

Parenteral Medications 231 Parenteral Medications Supplied as Liquids 231 Parenteral Medications Supplied in Powdered Form 237 Heparin 244 Summary 248

#### CASE STUDY 9.1 249

Practice Sets 252 Cumulative Review Exercises 265

# Unit 4

# Infusions and Pediatric Dosages 269

#### Chapter 10

# Flow Rates and Durations of Enteral and Intravenous Infusions 270

Introduction to Enteral and Intravenous Solutions 271

Enteral Feedings 271
Intravenous Infusions 272
Intravenous Solutions 272

Equipment for IV Infusions 275

Infusion Pumps 277

Calculations for Infusions 277

Fluid Balance: Intake/Output 288

Summary 289
CASE STUDY 10.1 289
Practice Sets 290

Cumulative Review Exercises 294

#### Chapter 11 Calculating Flow Rates for Intravenous Medications 296

Intravenous Administration of Medications 297 Intravenous Piggyback Infusions 297 Converting Dosage Rates to IV Flow Rates 300 Converting IV Flow Rates to Dosage Rates 303 IV Push 305 Compound Rates 308 Titrated Medications 314 Summary 317 **CASE STUDY 11.1 317** Practice Sets 318 Cumulative Review Exercises 323

## Chapter 12 Calculating Pediatric Dosages 325

Pediatric Drug Dosages 326 Administration of Oral Medications 326 Administration of Parenteral Medications 327 Calculating Drug Dosages Based on Body Size 327 Calculating Drug Dosages Based on Body Weight 327 Calculating Drug Dosages Based on BSA 330 Determining Safe Dosage Range 331 Administration of Intravenous Medications 333 Using a Volume Control Chamber 334 Calculating Daily Fluid Maintenance 336 Summary 337 CASE STUDY 12.1 338 Practice Sets 340 Cumulative Review Exercises 345

## **Comprehensive Self-Tests** 349

#### Appendices 363

Appendix A	Answer Section 364	
Appendix B	Common Abbreviations Used in Medical Documentation	381

#### Index 383