Chapter 7

Syringes

Learning Outcomes

After completing this chapter, you will be able to
1. Identify the parts of a syringe and needle.
2. Identify various types of syringes.
3. Read and measure dosages on syringes.
4. Select the appropriate syringe to administer prescribed doses.
5. Read the calibrations on hypodermic, tuberculin, insulin, and prefilled syringes.
6. Measure single insulin dosages.
7. Measure combined insulin dosages.

In this chapter, you will learn how to use various types of syringes to measure medication dosages. You will also discuss the difference between the types of insulin and how to measure single insulin dosages and combined insulin dosages.

Syringes are made of plastic or glass, designed for one-time use, and are packaged either separately or together with needles of appropriate sizes. After use, syringes must be discarded in special puncture-resistant containers.
Parts of a Syringe

A syringe consists of a barrel, plunger, and tip.

- **Barrel**: a hollow cylinder that holds the medication. It has calibrations (markings) on the outer surface.
- **Plunger**: fits in the barrel and is moved back and forth. Pulling back on the plunger draws medication or air into the syringe. Pushing in the plunger forces air or medication out of the syringe.
- **Tip**: the end of the syringe that holds the needle. The needle slips onto the tip or can be twisted and locked in place (Leur-Lok).

The inside of the barrel, plunger, and tip (shown in Figure 7.1) must always be sterile.

Needles

Needles are made of stainless steel and come in various lengths and diameters. They are packaged with a protective cover that keeps them from being contaminated. The parts of a needle are the **hub**, which attaches to the syringe, the **shaft**, the long part of the needle that is embedded in the hub, and the **bevel**, the slanted portion of the tip. The **length** of the needle is the distance...
from the point to the hub. Needles most commonly used in medication administration range from \( \frac{1}{2} \) inch to 2 inches. The \textit{gauge} of the needle refers to the thickness of the inside of the needle and varies from 18 to 28 (the larger the gauge, the thinner the needle). The parts of a needle are shown in Figure 7.1.

### Types of Syringes

The two major types of syringes are hypodermic and oral. In 1853, Drs. Charles Pravaz and Alexander Wood were the first to develop a syringe with a needle that was fine enough to pierce the skin. This is known as a \textit{hypodermic syringe}. (Use of oral syringes will be discussed in Chapter 12.)

\textbf{Hypodermic syringes} are calibrated (marked) in cubic centimeters (cc), milliliters (mL), or units. Practitioners often refer to syringes by the volume of cubic centimeters they contain, for example, a 3 cc syringe. Although many syringes are still labeled in cubic centimeters, manufacturers are now phasing in syringes labeled in milliliters. In this text, we will generally use mL instead of cc.

The smaller capacity syringes (1, 2, 2 \( \frac{1}{2} \), and 3 mL) are used most often for subcutaneous or intramuscular injections of medication. The larger sizes (5, 6, 10, and 12 mL) are commonly used to draw blood or prepare medications for intravenous administration. Syringes 20 mL and larger are used to inject large volumes of sterile solutions. A representative sample of commonly used syringes is shown in \textbullet\ Figure 7.2.

\begin{center}
\textbullet\ Figure 7.2
\end{center}

A sample of commonly used hypodermic syringes (35 cc, 12 cc, 5 cc, 3 mL, and 1 mL).

A 35 cc syringe is shown in \textbullet\ Figure 7.3. Each line on the barrel represents 1 mL, and the longer lines represent 5 mL.
A 12 cc syringe is shown in Figure 7.4. Each line on the barrel represents 0.2 mL, and the longer lines represent 1 mL.

A 5 cc syringe is shown in Figure 7.5. Each line on the barrel represents 0.2 mL, and the longer lines represent 1 mL.

In Figure 7.6, a 3 cc/mL syringe is shown. There are 10 spaces between the largest markings. This indicates that the syringe is measured in tenths of a milliliter. So, each of the lines is 0.1 mL. The longer lines indicate half and full milliliter measures. The liquid volume in a syringe is read from the top ring, not the bottom ring or the raised section in the middle of the plunger. Therefore, this syringe contains 0.9 mL.

NOTE
The syringe in Figure 7.6 is calibrated in both cc and mL. The use of the minim scale (apothecary) found on some 3 mL syringes is being phased out.
Example 7.1

How much liquid is in the 12 cc syringe shown in Figure 7.7?

The top ring of the plunger is at the second line after the 5 mL line. Because each line measures 0.2 mL, the second line measures 0.4 mL. Therefore, the amount in the syringe is 5.4 mL.

Example 7.2

How much liquid is in the 5 cc syringe shown in Figure 7.8?

The top ring of the plunger is at the second line after 4 mL. Because each line measures 0.2 mL, the second line measures 0.4 mL. Therefore, the amount of liquid in the syringe is 4.4 mL.

Example 7.3

How much liquid is in the 3 mL syringe in Figure 7.9?

The top ring of the plunger is at the second line after 1 mL. Because each line measures 0.1 mL, the two lines measure 0.2 mL. Therefore, the amount in the syringe is 1.2 mL.
The 1 mL syringe, also called a **tuberculin syringe**, shown in **Figure 7.10**, is calibrated in hundredths of a milliliter. Because there are 100 lines on the syringe, each line represents 0.01 mL. This syringe is used for intradermal injection of very small amounts of substances in tests for tuberculosis and allergies, as well as for intramuscular injection of small quantities of medication. The tuberculin syringe is the preferred syringe for use in measuring medications less than 1 mL.

![Figure 7.10](image)

A partially filled 1 mL tuberculin syringe.

The top ring of the plunger is at the second line after 0.5 mL. Therefore, the amount in the syringe is 0.52 mL.

**Example 7.4**

How much liquid is shown in the portion of the 1 mL tuberculin syringe shown in **Figure 7.11**?

The top ring of the plunger is 6 lines after the 0.3 mL calibration. Because each line represents 0.01 mL, the amount of liquid in the syringe is 0.36 mL.

![Figure 7.11](image)

A portion of a partially filled 1 mL syringe.

**NOTE**

Because the 1 mL tuberculin syringe can accurately measure amounts to hundredths of a milliliter, the volume of fluid to be measured in this syringe is rounded off to the nearest hundredth; for example, 0.358 mL is rounded off to 0.36 mL. The 3 mL syringe can accurately measure amounts to tenths of a milliliter; for example, 2.358 mL is rounded off to 2.4 mL.

**Insulin syringes** are used for the subcutaneous injection of insulin and are calibrated in **units** rather than **milliliters**. Insulin is a hormone used to treat patients who have insulin-dependent diabetes mellitus (IDDM). It is supplied as a premixed liquid measured in standardized units of potency rather than by weight or volume. These standardized units are called **USP units**, which are often shortened to **units**. The most commonly prepared concentration of insulin is 100 units per milliliter, which is referred to as **units 100 insulin** and is abbreviated as U-100 on insulin labels. Although a 500 unit concentration of insulin (U-500) is also available, it is used only for the rare patient who is markedly insulin-resistant. U-40 insulin is used in some countries; however in
the United States, insulin is standardized to U-100. Exubera, the first inhalable version of insulin, is available as a dry powder and is inhaled through the mouth using the handheld Exubera Inhaler. For the rest of this text, we will refer to U-100 insulin only.

Insulin syringes have three different capacities: the standard 100 unit capacity, and the Lo-Dose 50 unit or 30 unit capacities. The plunger of the insulin syringe is flat, and the liquid volume is measured from the top ring.

- **Figure 7.12** shows a *single-scale standard* 100 unit insulin syringe calibrated in 2 unit increments. Any odd number of units (e.g., 23, 35) is measured between the even calibrations. These calibrations and spaces are very small, so this is not the syringe of choice for a person with impaired vision.

- **Figure 7.12**
A single-scale standard 100 unit insulin syringe with 22 units of insulin.

The dual-scale version of this syringe is easier to read. **Figure 7.13** shows a *dual-scale* 100 unit insulin syringe, also calibrated in 2 unit increments. However, it has a scale with *even* numbers on one side and a scale with *odd* numbers on the opposite side. Both the even and odd sides are shown.

Each line on the barrel represents 2 units.

- **Figure 7.13**
Two views of the same dual-scale standard 100 unit insulin syringe.

A 50 unit Lo-Dose insulin syringe, shown in **Figure 7.14**, is a single-scale syringe with 50 units. It is calibrated in 1 unit increments.

- **Figure 7.14**
A 50 unit Lo-Dose insulin syringe.
A 30 unit Lo-Dose insulin syringe, shown in \textbf{Figure 7.15}, is a syringe with 30 units. It is calibrated in 1 unit increments and is used when the dose is less than 30 units.

\textbf{Figure 7.15}
A 30 unit Lo-Dose insulin syringe.

\section*{Measuring Insulin Doses}

\subsection*{Measuring a Single Dose of Insulin in an Insulin Syringe}

Insulin is available in 100 units/mL multidose vials. The major route of administration of insulin is by subcutaneous injection. \textit{Insulin is never given intramuscularly}. It can also be administered with an insulin pen that contains a cartridge filled with insulin or with a CSII pump (Continuous Subcutaneous Insulin Infusion). The CSII pump is used to administer a programmed dose of a rapid-acting 100 units insulin at a set rate of units per hour.

The source of insulin (animal or human) and type (rapid, short, intermediate, or long-acting) are indicated on the label. Today, the most commonly used source is human insulin. Insulin from a human source is designated on the label as recombinant DNA (rDNA origin). The type of insulin relates to both the onset and duration of action. It is indicated by the uppercase bold letter that follows the trade name on the label, for example, Humulin R (Regular), Humulin L (Lente), Humulin N (NPH), and Humulin U (Ultralente). These letters are important visual identifiers when selecting the insulin type. \textbf{Figure 7.16}.

\begin{table}[h]
\centering
\begin{tabular}{|c|c|}
\hline
Concentration & Trade Name \\
\hline
100 units/mL & Humulin N \\
\hline
\end{tabular}
\end{table}

\textbf{Figure 7.16}
Drug label for Humulin N insulin. (Copyright Eli Lilly and Company. Used with permission.)

Healthcare providers must be familiar with the various types of insulin, as summarized in Table 7.1.

\section*{NOTE}

Insulin is always ordered in units, the medication is supplied in 100 units/mL, and the syringes are calibrated for 100 units/mL. Therefore, no calculations are required to prepare insulin that is administered subcutaneously.

The insulin syringe is to be used in the measurement and administration of U-100 insulin \textit{only}. It must not be used to measure other medications that are also measured in units, such as heparin or Pitocin.

\section*{ALERT}

Select the appropriate syringe and be very attentive to the calibrations when measuring insulin dosages. Both the single- and dual-scale standard 100 unit insulin syringes are calibrated in 2 unit increments. The Lo-Dose syringes are calibrated in 1 unit increments.

\textbf{ALERT}

Insulin should be at room temperature when administered, and one source or brand of insulin should not be substituted for another without medical supervision.
## Table 7.1 Type of Insulin

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>How It Works</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rapid Acting</strong></td>
<td>Humalog (lispro)</td>
<td>Rapid-acting insulin covers insulin needs for meals eaten at the time of injection. Usually taken 15 minutes before meals or given just after a meal. This type of insulin is also given to cover until longer-acting insulins take effect.</td>
</tr>
<tr>
<td></td>
<td>Novolog (aspart)</td>
<td></td>
</tr>
<tr>
<td><strong>Onset</strong></td>
<td>15–30 minutes</td>
<td>10–20 minutes</td>
</tr>
<tr>
<td></td>
<td>30 minutes to 2 1/2 hours</td>
<td>1–3 hours</td>
</tr>
<tr>
<td></td>
<td>5–8 hours</td>
<td>3–5 hours</td>
</tr>
<tr>
<td><strong>Short Acting</strong></td>
<td>Humulin R, Novolin, or Semilente</td>
<td>Short-acting insulin covers insulin needs for meals eaten within 30–60 minutes. Usually taken 30 to 40 minutes before meals.</td>
</tr>
<tr>
<td></td>
<td>Velosulin (for use in an insulin pump)</td>
<td></td>
</tr>
<tr>
<td><strong>Onset</strong></td>
<td>30 minutes to 1 hour</td>
<td>30 minutes to 1 hour</td>
</tr>
<tr>
<td><strong>Peak</strong></td>
<td>2–5 hours</td>
<td>2–3 hours</td>
</tr>
<tr>
<td></td>
<td>4–10 hours</td>
<td>2–3 hours</td>
</tr>
<tr>
<td></td>
<td>14–16 hours</td>
<td>12–18 hours</td>
</tr>
<tr>
<td><strong>Intermediate Acting</strong></td>
<td>NPH (N)</td>
<td>Intermediate-acting insulin covers insulin needs for about half the day or overnight. Taken up to 1 hour before meals. This type of insulin is often combined with rapid- or short-acting insulin.</td>
</tr>
<tr>
<td></td>
<td>Lente (L)</td>
<td></td>
</tr>
<tr>
<td><strong>Onset</strong></td>
<td>2–4 hours</td>
<td>1–2 1/2 hours</td>
</tr>
<tr>
<td><strong>Peak</strong></td>
<td>4–10 hours</td>
<td>4–12 hours</td>
</tr>
<tr>
<td></td>
<td>14–16 hours</td>
<td>12–18 hours</td>
</tr>
<tr>
<td><strong>Long Acting</strong></td>
<td>Ultralente (U)</td>
<td>Long-acting insulin covers insulin needs for about 1 full day, not timed to meals. Some are given once or twice daily, and others once a day. Lantus once a day should be given at the same time. This type of insulin is often combined, when needed, with rapid- or short-acting insulin.</td>
</tr>
<tr>
<td></td>
<td>Lantus (glargine)</td>
<td></td>
</tr>
<tr>
<td><strong>Onset</strong></td>
<td>30 minutes--3 hours</td>
<td>1–1 1/2 hours</td>
</tr>
<tr>
<td><strong>Peak</strong></td>
<td>peakless</td>
<td>No peak time; insulin is delivered at a steady level</td>
</tr>
<tr>
<td></td>
<td>20–36 hours</td>
<td>20–24 hours</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>30 minutes--3 hours</td>
<td>1–1 1/2 hours</td>
</tr>
<tr>
<td></td>
<td>20–36 hours</td>
<td>20–24 hours</td>
</tr>
</tbody>
</table>

### Premixed Insulin Combinations

<table>
<thead>
<tr>
<th>Premixed</th>
<th>Humulin 70/30</th>
<th>Novolin 70/30</th>
<th>Novolog 70/30</th>
<th>Humulin 50/50</th>
<th>Humalog mix 75/25</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Onset</strong></td>
<td>30 minutes</td>
<td>30 minutes</td>
<td>10–20 minutes</td>
<td>30 minutes</td>
<td>15 minutes</td>
</tr>
<tr>
<td><strong>Peak</strong></td>
<td>2–4 hours</td>
<td>2–12 hours</td>
<td>1–4 hours</td>
<td>2–5 hours</td>
<td>30 minutes–2 1/2 hours</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>14–24 hours</td>
<td>up to 24 hours</td>
<td>up to 24 hours</td>
<td>18 to 24 hours</td>
<td>16–20 hours</td>
</tr>
</tbody>
</table>

Premixed insulin is a combination of specific proportions of intermediate-acting and short-acting insulin. The numbers after the name indicate the percentage of each insulin. These products are generally taken twice a day before mealtime, 15–45 minutes before meals.
Example 7.5

What is the dose of insulin in the single-scale 100 unit insulin syringe shown in Figure 7.17?

The top ring of the plunger is one line after 70. Because each line represents 2 units, the dose is 72 units of insulin.

Example 7.6

What is the dose of insulin in the dual-scale 100 unit insulin syringe shown in Figure 7.18?

The top ring of the plunger is slightly more than 2 lines after 55 on the odd side. Notice how difficult it would be to determine where 60 units would measure using the odd side of the syringe. However, on the even side, the plunger falls exactly on the 60.
Example 7.7

What is the dose of insulin in the 50 unit insulin syringe shown in Figure 7.19?

The top ring of the plunger is at 15. Because each line represents 1 unit, the dose is 15 units.

Example 7.8

What is the dose of insulin in the 30 unit insulin syringe shown in Figure 7.20?

The top ring of the plunger is three lines after 15. Because each line represents one unit, the dose is 18 units of insulin.

Example 7.9

The physician prescribed 26 units of Humulin L insulin subcutaneously at breakfast. Read the label in Figure 7.21 to determine the source of the insulin and place an arrow at the appropriate level of measurement on the insulin syringe in Figure 7.22.
The source of the insulin is human (rDNA origin), and the arrow should be placed one line after 25, as shown in Figure 7.22.

![Figure 7.22](image)

Insulin syringe for Example 7.9.

**Measuring Two Types of Insulin in One Syringe**

Individuals who have IDDM often must have two types of insulin administered at the same time. In order to reduce the number of injections, it is common practice to combine two insulins (usually a rapid-acting with either an intermediate- or a long-acting) in a single syringe. The important points to remember are these:

- The total volume in the syringe is the sum of the two insulin amounts.
- The smallest capacity syringe containing the dose should be used to measure the insulins because the enlarged scale is easier to read and therefore more accurate.
- The amount of air equal to the amount of insulin to be withdrawn from each vial must be injected into each vial.
- You must inject the air into the intermediate- or long-acting insulin before you inject the air into the Regular insulin.
- The Regular (rapid-acting) insulin is drawn up first; this prevents contamination of the Regular insulin with the intermediate or long-acting insulin.
- The intermediate-acting or long-acting insulins can precipitate; therefore, they must be mixed well before drawing up and administered without delay.
- Only insulins from the same source should be mixed together, for example, Humulin R and Humulin N are both human insulin and can be mixed.
- If you draw up too much of the intermediate or long-acting insulin, you must discard the entire medication and start over.

The steps of preparing two types of insulin in one syringe are shown in Example 7.10.

**Example 7.10**

The prescriber ordered 10 units Humulin R insulin and 30 units Humulin N insulin subcutaneously, 30 minutes before breakfast. Explain how you would prepare to administer this in one injection. **Figures 7.23 and 7.24.**
The total amount of insulin is 40 units (10 + 30). To administer this dose, use a 50 unit Lo-Dose syringe. Inject 30 units of air into the Humulin N vial and 10 units of air into the Humulin R vial. Withdraw 10 units of the Humulin R first and then withdraw 30 units of the Humulin N.

Measuring Premixed Insulin

Using premixed insulin (see Table 7.1) eliminates errors that may occur when mixing two types of insulin in one syringe (Figure 7.23).
**Example 7.11**

Order: Give 35 units of Humulin 70/30 insulin subcutaneously 30 minutes before breakfast. Use the label shown in Figure 7.25 and place an arrow at the appropriate calibration on the syringe.

In the syringe in Figure 7.26, the top ring of the plunger is at the 35 unit line.

**Prefilled Syringes**

A prefilled, single-dose syringe contains the usual dose of a medication. Some prefilled glass cartridges are available for use with a special plunger called a Tubex or Carpuject syringe (Figure 7.27). If a medication order is for the exact amount of drug in the prefilled syringe, the possibility of measurement error by the person administering the drug is decreased.
Example 7.12

The prefilled syringe cartridges shown in Figure 7.28 are calibrated so that each line measures 0.1 mL and each has a capacity of 2.5 mL. How many milliliters are indicated by the arrows shown in Figure 7.28?

Both cartridges have a total capacity of 2.5 mL, and the arrows are at 0.5 mL.

Example 7.13

How much medication is in the prepackaged cartridge shown in Figure 7.29?

The top of the plunger is at two lines after the 1.5 mL line. Because each line measures 0.1 mL, the two lines measure 0.2 mL. Therefore, there are 1.7 mL of medication in this prefilled cartridge.

Safety Syringes

In order to prevent the transmission of blood borne infections from contaminated needles, many syringes are now manufactured with various types of safety devices. For example, a syringe may contain a protective sheath that can be used to protect the needle’s sterility. This sheath is then pulled forward and locked into place to provide a permanent needle shield for disposal following injection. Others may have a needle that automatically retracts into the barrel after injection. Each of these devices reduces the chance of needle stick injury. Figure 7.30 shows examples of safety syringes.
Summary

In this chapter, the various types of syringes and needles were discussed. You learned how to measure the amount of liquid in various syringes. The types of insulin, how to measure a single dose, and how to mix two insulins in one syringe were explained. Prefilled, single-dose, and safety syringes were also presented.

- Milliliters (mL), rather than cubic centimeters (cc), are the preferred unit of measure for volume.
- All syringe calibrations must be read at the top ring of the plunger.
- Large-capacity hypodermic syringes (5, 12, 20, 35 mL) are calibrated in increments from 0.2 mL to 1 mL.
- Small-capacity hypodermic syringes (2, 2 1/2, 3 mL) are calibrated in tenths of a milliter (0.1 mL).
- The 1 mL hypodermic (tuberculin) syringe is calibrated in hundredths of a milliliter. It is the preferred syringe for use in measuring a dose of less than 1 milliliter.
- The calibrations on hypodermic syringes differ; therefore, be very careful when measuring medications in syringes.
- Insulin syringes are designed for measuring and administering U-100 insulin. They are calibrated for 100 units per mL.
- Standard insulin syringes have a capacity of 100 units.
- Lo-Dose insulin syringes are used for measuring small amounts of insulin. They have a capacity of 50 units or 30 units.
- For greater accuracy, use the smallest capacity syringe possible to measure and administer doses. However, avoid filling a syringe to its capacity.
- When measuring two types of insulin in the same syringe, Regular insulin is always drawn up in the syringe first.
- The total volume when mixing insulins is the sum of the two insulin amounts.
- Insulin syringes are for measuring and administering insulin only. Tuberculin syringes are used to measure and administer other medications that are less than 1 mL. Confusion of the two can cause a medication error.
- The prefilled single-dose syringe cartridge is to be used once and then discarded.
- Syringes intended for injections should not be used to measure or administer oral medications.
- Use safety syringes to prevent needle stick injuries.

A 55-year-old female with a medical history of obesity, hypertension, hyperlipidemia, and diabetes mellitus comes to the emergency department complaining of anorexia, nausea, vomiting, fever, chills, and severe sharp right upper quadrant pain that radiates to her back and right shoulder. She states that her pain is 9 (on a 0–10 pain scale). Vital signs are: T 100.2 °F, BP 148/94; P 104; R 24. The diagnostic workup confirms gallstones and she is admitted for a cholecystectomy (removal of gall bladder).

**Pre-Op Orders:**
- NPO
- V/S q4h
- Demerol (meperidine hydrochloride) 75 mg IM stat
- IV D5/RL @ 125 mL/h
- Insert NG (nasogastric) tube to low suction
- Pre-op meds: Demerol (meperidine hydrochloride) 75 mg and Phenergan (promethazine) 25 mg IM 30 minutes before surgery
- Cefuroxime 1.5 g IV 30 minutes before surgery

**Post-Op orders:**
- Discontinue NG tube
- NPO
- V/S q4h
- IV D5/RL @ 125 mL/h
- Compazine (prochlorperazine) 4 mg IM q4h prn nausea
- Demerol (meperidine hydrochloride) 75 mg and Vistaril (hydroxyzine) 25 mg IM q3h prn pain
- Merrem (meropenem)1g IVPB q8h
1. The label on the meperidine for the stat dose reads 100 mg/mL.
   (a) Draw a line indicating the measurement on each of the following syringes.
   (b) Which syringe will most accurately measure this dose?

2. Calculate the pre-op dose of the Phenergan and Demerol. Phenergan is available in 25 mg/mL vials. Demerol is available in prepackaged 2 mL syringes labeled 10 mg/mL, 25 mg/mL, 50 mg/mL, 75 mg/mL, and 100 mg/mL.
   (a) Which prepackaged syringe of Demerol will you use?
   (b) How many milliliters of Phenergan will you prepare?
   (c) Draw a line on the appropriate syringe indicating the dose of each of these drugs that you will administer.

3. The label on the cefuroxime vial states: “add 9 mL of diluent to the 1.5 g vial.” Draw a line on the appropriate syringe indicating the amount of diluent you will add to the vial.
4. The patient is complaining of severe nausea. The Compazine vial is labeled 5 mg/mL. Draw a line on the appropriate syringe indicating the dose of Compazine.
5. The patient is complaining of severe incisional pain of 10 (on a 0–10 pain scale) and has had no pain medication since her surgery. Calculate the dose of the Demerol and Vistaril order. The Vistaril is available in a concentration of 25 mg/mL and 50 mg/mL. The Demerol is available as 100 mg/mL.

(a) Which vial of Vistaril will you use?
(b) How many milliliters of Demerol do you need?
(c) How will you prepare these medications so that you can give the patient a single injection?
(d) Indicate on the appropriate syringe the number of milliliters you will administer.

6. The label on the Merrem states 50 mg/mL.
(a) How many mL will you need?
(b) Draw a line on the appropriate syringe indicating the dose of Merem.
7. The patient has progressed to a regular diet and is ordered Humulin N 13 units and Humulin R 6 units subcutaneous 30 minutes ac breakfast, and Humulin N 5 units and Humulin R 5 units subcutaneous 30 minutes ac dinner.
(a) How many units will the patient receive before breakfast?
(b) Indicate on the appropriate syringe the number of units of each insulin required before breakfast.

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**Practice Sets**

The answers to *Try These for Practice, Exercises, and Cumulative Review Exercises* appear in Appendix A at the end of the book. Ask your instructor for answers to the *Additional Exercises*.

**Try These for Practice**

Test your comprehension after reading the chapter.

In Problems 1 through 4, identify the type of syringe shown in the figure. Place an arrow at the appropriate level of measurement on the syringe for the volume given.

1. ________________ syringe; 0.72 mL
2. __________ syringe; 6.8 mL

3. __________ syringe; 2.8 mL

4. __________ syringe; 4.4 mL

5. The prescriber ordered 34 units of Regular insulin and 18 units of Humulin N subcutaneously 30 minutes ac breakfast. Read the labels and do the following:

(Copyright Eli Lilly and Company. Used with permission.)
(a) Select the appropriate syringe to administer this dose in one injection.
(b) Place an arrow at the measurement of the Regular insulin.
(c) Place an arrow at the measurement of the Humulin N insulin.
(d) Determine how many units the patient will receive.

**Exercises**

Reinforce your understanding in class or at home.

In problems 1 through 14, identify the type of syringe shown in the figure. Then, for each quantity, place an arrow at the appropriate level of measurement on the syringe.

1. _________________ syringe; 0.62 mL

2. _________________ syringe; 28 units

3. _________________ syringe; 3.6 mL
4. ______________ syringe; 1.4 mL

5. ______________ syringe 13 mL

6. ______________ syringe; 9.6 mL

7. ______________ syringe; 32 units

8. ______________ syringe; 56 units

9. ______________ syringe; 0.37 mL
10. ______________ syringe; 51 units

11. ______________ syringe; 6.6 mL

12. ______________ syringe; 0.72 mL

13. ______________ syringe; 8.2 mL

14. ______________ syringe 27 mL

In problems 15 through 20, read the order, use the appropriate label in Figure 7.31 (found at the end of the Exercises), calculate the dosage if necessary, and place an arrow at the appropriate level of measurement on the syringe.
Figure 7.31
(07-31a Copyright Eli Lilly and Company. Used with permission. 07-31b Reg. Trademark of Pfizer Inc. Reproduced with permission. 07-31c Reproduced with permission of GlaxoSmithKline. 07-31d Reg. Trademark Pfizer Inc. Reproduced with permission. 07-31e Copyright Eli Lilly and Company. Used with permission. 07-31f Copyright Eli Lilly and Company. Used with permission.)
15. Order: Give 26 units of Humalog 75/25 subcutaneously, 30 minutes ac breakfast

16. Order: Streptomycin 600 mg IM daily

17. Order: Give 14 units of Regular insulin and 44 units of NPH insulin subcutaneously 30 minutes ac breakfast

18. Order: ranitidine hydrochloride 50 mg IVPB q6h

19. Order: Oxytetracycline 100 mg IM q8h

20. Atropine 0.2 mg IM 30 minutes before surgery
Additional Exercises

Now, test yourself!

1. __________ syringe; 42 units

2. __________ syringe; 14 units

3. __________ syringe; 3.6 mL

4. __________ syringe; 1.8 mL

5. __________ syringe; 7.2 mL
6. ______________ syringe; 16 mL

7. ______________ syringe; 12 units

8. ______________ syringe; 54 units

9. ______________ syringe; 0.35 mL

10. ____________ syringe; 31 units
11. __________ syringe; 4.4 mL

12. __________ syringe; 16 units

13. __________ syringe; 8.8 mL

14. __________ syringe; 22 mL

In problems 15 through 20, read the order and use the appropriate label in Figure 7.32 calculate the dosage if necessary, and place an arrow at the appropriate level of measurement on the syringe.

15. Order: Insulin lispro 8 units subcutaneously 15 minutes ac breakfast
16. Order: Epoetin Alfa 12,000 units subcutaneously three times a week

17. Order: Prochlorperazine 9 mg IM, q4h prn vomiting

18. Order: filgrastim 750 mcg subcutaneously

19. Order: Quinidine 400 mg IM q4h prn

20. Order: Humulin 70/30 U-100 insulin 46 units subcutaneously ac dinner
Figure 7.32

Cumulative Review Exercises

Review your mastery of earlier chapters

1. 0.05 g = __________ mg
2. 1,600 mL = _______ L
3. The prescriber ordered Prilosec 40 mg PO daily. Each capsule contains 20 mg. How many capsules will the patient receive in two weeks? 

4. The order reads morphine sulfate 4 mg subcutaneously q4h prn. What is the maximum number of times the patient may receive this medication in one day? 

5. The prescriber ordered Biaxin 300 mg PO q12h. The label reads 375 mg/mL. How many milliliters will you administer? 

6. 1 t ______ mL 

7. The prescriber ordered 120 mL H₂O PO q2h for 10h. How many ounces should the patient receive? 

8. Convert 4 fluid oz to mL. 

9. 0.4 mg = gr 

10. Which of the following has the greatest weight? 0.3 mg, 0.05 mg, 0.125 mg 

11. The prescriber ordered Amoxicillin 750 mg PO q12h. Each capsule contains 250 mg. How many capsules will you administer to the patient? 

12. The prescriber ordered 0.3 mg of clonidine hydrochloride. If each tablet contains 0.1 mg, how many tablets will you administer to the patient? 

13. Read the information on the label in Figure 7.33 and calculate the number of capsules equal to 0.002 g. 

14. The prescriber ordered Vistaril 75 mg IM stat. The label reads 50 mg/mL. How many milliliters will you administer?
15. Read the label in Figure 7.34. How many milligrams equal 1 mL?

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Figure 7.34
Drug label for Aranesp.
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Animated examples, interactive practice questions with animated solutions, and challenge tests for this chapter can be found on the Prentice Hall Dosage Calculation Tutor that accompanies this text. Additional, unique, interactive resources and activities can be found on the Companion Website.