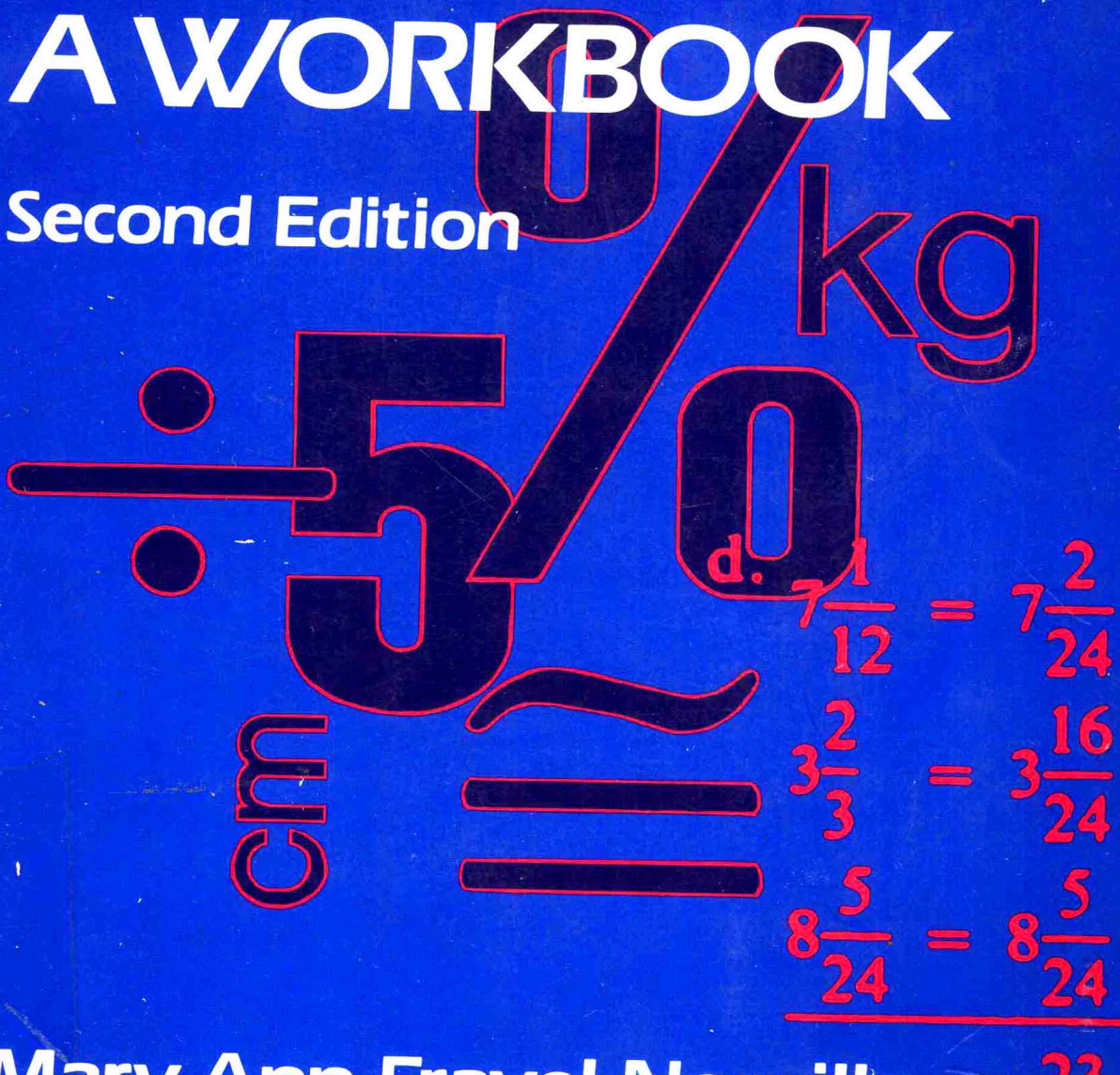
Drug Dosages and Solutions: A Workbook

Second Edition



Mary Ann Fravel Norville

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Second Edition

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Second Edition

To my husband, Charles.

Preface

In offering this second edition of my textbook to my colleagues and students, I wish to reaffirm my purposes as stated in the original edition, which were to facilitate the learning of dosage by nursing students (and by others in the health care professions) by presenting dosage in a manner that was clear and concise, and in a way in which the principles and problems of dosages and solutions might be simply stated, without compromising either the necessary information, or insulting the intelligence of the student. The acceptance of my original work by so many of my professional colleagues and their many favorable comments confirm my belief that such a text is needed, and justify the preparation of a second, enlarged edition.

Many new dosage problems have been added throughout the book, and I demonstrate how each problem can be solved by using either the ratio–proportion or the formula method. Practice problems have been included after each new explanation. The chapters have been rearranged so that problems based on the metric system are placed first. Recognizing a growing trend toward home health care, I have discussed household units of measurement and conversions from the metric system to make it easier for professionals to instruct clients in self-medication. The chapter on solutions has been clarified with explanations and practice problems using examples of solutions that might be used in home health situations.

Several chapters have been considerably enlarged, especially the chapters dealing with pediatrics and intravenous fluids, insulin, and solutions. In the chapter on pediatric dosage I have emphasized the need to confirm the appropriate dosage for an infant or child, and I have clarified and added new problems emphasizing dose per weight. The explanations have been rewritten for body surface area and nomogram use. I have de-emphasized Clark's, Fried's, and Young's rules, but include them for the benefit of those who may desire to use them.

The chapter on intravenous fluid rate calculations has been expanded. I use a simple two-step method to compute the large-volume IV flow rate. Only the second step is used to compute the flow rate for small-volume IVs, thus reducing the number of different formulas to be memorized. The section on flow rate calculation for large-volume IVs, how to deliver an ordered amount of drug per hour or per minute, has been expanded. Two new sections explain calculations for volume control sets (i.e., the Buretrol), how to determine if an IV is running off schedule, and how to correct this problem. All sections in the chapter contain practice problems.

The chapter on insulin includes the use of both an insulin syringe and cubic centimeter syringe.

Drug labels, syringes, and medicine cups are depicted throughout the text to make the problems more realistic for the student. I have included a new chapter on how to read the calibrations on the five syringes most frequently used to administer parenteral medications. I have also included a table of abbreviations commonly used in administering medications. This appears in the book's inside front cover for easy student reference.

Throughout, in revising the text, I have paid close attention to the criticism and suggestions of my colleagues and my students, rewriting and expanding areas in the original edition that were not clear to them. I thank my colleagues and my students for their thoughtful comments and suggestions.

Acknowledgments

I express my sincere appreciation to the many persons and drug companies who have helped me to complete this second edition of my book.

To my husband, Charles, who patiently read and critiqued my manuscript; to my family, for prodding me and encouraging me until this revision was completed.

To Jeffrey Longcope, former Nursing Editor of Appleton & Lange Publishers, for his advice, encouragement and support; to Joanne Jay, Director, Art/Editorial Production, for her many helpful suggestions; to Charles Evans, Production Editor, for his help and guidance through the editing process; and to all others at Appleton & Lange who have helped with the production of the second edition of this textbook.

To William L. Robinson, Jr., graphic artist, Essex Community College, my grateful appreciation for his graphic art work depicting the volume control set and syringes; to Carolyn Insley, who typed most of the manuscript and related correspondence, a special word of thanks for her friendship, patience, and understanding throughout; to Ruth Wright, and to Charles and Valerie Norville, who assisted with the typing.

To Helen V. Kramer, Professor of Nursing Emerita at Essex Community College, for her support from when I first discussed this book to the present; to my nursing faculty colleagues at Essex Community College, especially Terry Bianco and Karen Cooper who advised me about pediatric dosages, and Terry Majewski for her positive evaluation of my textbook; to my former colleague, Barbara Wise, who read and critiqued the pediatric chapter. In addition, I am grateful to my colleagues in the Allied Health and Mathematics Divisions of Essex Community College for their relevant insights and suggestions.

To Dr. Thomas M. Holcomb, Chairman of the Department of Pediatrics, and to the pharmacists and the many nurses at The Franklin Square Hospital, who helped and advised me on possible dosage problems; to Dr. Billy Wickcliffe, Assistant Professor of Pharmacy, University of Georgia, School of Pharmacy for her patience and wise counsel; to Mary Ann Hardage, Staff Pharmacist, St. Mary's Hospital, Athens, Georgia, for her help.

To the following pharmaceutical companies for the use of their copyrighted drug labels and/or pictures of equipment: Abbott Laboratories; Ivac Corporation; Eli Lilly & Company; Elkins-Sinn, Inc., a subsidiary of A. H. Robins Company; Merck, Sharp & Dohme, Division of Merck and Company; Parke Davis, Division of Warner-Lambert Company; Pfizer Laboratories Division; Roerig, a Division of Pfizer Pharmaceuticals; Smith Kline

and French Laboratories, a Smith Kline Beckman Company; and to all of the others who extended their courtesy and help to me.

Also, printed with permission by Bristol-Myers U.S. Pharmaceutical and Nutritional Group into the second edition of this textbook, the following drug labels: Dynapen 62.5 mg/5 ml; Polycillin 500 mg capsules; Polycillin-N 1 g for IM or IV use; Prostaphlin 500 mg for injection; Cefadyl 1 g for IV use; Amikin (Amikacin Sulfate injection) 500 mg/2 ml; Amikin (Amikacin Sulfate) 100 mg/2 ml; Polymox 125 mg/bottle; Cefadyl 1 g IV.

And, last but not least, I express my appreciation to my students (both past and present) for whom this book is written. Their words of praise and gratitude to me, along with their many helpful criticisms and suggestions, have made, and continue to make this project so worthwhile.

Introduction to Dosage and Solutions

In 1975 Congress passed the Metric Conversion Act, which states that the United States will convert to the metric system of weights and measures at some indefinite time in the future. We see some evidence of conversion to the metric system, for example, bottling companies are supplying soft drinks in metric measures, gasoline is being sold by the liter, and highway mileage signs are being posted in kilometers. In addition, modern measuring cups are inscribed with both metric and household measures.

In medicine, too, the trend has been toward the metric system. All drugs are now manufactured in metric units. Some drugs that have been used for many years also carry the apothecaries' equivalent on the label. Physicians trained in apothecaries' units still order drugs by this system of measurement. Therefore, nurses must know both the metric and the apothecaries' system to safely administer medications. In a recent survey of the hospitals and nursing homes in the state of Maryland, and in some other states as well, I found that the apothecaries' system is still being used by some physicians to order drugs.

In addition to these two systems, the nurse must be familiar with the household system used to teach self-medication in the home. Each of these three systems has different symbols and abbreviations. *Conversions among the three systems are only approximate; there are no absolute equivalents among the systems.* Each of these systems of measurement is discussed separately in the following chapters. First, I discuss the metric system, and explain how to solve problems using this system. The apothecaries' system and the household system are discussed afterward, along with methods of converting equivalent values from one system to the other.

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Contents

Preface ..... *ix*

Acknowledgments ..... *xi*

Introduction to Dosage and Solutions ..... *xiii*

Arithmetic Self-evaluation 1

1. The Metric System 21

2. Reading Drug Bottle Labels 29

3. Reading Syringe Calibrations 39

4. Dosage Problems 43

5. Units and Milliequivalents 59

6. Insulin Administration 67

7. Reconstituting Drugs in Powdered or Crystalline Form 81

8. Pediatric Dosage 97

9. Intravenous Fluid Rate Calculation 129

10. Conversion of Temperature Between Fahrenheit and Celsius 161

11. Preparation of Solutions 167

12. Apothecaries' System 203

13. Household System 209

14. Conversion Among the Apothecaries', Household, and Metric Systems 213

15. Computerization of Drug Records 229

Practice Tests

Practice Test 1 235

Practice Test 2 242

Practice Test 3 257

Practice Test 4 275

Arithmetic Self-evaluation

To begin your study of dosage and solutions, first review your basic math skills by doing this self-evaluation.

The number concepts needed to master the content of this dosage workbook are exemplified in the following problems. Work each set of examples to see if you remember how to find the answer. The explanations and answers are found on the pages following the test.

1. *Circle the largest number in each set. Underline the smallest number.*

   a. $\frac{1}{4}, \frac{4}{8}, \frac{3}{16}$

   b. $\frac{8}{9}, \frac{8}{25}, \frac{8}{125}$

   c. 0.5, 0.25, 0.125

   d. 0.325, 1.3333, 1.75

2. *Add the following fractions and mixed numbers.*

   a. $\frac{7}{8} + \frac{5}{4} =$ _____

   b. $10\frac{1}{2} + 12\frac{1}{4} + 16\frac{3}{4} =$ _____

   c. $\frac{3}{4} + \frac{1}{6} + \frac{1}{8} =$ _____

d. $7\frac{1}{12} + 3\frac{2}{3} + 8\frac{5}{24} =$ _____

3. *Add the following decimals.*

a. $10.4 + 45.62 + 0.44 =$ _____

b. $0.01 + 0.625 + 2.3 =$ _____

c. $16 + 8.24 + 0.084 =$ _____

d. $0.125 + 0.025 + 0.05 =$ _____

4. *Subtract the following fractions and mixed numbers.*

a. $\frac{2}{3} - \frac{1}{4} =$ _____

b. $6\frac{2}{5} - 5\frac{3}{10} =$ _____

c. $100\frac{1}{33} - 33\frac{1}{3} =$ _____

d. $175\frac{4}{6} - 148\frac{1}{3} =$ _____

5. *Subtract the following decimal fractions.*

a. $950 - 250.25 =$ _____

b. $0.05 - 0.025 =$ _____

c. $16.23 - 14.293 =$ _____

d. $2.8 - 0.95 =$ _____

6. *Multiply the following fractions.*

a. $\frac{2}{4} \times \frac{4}{6} =$ _____

b. $\frac{1}{2} \times \frac{1}{3} =$ _____

c. $5\frac{1}{6} \times \frac{1}{8} =$ _____

d. $4\frac{4}{5} \times 2\frac{1}{5} \times 8\frac{1}{4} =$ _____

7. *Multiply the following decimals.*

   a. $1.5 \times 3 =$ _____

   b. $0.05 \times 1.5 =$ _____

   c. $36.284 \times 7.21 =$ _____

   d. $0.0033 \times 6.02 =$ _____

8. *Divide the following fractions.*

   a. $\frac{1}{2} \div \frac{1}{3} =$ _____

   b. $\frac{1}{150} \div \frac{1}{2} =$ _____

   c. $3\frac{3}{4} \div \frac{2}{3} =$ _____

   d. $\dfrac{1\frac{1}{2}}{\frac{7}{8}} \div \dfrac{1\frac{1}{3}}{2\frac{1}{2}} =$ _____

9. *Divide the following decimals.*

   a. $64.5 \div 2.5 =$ _____

   b. $2.5 \div 0.01 =$ _____

   c. $12.075 \div 2.5 =$ _____

   d. $0.065 \div 10 =$ _____

10. *Solve for* N *using a formula and prove your answer.*

    a. $\frac{24}{48} \times 5 = N$

    b. $\frac{120}{60} \times 2.2 = N$

    c. $\frac{3.5}{1.75} \times 5 = N$

    d. $\frac{32}{16} \times N = 60$

    e. $\frac{4}{9} \times N = 8$

f. $\frac{N}{4} \times 6 = 4.5$

g. $\frac{N}{8} \times 4 = 3$

h. $\frac{6}{N} \times 6 = 4$

11. *Solve for* x *using the ratio–proportion method and prove your answer.*

a. $5:20::2:x$

b. $\frac{1}{6}:1::x:1\frac{1}{2}$

c. $\frac{2.5}{x} :: \frac{5}{10}$

d. $\frac{x}{\frac{3}{4}} :: \frac{\frac{7}{9}}{\frac{21}{24}}$

e. $x:16::4:8$

f. $27:x::9:3$

g. $\frac{4}{5} :: \frac{20}{x}$

h. $\frac{7}{8} :: \frac{x}{64}$

12. *Write the following Arabic numerals as Roman numerals.*

a. 8 _____

b. 3 _____

c. 21 _____

d. 50 _____

e. 5 _____

f. 14 _____

g. 101 _____

h. 1988 _____

13. *Write the following Roman numerals as Arabic numerals.*

a. CIV _____
b. XL _____
c. MCMLXXXI _____
d. XV _____
e. IV _____
f. XI _____
g. XXXIV _____
h. VII _____

14. *Convert the following units to the indicated equivalents.*

	Percentage	Decimal	Fraction	Ratio
a.	10%			
b.		0.65		
c.			1/4	
d.				1:500

15. *Round the following numbers as indicated.*

	Number	Round to the Nearest Whole Number	Round to the Nearest Tenth
a.	3.471		
b.	8.94		
c.	0.93		
d.	0.082		
e.	25.69		

	Number	Round to the Nearest Hundredth	Round to the Nearest Thousandth
f.	21.6107		
g.	4.2187		
h.	0.6709		
i.	8.4653		
j.	10.0294		