Chapter 7

Dosage Calculations

CHAPTER OUTLINE

LEARNING OUTCOMES

Upon completion of the chapter, the student will be able to:

7-1 Differentiate the dosage strength of the supplied medication from the ordered dose.

7-2 Apply the *CASE* approach to calculate dosages using ratio-proportion, the formula method, and dimensional analysis.

KEY TERMS

***CASE* approach**
dimensional analysis
factor-label method
formula method
fractional ratio-proportion
linear ratio-proportion

Case Consideration … Calculation Choices

After learning about each medication, the nursing student was ready to prepare the medications for administration. The patient needed an intravenous (IV) antibiotic, a liquid cough medicine, and several other medications that were dispensed as tablets and capsules. The student reviewed the medication administration record (MAR) and realized dosage calculations were indicated.

1. How is dosage calculation performed?
2. Is there one approach that can be used for all dosage calculations?

INTRODUCTION

When administering medications, each *case* should be considered separately. Because medications may be supplied in varying dosage strengths, varying amounts may be required to administer the same dosage of medication. For example, Paxil® CR is supplied as 12.5 mg tablets and 25 mg tablets. Administration of a 25 mg dose would require two 12.5 mg tablets or only one 25 mg tablet. Even though the dose is the same, the amount to administer is different.

The patient's needs may change; a patient who was able to take an oral dose of medication may be ordered to take nothing by mouth (NPO), and will then require a different form and route of medication. Medications should be ordered on a case-by-case basis; safe dosages vary depending on the patient's age, weight, kidney function, liver function, and individual response. The authorized prescriber will order the dosage and route, but the nurse will have to consider the individual patient and supplied medication prior to administration.

To ensure safety and accuracy with dosage calculations, use the **CASE approach**. *CASE* is an acronym for four steps of safe dosage calculation, which are:

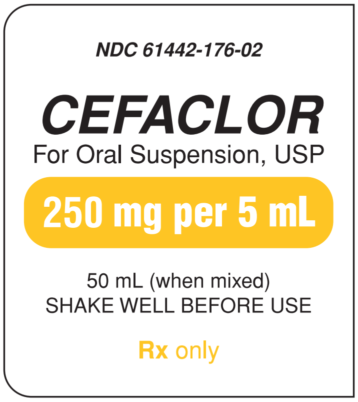
- ***C***: *Convert*—convert to like units of measurement
- ***A***: *Approximate*—estimate the amount to administer
- ***S***: *Solve*—perform dosage calculation
- ***E***: *Evaluate*—check the dosage calculation and compare to approximated amount

The word *CASE* also reminds the nurse to consider the appropriateness of the medication and dose ordered in each individual case.

7-1 Comparing the Supply to the Ordered Dose

The first two steps of the *CASE* approach, ***C***: *Convert* and ***A***: *Approximate*, require the comparison of the dosage strength (referred to as "supply") to the ordered dose. For example, the ordered dose may be in grams (g), while the supply is in milligrams (mg). Step ***C***: *Convert*, requires comparing the supply to the ordered dose and converting to the same unit of measurement, if they are different. If the supplied dosage strength and the ordered dose are in the same unit of measurement, the conversion step is not applicable (N/A).

Example:



Courtesy of FSC Pediatrics

Ordered dose: 0.35 g

Supply: 250 mg/5 mL

Because the ordered dose is in grams and the supply is in milligrams, convert the ordered dose (0.35 g) to the unit of measurement in the supply, mg, using a ratio-proportion equivalency. To use ratio-proportion, set up the known equivalency $\frac{1\ \text{g}}{1{,}000\ \text{mg}}$ on the left against the unknown equivalency on the right:

$$\frac{1\ \text{g}}{1{,}000\ \text{mg}} = \frac{0.35\ \text{g}}{x\ \text{mg}}$$

$$x = 1{,}000 \times 0.35$$

$$x = 350\ \text{mg}$$

To convert grams to milligrams by dimensional analysis, use the conversion factor $\frac{1{,}000\ \text{mg}}{1\ \text{g}}$ to have mg in the final answer, allowing grams to be cancelled:

$$0.35\ \cancel{\text{g}} \times \frac{1{,}000\ \text{mg}}{1\ \cancel{\text{g}}} = 350\ \text{mg}$$

Both methods of conversion reveal the ordered dose, 0.35 g, is equivalent to 350 mg.

Step ***A***: *Approximate*, requires approximating how much of the supplied medication to administer. To approximate, compare the supply to the ordered dose, and consider which is larger. In the previous example, the ordered dose, 350 mg, is larger than the supply of 250 mg, but less than twice the supply. Because the ordered dose is larger than the supply, it follows that the amount to administer will be larger than the supply dosage unit of 5 mL. Because it was determined that the ordered dose is less than twice the supply, it follows that the amount to administer will be less than 10 mL. Therefore, the amount to administer will be between 5–10 mL.

Example 1: Approximate the amount to administer.

Ordered dose: 500 mg

Supply: 250 mg/5 mL

To approximate the amount to administer, compare the supplied dosage of 250 mg to the ordered dosage of 500 mg. The ordered dose of 500 mg is twice as much as the supplied dosage of 250 mg, so the amount to administer needs to be proportionally larger (twice as much of the supply dosage unit). Because 250 mg are contained in the dosage unit of 5 mL, two times the dosage unit (i.e., 10 mL) will be required to administer a 500 mg dose.

Example 2: Approximate the amount to administer.

Ordered dose: 75 mg

Supply: 150 mg/tablet

The ordered dose of 75 mg is half as large as the supplied dose of 150 mg, therefore the amount to administer will be proportionately smaller (half the dosage unit). Because the dosage unit is 1 tablet, ½ tablet will be needed.

When the ratio is not as clear, find measurable parameters, such as the ordered dose may be more than twice as much, but less than three times as much as the supplied dosage, or the ordered dose is less than half the supplied dosage strength but more than one-third.

Example 3: Approximate the amount to administer.

Ordered dose: 210 mg

Supply: 125 mg/mL

The ordered dose is larger than the supplied dosage, but it is not twice as large, because 2 × 125 mg is 250 mg, and the ordered dose is 210. Therefore, more than 1 mL, but less than 2 mL will be required to administer 210 mg. This rough estimation will promote confidence in the calculated amount if it is between 1 and 2 mL.

WARNING!

Approximation Is Not a Substitute for Calculation

Approximation is a critical thinking step used to verify the correct equation was used and the calculation was performed accurately. The amount to administer should be calculated not approximated.

LEARNING ACTIVITY 7-1

Refer to the following labels to compare the ordered dose to the supply and determine steps *C* and *A* of the *CASE* approach. If the conversion step is not applicable, indicate N/A.

1. Order: dantrolene 75 mg. Supply: See **Figure 7-1**.

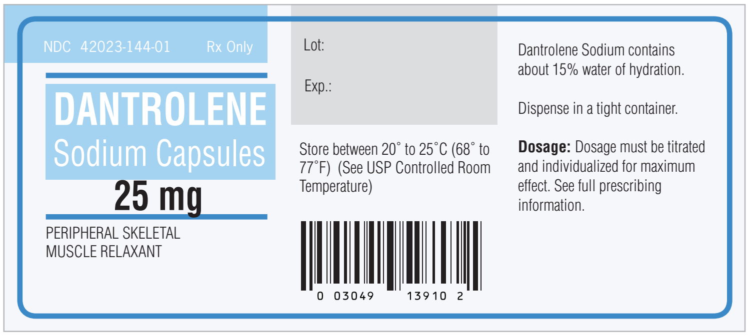


FIGURE 7-1

a. ***C***: *Convert*
b. ***A***: *Approximate*

2. Order: tamsulosin 400 mcg. Supply: See **Figure 7-2**.

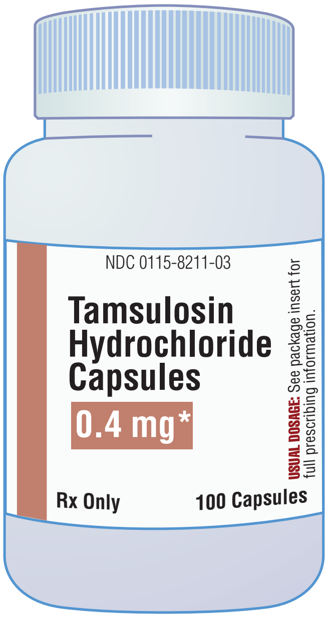


FIGURE 7-2

a. ***C***: *Convert*
b. ***A***: *Approximate*

3. Order: diazepam 5 mg. Supply: See **Figure 7-3**.

FIGURE 7-3

a. ***C***: *Convert*
b. ***A***: *Approximate*

7-2 Methods of Dosage Calculation

To perform step ***S***: *Solve* of the *CASE* approach, three different methods of dosage calculation can be used, which are presented in this section: *ratio-proportion*, the *formula method*, and *dimensional analysis*. After performing the calculation, step ***E:*** *Evaluate*, is accomplished by comparing the answer to the approximated amount in step ***A*** and by checking (redoing) the calculation after replacing *x* with the calculated value.

To use ratio-proportion to solve basic dosage calculations, two equal fractions or ratios will be set up to compare the known supply to the ordered dose and unknown amount to administer:

- **Fractional ratio-proportion**:

$$\frac{\text{supplied dose}}{\text{dosage unit}} = \frac{\text{ordered dose}}{\text{amount to administer } (x)}$$

- **Linear ratio-proportion**:

$$\text{supplied dose} : \text{dosage unit} = \text{ordered dose} : \text{amount to administer } (x)$$

This method is most useful when the units of measurement are the same. If conversion of a unit of measurement is required, it is done as an additional step, prior to setting up the dosage calculation. Complex IV infusion calculations, or other calculations requiring multiple conversions, are not generally performed using the ratio-proportion method.

The **formula method** is a simple way of calculating the amount to administer. As with ratio-proportion, if a unit of measurement conversion is required, it is done in a separate step, prior to setting up the dosage calculation. With the formula method, the supplied dose, ordered dose, and the supplied dosage unit are placed in a formula to determine the amount to administer:

$$\frac{\text{ordered dose i.e., } \textbf{D}\text{esired dose } (D)}{\text{supplied dose i.e., dose on } \textbf{H}\text{and } (H)} \times \text{dosage unit i.e., } \textbf{Q}\text{uantity } (Q) = \text{amount to administer}(x)$$

Although this method is a quick way to perform dosage calculation, there is a tendency to eliminate the dosage unit in the dosage calculation because it is often 1 (e.g., 1 capsule, 1 tablet, 1 mL). When a dosage unit is a quantity other than 1, eliminating it in the calculation will yield an incorrect amount. To avoid error with the formula method, it is important to insert the dosage unit into every calculation. Additionally, different formulas are required for IV rate calculation. Implementing the wrong formula can result in medication errors.

Dimensional analysis, also known as the **factor-label method** (or conversion factor method, as referred to in Chapter 2), determines the amount to administer by multiplying a series of fractions. Dimensional analysis is a systematic method of converting units of measurement (dimensions). In other words, dimensions such as mg and mL in the dose and supply are multiplied by conversion factors to determine the amount to administer.

$$\text{amount to administer} = \overset{\textit{Supply}}{\frac{\text{dosage unit}}{\text{dose supplied}}} \times \overset{\textit{CF}}{\text{conversion factor}(s)} \times \overset{\textit{Order}}{\frac{\text{ordered dose}}{1}}$$

Compared to the other methods of dosage calculation, dimensional analysis is easier to remember, improves accuracy, and helps reduce medication errors (Cookson, 2013).

Dimensional analysis can be used for any dosage calculation. It is extremely useful when several conversions must be made to determine the amount to administer (e.g., converting minutes to hours, and grams to micrograms to determine the rate to administer certain IV medications). Using the *CASE* approach, the conversion step is used to identify the conversion factor(s) required, but the actual conversion(s) is performed during the calculation step. Because this is a very efficient way of performing multiple conversions, dimensional analysis is often used by critical care nurses. A research study done through Adelphi University examined the accuracy of dosage calculations done by students that used traditional methods versus dimensional analysis. Data analysis revealed that the dimensional analysis group performed with greater accuracy (Greenfield, Whelan, & Cohn, 2006). The current trend for nursing schools is to adopt dimensional analysis as the preferred method of dosage calculation.

Ratio-Proportion

A proportion compares two equivalent fractions or ratios. The fractional ratio-proportion compares two equivalent fractions and the linear ratio-proportion compares two equivalent ratios.

Fractional Ratio-Proportion

When preparing a fractional ratio-proportion, set the supplied dosage strength (supply) as the *known* equivalent on the left side of the equal sign, and the ordered dosage (order) as the *unknown* equivalent on the right side of the equal sign:

$$\frac{\text{supplied dose}}{\text{dosage unit}} = \frac{\text{ordered dose}}{\text{amount to administer } (x)}$$

Write the supplied dosage strength as a fraction with the supplied dose as the numerator and the dosage unit as the denominator. Write the ordered dose to administer as a fraction with the ordered dose as the numerator and the ordered amount to administer (usually *x*) as the denominator. Be sure to label all units of measurement, including *x*. The correct label for the answer will be the label attached to *x*.

Example 1: Set up a fractional ratio-proportion equation in which *x* is the amount to administer.

Order: digoxin 125 mcg PO daily

Supply: See label.

Courtesy of Sandoz

$$\begin{array}{ccc} \textit{Supply} & & \textit{Order} \\ \dfrac{500 \text{ mcg}}{2 \text{ mL}} & = & \dfrac{125 \text{ mcg}}{x \text{ mL}} \end{array}$$

Example 2: Set up a fractional ratio-proportion equation in which *x* is the amount to administer.

Order: bupropion HCl XR 300 mg PO daily

Supply: See label.

$$\begin{array}{ccc} \textit{Supply} & & \textit{Order} \\ \dfrac{150\text{ mg}}{1\text{ tab}} & = & \dfrac{300\text{ mg}}{x\text{ tab}} \end{array}$$

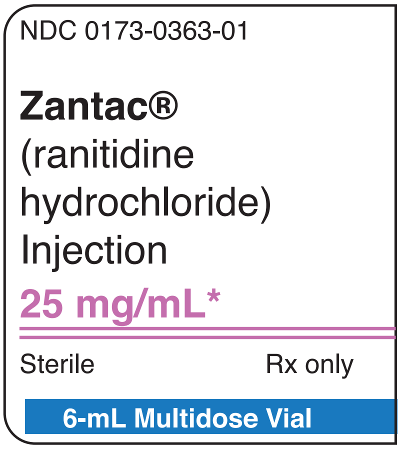
LEARNING ACTIVITY 7-2

Use the information from each medication label to set up a fractional ratio-proportion equation.

1. **Order:** Benztropine mesylate 1 mg PO bid
   Supply: See label.

2. **Order:** Zantac® 50 mg IV q8h

   Supply: See label.



Courtesy of GlaxoSmithKline

3. **Order:** furosemide 40 mg PO daily

   Supply: See label.

Courtesy of Sanofi

For patient safety, when determining the amount of medication to administer using ratio-proportion, implement the *CASE* method.

Example 1: Determine the number of capsules to administer, using ratio-proportion and the CASE method.

Order: 0.5 g

Supply: 250 mg per capsule

C: *Convert*—Convert ordered amount in grams to milligrams, using the equivalent 1 g = 1,000 mg

$$\frac{1 \text{ g}}{1{,}000 \text{ mg}} = \frac{0.5 \text{ g}}{x \text{ mg}}$$

$$1 \times x = 1{,}000 \times 0.5$$

$$x = 500 \text{ mg}$$

A: *Approximate*—Because the ordered dose is twice the supplied dose, two capsules will be needed.

S: *Solve*—Supply = 250 mg/1 cap; Order = 500 mg

- Set up the ratios, supply (known equivalent) = order (unknown equivalent):

$$\begin{array}{ccc} \textit{Supply} & & \textit{Order} \\ \dfrac{250\text{ mg}}{1\text{ cap}} & = & \dfrac{500\text{ mg}}{x\text{ cap}} \end{array}$$

- Cross-multiply: $250 \times x = 1 \times 500$
- Simplify: $250x = 500$
- Divide both sides by 250 to let x stand alone:

$$\frac{\cancel{250}x}{\cancel{250}} = \frac{500}{250}$$

$$x = 2\text{ cap}$$

Because x cap is what is being solved, "cap" is the correct label for this answer.

E: *Evaluate*—Set up the ratio, replacing x cap with 2 cap and check the math:

$$\frac{250\text{ mg}}{1\text{ cap}} = \frac{500\text{ mg}}{2\text{ cap}}$$

$$250 \times 2 = 1 \times 500$$

$$500 = 500$$

Because the calculated amount forms a true statement and is consistent with the approximated amount, 2 cap, the answer is confirmed.

Example 2: Determine the volume to administer, using ratio-proportion and the CASE method.

Order: 0.03 g

Supply: 15 mg/5 mL

C: *Convert*—Convert ordered amount in grams to milligrams, using the equivalent 1 g = 1,000 mg:

$$\frac{1\text{ g}}{1{,}000\text{ mg}} = \frac{0.03\text{ g}}{x\text{ mg}}$$

$$1 \times x = 1{,}000 \times 0.03$$

$$x = 30\text{ mg}$$

A: *Approximate*—Because the ordered dose is twice the dose supplied in 5 mL, 10 mL will be needed.

S: *Solve*—Supply = 15 mg/5 mL; Order = 30 mg

- Set up the ratios, supply (known equivalent) = order (unknown equivalent):

$$\begin{array}{cc} \textit{Supply} & \textit{Order} \end{array}$$

$$\frac{15 \text{ mg}}{5 \text{ mL}} = \frac{30 \text{ mg}}{x \text{ mL}}$$

- Cross-multiply: $15 \times x = 5 \times 30$
- Simplify: $15x = 150$
- Divide both sides by 15 to let x stand alone:

$$\frac{\cancel{15}x}{\cancel{15}} = \frac{150}{15}$$

$$x = 10 \text{ mL}$$

E: *Evaluate*—Set up the ratio, replacing x mL with 10 mL and check the math:

$$\frac{15 \text{ mg}}{5 \text{ mL}} = \frac{30 \text{ mg}}{10 \text{ mL}}$$

$$15 \times 10 = 5 \times 30$$

$$150 = 150$$

Because the calculated amount forms a true statement and is consistent with the approximated amount, 10 mL, the answer is confirmed.

Example 3:

Order: 450 mg

Supply: 150 mg per tablet

C: *Convert*—Because the ordered dose and supplied dose are both measured in mg, no conversion is needed.

A: *Approximate*—Because the ordered dose is three times the supplied dose, three tablets will be needed.

S: *Solve*—Supply = 150 mg/1 tab; Order = 450 mg

- Set up the ratios, supply (known equivalent) = order (unknown equivalent):

$$\begin{array}{cc} \textit{Supply} & \textit{Order} \end{array}$$

$$\frac{150 \text{ mg}}{1 \text{ tab}} = \frac{450 \text{ mg}}{x \text{ tab}}$$

- Cross-multiply: $150 \times x = 1 \times 450$
- Simplify: $150x = 450$
- Divide both sides by 150 to let x stand alone:

$$\frac{\cancel{150}x}{\cancel{150}} = \frac{450}{150}$$

$$x = 3 \text{ tab}$$

E: *Evaluate*—Set up the ratio, replacing *x* tab with 3 tab and check the math:

$$\frac{150 \text{ mg}}{1 \text{ tab}} = \frac{450 \text{ mg}}{3 \text{ tab}}$$
$$150 \times 3 = 1 \times 450$$
$$450 = 450$$

Because the calculated amount forms a true statement and is consistent with the approximated amount, 3 tab, the answer is confirmed.

LEARNING ACTIVITY 7-3 Using fractional ratio-proportion within the *CASE* approach, calculate the amount to administer for each ordered dose.

1. Order: 2.5 mg; Supply: 5 mg/mL
2. Order: 0.075 g; Supply: 25 mg per tablet
3. Order: 1.45 mg; Supply 2 mg/5 mL

Linear Ratio-Proportion

When preparing a linear ratio-proportion, set the supplied dosage strength as a ratio on one side, and create a proportion using the ordered dosage and *x* as the unknown amount to administer:

$$\text{supplied dosage strength (supply)} = \text{ordered amount to administer (order)}$$
$$\text{supplied dose} : \text{dosage unit} = \text{ordered dose} : \text{amount to administer } (x)$$

Be sure to label all units of measurement, including *x*. The correct label for the answer will be the label attached to *x*. To solve a linear ratio-proportion, the product of the means (the two middle numbers) is equal to the product of the extremes (the two outer numbers).

Example 1:

Order: erythromycin delayed release 0.5 g PO bid

Supply: 250 mg per capsule

C: *Convert*—Convert ordered amount in grams to milligrams, using the equivalent 1 g = 1,000 mg

$$\frac{1 \text{ g}}{1{,}000 \text{ mg}} = \frac{0.5 \text{ g}}{x \text{ mg}}$$
$$1 \times x = 1{,}000 \times 0.5$$
$$x = 500 \text{ mg}$$

A: *Approximate*—Because the ordered dose is twice the supplied dose, two capsules will be needed.

S: *Solve*—Supply = 250 mg/1 cap; Order = 500 mg

- Set up the ratios, supply = order:

$$\begin{array}{cc} \textit{Supply} & \textit{Order} \end{array}$$
$$250 \text{ mg} : 1 \text{ cap} = 500 \text{ mg} : x \text{ cap}$$

Extremes Means

- Set up the equation: $250 \times x = 1 \times 500$
- Simplify the equation: $250x = 500$
- Divide both sides by 250 to let x stand alone:

$$\frac{\cancel{250}x}{\cancel{250}} = \frac{500}{250}$$

$$x = 2 \text{ cap}$$

Because x cap is what is being solved, "cap" is the correct label for this answer.

E: *Evaluate*—Set up the ratio, replacing x cap with 2 cap and check the math:

$$250 \text{ mg} : 1 \text{ cap} = 500 \text{ mg} : 2 \text{ cap}$$

$$250 \times 2 = 1 \times 500$$

$$500 = 500$$

Because the calculated amount forms a true statement and is consistent with the approximated amount, 2 cap, the answer is confirmed.

Example 2:

Order: 0.03 g

Supply: 15 mg/5 mL

C: *Convert*—Convert ordered amount in grams to milligrams, using the equivalent 1 g = 1,000 mg

$$\frac{1 \text{ g}}{1{,}000 \text{ mg}} = \frac{0.03 \text{ g}}{x \text{ mg}}$$

$$1 \times x = 1{,}000 \times 0.03$$

$$x = 30 \text{ mg}$$

A: *Approximate*—Because the ordered dose is twice the dose supplied in 5 mL, 10 mL will be needed.

S: *Solve*—Supply = 15 mg/5; Order = 30 mg

- Set up the ratios, supply = order:

Supply Order

$$15 \text{ mg} : 5 \text{ mL} = 30 \text{ mg} : x \text{ mL}$$

Extremes Means

- Set up the equation: $15 \times x = 5 \times 30$
- Simplify the equation: $15x = 150$
- Divide both sides by 15 to let x stand alone:

$$\frac{\cancel{15}x}{\cancel{15}} = \frac{150}{15}$$

$$x = 10 \text{ mL}$$

E: *Evaluate*—Set up the ratio, replacing x mL with 10 mL and check the math:

$$15 \text{ mg} : 5 \text{ mL} = 30 \text{ mg} : 10 \text{ mL}$$
$$15 \times 10 = 5 \times 30$$
$$150 = 150$$

Because the calculated amount forms a true statement and is consistent with the approximated amount, 10 mL, the answer is confirmed.

Example 3:

Order: 450 mg

Supply: 150 mg per tablet

C: *Convert*—Because the ordered dose and supplied dose are both measured in mg, no conversion is needed.

A: *Approximate*—Because the ordered dose is three times the supplied dose, three tablets will be needed.

S: *Solve*—Supply = 150 mg/1 tab; Order = 450 mg

- Set up the ratios, supply = order:

$$\underset{Supply}{150 \text{ mg} : 1 \text{ tab}} = \underset{Order}{450 \text{ mg} : x \text{ tab}}$$

Extremes *Means*

- Set up the equation: $150 \times x = 1 \times 450$
- Simplify the equation: $150x = 450$
- Divide both sides by 150 to let x stand alone:

$$\frac{\cancel{150}x}{\cancel{150}} = \frac{450}{150}$$
$$x = 3 \text{ tab}$$

E: *Evaluate*—Set up the ratio, replacing x tab with 3 tab and check the math:

$$150 \text{ mg} : 1 \text{ tab} = 450 \text{ mg} : 3 \text{ tab}$$
$$150 \times 3 = 1 \times 450$$
$$450 = 450$$

Because the calculated amount forms a true statement and is consistent with the approximated amount, 3 tab, the answer is confirmed.

LEARNING ACTIVITY 7-4 Using the linear ratio-proportion method within the *CASE* approach, calculate the amount to administer for each ordered dose.

1. Order: 5 mg; Supply: 2 mg/tab
2. Order: 0.5 g; Supply: 100 mg/15 mL
3. Order: 0.25 g; Supply 125 mg/cap

Formula Method

The formula method uses the following formula to calculate the amount to administer:

$$\frac{\text{ordered dose i.e., }\mathbf{D}\text{esired dose }(D)}{\text{supplied dose i.e., dose on }\mathbf{H}\text{and }(H)} \times \text{dosage unit i.e., }\mathbf{Q}\text{uantity}\,(Q) = \text{amount to administer}(x)$$

$$\frac{D}{H} \times Q = x$$

Example 1:

Ordered Dose: 0.5 g

Supply: 250 mg per capsule

C: *Convert*—Convert the ordered dose from grams to milligrams, using the conversion factor $\frac{1{,}000 \text{ mg}}{1 \text{ g}}$.

$$0.5 \cancel{\text{g}} \times \frac{1{,}000 \text{ mg}}{1 \cancel{\text{g}}} = 500 \text{ mg}$$

A: *Approximate*—Because the ordered dose is twice the supplied dose, two capsules will be needed.

S: *Solve*—D = 500 mg; H = 250 mg; Q = 1 cap

$$\frac{500 \cancel{\text{mg}}}{250 \cancel{\text{mg}}} \times 1 \text{ cap} = x \text{ (cap)}$$

$$2 \times 1 \text{ cap} = x$$

$$2 \text{ cap} = x$$

E: *Evaluate*—Replace x with 2 cap and check the math:

$$\frac{500 \cancel{\text{mg}}}{250 \cancel{\text{mg}}} \times 1 \text{ cap} = 2 \text{ cap}$$

$$2 \times 1 \text{ cap} = 2 \text{ cap}$$

Because the calculated amount forms a true statement and is consistent with the approximated amount, 2 cap, the answer is confirmed.

> **NOTE:** Because the dose is supplied in capsules, the unit of measurement for *x* must be capsules. This reminds the nurse that after all units of measurement cancel out, cap should remain. If after performing the calculations for *x*, mg remains, the nurse knows the equation was set up incorrectly.

Example 2:

Ordered Dose: 0.03 g

Supply: 15 mg/5 mL

C: *Convert*—Convert the ordered dose from grams to milligrams, using the conversion factor $\frac{1{,}000 \text{ mg}}{1 \text{ g}}$.

$$0.03 \cancel{\text{g}} \times \frac{1{,}000 \text{ mg}}{1 \cancel{\text{g}}} = 30 \text{ mg}$$

A: *Approximate*—Because the ordered dose is twice the supplied dose, twice the volume (10 mL) will be needed.

S: *Solve*—D = 30 mg; H = 15 mg; Q = 5 mL

$$\frac{30 \cancel{\text{mg}}}{15 \cancel{\text{mg}}} \times 5 \text{ mL} = x \text{ (mL)}$$

$$2 \times 5 \text{ mL} = x$$

$$10 \text{ mL} = x$$

E: *Evaluate*—Replace x with 10 mL and check the math:

$$\frac{30 \cancel{\text{mg}}}{15 \cancel{\text{mg}}} \times 5 \text{ mL} = 10 \text{ mL}$$

$$2 \times 5 \text{ mL} = 10 \text{ mL}$$

Because the calculated amount forms a true statement and is consistent with the approximated amount, 10 mL, the answer is confirmed.

Example 3:

Ordered Dose: 450 mg

Supply: 150 mg per tablet

C: *Convert*—Because the ordered dose and supplied dose are both measured in mg, no conversion is needed.

A: *Approximate*—Because the ordered dose three times the supplied dose, three tablets will be needed.

S: *Solve*—D = 450 mg; H = 150 mg; Q = 1 tab

$$\frac{450 \cancel{\text{mg}}}{150 \cancel{\text{mg}}} \times 1 \text{ tab} = x \text{ (tab)}$$

$$3 \times 1 \text{ tab} = x$$

$$3 \text{ tab} = x$$

E: *Evaluate*—Replace x with 3 tab and check the math:

$$\frac{450 \cancel{\text{mg}}}{150 \cancel{\text{mg}}} \times 1 \text{ tab} = 3 \text{ tab}$$

$$3 \times 1 \text{ tab} = 3 \text{ tab}$$

Because the calculated amount forms a true statement and is consistent with the approximated amount, 3 tab, the answer is confirmed.

LEARNING ACTIVITY 7-5 Using the formula method within the *CASE* approach, calculate the amount to administer for each ordered dose.

1. Ordered Dose: 0.45 g; Supply: 150 mg/tab
2. Ordered Dose: 0.2 mg; Supply: 100 mcg/mL
3. Ordered Dose: 20 mg; Supply 100 mg/5 mL

Dimensional Analysis

Dimensional analysis links known quantities to an unknown quantity through a series of conversion factors (CF). For example, to determine the number of seconds in 1 week, a series of conversion factors will be set up in an equation in order that all factor labels (units of measurement) will cancel out except seconds and week:

$$x\,(\text{seconds/week}) = \frac{60 \text{ seconds}}{1\ \cancel{\text{minute}}} \times \frac{60\ \cancel{\text{minutes}}}{1\ \cancel{\text{hour}}} \times \frac{24\ \cancel{\text{hours}}}{1\ \cancel{\text{day}}} \times \frac{7\ \cancel{\text{days}}}{1 \text{ week}} = 604{,}800 \text{ seconds/week}$$

Notice in the above example, that seconds/week is the amount to be determined, so seconds is placed in the numerator of the first fraction, and week is placed in the denominator of the final fraction. Small, known conversion factors form a bridge between seconds and weeks. To avoid error, it is important that the conversion factors are for 1 unit of measurement (i.e., 1 minute or 1 hour or 1 day, in the previous example). Although it is possible to use larger conversion factors such as 3,600 seconds/60 minutes, this factor is error-prone. After all of the labels (units of measurement) are cancelled, seconds/week remains. Unit of measurement cancellation is an important aspect of dimensional analysis.

To apply dimensional analysis to dosage calculation, set up the equation as follows:

$$\text{amount to administer} = \underbrace{\frac{\text{dosage unit}}{\text{dose supplied}}}_{\textit{Supply}} \times \underbrace{\text{conversion factor}(s)}_{\textit{CF}} \times \underbrace{\frac{\text{ordered dose}}{1}}_{\textit{Order}}$$

Multiple conversions can be included in one equation, and dimensional analysis can be used to determine dosage in complex IV equations. For example, to determine how many mcg are administered over 1 minute, if a solution containing 2.4 g/L is infusing IV at 5 mL/h, the equation would be set up as:

$$x\,(\text{mcg/min}) = \underbrace{\frac{1{,}000 \text{ mcg}}{1\ \cancel{\text{mg}}}}_{\textit{CF}} \times \underbrace{\frac{1{,}000\ \cancel{\text{mg}}}{1\ \cancel{\text{g}}}}_{\textit{CF}} \times \underbrace{\frac{2.4\ \cancel{\text{g}}}{1\ \cancel{\text{L}}}}_{\textit{Supply}} \times \underbrace{\frac{1\ \cancel{\text{L}}}{1{,}000\ \cancel{\text{mL}}}}_{\textit{CF}} \times \underbrace{\frac{5\ \cancel{\text{mL}}}{1\ \cancel{\text{h}}}}_{\textit{Order}} \times \underbrace{\frac{1\ \cancel{\text{h}}}{60 \text{ min}}}_{\textit{CF}}$$

Although this complex calculation may look intimidating and difficult, it will be covered and simplified in Chapter 15, "Critical Care Calculations." For safety and accuracy, the *CASE* approach should be employed when using dimensional analysis.

Example 1:

Ordered Dose: 0.5 g

Supply: 250 mg per capsule

C: *Convert*—To cancel grams, use the conversion factor $\frac{1{,}000 \text{ mg}}{1 \text{ g}}$.

A: *Approximate*—Mentally convert 0.5 g to 500 mg to determine the ordered dose is twice the supplied dose, therefore, two capsules will be needed.

S: *Solve*—Supply = 1 cap/250 mg; Conversion factor = 1,000 mg/1g; Order = 0.5 g/1

$$x\ (\text{cap}) = \frac{1\ \text{cap}}{250\ \cancel{\text{mg}}} \times \frac{1{,}000\ \cancel{\text{mg}}}{1\ \cancel{\text{g}}} \times \frac{0.5\ \cancel{\text{g}}}{1}$$

$$x = \frac{500\ \text{cap}}{250}$$

$$x = 2\ \text{cap}$$

E: *Evaluate*—Replace x with 2 cap and check the math:

$$2\ \text{cap} = \frac{1\ \text{cap}}{250\ \cancel{\text{mg}}} \times \frac{1{,}000\ \cancel{\text{mg}}}{1\ \cancel{\text{g}}} \times \frac{0.5\ \cancel{\text{g}}}{1}$$

$$2\ \text{cap} = \frac{500\ \text{cap}}{250}$$

$$2\ \text{cap} = 2\ \text{cap}$$

Because the calculated amount forms a true statement and is consistent with the approximated amount, 2 cap, the answer is confirmed.

NOTE: Because the dose is supplied in capsules, the unit of measurement for *x* must be capsules. This reminds the nurse to place cap in the numerator. After all units of measurement cancel out, cap should remain. If after performing the calculations for *x*, mg remains, the nurse knows the equation was set up incorrectly.

Example 2:

Ordered Dose: 0.03 g

Supply: 15 mg/5 mL

C: *Convert*—To cancel grams, use the conversion factor $\frac{1{,}000\ \text{mg}}{1\ \text{g}}$.

A: *Approximate*—Mentally convert 0.03 g to 30 mg to determine the ordered dose is twice the supplied dose, therefore, twice the supply volume, or 10 mL, will be needed.

S: *Solve*—Supply = 5 mL/15 mg; Conversion factor = 1,000 mg/1 g; Order = 0.03 g/1

$$x\,(\text{mL}) = \frac{5\ \text{mL}}{15\ \cancel{\text{mg}}} \times \frac{1{,}000\ \cancel{\text{mg}}}{1\ \cancel{\text{g}}} \times \frac{0.03\ \cancel{\text{g}}}{1}$$

$$x = \frac{150\ \text{mL}}{15}$$

$$x = 10\ \text{mL}$$

E: *Evaluate*—Replace *x* with 10 mL and check the math:

$$10 \text{ mL} = \frac{5 \text{ mL}}{15 \cancel{\text{mg}}} \times \frac{1{,}000 \cancel{\text{mg}}}{1 \cancel{\text{g}}} \times \frac{0.03 \cancel{\text{g}}}{1}$$

$$10 \text{ mL} = \frac{150 \text{ mL}}{15}$$

$$10 \text{ mL} = 10 \text{ mL}$$

Because the calculated amount forms a true statement and is consistent with the approximated amount, 10 mL, the answer is confirmed.

Example 3:

Ordered Dose: 450 mg

Supply: 150 mg per tablet

C: *Convert*—Because the ordered dose and supplied dose are both measured in mg, no conversion factor is needed.

A: *Approximate*—Because the ordered dose is three times the supplied dose, three tablets will be needed.

S: *Solve*—Supply = 1 tab/150 mg; Order = 450 mg/1

$$x\,(\text{tab}) = \frac{1 \text{ tab}}{150 \cancel{\text{mg}}} \times \frac{450 \cancel{\text{mg}}}{1}$$

$$x = \frac{450 \text{ tab}}{150}$$

$$x = 3 \text{ tab}$$

E: *Evaluate*—Replace *x* with 3 tab and check the math:

$$3 \text{ tab} = \frac{1 \text{ tab}}{150 \text{ mg}} \times \frac{450 \text{ mg}}{1}$$

$$3 \text{ tab} = \frac{450 \text{ tab}}{150}$$

$$3 \text{ tab} = 3 \text{ tab}$$

Because the calculated amount forms a true statement and is consistent with the approximated amount, 3 tab, the answer is confirmed.

LEARNING ACTIVITY 7-6

Using dimensional analysis within the *CASE* approach, calculate the amount to administer for each ordered dose.

1. Ordered Dose: 2 g; Supply: 100 mg/mL
2. Ordered Dose: 150 mcg; Supply: 0.25 mg/2 mL
3. Ordered Dose: 1 mg; Supply 2 mg/5 mL

Calculation Choices … Case Closure

The *CASE* approach should be implemented to prevent calculation errors. Any of the three methods (ratio-proportion, formula, or dimensional analysis) may be used to solve basic calculations. However, when multiple conversions are necessary, as in complex IV rate calculations, ratio-proportion is generally not used. Several different formulas are needed to perform all types of dosage calculation by the formula method. Many find it difficult to memorize and recall the various formulas, which may result in dosage calculation errors.

Dimensional analysis can be used when no conversion is needed, but it is particularly useful when multiple conversions are needed to calculate the dose. All dosage calculations can be performed using dimensional analysis. Because dimensional analysis is less error-prone, it is the preferred calculation method of many institutions.

Chapter Summary

Learning Outcomes	Points to Remember
7-1 Differentiate the dosage strength of the supplied medication from the ordered dose.	Dosage strength = $\frac{\text{dose supplied}}{\text{dosage unit}}$; for example, the dosage strength of 250 mg tablets = $\frac{250 \text{ mg}}{1 \text{ tab}}$ To compare the supplied dosage strength to the ordered dose, use the first two steps of the *CASE* approach, ***C***: *Convert* and ***A***: *Approximate*: ***C***: *Convert*—Convert ordered dose and supplied dose to the same unit of measurement (if necessary). ***A***: *Approximate*—Approximate the number of dosage units to administer by comparing the ordered dose to the supplied dose. Example: Order: 0.45 g Supply: 225 mg per tablet ***C***: *Convert*—0.45 g to 450 mg ***A***: *Approximate*—Because the ordered dose, 450 mg, is twice the supplied dose of 225 mg per tablet, two tablets are needed.

7-2 Apply the *CASE* approach to calculate dosages using ratio-proportion, the formula method, and dimensional analysis.	After performing ***C***: *Convert* and ***A:*** *Approximate* as shown in the previous example, execute the final two steps, ***S:*** *Solve* and ***E:*** *Evaluate***:**

S: *Solve*—Determine the amount to administer by using any of the following methods:

Ratio-Proportion:

- Fractional ratio-proportion

$$\overset{\textit{SUPPLY}}{\frac{\text{supplied dose}}{\text{dosage unit}}} = \overset{\textit{ORDER}}{\frac{\text{ordered dose}}{\text{amount to administer (or } x)}}$$

$$\text{Example: } \frac{225 \text{ mg}}{1 \text{ tab}} = \frac{450 \text{ mg}}{x \text{ tab}}$$

- Linear ratio-proportion

$$\text{supplied dose : dosage unit} = \text{ordered dose : amount to administer } (x)$$

$$\text{Example: } 225 \text{ mg} : 1 \text{ tab} = 450 \text{ mg} : x \text{ tab}$$

Formula:

$$\frac{\text{ordered dose/}\textbf{D}\text{esired dose } (D)}{\text{supplied dose/dose on }\textbf{H}\text{and } (H)} \times \text{dosage unit/}\textbf{Q}\text{uantity}(Q) = \text{amount to administer } (x)$$

$$\text{Example: } \frac{450 \cancel{\text{mg}}}{225 \cancel{\text{mg}}} \times 1 \text{ tab} = x \text{ (tab)}$$

Dimensional Analysis:

$$\text{amount to administer } (x) = \frac{\text{dosage unit}}{\text{supplied dose}} \times \text{conversion factor}(s) \times \frac{\text{ordered dose}}{1}$$

$$x \text{ (tab)} = \frac{1 \text{ tab}}{225 \cancel{\text{mg}}} \times \frac{1{,}000 \cancel{\text{mg}}}{1 \cancel{\text{g}}} \times \frac{0.45 \cancel{\text{g}}}{1}$$

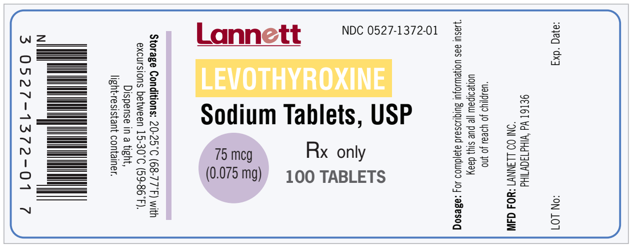
$$x = 2 \text{ tab}$$

E: *Evaluate*—Evaluate the accuracy of the result by replacing *x* with the answer and checking the math; also compare the answer to the approximated answer to confirm the result. Because 2 tab is consistent with the approximated answer, the answer for this example is confirmed.

Homework

For exercises 1–10, refer to the following labels to compare the ordered dose to the supply and determine steps *C* and *A* of the *CASE* method. (LO 7-1)

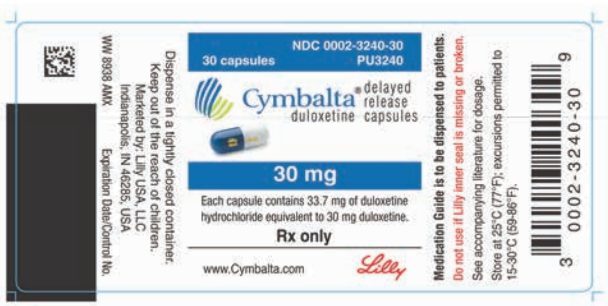
1. **Order:** levothyroxine 0.075 mg PO daily
   Supply:



Courtesy of Lannett

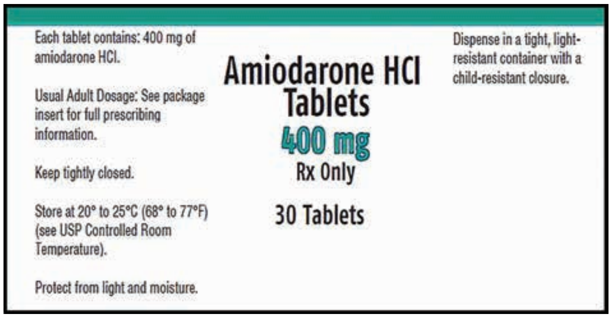
   a. *C*: *Convert*
   b. *A*: *Approximate*

2. **Order:** Cymbalta® 60 mg PO daily
   Supply:



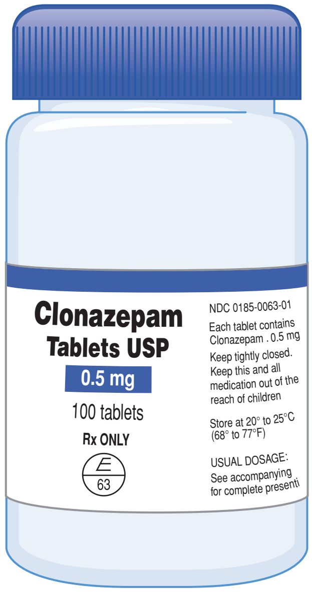
   a. *C*: *Convert*
   b. *A*: *Approximate*

3. **Order:** amiodarone 400 mg PO daily
   Supply:



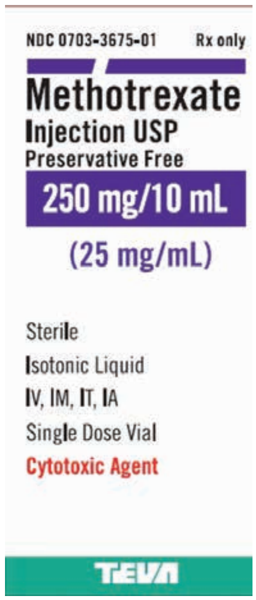
   a. *C*: *Convert*
   b. *A*: *Approximate*

4. **Order:** clonazepam 500 mcg PO bid
   Supply:



   a. *C*: *Convert*
   b. *A*: *Approximate*

5. **Order:** methotrexate 0.025 g IM weekly
   Supply:



Courtesy of Teva USA

   a. *C*: *Convert*
   b. *A*: *Approximate*

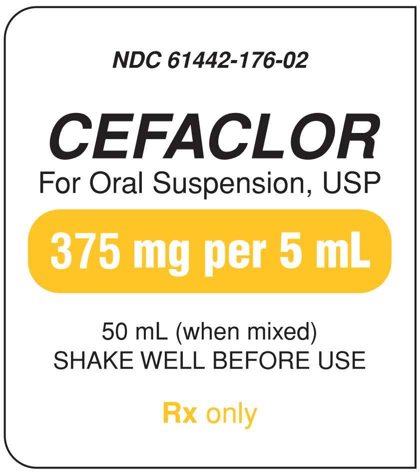
6. Order: methadone HCl 15 mg GT daily
Supply:

a. *C*: *Convert*
b. *A*: *Approximate*

7. Order: docusate sodium 100 mg PO nightly
Supply:

a. *C*: *Convert*
b. *A*: *Approximate*

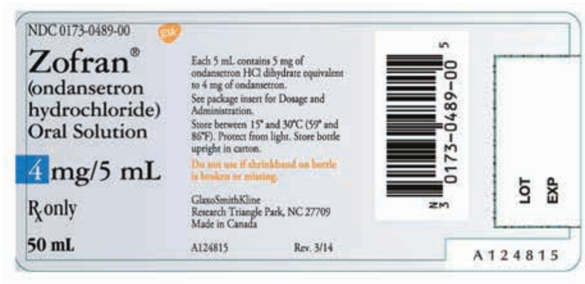
8. Order: cefaclor 0.25 g PO bid
Supply:



Courtesy of FSC Pediatrics

a. *C*: *Convert*
b. *A*: *Approximate*

9. Order: ondansetron HCl 8 mg PO bid
Supply:



Courtesy of GlaxoSmithKline

a. *C*: *Convert*
b. *A*: *Approximate*

10. Order: Epogen® 1,200 units subcut 3 times per week
Supply:

Source: Amgen, Inc.

a. *C*: *Convert*
b. *A*: *Approximate*

For questions 11–20, use fractional ratio-proportion within the *CASE* approach to determine the amount to administer. Assume all tablets are scored and can be split. (LO 7-2)

11. Ordered Dose: 2.25 g
Supply: 750 mg/cap

12. Ordered Dose: 375 mg
Supply: 250 mg/tablet

13. Ordered Dose: 0.325 g
Supply: 250 mg/5 mL

14. Ordered Dose: 0.25 g
Supply: 125 mg/tab

15. Ordered Dose: 0.75 g
Supply: 1 g/10 mL

16. Ordered Dose: 450 mcg
Supply: 1 mg/10 mL

17. Ordered Dose: 125 mg
Supply: 50 mg/tab

18. Ordered Dose: 300 mcg
Supply: 0.15 mg/tab

19. **Ordered Dose:** 750 mg
Supply: 300 mg/5 mL
20. **Ordered Dose:** 30 mEq
Supply: 20 mEq/15 mL

For questions 21–30, use linear ratio-proportion within the *CASE* approach to determine the amount to administer. Assume all tablets are scored and can be split. (LO 7-2)

21. **Ordered Dose:** 1.5 g
Supply: 750 mg/cap
22. **Ordered Dose:** 125 mg
Supply: 250 mg/tablet
23. **Ordered Dose:** 1.25 g
Supply: 250 mg/5 mL
24. **Ordered Dose:** 375 mg
Supply: 125 mg/tab
25. **Ordered Dose:** 1 g
Supply: 750 mg/10 mL
26. **Ordered Dose:** 375 mcg
Supply: 1 mg/10 mL
27. **Ordered Dose:** 650 mg
Supply: 325 mg/tab
28. **Ordered Dose:** 250 mcg
Supply: 0.5 mg/tab
29. **Ordered Dose:** 750 mg
Supply: 375 mg/cap
30. **Ordered Dose:** 40 mEq
Supply: 20 mEq/15 mL

For questions 31–40, use the formula method within the *CASE* approach to determine the amount to administer. Assume all tablets are scored and can be split. (LO 7-2)

31. **Ordered Dose:** 1.5 g
Supply: 500 mg/cap
32. **Ordered Dose:** 300 mg
Supply: 250 mg/5 mL
33. **Ordered Dose:** 0.75 g
Supply: 250 mg/5 mL
34. **Ordered Dose:** 75 mg
Supply: 150 mg/tab
35. **Ordered Dose:** 0.32 g
Supply: 80 mg/10 mL
36. **Ordered Dose:** 50 mg
Supply: 10 mg/5 mL
37. **Ordered Dose:** 375 mg
Supply: 125 mg/cap
38. **Ordered Dose:** 200 mg
Supply: 0.6 g/12 mL
39. **Ordered Dose:** 1,500 mg
Supply: 750 mg/10 mL
40. **Ordered Dose:** 0.5 g
Supply: 250 mg/50 mL

For questions 41–50, use dimensional analysis within the *CASE* approach to determine the amount to administer. Assume all tablets are scored and can be split. (LO 7-2)

41. **Ordered Dose:** 450 mg
Supply: 150 mg/cap
42. **Ordered Dose:** 0.5 g
Supply: 250 mg/tablet
43. **Ordered Dose:** 0.625 g
Supply: 250 mg/5 mL
44. **Ordered Dose:** 175 mg
Supply: 70 mg/tab
45. **Ordered Dose:** 1 g
Supply: 500 mg/10 mL
46. **Ordered Dose:** 60 mg
Supply: 40 mg/20 mL
47. **Ordered Dose:** 12.5 mg
Supply: 25 mg/tab
48. **Ordered Dose:** 100 mg
Supply: 20 mg/5 mL
49. **Ordered Dose:** 0.12 g
Supply: 60 mg/15 mL
50. **Ordered Dose:** 10 mEq
Supply: 20 mEq/15 mL

NCLEX-Style Review Questions

For questions 1–4, select the best response. Assume all tablets are scored and can be split.

1. The prescriber orders 345 mg of a medication. The medication is supplied as 230 mg tablets. The nurse should administer:
   a. 2½ tablets
   b. 2 tablets
   c. 1½ tablets
   d. 1 tablet

2. The prescriber orders 3.75 mg of a corticosteroid. The dosage strength is 2.5 mg/tab. The nurse should administer:
   a. ½ tab
   b. 1½ tab
   c. 2 tab
   d. 2½ tab
3. The order calls for 50 mg. Which dosage strength should the nurse choose?
   a. 12.5 mg/tab
   b. 25 mg/tab
   c. 75 mg/tab
   d. 100 mg/tab
4. The prescriber orders 200 mg of an anti-infective medication. The dosage strength is 50 mg in 5 mL. The nurse should administer:
   a. 4 mL
   b. 10 mL
   c. 20 mL
   d. 40 mL

For questions 5–6, select all that apply.

5. The prescriber orders 160 mg of an antipyretic. The dosage strength is 80 mg/teaspoon. The nurse should administer:
   a. 2.5 mL
   b. 5 mL
   c. 7.5 mL
   d. 10 mL
   e. ½ t
   f. 2 t
6. The prescriber orders 750 mg of cough syrup. The dosage strength is 250 mg/10 mL. The nurse advises the patient to take:
   a. 1 T
   b. 1 oz
   c. 2 T
   d. 6 t
   e. 30 mL
   f. 0.33 mL

REFERENCES

Cookson, K. L. (2013). Dimensional analysis: Calculate dosages the easy way. *Nursing*, *43*(6), 57–62. Lippincott Williams, & Wilkins.

Greenfield, S., Whelan, B., & Cohn, E. (2006). Use of dimensional analysis to reduce medication errors. *Journal of Nursing Education, 45*(2), 91–94. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/16496864

Chapter 7 ANSWER KEY

Learning Activity 7-1

1. a. N/A
   b. The ordered amount is triple the supply, so 3 capsules are needed to deliver the ordered dose.
2. a. Convert 0.4 mg to mcg.

$$\frac{1\text{ mg}}{1{,}000\text{ mcg}} = \frac{0.4\text{ mg}}{x\text{ mcg}}$$

$$1x = 1{,}000 \times 0.4 = 400\text{ mcg}$$

or

$$x(\text{mcg}) = \frac{1{,}000\text{ mcg}}{1\ \cancel{\text{mg}}} \times 0.4\ \cancel{\text{mg}} = 400\text{ mcg}$$

   b. The ordered amount is equivalent to the supplied dosage, so 1 cap is needed to deliver the ordered dose.
3. a. N/A
   b. The ordered dose is less than the supplied dosage strength by half, so ½ tab is needed to deliver the ordered amount.

Learning Activity 7-2

1. $\frac{0.5\text{ mg}}{1\text{ tab}} = \frac{1\text{ mg}}{x\text{ tab}}$

2. $\frac{25\text{ mg}}{1\text{ mL}} = \frac{50\text{ mg}}{x\text{ mL}}$

3. $\frac{20\text{ mg}}{1\text{ tab}} = \frac{40\text{ mg}}{x\text{ tab}}$

Learning Activity 7-3

1. **C:** N/A
   A: Ordered amount is half of the supplied amount; half the supply volume, or 0.5 mL, is needed to deliver the ordered amount.
   S:

$$\frac{5\text{ mg}}{1\text{ mL}} = \frac{2.5\text{ mg}}{x\text{ mL}}$$

$$5x = 2.5$$

$$\frac{\cancel{5}x}{\cancel{5}} = \frac{2.5}{5}$$

$$x = 0.5\text{ mL}$$

E:

$$\frac{5\text{ mg}}{1\text{ mL}} = \frac{2.5\text{ mg}}{0.5\text{ mL}}$$

$$5 \times 0.5 = 1 \times 2.5$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 0.5 mL, the answer is confirmed.

2. **C:** Convert 0.075 g to 75 mg.

A: Order is greater than the supply by three times, so 3 tablets are needed to deliver the ordered amount.

S:

$$\frac{25\text{ mg}}{1\text{ tab}} = \frac{75\text{ mg}}{x\text{ tab}}$$

$$25x = 75$$

$$x = 3\text{ tab}$$

E:

$$\frac{25\text{ mg}}{1\text{ tab}} = \frac{75\text{ mg}}{3\text{ tab}}$$

$$25 \times 3 = 1 \times 75$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 3 tablets, the answer is confirmed.

3. **C:** N/A

A: The order is less than the supply, therefore less than 5 mL will be needed to deliver the ordered amount.

S:

$$\frac{2\text{ mg}}{5\text{ mL}} = \frac{1.45\text{ mg}}{x\text{ mL}}$$

$$2x = 5 \times 1.45$$

$$\frac{\cancel{2}x}{\cancel{2}} = \frac{7.25}{2}$$

$$x = 3.625\text{ mL, which rounds to 3.6 mL}$$

E:

$$\frac{2\text{ mg}}{5\text{ mL}} = \frac{1.45\text{ mg}}{3.625\text{ mL}}$$

$$2 \times 3.625 = 5 \times 1.45$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, less than 5 mL, the answer is confirmed.

Learning Activity 7-4

1. **C:** N/A

A: Ordered amount is more than two times the supplied amount, so more than 2 tabs are needed to deliver the ordered amount.

S:

$$2\text{ mg} : 1\text{ tab} = 5\text{ mg} : x\text{ tab}$$

$$2x = 1 \times 5$$

$$\frac{\cancel{2}x}{\cancel{2}} = \frac{5}{2}$$

$$x = 2\frac{1}{2}\text{ tab}$$

E:

$$2\text{ mg} : 1\text{ tab} = 5\text{ mg} : 2\frac{1}{2}\text{ tab}$$

$$2 \times 2\frac{1}{2} = 1 \times 5$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, more than 2 tablets, the answer is confirmed.

2. **C:** Convert 0.5 g to 500 mg.

A: Order is five times greater than the supply, so five times the supply volume, or 75 mL, is needed to deliver the ordered amount.

S:

$$100\text{ mg} : 15\text{ mL} = 500\text{ mg} : x\text{ mL}$$

$$100x = 15 \times 500$$

$$\frac{\cancel{100}x}{\cancel{100}} = \frac{7,500}{100}$$

$$x = 75\text{ mL}$$

E:

$$100\text{ mg} : 15\text{ mL} = 500\text{ mg} : 75\text{ mL}$$

$$100 \times 75 = 15 \times 500$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 75 mL, the answer is confirmed.

3. **C:** Convert 0.25 g to 250 mg.

A: Order is two times the supplied amount, so 2 capsules are needed to deliver the ordered amount.

S:

$$125\text{ mg} : 1\text{ cap} = 250\text{ mg} : x\text{ cap}$$

$$125x = 1 \times 250$$

$$\frac{\cancel{125}x}{\cancel{125}} = \frac{250}{125}$$

$$x = 2\text{ cap}$$

E:

$$125\text{ mg} : 1\text{ cap} = 250\text{ mg} : 2\text{ cap}$$

$$125 \times 2 = 1 \times 250$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 2 cap, the answer is confirmed.

Learning Activity 7-5

1. **C:** Convert 0.45 g to 450 mg.
   A: Order is three times the supplied amount, so 3 capsules are needed to deliver the ordered amount.
   S:
   $$\frac{450\ \cancel{mg}}{150\ \cancel{mg}} \times 1\ \text{tab} = x\ (\text{tab})$$
   $$3\ \text{tab} = x$$
   E:
   $$\frac{450\ \cancel{mg}}{150\ \cancel{mg}} \times 1\ \text{tab} = 3\ \text{tab}$$
   Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 3 tab, the answer is confirmed.
2. **C:** Convert 0.2 mg to 200 mcg.
   A: Order is two times the supplied amount, so 2 mL are needed to deliver the ordered amount.
   S:
   $$\frac{200\ \cancel{mcg}}{100\ \cancel{mcg}} \times 1\ \text{mL} = x\ (\text{mL})$$
   $$2\ \text{mL} = x$$
   E:
   $$\frac{200\ \cancel{mcg}}{100\ \cancel{mcg}} \times 1\ \text{mL} = 2\ \text{mL}$$
   Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 2 mL, the answer is confirmed.
3. **C:** N/A
   A: The ordered amount is one-fifth of the supplied amount, so one-fifth of the supply volume, or 1 mL, is needed to deliver the ordered amount.
   S:
   $$\frac{20\ \cancel{mg}}{100\ \cancel{mg}} \times 5\ \text{mL} = x\ (\text{mL})$$
   $$1\ \text{mL} = x$$
   E:
   $$\frac{20\ \cancel{mg}}{100\ \cancel{mg}} \times 5\ \text{mL} = 1\ \text{mL}$$
   Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 1 mL, the answer is confirmed.

Learning Activity 7-6

1. **C:** Use the conversion factor 1,000 mg/1 g.
   A: Mentally convert 2 g to 2,000 mg and determine that the ordered amount is 20 times larger than the supplied amount, so 20 times the supply volume, or 20 mL, is needed to deliver the ordered amount.
   S:
   $$x(\text{mL}) = \frac{1\ \text{mL}}{100\ \cancel{mg}} \times \frac{1{,}000\ \cancel{mg}}{1\ \cancel{g}} \times \frac{2\ \cancel{g}}{1}$$
   $$x = \frac{2{,}000}{100} = 20\ \text{mL}$$
   E:
   $$20\ \text{mL} = \frac{1\ \text{mL}}{100\ \cancel{mg}} \times \frac{1{,}000\ \cancel{mg}}{1\ \cancel{g}} \times \frac{2\ \cancel{g}}{1}$$
   Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 20 mL, the answer is confirmed.
2. **C:** Convert using the conversion factor 1 mg/1,000 mcg.
   A: Mentally convert 150 mcg to 0.15 mg to determine the ordered amount is less than the supplied amount, so less than 2 mL are needed to deliver the ordered amount.
   S:
   $$x(\text{mL}) = \frac{2\ \text{mL}}{0.25\ \cancel{mg}} \times \frac{1\ \cancel{mg}}{1{,}000\ \cancel{mcg}} \times \frac{150\ \cancel{mcg}}{1}$$
   $$x = \frac{300\ \text{mL}}{250} = 1.2\ \text{mL}$$
   E:
   $$1.2\ \text{mL} = \frac{2\ \text{mL}}{0.25\ \cancel{mg}} \times \frac{1\ \cancel{mg}}{1{,}000\ \cancel{mcg}} \times \frac{150\ \cancel{mcg}}{1}$$
   Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, less than 2 mL, the answer is confirmed.
3. **C:** N/A
   A: The ordered amount is half the supplied amount, so half the supply volume, or 2.5 mL, is needed to deliver the ordered amount.
   S:
   $$x\ (mL) = \frac{5\ \text{mL}}{2\ \cancel{mg}} \times \frac{1\ \cancel{mg}}{1}$$
   $$x = \frac{5\ \text{mL}}{2} = 2.5\ \text{mL}$$

E:

$$2.5 \text{ mL} = \frac{5 \text{ mL}}{2 \cancel{\text{mg}}} \times \frac{1 \cancel{\text{mg}}}{1}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 2.5 mL, the answer is confirmed.

Homework

1. **C:** Convert 0.075 mg to 75 mcg.
   A: Because the amount ordered equals the amount in 1 tablet, 1 tablet is needed to provide the ordered dose.
2. **C:** N/A
   A: Because the amount ordered is twice the supplied dose, 2 capsules are needed to provide the ordered dose.
3. **C:** N/A
   A: Because the ordered dose is the same as the supplied dose, 1 tablet is needed to provide the ordered dose.
4. **C:** Convert 500 mcg to 0.5 mg or use the conversion factor 1 mg/1,000 mcg.
   A: Because the ordered dose equals the supplied dose, 1 tablet is needed to provide the ordered dose.
5. **C:** Convert 0.025 g to 25 mg or use the conversion factor 1,000 mg/1 g.
   A: Because the ordered dose equals the supplied dose, 1 mL is needed to provide the ordered dose.
6. **C:** N/A
   A: Because the ordered dose is one and one-half (1½) the dose supplied in 5 mL, 7.5 mL are needed to provide the ordered dose.
7. **C:** N/A
   A: Because the ordered dose is 10 times the supplied dose, 10 times the supply volume, or 10 mL, is needed to provide the ordered dose.
8. **C:** Convert 0.25 g to 250 mg or use the conversion factor 1,000 mg/1 g.
   A: Because the ordered dose is less than the supplied dose, less than the supply volume of 5 mL is needed to provide the ordered dose.
9. **C:** N/A
   A: Because the ordered dose is twice the supplied dose, two times the supply volume, or 10 mL, is needed to provide the ordered dose.
10. **C:** N/A
    A: Because the ordered dose is less than ½ of the dose supplied in 2 mL, less than 1 mL is needed to provide the ordered dose. (Note: For a more accurate estimate, the supplied amount could be further reduced to ⅛ of the dose supplied in 2 mL. Therefore, the amount to administer will be less than 0.25 mL.)
11. **C:** Convert 2.25 g to 2,250 mg.
    A: Because the amount ordered is approximately three times the supplied dose, about 3 capsules are needed to provide the ordered dose.

S:

$$\frac{750 \text{ mg}}{1 \text{ cap}} = \frac{2,250 \text{ mg}}{x \text{ cap}}$$

$$750x = 2,250$$

$$x = 3 \text{ cap}$$

E:

$$\frac{750 \text{ mg}}{1 \text{ cap}} = \frac{2,250 \text{ mg}}{3 \text{ cap}}$$

$$750 \times 3 = 1 \times 2,250$$

$$2,250 = 2,250$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 3 capsules, the answer is confirmed.

12. **C:** N/A
    A: Because the ordered dose is 1½ times the supplied dose, 1½ tablets are needed to provide the ordered dose.

S:

$$\frac{250 \text{ mg}}{1 \text{ tab}} = \frac{375 \text{ mg}}{x \text{ tab}}$$

$$250x = 375$$

$$x = 1\frac{1}{2} \text{ tab}$$

E:

$$\frac{250 \text{ mg}}{1 \text{ tab}} = \frac{375 \text{ mg}}{1\frac{1}{2} \text{ tab}}$$

$$250 \times 1\frac{1}{2} = 1 \times 375$$

$$375 = 375$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 1½ tablets, the answer is confirmed.

13. **C:** Convert 0.325 g to 325 mg.
 A: Because the ordered dose is more than one times but less than twice the supply, more than 5 mL but less than 10 mL are needed to provide the ordered dose.

 S:
$$\frac{250\text{ mg}}{5\text{ mL}} = \frac{325\text{ mg}}{x\text{ mL}}$$
$$250x = 5 \times 325$$
$$x = 6.5\text{ mL}$$

 E:
$$\frac{250\text{ mg}}{5\text{ mL}} = \frac{325\text{ mg}}{6.5\text{ mL}}$$
$$250 \times 6.5 = 5 \times 325$$

 Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 5 to 10 mL, the answer is confirmed.

14. **C:** Convert 0.25 g to 250 mg.
 A: Because the ordered dose is twice the dose supplied in 1 tablet, 2 tablets are needed to provide the ordered dose.

 S:
$$\frac{125\text{ mg}}{1\text{ tab}} = \frac{250\text{ mg}}{x\text{ tab}}$$
$$125x = 250$$
$$x = 2\text{ tab}$$

 E:
$$\frac{125\text{ mg}}{1\text{ tab}} = \frac{250\text{ mg}}{2\text{ tab}}$$
$$125 \times 2 = 1 \times 250$$

 Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 2 tablets, the answer is confirmed.

15. **C:** N/A
 A: Because the ordered amount is less than the supply, less than 10 mL are needed to provide the ordered dose.

 S:
$$\frac{1\text{ g}}{10\text{ mL}} = \frac{0.75\text{ g}}{x\text{ mL}}$$
$$x = 10 \times 0.75$$
$$x = 7.5\text{ mL}$$

 E:
$$\frac{1\text{ g}}{10\text{ mL}} = \frac{0.75\text{ g}}{7.5\text{ mL}}$$
$$1 \times 7.5 = 10 \times 0.75$$

 Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, less than 10 mL, the answer is confirmed.

16. **C:** Convert 450 mcg to 0.45 mg.
 A: Because the ordered dose is less than half the supply, less than half of 10 mL is needed to provide the ordered dose.

 S:
$$\frac{1\text{ mg}}{10\text{ mL}} = \frac{0.45\text{ mg}}{x\text{ mL}}$$
$$x = 10 \times 0.45$$
$$x = 4.5\text{ mL}$$

 E:
$$\frac{1\text{ mg}}{10\text{ mL}} = \frac{0.45\text{ mg}}{4.5\text{ mL}}$$
$$1 \times 4.5 = 10 \times 0.45$$

 Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, less than 5 mL, the answer is confirmed.

17. **C:** N/A
 A: The ordered dose is more than twice the supply, so more than 2 tabs are needed to provide the ordered dose.

 S:
$$\frac{50\text{ mg}}{1\text{ tab}} = \frac{125\text{ mg}}{x\text{ tab}}$$
$$50x = 125$$
$$x = 2\frac{1}{2}\text{ tab}$$

 E:
$$\frac{50\text{ mg}}{1\text{ tab}} = \frac{125\text{ mg}}{2\frac{1}{2}\text{ tab}}$$
$$50 \times 2\frac{1}{2} = 1 \times 125$$

 Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, more than 2 tablets, the answer is correct.

18. **C:** Convert 0.15 mg to 150 mcg.
 A: Because the ordered dose is 2 times the dose supplied, 2 tablets are needed to provide the ordered dose.

 S:
$$\frac{150\text{ mcg}}{1\text{ tab}} = \frac{300\text{ mcg}}{x\text{ tab}}$$
$$150x = 300$$
$$x = 2\text{ tab}$$

E:

$$\frac{150 \text{ mcg}}{1 \text{ tab}} = \frac{300 \text{ mcg}}{2 \text{ tab}}$$

$$150 \times 2 = 1 \times 300$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 2 tablets, the answer is confirmed.

19. **C:** N/A

A: Because the ordered dose is more than twice the supply, more than 10 mL are needed to provide the ordered dose.

S:

$$\frac{300 \text{ mg}}{5 \text{ mL}} = \frac{750 \text{ mg}}{x \text{ mL}}$$

$$300x = 3{,}750$$

$$x = 12.5 \text{ mL}$$

E:

$$\frac{300 \text{ mg}}{5 \text{ mL}} = \frac{750 \text{ mg}}{12.5 \text{ mL}}$$

$$300 \times 12.5 = 5 \times 750$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, greater than 10 mL, the answer is confirmed.

20. **C:** N/A

A: Because the ordered dose is 1½ times the dose supplied in 15 mL, more than 15 mL, but less than 30 mL, are needed to provide the ordered dose.

S:

$$\frac{20 \text{ mEq}}{15 \text{ mL}} = \frac{30 \text{ mEq}}{x \text{ mL}}$$

$$20x = 450$$

$$x = 22.5 \text{ mL}$$

E:

$$\frac{20 \text{ mEq}}{15 \text{ mL}} = \frac{30 \text{ mEq}}{22.5 \text{ mL}}$$

$$20 \times 22.5 = 15 \times 30$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 15 to 30 mL, the answer is correct.

21. **C:** Convert 1.5 g to 1,500 mg.

A: Because the ordered dose is twice the supplied dose, 2 capsules are needed to provide the ordered dose.

S:

$$750 \text{ mg} : 1 \text{ cap} = 1{,}500 \text{ mg} : x \text{ cap}$$

$$750x = 1{,}500$$

$$x = 2 \text{ cap}$$

E:

$$750 \text{ mg} : 1 \text{ cap} = 1{,}500 \text{ mg} : 2 \text{ cap}$$

$$750 \times 2 = 1 \times 1{,}500$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 2 capsules, the answer is correct.

22. **C:** N/A

A: Because the ordered dose is half as much as the supplied dose, ½ tablet is needed to provide the ordered dose.

S:

$$250 \text{ mg} : 1 \text{ tab} = 125 \text{ mg} : x \text{ tab}$$

$$250x = 125$$

$$x = \frac{1}{2} \text{ tab}$$

E:

$$250 \text{ mg} : 1 \text{ tab} = 125 \text{ mg} : \frac{1}{2} \text{ tab}$$

$$250 \times \frac{1}{2} = 1 \times 125$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, ½ tablet, the answer is confirmed.

23. **C:** Convert 1.25 g to 1,250 mg.

A: Because the ordered dose is five times as large as the supply, five times the supply volume, or 25 mL, is needed to provide the ordered dose.

S:

$$250 \text{ mg} : 5 \text{ mL} = 1{,}250 \text{ mg} : x \text{ mL}$$

$$250x = 6{,}250$$

$$x = 25 \text{ mL}$$

E:

$$250 \text{ mg} : 5 \text{ mL} = 1{,}250 \text{ mg} : 25 \text{ mL}$$

$$250 \times 25 = 5 \times 1{,}250$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 25 mL, the answer is confirmed.

24. **C:** N/A

A: Because the ordered dose is three times the dose supplied in 1 tablet, 3 tablets are needed to provide the ordered dose.

S: $$125 \text{ mg} : 1 \text{ tab} = 375 \text{ mg} : x \text{ tab}$$
$$125x = 375$$
$$x = 3 \text{ tab}$$

E: $$125 \text{ mg} : 1 \text{ tab} = 375 \text{ mg} : 3 \text{ tab}$$
$$125 \times 3 = 1 \times 375$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 3 tablets, the answer is confirmed.

25. **C:** Convert 1 g to 1,000 mg.
A: Because the ordered amount is greater than the dose supplied in 10 mL, more than 10 mL are needed to provide the ordered dose.

S: $$750 \text{ mg} : 10 \text{ mL} = 1{,}000 \text{ mg} : x \text{ mL}$$
$$750x = 10{,}000$$
$$x = 13.3333 \text{ mL or } 13.3 \text{ mL}$$

E: $$750 \text{ mg} : 10 \text{ mL} = 1{,}000 \text{ mg} : 13.33 \text{ mL}$$
$$750 \times 13.3333 \cong 10 \times 1{,}000$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, greater than 10 mL, the answer is confirmed.

26. **C:** Convert 1 mg to 1,000 mcg.
A: Because the ordered dose is less than half of the dose supplied in 10 mL, less than 5 mL are needed to provide the ordered dose.

S: $$1{,}000 \text{ mcg} : 10 \text{ mL} = 375 \text{ mcg} : x \text{ mL}$$
$$1{,}000x = 3{,}750$$
$$x = 3.75 \text{ rounded to } 3.8 \text{ mL}$$

E: $$1{,}000 \text{ mcg} : 10 \text{ mL} = 375 \text{ mcg} : 3.75 \text{ mL}$$
$$1{,}000 \times 3.75 = 10 \times 375$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, less than 5 mL, the answer is confirmed.

27. **C:** N/A
A: The ordered dose is twice the supplied dose, so 2 tablets are needed to provide the ordered dose.

S: $$325 \text{ mg} : 1 \text{ tab} = 650 \text{ mg} : x \text{ tab}$$
$$325x = 650$$
$$x = 2 \text{ tab}$$

E: $$325 \text{ mg} : 1 \text{ tab} = 650 \text{ mg} : 2 \text{ tab}$$
$$325 \times 2 = 1 \times 650$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 2 tablets, the answer is confirmed.

28. **C:** Convert 0.5 mg to 500 mcg.
A: Because the ordered dose is half of the dose supplied in 1 tablet, ½ tablet is needed to provide the ordered dose.

S: $$500 \text{ mcg} : 1 \text{ tab} = 250 \text{ mg} : x \text{ tab}$$
$$500x = 250$$
$$x = \frac{1}{2} \text{ tab}$$

E: $$500 \text{ mcg} : 1 \text{ tab} = 250 \text{ mg} : \frac{1}{2} \text{ tab}$$
$$500 \times \frac{1}{2} = 1 \times 250$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, ½ tablet, the answer is confirmed.

29. **C:** N/A
A: Because the ordered dose is twice the dose supplied in 1 capsule, 2 capsules are needed to provide the ordered dose.

S: $$375 \text{ mg} : 1 \text{ cap} = 750 \text{ mg} : x \text{ cap}$$
$$375x = 750$$
$$x = 2 \text{ cap}$$

E: $$375 \text{ mg} : 1 \text{ cap} = 750 \text{ mg} : 2 \text{ cap}$$
$$375 \times 2 = 1 \times 750$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 2 capsules, the answer is confirmed.

30. **C:** N/A
A: Because the ordered dose is twice the dose supplied in 15 mL, twice the supply volume, or 30 mL, are needed to provide the ordered dose.

S: $$20 \text{ mEq} : 15 \text{ mL} = 40 \text{ mEq} : x \text{ mL}$$
$$20x = 600$$
$$x = 30 \text{ mL}$$

E:
$$20\text{ mEq} : 15\text{ mL} = 40\text{ mEq} : 30\text{ mL}$$
$$20 \times 30 = 15 \times 40$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 30 mL, the answer is confirmed.

31. **C:** Convert 1.5 g to 1,500 mg.
A: Because the ordered dose is three times the supplied dose, 3 capsules are needed to provide the ordered dose.

S:
$$\frac{1,500\ \cancel{\text{mg}}}{500\ \cancel{\text{mg}}} \times 1\text{ cap} = x\text{ (cap)}$$
$$3\text{ cap} = x$$

E:
$$\frac{1,500\ \cancel{\text{mg}}}{500\ \cancel{\text{mg}}} \times 1\text{ cap} = 3\text{ cap}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 3 capsules, the answer is correct.

32. **C:** N/A
A: Because the ordered dose is more than one times but less than twice as much as the supplied dose, between 5 and 10 mL are needed to provide the ordered dose.

S:
$$\frac{300\ \cancel{\text{mg}}}{250\ \cancel{\text{mg}}} \times 5\text{ mL} = x\text{ (mL)}$$
$$6\text{ mL} = x$$

E:
$$\frac{300\ \cancel{\text{mg}}}{250\ \cancel{\text{mg}}} \times 5\text{ mL} = 6\text{ mL}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, between 5 and 10 mL, the answer is confirmed.

33. **C:** Convert 0.75 g to 750 mg.
A: Because the ordered dose is three times larger than the dose supplied in 5 mL, three times the supply volume, or 15 mL, is needed to provide the ordered dose.

S:
$$\frac{750\ \cancel{\text{mg}}}{250\ \cancel{\text{mg}}} \times 5\text{ mL} = x\text{ (mL)}$$
$$15\text{ mL} = x$$

E:
$$\frac{750\ \cancel{\text{mg}}}{250\ \cancel{\text{mg}}} \times 5\text{ mL} = 15\text{ mL}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 15 mL, the answer is confirmed.

34. **C:** N/A
A: Because the ordered dose is half as large as the dose supplied in 1 tablet, ½ tablet is needed to provide the ordered dose.

S:
$$\frac{75\ \cancel{\text{mg}}}{150\ \cancel{\text{mg}}} \times 1\text{ tab} = x\text{ (tab)}$$
$$\frac{1}{2}\text{ tab} = x$$

E:
$$\frac{75\ \cancel{\text{mg}}}{150\ \cancel{\text{mg}}} \times 1\text{ tab} = \frac{1}{2}\text{ tab}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, ½ tab, the answer is confirmed.

35. **C:** Convert 0.32 g to 320 mg.
A: Because the ordered amount is four times greater than the dose supplied in 10 mL, four times the supply volume, or 40 mL, is needed to provide the ordered dose.

S:
$$\frac{320\ \cancel{\text{mg}}}{80\ \cancel{\text{mg}}} \times 10\text{ mL} = x\text{ (mL)}$$
$$40\text{ mL} = x$$

E:
$$\frac{320\ \cancel{\text{mg}}}{80\ \cancel{\text{mg}}} \times 10\text{ mL} = 40\text{ mL}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 40 mL, the answer is confirmed.

36. **C:** N/A
A: Because the ordered dose is five times larger than the dose supplied in 5 mL, five times the supply volume, or 25 mL, are needed to provide the ordered dose.

S:
$$\frac{50\ \cancel{\text{mg}}}{10\ \cancel{\text{mg}}} \times 5\text{ mL} = x\text{ (mL)}$$
$$25\text{ mL} = x$$

E:
$$\frac{50\ \cancel{\text{mg}}}{10\ \cancel{\text{mg}}} \times 5\text{ mL} = 25\text{ mL}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 25 mL, the answer is confirmed.

37. **C:** N/A
A: The ordered dose is three times the supplied dose, so 3 capsules are needed to provide the ordered dose.

S: $$\frac{375\ \cancel{mg}}{125\ \cancel{mg}} \times 1\text{ cap} = x\text{ (cap)}$$
$$3\text{ cap} = x$$

E: $$\frac{375\ \cancel{mg}}{125\ \cancel{mg}} \times 1\text{ cap} = 3\text{ cap}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 3 cap, the answer is confirmed.

38. **C:** Convert 0.6 g to 600 mg.
A: Because the ordered dose is 1/3 of the dose supplied in 12 mL, 1/3 of the supply volume, or 4 mL, is needed to provide the ordered dose.

S: $$\frac{200\ \cancel{mg}}{600\ \cancel{mg}} \times 12\text{ mL} = x\text{ (mL)}$$
$$4\text{ mL} = x$$

E: $$\frac{200\ \cancel{mg}}{600\ \cancel{mg}} \times 12\text{ mL} = 4\text{ mL}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 4 mL, the answer is confirmed.

39. **C:** N/A
A: Because the ordered dose is twice the dose supplied in 10 mL, twice the supply volume, or 20 mL, is needed to provide the ordered dose.

S: $$\frac{1,500\ \cancel{mg}}{750\ \cancel{mg}} \times 10\text{ mL} = x\text{ (mL)}$$
$$20\text{ mL} = x$$

E: $$\frac{1,500\ \cancel{mg}}{750\ \cancel{mg}} \times 10\text{ mL} = 20\text{ mL}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 20 mL, the answer is confirmed.

40. **C:** Convert 0.5 g to 500 mg.
A: Because the ordered dose is twice the dose supplied in 50 mL, twice the supply volume, or 100 mL, is needed to provide the ordered dose.

S: $$\frac{500\ \cancel{mg}}{250\ \cancel{mg}} \times 50\text{ mL} = x\text{ (mL)}$$
$$100\text{ mL} = x$$

E: $$\frac{500\ \cancel{mg}}{250\ \cancel{mg}} \times 50\text{ mL} = 100\text{ mL}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 100 mL, the answer is confirmed.

41. **C:** N/A
A: Because the ordered dose is three times the supplied dose, 3 capsules are needed to provide the ordered dose.

S: $$x\text{ (cap)} = \frac{1\text{ cap}}{150\ \cancel{mg}} \times \frac{450\ \cancel{mg}}{1}$$
$$x = 3\text{ cap}$$

E: $$3\text{ cap} = \frac{1\text{ cap}}{150\ \cancel{mg}} \times \frac{450\ \cancel{mg}}{1}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 3 capsules, the answer is confirmed.

42. **C:** Use the conversion factor 1,000 mg/1 g to cancel grams.
A: Mentally convert 0.5 g to 500 mg to determine the ordered dose is twice the supplied dose, so 2 tablets are needed to provide the ordered dose.

S: $$x\text{ (tab)} = \frac{1\text{ tab}}{250\ \cancel{mg}} \times \frac{1,000\ \cancel{mg}}{1\ \cancel{g}} \times \frac{0.5\ \cancel{g}}{1}$$
$$x = 2\text{ tab}$$

E: $$2\text{ tab} = \frac{1\text{ tab}}{250\ \cancel{mg}} \times \frac{1,000\ \cancel{mg}}{1\ \cancel{g}} \times \frac{0.5\ \cancel{g}}{1}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 2 tab, the answer is confirmed.

43. **C:** Use the conversion factor 1,000 mg/1 g to cancel grams.
A: Mentally convert 0.625 g to 625 mg to determine the ordered dose is more than twice as large as the dose supplied in 5 mL, therefore, more than 10 mL are needed to provide the ordered dose.

S: $$x\text{ (mL)} = \frac{5\text{ mL}}{250\ \cancel{mg}} \times \frac{1,000\ \cancel{mg}}{1\ \cancel{g}} \times \frac{0.625\ \cancel{g}}{1}$$
$$x = 12.5\text{ mL}$$

E: $$12.5 \text{ mL} = \frac{5 \text{ mL}}{250 \cancel{\text{mg}}} \times \frac{1{,}000 \cancel{\text{mg}}}{1 \cancel{\text{g}}} \times \frac{0.625 \cancel{\text{g}}}{1}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, the answer, 12.5 mL, is confirmed.

44. **C:** N/A

A: Because the ordered dose is more than twice the dose supplied in 1 tablet, more than 2 tablets are needed to provide the ordered dose.

S: $$x\left(\text{tab}\right) = \frac{1 \text{ tab}}{70 \cancel{\text{mg}}} \times \frac{175 \cancel{\text{mg}}}{1}$$

$$x = 2\frac{1}{2} \text{ tab}$$

E: $$2\frac{1}{2} \text{ tab} = \frac{1 \text{ tab}}{70 \cancel{\text{mg}}} \times \frac{175 \cancel{\text{mg}}}{1}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, the answer, 2½ tablets, is confirmed.

45. **C:** Use the conversion factor 1,000 mg/1 g to cancel grams.

A: Mentally convert 1 g to 1,000 mg to determine the ordered amount is twice the dose supplied in 10 mL, therefore, twice the supply volume, or 20 mL, is needed to provide the ordered dose.

S: $$x\left(\text{mL}\right) = \frac{10 \text{ mL}}{500 \cancel{\text{mg}}} \times \frac{1{,}000 \cancel{\text{mg}}}{1 \cancel{\text{g}}} \times \frac{1 \cancel{\text{g}}}{1}$$

$$x = 20 \text{ mL}$$

E: $$20 \text{ mL} = \frac{10 \text{ mL}}{500 \cancel{\text{mg}}} \times \frac{1{,}000 \cancel{\text{mg}}}{1 \cancel{\text{g}}} \times \frac{1 \cancel{\text{g}}}{1}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 20 mL, the answer is confirmed.

46. **C:** N/A

A: Because the ordered dose is 1½ times the dose supplied in 20 mL, more than 20 mL but less than 40 mL are needed to provide the ordered dose.

S: $$x\left(\text{mL}\right) = \frac{20 \text{ mL}}{40 \cancel{\text{mg}}} \times \frac{60 \cancel{\text{mg}}}{1}$$

$$x = 30 \text{ mL}$$

E: $$30 \text{ mL} = \frac{20 \text{ mL}}{40 \cancel{\text{mg}}} \times \frac{60 \cancel{\text{mg}}}{1}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 20–40 mL, the answer is confirmed.

47. **C:** N/A

A. The ordered dose is half the supplied dose, so ½ tablet is needed to provide the ordered dose.

S: $$x\left(\text{tab}\right) = \frac{1 \text{ tab}}{25 \cancel{\text{mg}}} \times \frac{12.5 \cancel{\text{mg}}}{1}$$

$$x = \frac{1}{2} \text{ tab}$$

E: $$\frac{1}{2} \text{ tab} = \frac{1 \text{ tab}}{25 \cancel{\text{mg}}} \times \frac{12.5 \cancel{\text{mg}}}{1}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, ½ tablet, the answer is confirmed.

48. **C:** N/A

A: Because the ordered dose is five times the dose supplied in 5 mL, five times the supply volume, or 25 mL, is needed to provide the ordered dose.

S: $$x\left(\text{mL}\right) = \frac{5 \text{ mL}}{20 \cancel{\text{mg}}} \times \frac{100 \cancel{\text{mg}}}{1}$$

$$x = 25 \text{ mL}$$

E: $$25 \text{ mL} = \frac{5 \text{ mL}}{20 \cancel{\text{mg}}} \times \frac{100 \cancel{\text{mg}}}{1}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 25 mL, the answer is confirmed.

49. **C:** Use the conversion factor 1,000 mg/1 g to cancel grams.

A: Mentally convert 0.12 g to 120 mg to determine that the ordered dose is twice the dose supplied in 15 mL, so twice the supply volume, or 30 mL, is needed to provide the ordered dose.

S: $$x\left(\text{mL}\right) = \frac{15 \text{ mL}}{60 \cancel{\text{mg}}} \times \frac{1{,}000 \cancel{\text{mg}}}{1 \cancel{\text{g}}} \times \frac{0.12 \cancel{\text{g}}}{1}$$

$$x = 30 \text{ mL}$$

E: $$30 \text{ mL} = \frac{15 \text{ mL}}{60 \cancel{\text{mg}}} \times \frac{1{,}000 \cancel{\text{mg}}}{1 \cancel{\text{g}}} \times \frac{0.12 \cancel{\text{g}}}{1}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 30 mL, the answer is confirmed.

50. **C:** N/A

A: Because the ordered dose is half the dose supplied in 15 mL, half the supply volume, or 7.5 mL, is needed to provide the ordered dose.

S:
$$x\,(\text{mL}) = \frac{15\text{ mL}}{20\ \cancel{\text{mEq}}} \times \frac{10\ \cancel{\text{mEq}}}{1}$$
$$x = 7.5\text{ mL}$$

E:
$$7.5\text{ mL} = \frac{15\text{ mL}}{20\ \cancel{\text{mEq}}} \times \frac{10\ \cancel{\text{mEq}}}{1}$$

Because the calculated amount forms a true statement when inserted into the equation and is consistent with the approximated amount, 7.5 mL, the answer is confirmed.

NCLEX-Style Review Questions

1. c

Rationale: $x = \dfrac{1\text{ tab}}{230\ \cancel{\text{mg}}} \times \dfrac{345\ \cancel{\text{mg}}}{1} = 1\dfrac{1}{2}\text{ tab}$

2. b

Rationale: $x = \dfrac{1\text{ tab}}{2.5\ \cancel{\text{mg}}} \times \dfrac{3.75\ \cancel{\text{mg}}}{1} = 1\dfrac{1}{2}\text{ tab}$

3. b

Rationale: The nurse should give the fewest whole tablets; therefore, the nurse should give two 25 mg tablets. If half-tablets are needed, the tablet should be scored (see Chapter 8).

4. c

Rationale: $x = \dfrac{5\text{ mL}}{50\ \cancel{\text{mg}}} \times \dfrac{200\ \cancel{\text{mg}}}{1} = 20\text{ mL}$

5. d, f

Rationale: $x = \dfrac{1\text{ t}}{80\ \cancel{\text{mg}}} \times \dfrac{160\ \cancel{\text{mg}}}{1} = 2\text{ t} = 10\text{ mL}$

6. b, c, d, e

Rationale:
$$x = \frac{10\text{ mL}}{250\ \cancel{\text{mg}}} \times \frac{750\ \cancel{\text{mg}}}{1} = 30\text{ mL} = 2\text{ T} = 1\text{ oz} = 6\text{ t}$$