Part I Introduction

Chapter 1

Fundamentals of Math

Overview

To prevent medication errors, the pharmacy technician must master the ability to add, subtract, multiply, and divide whole numbers, fractions, and decimals. Anyone prone to errors in these basic skills will have difficulty computing proper dosages. Pharmacy technicians must master basic mathematics to calculate the dosage of drugs by weight and measures of volume. The technician must be able to solve various types of mathematical problems. Therefore, it is essential for the pharmacy technician to have a sound knowledge of basic mathematical skills.

It is also necessary for pharmacy technicians to understand the systems of measurement and how to convert (change) from one system to another in order to reduce the risk of medication errors. Three systems are used for measuring drugs and solutions: the metric, apothecary, and household systems. The weight of the patient and correct amount of the medication prescribed to the patient are essential factors to performing calculations in the various systems of measurement. Dosage calculations are most concerned with the measurement of weight and volume.

Glossary

apothecary system A system of measurement that was used in pharmacies until the early twentieth century; it has been replaced by the metric system.

Arabic numbers The numerical system commonly used, based on the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9.

exponent A method of expressing a number that is multiplied by itself.

gram The basic unit of weight in the metric system.

household system A system of measurement primarily used by patients at home; it is less accurate than the metric system. Its most common units of measure include drops, teaspoons, and tablespoons.

international unit A measurement used to describe potency of vitamins and chemicals. The quantity that measures biological activity, or effect, of substances, developed from the French "Système Internationale."

liter The basic unit of volume in the metric system.

meter The basic unit of length in the metric system.

metric system The most commonly used system of measurement; it is simple to use because it is based on parts and multiples of 10.

milliequivalent One-thousandth of an equivalent, the mass of a chemical ion that will combine with 1 gram of hydrogen or 8 grams of oxygen.

milliunit One-thousandth of a unit.

Roman numerals The numerical system in which symbols (letters) are used to represent Arabic numbers.

scientific notation A shorthand method of expressing large numbers that are a product of a number between 1 and 10 and a power of 10.

Système International (SI) A complete metric system of measurement for scientists; it includes measurements for length, weight, electric current, temperature, matter, and luminous intensity.

unit A standard of measurement based on the biological activity of a drug rather than its weight; used to express measurement quantities of vitamins, some antibiotics, and certain biologics such as vaccines.

Outline

Overview

Number Systems

- Arabic Numbers
- Roman Numerals

Conversion between Systems

Metric System

- Units of Measure
- Terminology and Abbreviations
- Metric Notation

Apothecary System

Household System

Milliequivalents and Units

Objectives

Upon completion of this chapter, the student should be able to:

1. Describe Arabic numbers.
2. Describe Roman numerals.
3. Recognize the symbols used to represent numbers in the Roman numeral system.
4. Convert and correctly write Arabic numbers as Roman numerals and Roman numerals as Arabic numbers.
5. Describe the system of measurement accepted worldwide as well as the household system.
6. List the basic units of weight, volume, and length of the metric system.
7. Explain the rules for changing grams to milligrams and milliliters to liters.
8. Calculate equivalent measurements within the metric system.
9. Summarize metric notation.

10. Recognize the symbols for dram, ounce, grain, and drop.

11. Describe the international unit.

12. Compare apothecary and household equivalents.

13. Explain the use of milliequivalents (mEq) and units in dosage calculations.

14. Describe the use of international units and milliunits (mU) in dosage calculations.

Teaching Strategies

As you are teaching Chapter 1, give examples of the Arabic and Roman numeral systems, and show students the symbols (letters) used to represent numbers in the Roman numeral system. Provide several examples of converting Arabic numbers to Roman numerals and converting Roman numerals to Arabic numbers. Repetition of terms and symbols reinforces the learning process and builds student confidence. Use the PowerPoint presentation for students who are visual learners.

ANSWERS TO STOP AND REVIEW EXERCISES

METRIC MEASURES – PAGE 11

1. 2.5
2. 0.63
3. 1.6
4. 1.3
5. 0.5
6. 0.15
7. 0.85
8. 0.25
9. 5.5
10. 0.1

MEASURES IN ABBREVIATIONS AND NOTATION – PAGE 12

1. 5 g
2. 200 mL
3. 0.5 L
4. 0.03 g
5. 400 mcg
6. 0.2 mg
7. 0.4 mg
8. 900 mcg
9. 10.3 mcg
10. 2.7 kg
11. 0.05 g
12. 6.4 kg

METRIC UNIT ABBREVIATIONS – PAGE 12

1. mg
2. mm
3. g
4. mcg
5. kg
6. m
7. mL
8. L
9. cm
10. kl

THE APOTHECARY SYSTEM – PAGE 14

1. gr iii
2. dr $\frac{2}{3}$
3. ʒ viii
4. lb iv
5. gr $\frac{1}{200}$
6. dr $\left(\overline{SS}\right)$
7. ʒ iii
8. lb ii
9. lb ii ʒ xi
10. gr $\left(\overline{SS}\right)$

THE HOUSEHOLD SYSTEM – PAGE 16

1. 1
2. 3
3. 1.5
4. 32
5. 2.67

ANSWER KEY TO TEST YOUR KNOWLEDGE QUESTIONS

1. V	11. XLV	21. 4	31. 18
2. XVIII	12. LXXXIX	22. 7	32. 12
3. IX	13. CXII	23. 9	33. 11
4. XVI	14. CLV	24. 13	34. 31
5. XIX	15. CXCVIII	25. 14	35. 21
6. XXII	16. CCII	26. 18	36. 6
7. XXIV	17. DVI	27. 19	37. 18
8. XXVII	18. DXXXIV	28. 24	38. 10
9. XXIX	19. M	29. 27	39. 9
10. XXX	20. MXXV	30. 29	40. 3

41. ℥
42. pt
43. gr
44. fl oz
45. dr
46. gtt
47. fl dr
48. qt
49. kg
50. L
51. mg
52. g
53. mL
54. mcg
55. m
56. cm
57. T or tbsp
58. c
59. t or tsp
60. gal
61. oz
62. 0.04 g
63. 17.5 kg
64. 3.5 kg
65. 5.3 mL
66. 10.4 mcg
67. 200 mcg
68. 15.2 mcg
69. 0.6 L
70. 8 g
71. 0.4 mL
72. 0.09 mg
73. gr v
74. $\frac{1}{2}$ t or $\frac{1}{2}$ tsp
75. 9 oz
76. $7\frac{1}{2}$ oz
77. gr xvi
78. gr $\left(\overline{SS}\right)$
79. dr iv
80. 25 mEq
81. 10,000 units
82. $\frac{1}{2}$ T or $\frac{1}{2}$ tbsp
83. $3\frac{1}{2}$ oz
84. $\frac{1}{2}$ oz
85. 15
86. 6
87. 32
88. 40
89. 76 (rounded)
90. 3
91. 1.2 (rounded)
92. 2
93. meter
94. dram
95. minim
96. grain
97. quart
98. ounce
99. ounce
100. $\frac{1}{2}$
101. millimeter
102. gram
103. gtt
104. gr
105. t or tsp
106. U, but this symbol should be avoided.*
107. T or tbsp
108. dr
109. mEq
110. pt
111. oz
112. length
113. volume
114. weight
115. 1000
116. 1
117. 10
118. 1000
119. 10
120. 1000
121. 0.1
122. 10 mg
123. 4.5 mL
124. 7 kg
125. 2.5 mm
126. 8.5 mcg

*Note: Remind students to avoid using the abbreviation "U" for "units."

CRITICAL THINKING

1a. The patient should use a tablespoon to administer the medication.

1b. The patient should take one tablespoon three times a day.

1c. 45 mL per day × 10 days equals 450 mL total. Because 450 mL is equivalent to 0.95 of a pint, the patient needs 2 half-pint bottles to contain enough medication for the 10-day period.

2. The pharmacy technician should ask the pharmacist or check a website to understand what the "L" stands for in the Roman numeral system.