CHAPTER 14

# Calculation of Medication and Intravenous Prescriptions

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## Priority Concepts

Clinical Judgment, Safety

I. Medication Administration (Box 14-1)
In most clinical settings, an electronic infusion device is used to administer intravenous (IV) solutions and IV medications. However, the NCLEX-RN® examination is going to require that you correctly calculate an intravenous infusion rate via drops per minute, so be sure that you master this skill.

II. Medication Measurement Systems

A. Metric system (Box 14-2)

1. The basic units of metric measures are the meter, liter, and gram.
2. Meter measures length; liter measures volume; gram measures mass.

B. Apothecary and household systems

1. The apothecary and household systems are the oldest of the medication measurement systems.
2. Apothecary measures such as grain, dram, and minim are not commonly used in the clinical setting.
3. Commonly used household measures include drop, teaspoon, tablespoon, ounce, pint, and cup.

*The NCLEX will not present questions that require you to convert from the apothecary system of measurement to the metric system; however, this system is still important to know because, although it is not commonly used, you may encounter it in the clinical setting.*

C. Additional common medication measures

1. Milliequivalent

a. Milliequivalent is abbreviated mEq.
b. The milliequivalent is an expression of the number of grams of a medication contained in 1 mL of a solution.
c. For example, the measure of serum

potassium is given in milliequivalents.

2. Unit
    a. Unit measures a medication in terms of its action, not its physical weight.
    b. For example, penicillin, heparin sodium, and insulin are measured in units.

III. **Conversions**

A. Conversion between metric units (Box 14-3)

1. The metric system is a decimal system; therefore, conversions between the units in this system can be done by dividing or multiplying by 1000 or by moving the decimal point 3 places to the right or 3 places to the left.
2. In the metric system, to convert larger to smaller, multiply by 1000 or move the decimal point 3 places to the right.
3. In the metric system, to convert smaller to larger, divide by 1000 or move the decimal point 3 places to the left.

B. Conversion between household and metric systems

1. Household and metric measures are equivalent and not equal measures.
2. Conversion to equivalent measures between systems is necessary when a medication prescription is written in one system but the medication label is stated in another.
3. Medications are not always prescribed and prepared in the same system of measurement; therefore, conversion of units from one system to another is necessary. However, the metric system is the most commonly used system in the clinical setting.
4. Calculating equivalents between 2 systems may be done by using the method of ratio and proportion (Boxes 14-4 and 14-5).

*Conversion is the first step in the calculation of dosages.*

IV. Medication Labels

A. A medication label always contains the **generic name** and may contain the **trade name** of the medication.

B. Always check expiration dates on medication labels.

*The NCLEX tests you on generic names of medications. Trade names will not be presented on the exam for most medications, so be sure to learn medications by their generic names. However, you will likely still encounter the trade names in the clinical setting.*

V. Medication Prescriptions (Box 14-6)

A. In a medication prescription, the name of the medication is written first, followed by the dosage, route, and frequency (depending on the frequency of the prescription, times of administration are usually established by the health care agency and written in an agency policy).

B. Medication prescriptions need to be written using accepted abbreviations, acronyms, and symbols approved by The Joint Commission; also follow agency guidelines.

*If the nurse has any questions about or sees inconsistencies in the written prescription, the nurse must contact the person who wrote the prescription immediately and must verify the prescription.*

VI. Oral Medications

A. Scored tablets contain an indented mark to be used for possible breakage into partial doses; when necessary, scored tablets (those marked for division) can be divided into halves or quarters according to agency policy.

B. Enteric-coated tablets and sustained-released capsules delay absorption until the medication reaches the small intestine; these medications should not be crushed.

C. Capsules contain a powdered or oily medication in a gelatin cover.

D. Orally administered liquids are supplied in solution form and contain a specific amount of medication in a given amount of solution, as stated on the label.

E. The medicine cup

1. The medicine cup has a capacity of 30 mL or 1 ounce (oz) and is used for orally administered liquids.
2. The medicine cup is calibrated to measure teaspoons, tablespoons, and ounces.
3. To pour accurately, place the medication cup on a level surface at eye level and then pour the liquid while reading the measuring markings

F. Volumes of less than 5 mL are measured using a syringe with the needle removed.

*A calibrated syringe is used for giving medicine to children.*

VII. **Parenteral Medications**

A. Parenteral means an injection route, and parenteral medications are administered by intravenous (IV), intramuscular, subcutaneous, or intradermal injection (see Fig. 14-1 for angles of injection).

B. Parenteral medications are packaged in single-use ampules, in single- and multiple-use rubber-stoppered vials, and in premeasured syringes and cartridges.

C. The standard 3-mL syringe is used to measure most injectable medications and is calibrated in tenths (0.1) of a milliliter.

D. The syringe is filled by drawing in solution until the top ring on the plunger (i.e., the ring closest to the needle), not the middle section or the bottom ring of the plunger, is aligned with the desired calibration (Fig. 14-2).

E. The nurse should not administer more than 3 mL per intramuscular injection site (2 mL for the deltoid) or 0.5 to 1.5 mL for an adult per subcutaneous injection site; larger volumes are difficult for an injection site to absorb and, if prescribed, need to be verified. Variations for pediatric clients are discussed in the pediatric sections of this text.

F. In an adult that is of normal size, a 25-gauge 5⁄8-inch needle at a 45-degree angle or a 1⁄2-inch needle at a 90-degree angle is used for subcutaneous injections.

G. For an intramuscular injection in an adult client, the client's weight, site for injection, and the amount of adipose tissue influences needle size. An obese person may require a needle 2 to 3 inches long, whereas a thin person requires only a 1⁄2- to 1-inch needle; the gauge of the needle will depend on the viscosity of the solution being injected, with a larger gauge needed for more viscous solutions. If a Z-track method is used, a larger, deeper muscle such as the ventrogluteal muscle should be chosen as the site.

H. For an intradermal injection, a tuberculin or small syringe is used. The angle of insertion for an intradermal injection is 5 to 15 degrees.

*Always question and verify excessively large or small volumes of medication.*

I. Prefilled medication cartridge

1. The medication cartridge slips into the cartridge holder, which provides a plunger for injection of the medication.
2. The cartridge is designed to provide sufficient space to allow for the addition of a second medication when combined dosages are prescribed.
3. The prefilled medication cartridge is to be used once

and discarded; if the nurse is to give less than the full single dose provided, the nurse needs to discard the extra amount before giving the client the injection, in accordance with agency policies and procedures.

J. In general, standard medication doses for adults are to be rounded to the nearest tenth (0.1 mL) of a milliliter and measured on the milliliter scale; for example, 1.28 mL is rounded to 1.3 mL (follow agency policy for rounding medication doses).

K. When volumes larger than 3 mL are required, the nurse may use a 5-mL syringe; these syringes are calibrated in fifths (0.2 mL) (Fig. 14-3).

L. Other syringe sizes may be available (10, 20, and 50 mL) and may be used for medication administration requiring dilution.

*When performing a calculation, if rounding is necessary, perform the rounding at the end of the calculation. When taking the NCLEX, follow the instructions provided in the question regarding the need to round. For example, the NCLEX question may read: Record your answer using one decimal place.*

M. Tuberculin syringe (Fig. 14-4)

1. The tuberculin syringe holds 1 mL and is used to measure small or critical amounts of medication, such as allergen extract, vaccine, or a child's medication.

2. The syringe is calibrated in hundredths (0.01) of a milliliter, with each one-tenth (0.1) marked on the metric scale.

N. Insulin syringe (Fig. 14-5)

1. The standard 100-unit insulin syringe is calibrated for 100 units of insulin (100 units = 1 mL); low-dose insulin syringes, such as a 30-unit insulin syringe or a 50-unit insulin syringe, are available for a more precise insulin draw for clients with low-dose insulin prescriptions.
2. Insulin should not be measured in any other type of syringe.

*If the insulin prescription states to administer regular and NPH insulin, combine both types of insulin in the same syringe. Use the mnemonic RN: Draw Regular insulin into the insulin syringe first, and then draw the NPH insulin. Of note, with newer insulin types on the market, such as long-acting and rapid-acting insulin, Regular and NPH insulin are used less frequently because of safety and convenience factors.*

O. Safety needles contain shielding devices that are attached to the needle and slipped over the needle to reduce the incidence of needlestick injuries.

VIII. Injectable Medications in Powder Form

A. Some medications become unstable when stored in solution form and are therefore packaged in powder form.

B. Powders must be dissolved with a sterile diluent before use; usually, sterile water or normal saline is used. The dissolving procedure is called reconstitution (Box 14-7).

IX. Calculating the Correct Dosage (see Box 14-8 for the standard formula)

A. When calculating dosages of oral medications, check the calculation and question the prescription if the calculation calls for more than 3 tablets.

B. When calculating dosages of parenteral medications, check the calculation and question the prescription if the amount to be given is too large a dose.

C. Be sure that all measures are in the same system and that all units are in the same size, converting when necessary; carefully consider what the reasonable amount of the medication that should be administered is.

D. Round standard injection doses to tenths and measure in a 3-mL syringe (follow agency policy).

E. Per agency policy, it may be acceptable to round down (avoid rounding up) small, critical amounts or children's doses to hundredths and measure in a 1-mL tuberculin syringe (example: 1.752 mL can be rounded to 1.75 mL).

F. In addition to using the standard formula (see Box 14-8), calculations can be done using dimensional analysis, a method that uses conversion factors to move from one unit of measurement to another; the required elements of the equation include the desired answer units, conversion formula that includes the desired answer units and the units that need to be converted, and the original factors to convert, including quantity and units.

*Regardless of the source or cause of a medication error, if the nurse gives an incorrect dose, the nurse is legally responsible for the action.*

X. Percentage and Ratio Solutions

A. Percentage solutions

1. Express the number of grams (g) of the medication per 100 mL of solution.
2. For example, calcium gluconate 10% is 10 g of pure medication per 100 mL of solution.

B. Ratio solutions

1. Express the number of grams of the medication per total milliliters of solution.

2. For example, epinephrine 1:1000 is 1 g of pure medication per 1000 mL of solution.

XI. Intravenous Flow Rates (Box 14-9)

A. Monitor IV flow rate frequently even if the IV solution is being administered through an electronic infusion device (follow agency policy regarding frequency).

B. If an IV is running behind schedule, collaborate with the primary health care provider to determine the client's ability to tolerate an increased flow rate, particularly for older clients and those with cardiac, pulmonary, renal, or neurological conditions.

*The nurse should never increase the rate of (i.e., speed up) an IV infusion to catch up if the infusion is running behind schedule. The nurse should include any IV fluid administered in the intake portion of the client's assessment.*

C. Whenever a prescribed IV rate is increased, the nurse should assess the client for increased heart rate, increased respirations, and increased lung congestion, which could indicate fluid overload.

D. Intravenously administered fluids are prescribed most frequently based on milliliters per hour.

E. The volume per hour prescribed is administered by setting the flow rate, which is counted in drops per minute.

F. Most flow rate calculations involve changing milliliters per hour to drops per minute.

G. Intravenous tubing

1. IV tubing sets are calibrated in drops per milliliter; this calibration is needed for calculating flow rates.
2. A standard or macrodrip set is used for routine adult IV administrations; depending on the manufacturer and type of tubing, the set will require 10 to 20 drops (gtt) to equal 1 mL.
3. A minidrip or microdrip set is used when more exact measurements are needed, such as in intensive care units and pediatric units.
4. In a minidrip or microdrip set, 60 gtt is usually equal to 1 mL.
5. The calibration, in drops per milliliter, is written on the IV tubing package.

XII. Calculation of Infusions Prescribed by Unit Dosage per Hour

A. The most common medications that will be prescribed by unit dosage per hour and run by continuous infusion are heparin sodium and regular insulin.

B. Calculation of these infusions can be done using a 2-step process (Box 14-10).

**Box 14-1**

## Medication Administration

- Assess the medication prescription.
- Compare the client's medication prescription with all medications that the client was previously taking (medication reconciliation).
- Ask the client about a history of allergies or use of herbal substances.
- Assess the client's current condition and the purpose for the medication or intravenous (IV) solution.
- Determine the client's understanding of the purpose of the prescribed medication or need for IV solution.
- Teach the client about the medication and about self-administration at home.
- Identify and address concerns (social, cultural, religious, spiritual) that the client may have about taking the medication.
- Assess the need for conversion when preparing a dose of medication for administration to the client.
- Assess the rights of medication administration such as: right prescription, right medication, right dose, right client, right route, right frequency/time, right reason, right education (medication name, purpose, action, and possible undesirable side or adverse effects), right assessment (performed by a qualified health care provider), right to refuse medication regardless of the consequences, right approach/technique, right evaluation/response, and right documentation.
- Inform the client of additional medication rights, which include not receiving unnecessary medication; being advised of the experimental nature of medication therapy and to give written consent for its use; being informed if prescribed medications are a part of a research study; and receiving appropriate supportive therapy in relation to medication therapy.
- Assess the vital signs, check significant laboratory results, and identify any potential interactions (food or medication interactions) before administering medication, when appropriate.
- Document the administration of the prescribed therapy and the client's response to the therapy.

**Box 14-2**

## Metric System

### Abbreviations

meter: m
liter: L
milliliter: mL

kilogram: kg
gram: g
milligram: mg
microgram: mcg
milliequivalents: mEq

### Equivalents

1 mcg = 0.000001 g
1 mg = 1000 mcg or 0.001 g
1 g = 1000 mg
1 kg = 1000 g
1 kg = 2.2 lb
1 mL = 0.001 L

**Box 14-3**

## Conversion Between Metric Units

### Problem 1

Convert 2 g to milligrams.

### Solution

Change a larger unit to a smaller unit:
2 g = 2000 mg (multiply by 1000 or move decimal point 3 places to the right)

### Problem 2

Convert 250 mL to liters.

### Solution

Change a smaller unit to a larger unit:
250 mL = 0.25 L (divide by 1000 or move decimal point 3 places to the left)

**Box 14-4**

## Ratio and Proportion

*Ratio:* The relationship between 2 numbers, separated by a colon; for example, 1:2 (1 to 2).
*Proportion:* The relationship between 2 ratios, separated by a double colon (::) or an equal sign (=).

### Formula:

$$H(\text{on hand}) : V(\text{vehicle}) :: (=)(\text{desired dose}) : X(\text{unknown})$$

*To solve a ratio and proportion problem:* The middle numbers (means) are multiplied and the end numbers (extremes) are multiplied.

### Sample Problem

H = 1
V = 2
Desired dose = 3
X = unknown
Set up the formula: 1 : 2 :: 3 : X
*Solve:* Multiply means and extremes:
1X = 6
X = 6

**Box 14-5**

## Calculating Equivalents Between Two Systems

Calculating equivalents between 2 systems may be done by using the method of ratio and proportion.

### Problem

The primary health care provider prescribes nitroglycerin $\frac{1}{150}$ grain (gr).

The medication label reads 0.4 milligrams (mg) per tablet. The nurse prepares to administer how many tablets to the client?

If you knew that $\frac{1}{150}$ gr was equal to 0.4 mg, you would know that you need to administer 1 tablet. Otherwise, use the ratio and proportion formula.

*Note that grain is a measure in the apothecary system but nitroglycerin is one medication that you may find prescribed in this unit of measure.*

### Ratio and Proportion Formula

$$H(\text{on hand}) : V(\text{vehicle}) :: (=)(\text{desired dose}) : X(\text{unknown})$$

$$1\,\text{gr} : 60\,\text{mg} :: \frac{1}{150}\,\text{gr} : X\,\text{mg}$$

$$60 \times \frac{1}{150} = X$$

$$X = 0.4\ \text{mg}(1\ \text{tablet})$$

**Box 14-6**

## Medication Prescriptions

- Name of client
- Date and time when prescription is written
- Name of medication to be given
- Dosage of medication
- Medication route
- Time and frequency of administration
- Signature of person writing the prescription

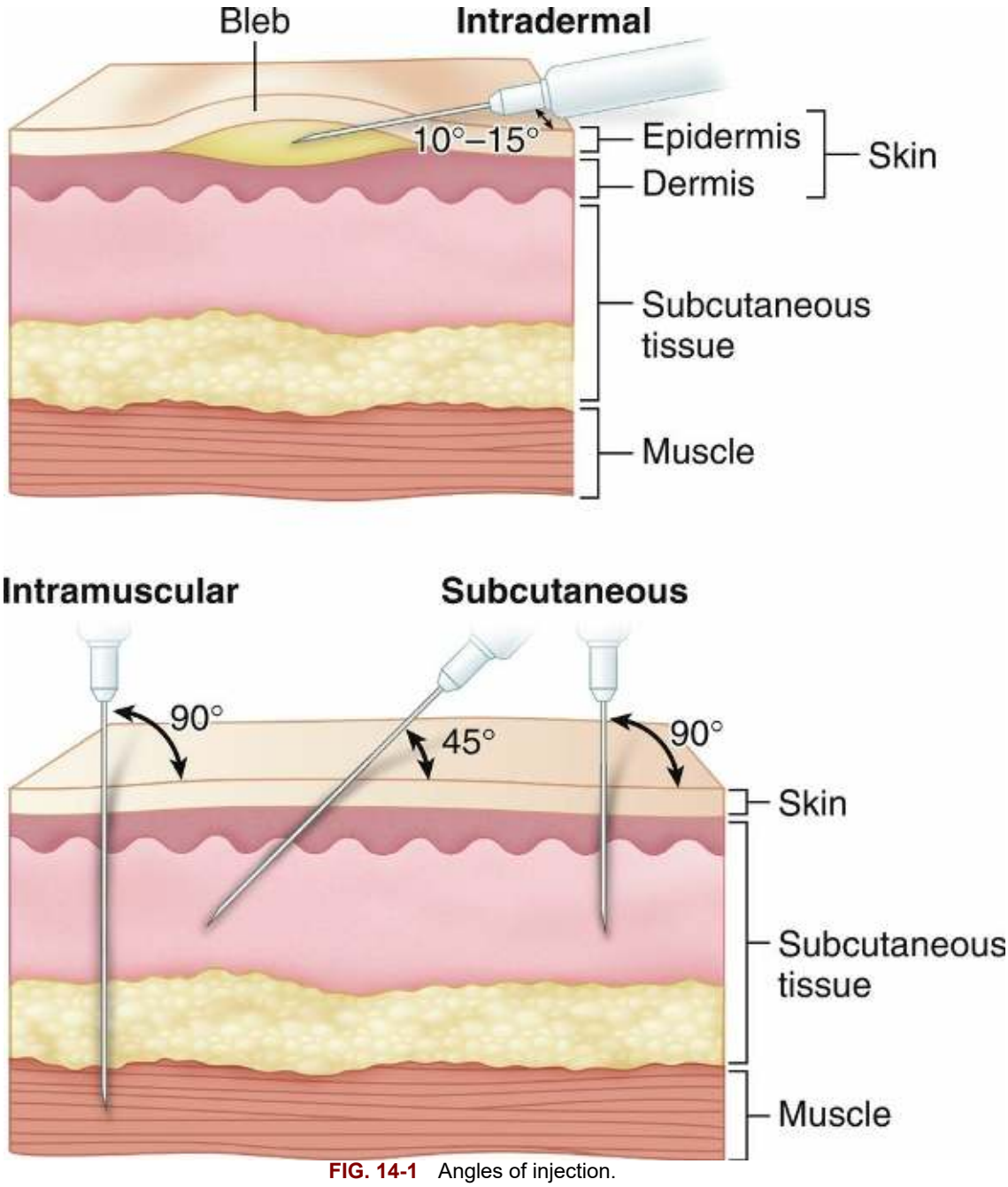


**FIG. 14-1** Angles of injection.

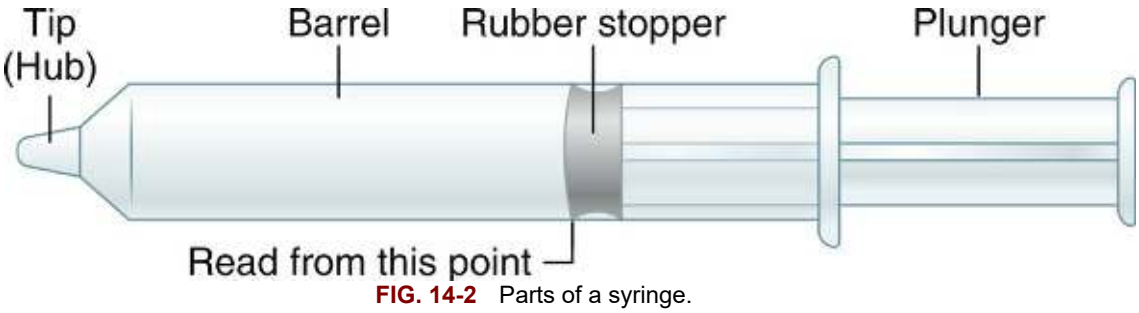


**FIG. 14-2** Parts of a syringe.

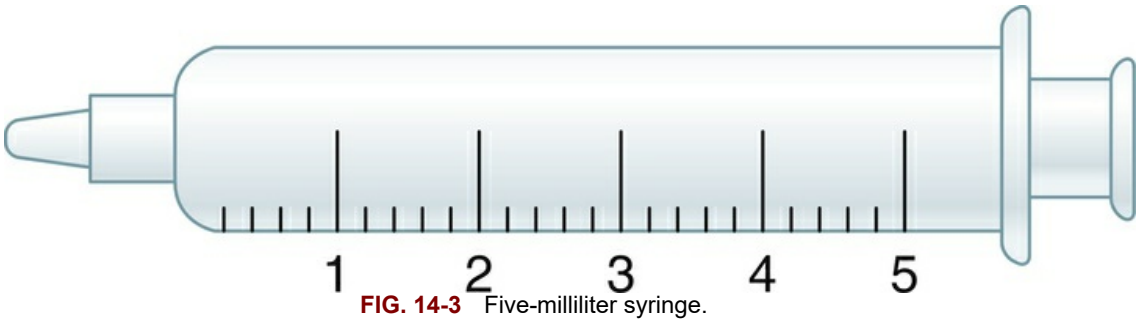

FIG. 14-3 Five-milliliter syringe.

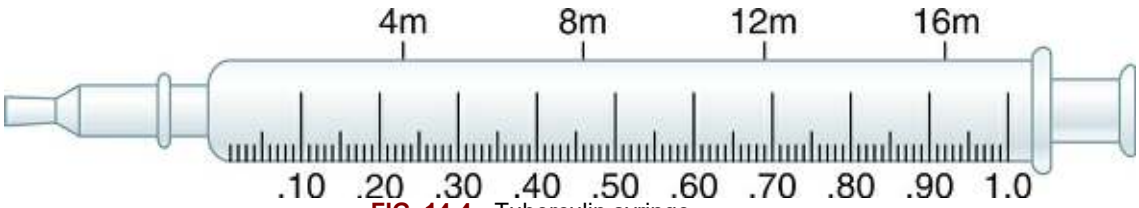

FIG. 14-4 Tuberculin syringe.

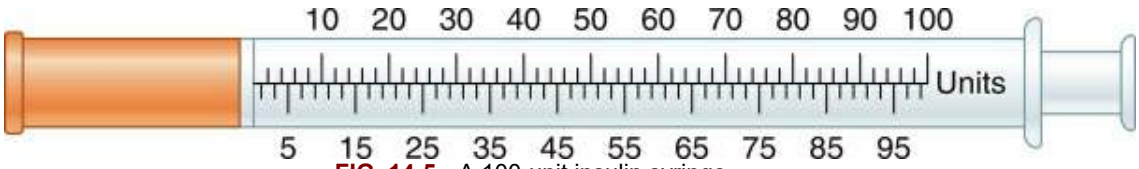

FIG. 14-5 A 100-unit insulin syringe.

**Box 14-7**

## Reconstitution

- In reconstituting a medication, locate the instructions on the label or in the vial package insert and read and follow the directions carefully.
- Instructions will state the volume of diluent to be used and the resulting volume of the reconstituted medication.
- Often, the powdered medication adds volume to the solution in addition to the amount of diluent added.
- The total volume of the prepared solution will exceed the volume of the diluent added.
- When reconstituting a multiple-dose vial, label the medication vial with the date and time of preparation, your initials, and the date of expiration.
- Indicating the strength per volume on the medication label also is important.

**Box 14-8**

## Standard Formula for Calculating a Medication Dosage

$$\frac{D}{A} \times Q = X$$

D (desired) is the dosage that the primary health care provider prescribed.
A (available) is the dosage strength as stated on the medication label.
Q (quantity) is the volume or form in which the dosage strength is available, such as tablets, capsules, or milliliters.

**Box 14-9**

## Formulas for Intravenous Calculations

### Flow Rates

$$\frac{\text{Total volume} \times \text{Drop factor}}{\text{Time in minutes}} = \text{Drops per minute}$$

### Infusion Time

$$\frac{\text{Total volume to infuse}}{\text{Milliliters per hour being infused}} = \text{Infusion time}$$

### Number of Milliliters per Hour

$$\frac{\text{Total volume in milliliters}}{\text{Number of hours}} = \text{Number of milliliters per hour}$$

**Box 14-10**

## Infusions Prescribed by Unit Dosage per Hour

Calculation of these problems can be done using a 2-step process.

1. Determine the amount of medication per milliliter (mL).
2. Determine the infusion rate or milliliters per hour.

### Problem 1

*Prescription:* Continuous heparin sodium by IV at 1000 units per hour
*Available:* IV bag of 500 mL $D_5W$ with 20,000 units of heparin sodium
How many milliliters per hour are required to administer the correct dose?

### Solution

*Step 1:* Calculate the amount of medication (units) per 1 mL.

$$\frac{\text{Known amount of medication in solution}}{\text{Total volume of diluent}} = \text{Amount of medication per milliliter}$$

$$\frac{20{,}000 \text{ units}}{500 \text{ mL}} = 40 \text{ units} / 1 \text{ mL}$$

*Step 2:* Calculate milliliters per hour.

$$\frac{\text{Dose per hour desired}}{\text{Concentration per milliliter}} = \text{Infusion rate, or mL / hour}$$

$$\frac{1000 \text{ units}}{40 \text{ units}} = 25 \text{ mL / hour}$$

## Problem 2

*Prescription:* Continuous regular insulin by IV at 10 units per hour
*Available:* IV bag of 100 mL NS with 50 units regular insulin
How many milliliters per hour are required to administer the correct dose?

## Solution

*Step 1:* Calculate the amount of medication (units) per 1 mL.

$$\frac{\text{Known amount of medication in solution}}{\text{Total volume of diluent}} = \text{Amount of medication per milliliter}$$

$$\frac{50 \text{ units}}{100 \text{ mL}} = 0.5 \text{ units / 1 mL}$$

$$\frac{\text{Dose per hour desired}}{\text{Concentration per milliliter}} = \text{Infusion rate, or mL / hour}$$

$$\frac{10\,\text{units}}{0.5\,\text{units}/\text{mL}} = 20\,\text{mL}/\text{hour}$$

## Practice Questions

111. A prescription reads 1000 mL of normal saline (NS) to infuse over 12 hours. The drop factor is 15 drops (gtt)/1 mL. The nurse prepares to set the flow rate at how many drops per minute? **Fill in the blank. Record your answer to the nearest whole number.**

    **Answer:** _____ drops per minute

112. A prescription reads to administer an intravenous (IV) dose of 400,000 units of penicillin G benzathine. The label on the 10-milliliters (mL) ampule sent from the pharmacy reads penicillin G benzathine, 300,000 units/mL. The nurse prepares how much medication to administer the correct dose? **Fill in the blank. Record your answer using 1 decimal place.**

    **Answer:** _____ mL

113. A prescription reads potassium chloride 30 mEq to be added to 1000 mL normal saline (NS) and to be administered over a 10-hour period. The label on the medication bottle reads 40 mEq/20 mL. The nurse prepares how many milliliters (mL) of potassium chloride to administer the correct dose of medication? **Fill in the blank.**

    **Answer:** _____ mL

114. A prescription reads clindamycin phosphate 0.3 g in 50 mL normal saline (NS) to be administered intravenously over 30 minutes. The medication label reads clindamycin phosphate 900 mg in 6 mL. The nurse prepares how many milliliters (mL) of the medication to administer the correct dose? **Fill in the blank.**

    **Answer:** _____ mL

115. A prescription reads phenytoin 0.2 g orally twice daily. The medication label states that each capsule is 100 mg. The nurse prepares how many capsule(s) to administer 1 dose? **Fill in the blank.**

    **Answer:** _____ capsule(s)

116. A prescription reads 1000 mL of normal saline 0.9% to infuse over 8 hours. The drop factor is 15 drops (gtt)/1 mL. The nurse sets the flow rate at how many drops per minute? **Fill in the blank. Record your answer to the nearest whole number.**

    **Answer:** _____ drops per minute

117. A prescription reads heparin sodium, 1300 units/hr by continuous intravenous (IV) infusion. The pharmacy prepares the medication and delivers an IV bag labeled heparin sodium 20,000 units/250 mL $D_5W$. An infusion pump must be used to administer the medication. The nurse sets the infusion pump at how many milliliters (mL) per hour to deliver 1300 units/hour? **Fill in the blank. Record your answer to the nearest whole number.**

**Answer:** _____ mL/hr

118. A prescription reads 3000 mL of $D_5W$ to be administered over a 24-hour period. The nurse determines that how many milliliters (mL) per hour will be administered to the client? **Fill in the blank.**

**Answer:** _____ mL/hr

119. Gentamicin sulfate, 80 mg in 100 mL normal saline (NS), is to be administered over 30 minutes. The drop factor is 10 drops (gtt)/1 mL. The nurse sets the flow rate at how many drops per minute? **Fill in the blank. Record your answer to the nearest whole number.**

**Answer:** _____ drops per minute

120. A prescription reads levothyroxine, 150 mcg orally daily. The medication label reads levothyroxine, 0.1 mg/tablet. The nurse administers how many tablet(s) to the client? **Fill in the blank.**

**Answer:** _____ tablet(s)

121. Cefuroxime sodium, 1 g in 50 mL normal saline (NS), is to be administered over 30 minutes. The drop factor is 15 drops (gtt)/1 mL. The nurse sets the flow rate at how many drops per minute? **Fill in the blank.**

**Answer:** _____ drops per minute

122. A prescription reads 1000 mL $D_5W$ to infuse at a rate of 125 mL/hr. The nurse determines that it will take how many hours for 1 L to infuse? **Fill in the blank.**

**Answer:** _____ hour(s)

123. A prescription reads to infuse 1 unit of packed red blood cells over 4 hours. The unit of blood contains 250 mL. The drop factor is 10 drops (gtt)/1 mL. The nurse prepares to set the flow rate at how many drops per minute? **Fill in the blank. Record your answer to the nearest whole number.**

**Answer:** _____ drops per minute

124. A prescription reads morphine sulfate, 8 mg stat. The medication ampule reads morphine sulfate, 10 mg/mL. The nurse prepares how many milliliters (mL) to administer the correct dose? **Fill in the blank.**

**Answer:** _____ mL

125. A prescription reads regular insulin, 8 units/hr by continuous intravenous (IV) infusion. The pharmacy prepares the medication and then delivers an IV bag labeled 100 units of regular insulin in 100 mL normal saline (NS). An infusion pump must be used to administer the medication. The nurse sets the infusion pump at how many milliliters (mL) per hour to deliver 8 units/hr? **Fill in the blank.**

**Answer:** _____ mL/hr

# Answers

111. ***Answer:*** 21

***Rationale:*** Use the intravenous (IV) flow rate formula.
***Formula:***

$$\frac{\text{Total Volume} \times \text{Drop factor}}{\text{Time in minutes}} = \text{Drops per minute}$$

$$\frac{1000\ \text{mL} \times 15\ \text{gtt}}{720\ \text{minutes}} = \frac{15{,}000}{720} = 20.8, \text{or } 21\ \text{gtt/min}$$

***Test-Taking Strategy:*** Focus on the **subject**, calculating an IV flow rate. Use the formula for calculating IV flow rates when answering the question. Once you have performed the calculation, verify your answer using a calculator and make sure that the answer makes sense. Remember to record the answer to the nearest whole number.

***Level of Cognitive Ability:*** Applying
***Client Needs:*** Physiological Integrity
***Integrated Process:*** Nursing Process—Implementation
***Content Area:*** Skills: Dosage Calculations
***Health Problem:*** N/A
***Priority Concepts:*** Clinical Judgment; Safety
***Reference:*** Potter et al. (2017), pp. 978-979.

112. ***Answer:*** 1.3

***Rationale:*** Use the medication dose formula.
***Formula:***

$$\frac{\text{Desired} \times \text{mL}}{\text{Available}} = \text{Milliliters per dose}$$

$$\frac{400{,}000\ \text{units} \times 1\ \text{mL}}{300{,}000\ \text{units}} = \text{Milliliters per dose}$$

$$\frac{400{,}000}{300{,}000} = 1.33 = 1.3\,\text{mL}$$

***Test-Taking Strategy:*** Focus on the **subject,** a dosage calculation. Follow the formula for the calculation of the correct medication dose. Once you have performed the calculation, verify your answer using a calculator and make sure that the answer makes sense. Remember to record your answer using 1 decimal place.
***Level of Cognitive Ability:*** Applying
***Client Needs:*** Physiological Integrity
***Integrated Process:*** Nursing Process—Implementation
***Content Area:*** Skills: Dosage Calculations
***Health Problem:*** Adult Health: Immune: Infections
***Priority Concepts:*** Clinical Judgment; Safety
***Reference:*** Potter et al. (2017), pp. 618-620, 632.

113. ***Answer:*** 15

***Rationale:*** In most facilities, potassium chloride is premixed in the intravenous solution and the nurse will need to verify the correct dose before administration. In some cases the nurse will need to add the potassium chloride and will use the medication calculation formula to determine the mL to be added.
***Formula:***

$$\frac{\text{Desired} \times \text{mL}}{\text{Available}} = \text{Milliliters per dose}$$

$$\frac{30\,\text{mEq} \times 20\,\text{mL}}{40\,\text{mEq}} = 15\,\text{mL}$$

***Test-Taking Strategy:*** Focus on the **subject,** a dosage calculation. Follow the formula for the calculation of the correct medication dose. Once you have performed the calculation, verify your answer using a calculator and make sure that the answer makes sense.
***Level of Cognitive Ability:*** Applying
***Client Needs:*** Physiological Integrity
***Integrated Process:*** Nursing Process—Implementation
***Content Area:*** Skills: Dosage Calculations
***Health Problem:*** N/A
***Priority Concepts:*** Clinical Judgment; Safety

***Reference:*** Gahart, Nazareno, Ortega (2017), p. 1065; Potter et al. (2017), pp. 978-979.

114. ***Answer:*** 2

***Rationale:*** You must convert 0.3 g to milligrams. In the metric system, to convert larger to smaller, multiply by 1000 or move the decimal 3 places to the right. Therefore, 0.3 g = 300 mg. After conversion from grams to milligrams, use the formula to calculate the correct dose.

***Formula:***

$$\frac{\text{Desired} \times \text{mL}}{\text{Available}} = \text{Milliliters per dose}$$

$$\frac{300\,\text{mg} \times 6\,\text{mL}}{900\,\text{mg}} = \frac{1800}{900} = 2\,\text{mL}$$

***Test-Taking Strategy:*** Focus on the **subject,** a dosage calculation. In this medication calculation problem, first you must convert grams to milligrams. Once you have performed the calculation, verify your answer using a calculator and make sure that the answer makes sense.

***Level of Cognitive Ability:*** Applying
***Client Needs:*** Physiological Integrity
***Integrated Process:*** Nursing Process—Implementation
***Content Area:*** Skills: Dosage Calculations
***Health Problem:*** Adult Health: Immune: Infections
***Priority Concepts:*** Clinical Judgment; Safety
***Reference:*** Perry et al. (2018), pp. 514-515.

115. ***Answer:*** 2

***Rationale:*** You must convert 0.2 g to milligrams. In the metric system, to convert larger to smaller, multiply by 1000 or move the decimal point 3 places to the right. Therefore, 0.2 g equals 200 mg. After conversion from grams to milligrams, use the formula to calculate the correct dose.

***Formula:***

$$\frac{\text{Desired} \times \text{Capsule(s)}}{\text{Available}} = \text{Capsule(s) per dose}$$

$$\frac{200\,\text{mg} \times 1\,\text{Capsule}}{100\,\text{mg}} = 2\ \text{Capsules}$$

***Test-Taking Strategy:*** Focus on the **subject,** a dosage calculation. In this medication calculation problem, first you must convert grams to milligrams. Once you have done the conversion and reread the medication calculation problem, you will know that 2 capsules is the correct answer. Recheck your work using a calculator and make sure that the answer makes sense.

***Level of Cognitive Ability:*** Applying
***Client Needs:*** Physiological Integrity
***Integrated Process:*** Nursing Process—Implementation
***Content Area:*** Skills: Dosage Calculations
***Health Problem:*** Adult Health: Neurological: Seizure disorder/epilepsy
***Priority Concepts:*** Clinical Judgment; Safety
***Reference:*** Potter et al. (2017), pp. 618-619.

116. ***Answer:*** 31

***Rationale:*** Use the intravenous (IV) flow rate formula.
***Formula:***

$$\frac{\text{Total volume} \times \text{Drop factor}}{\text{Time in Minutes}} = \text{Drop per minute}$$

$$\frac{1000\ \text{mL} \times 15\,\text{gtt}}{480\ \text{minutes}} = \frac{15{,}000}{480} = 31.2, \text{ or } 31\,\text{gtt/min}$$

***Test-Taking Strategy:*** Focus on the **subject,** an IV flow rate. Use the formula for calculating IV flow rates when answering the question. Once you have performed the calculation, verify your answer using a calculator and make sure that the answer makes sense. Remember to record the answer to the nearest whole number.

***Level of Cognitive Ability:*** Applying
***Client Needs:*** Physiological Integrity
***Integrated Process:*** Nursing Process—Implementation
***Content Area:*** Skills: Dosage Calculations
***Health Problem:*** N/A
***Priority Concepts:*** Clinical Judgment; Safety
***Reference:*** Potter et al. (2017), pp. 978-979.

117. ***Answer:*** 16

***Rationale:*** Calculation of this problem can be done using a 2-step process. First, you need to determine the amount of heparin sodium in 1 mL. The next step is to determine the infusion rate, or milliliters per hour.
***Formula:***
***Step 1:***

$$\frac{\text{Known amount of medication in solution}}{\text{Total volume of diluent}} = \text{Amount of medication per milliliter}$$

$$\frac{20{,}000\,\text{units}}{250\,\text{mL}} = 80\,\text{units/mL}$$

***Step 2:***

$$\frac{\text{Dose per hour desired}}{\text{Concentration per milliliter}} = \text{Infusion rate, or mL/hr}$$

$$\frac{1300\,\text{units}}{80\,\text{units/mL}} = 16.25, \text{ or } 16\,\text{mL/hr}$$

***Test-Taking Strategy:*** Focus on the **subject,** an IV flow rate. Read the question carefully, noting that 2 steps can be used to solve this medication problem. Follow the formula, verify your answer using a calculator, and make sure that the answer makes sense. Remember to record the answer to the nearest whole number.
***Level of Cognitive Ability:*** Analyzing
***Client Needs:*** Physiological Integrity
***Integrated Process:*** Nursing Process—Implementation
***Content Area:*** Skills: Dosage Calculations
***Health Problem:*** Adult Health: Hematological: Bleeding/Clotting Disorders
***Priority Concepts:*** Clinical Judgment; Safety
***Reference:*** Potter et al. (2017), pp. 958, 978-979.

118. ***Answer:*** 125

***Rationale:*** Use the intravenous (IV) formula to determine milliliters per hour.
***Formula:***

$$\frac{\text{Total volume in milliliters}}{\text{Number of hours}} = \text{Milliliters per hour}$$

$$\frac{3000\ \text{mL}}{24\ \text{hours}} = 125\ \text{mL/hr}$$

***Test-Taking Strategy:*** Focus on the **subject,** an IV infusion calculation of mL per hour. Read the question carefully, noting that the question is asking about milliliters per hour to be administered to the client. Use the formula for calculating milliliters per hour. Once you have performed the calculation, verify your answer using a calculator and make sure that the answer makes sense.
***Level of Cognitive Ability:*** Applying
***Client Needs:*** Physiological Integrity
***Integrated Process:*** Nursing Process—Implementation
***Content Area:*** Skills: Dosage Calculations
***Health Problem:*** N/A
***Priority Concepts:*** Clinical Judgment; Safety
***Reference:*** Potter et al. (2017), pp. 978-979.

119. ***Answer:*** 33

***Rationale:*** Use the intravenous (IV) flow rate formula.
***Formula:***

$$\frac{\text{Total volume} \times \text{Drop factor}}{\text{Time in minutes}} = \text{Drops per minute}$$

$$\frac{100\ \text{mL} \times 10\ \text{gtt}}{30\ \text{minutes}} = \frac{1000}{30} = 33.3, \text{ or } 33\ \text{gtt/min}$$

***Test-Taking Strategy:*** Focus on the **subject,** an IV infusion calculation. Use the formula for calculating IV flow rates when answering the question. Once you have performed the calculation, verify your answer using a calculator and make sure that the answer makes sense. Remember to record the answer to the nearest whole number.
***Level of Cognitive Ability:*** Applying
***Client Needs:*** Physiological Integrity
***Integrated Process:*** Nursing Process—Implementation
***Content Area:*** Skills: Dosage Calculations
***Health Problem:*** Adult Health: Immune: Infections
***Priority Concepts:*** Clinical Judgment; Safety
***Reference:*** Potter et al. (2017), pp. 978-979.

120. ***Answer:*** 1.5

***Rationale:*** You must convert 150 mcg to milligrams. In the metric system, to convert smaller to larger, divide by 1000 or move the decimal 3 places to the left. Therefore, 150 mcg equals 0.15 mg. Next, use the formula to calculate the correct dose.
***Formula:***

$$\frac{\text{Desired}}{\text{Available}} \times \text{Tablet} = \text{Tablets per dose}$$

$$\frac{0.15\text{mg}}{0.1\text{mg}} \times 1\text{tablet} = 1.5\text{ tablets}$$

***Test-Taking Strategy:*** Focus on the **subject,** a dosage calculation. In this medication calculation problem, first you must convert micrograms to milligrams. Next, follow the formula for the calculation of the correct dose, verify your answer using a calculator, and make sure that the answer makes sense.
***Level of Cognitive Ability:*** Applying
***Client Needs:*** Physiological Integrity
***Integrated Process:*** Nursing Process—Implementation
***Content Area:*** Skills: Dosage Calculations
***Health Problem:*** Adult Health: Endocrine: Thyroid Disorders
***Priority Concepts:*** Clinical Judgment; Safety
***Reference:*** Perry et al. (2018), pp. 514-515.

121. ***Answer:*** 25

***Rationale:*** Use the intravenous (IV) flow rate formula.
***Formula:***

$$\frac{\text{Total volume} \times \text{Drop factor}}{\text{Time in minutes}} = \text{Drops per minute}$$

$$\frac{50\text{mL} \times 15\text{gtt}}{30\text{minutes}} = \frac{750}{30} = 25\text{gtt/min}$$

***Test-Taking Strategy:*** Focus on the **subject,** an IV infusion calculation. Use the formula for calculating IV flow rates when answering the question. Once you have performed the calculation, verify your answer using a calculator and make sure that the answer makes sense.
***Level of Cognitive Ability:*** Applying
***Client Needs:*** Physiological Integrity
***Integrated Process:*** Nursing Process—Implementation
***Content Area:*** Skills: Dosage Calculations
***Health Problem:*** Adult Health: Immune: Infections
***Priority Concepts:*** Clinical Judgment; Safety
***Reference:*** Potter et al. (2017), pp. 978-979.

122. ***Answer:*** 8

***Rationale:*** You must determine that 1 L equals 1000 mL. Next, use the formula for determining infusion time in hours.

***Formula:***

$$\frac{\text{Total volume to infuse}}{\text{Milliliters per hour being infused}} = \text{Infusion time}$$

$$\frac{1000\,\text{mL}}{125\,\text{mL}} = 8\,\text{hours}$$

***Test-Taking Strategy:*** Focus on the **subject,** an IV infusion time calculation. Read the question carefully, noting that the question is asking about infusion time in hours. First, convert 1 L to milliliters. Next, use the formula for determining infusion time in hours. Verify your answer using a calculator and make sure that the answer makes sense.

***Level of Cognitive Ability:*** Applying
***Client Needs:*** Physiological Integrity
***Integrated Process:*** Nursing Process—Implementation
***Content Area:*** Skills: Dosage Calculations
***Health Problem:*** N/A
***Priority Concepts:*** Clinical Judgment; Safety
***Reference:*** Potter et al. (2017), p. 978.

123. ***Answer:*** 10

***Rationale:*** Use the intravenous (IV) flow rate formula.

***Formula:***

$$\frac{\text{Total volume} \times \text{Drop factor}}{\text{Time in minute}} = \text{Drops per minute}$$

$$\frac{250\ \text{mL} \times 10\ \text{gtt}}{240\ \text{minutes}} = \frac{2500}{240} = 10.4, \text{or} 10\ \text{gtt/min}$$

***Test-Taking Strategy:*** Focus on the **subject,** an IV infusion rate. Although an infusion pump would be used, use the formula to calculate drops per minute to answer the question. The formula for calculating IV flow rates when answering the question. Once you have performed the calculation, verify your answer using a calculator and make sure that the answer makes sense. Remember to record the answer to the nearest whole number.

***Level of Cognitive Ability:*** Applying
***Client Needs:*** Physiological Integrity
***Integrated Process:*** Nursing Process—Implementation
***Content Area:*** Skills: Dosage Calculations
***Health Problem:*** N/A
***Priority Concepts:*** Clinical Judgment; Safety
***Reference:*** Potter et al. (2017), pp. 978-979.

124. ***Answer:*** 0.8

***Rationale:*** Use the formula to calculate the correct dose.
***Formula:***

$$\frac{\text{Desired} \times \text{mL}}{\text{Available}} = \text{Milliliters per dose}$$

$$\frac{8\ \text{mg} \times 1\ \text{mL}}{10\ \text{mg}} = 0.8\ \text{mL}$$

***Test-Taking Strategy:*** Focus on the **subject,** a dosage calculation. Follow the formula for the calculation of the correct dose. Once you have performed the calculation, verify your answer using a calculator and make sure that the answer makes sense.

***Level of Cognitive Ability:*** Applying
***Client Needs:*** Physiological Integrity
***Integrated Process:*** Nursing Process—Implementation
***Content Area:*** Skills: Dosage Calculations
***Health Problem:*** Adult Health: Neurological: Pain
***Priority Concepts:*** Clinical Judgment; Safety
***Reference:*** Potter et al. (2017), pp. 618-620.

125. ***Answer:*** 8

***Rationale:*** Calculation of this problem can be done using a 2-step process. First, you need to determine the amount of regular insulin in 1 mL. The next step is to determine the infusion rate, or milliliters per hour.

***Formula:***

***Step 1:***

$$\frac{\text{Known amount of medication in solution}}{\text{Total volume of diluent}} = \text{Amount of medication per milliliter}$$

$$\frac{100\,\text{units}}{100\,\text{mL}} = 1\,\text{unit/mL}$$

***Step 2:***

$$\frac{\text{Dose per hour desired}}{\text{Concentration per milliliter}} = \text{Infusion rate, or milliliters per hour}$$

$$\frac{8\,\text{units}}{1\,\text{unit/mL}} = 8\,\text{mL/hour}$$

***Test-Taking Strategy:*** Focus on the **subject,** an IV flow rate. Read the question carefully, noting that 2 steps can be used to solve this medication problem. Once you have performed the calculation, verify your answer using a calculator and make sure that the answer makes sense. These steps can be used for similar medication problems related to the administration of heparin sodium or regular insulin by IV infusion.

***Level of Cognitive Ability:*** Analyzing
***Client Need:*** Physiological Integrity
***Integrated Process:*** Nursing Process—Implementation
***Content Area:*** Skills: Dosage Calculations
***Health Problem:*** Adult Health: Endocrine: Diabetes Mellitus
***Priority Concepts:*** Clinical Judgment; Safety
***Reference:*** Potter et al. (2017), pp. 652, 978-979.