Nursing Division

PN
Dosage Proficiency Exam
Study Guide

Effective Fall 2012
PN Dosage Proficiency Exam (DPE)
Study Guide

Description

This study guide is for Practical Nursing (PN) and Associate Degree Nursing (ADN) students to assist them in preparing for the PN Dosage Proficiency Exam (DPE). PN and ADN students are required to meet a 95% proficiency on the PN DPE prior to progressing to Nursing Care Management I (NUR 104).

Students will have three (3) opportunities to meet the 95% proficiency on the PN DPE. The first opportunity, which is considered a placement test, will be prior to the first class day of Health Calculations I (AHS 126). Students who meet the 95% proficiency on the first attempt place out of AHS 126 and can drop the course. Students not meeting the 95% proficiency must remain in the class.

Students not passing Health Calculations I (AHS 126) after three attempts in the course are not eligible to continue in the nursing program. Grades for AHS 126 are good for two years.

Students needing assistance with basic mathematical concepts (multiplication, ratio and proportion, long division, etc.) can request tutoring through the Learning Center by calling 574-6409 for an appointment. Students needing assistance with dosage calculation can request tutoring through the Nursing Resource Center (NRC). To schedule an appointment, e-mail Mrs. Turner, Director of the NRC at Deborah.turner@tridenttech.edu.

AHS 126 focuses on content in chapters 2, 3, 5, 6, 7 and 8. Reading and homework assignments follow each objective. Practice is the key to passing the DPE. So, practice as many problems as you can.

Textbook and Other Required Materials


Study Guide for PN Dosage Proficiency Exam (www.tridenttech.edu/nursing.htm)

2012-2013 Course Materials

Approved Calculators: Texas Instruments TI 1706SV and Office Max OM 96127

Objectives

1. Use abbreviations for the times and routes of drug administration as well as metric, apothecary and household abbreviations and abbreviations for drug preparation.
2. Convert measurements between metric, apothecary and household systems.
3. Demonstrate a working knowledge of drug preparations and equipment to measure doses.
4. Calculate solid and liquid oral medications using one of the following methods: formula method, proportion expressed as two ratios or proportion expressed as two fractions.
5. Calculate liquids for injection using one of the following methods: formula method, proportion expressed as two ratios or proportion expressed as two fractions.
6. Calculate basic IV rates in mL/hr (on IV infusion pumps) and gtt/min with tubing sets.
7. Apply the rounding guidelines when solving health calculation problems.

Study Guide Learning Activities

**Objective 1:**

*Use abbreviations for the times and routes of drug administration as well as metric, apothecary and household abbreviations and abbreviations for drug preparation.*

Understanding abbreviations and using them correctly are critical to safe medication administration. Therefore it is important that you start now memorizing these abbreviations and their meanings.

### Abbreviations for Times of Medications

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>ac</td>
<td>before meals</td>
<td>q2h</td>
<td>every 2 hours</td>
</tr>
<tr>
<td>pc</td>
<td>after meals</td>
<td>q4hr</td>
<td>every 4 hours</td>
</tr>
<tr>
<td>daily</td>
<td>every day</td>
<td>q6 hr</td>
<td>every 6 hours</td>
</tr>
<tr>
<td>bid</td>
<td>twice a day</td>
<td>prn</td>
<td>as needed</td>
</tr>
<tr>
<td>tid</td>
<td>three times a day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>qid</td>
<td>four times a day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>qh</td>
<td>every hour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>at bedtime</td>
<td>hour of sleep</td>
<td></td>
<td></td>
</tr>
<tr>
<td>stat</td>
<td>immediately</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Abbreviations for Routes of Administration

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>HHN</td>
<td>Hand-held nebulizer</td>
<td>po (PO)</td>
<td>by mouth</td>
</tr>
<tr>
<td>IM</td>
<td>Intramuscularly</td>
<td>pr (PR)</td>
<td>in the rectum</td>
</tr>
<tr>
<td>IV</td>
<td>Intravenously</td>
<td>Sub Q</td>
<td>subcutaneously</td>
</tr>
<tr>
<td>IVP</td>
<td>Intravenous push</td>
<td>SL</td>
<td>sublingual</td>
</tr>
<tr>
<td>IVPB</td>
<td>Intravenous piggyback</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Metric and SI Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>g (gm, Gm)</td>
<td>Gram</td>
<td>mEq</td>
<td>Milliequivalent</td>
</tr>
<tr>
<td>kg (Kg)</td>
<td>Kilogram</td>
<td>mg</td>
<td>Milligram</td>
</tr>
<tr>
<td>L</td>
<td>Liter</td>
<td>mL</td>
<td>Milliliter</td>
</tr>
<tr>
<td>mcg</td>
<td>Microgram</td>
<td>unit</td>
<td>Unit</td>
</tr>
</tbody>
</table>

Apothecary Abbreviations

Apothecary measures are rarely used in hospitals so minims, drams and grains are not taught in AHS 126. The only apothecary abbreviation that you need to memorize is:

gtt = drop

Household Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>pt</td>
<td>Pint</td>
<td>tsp</td>
<td>Teaspoon</td>
</tr>
<tr>
<td>qt</td>
<td>Quart</td>
<td>oz</td>
<td>Ounce</td>
</tr>
<tr>
<td>tbsp</td>
<td>Tablespoon</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations for Drug Preparation

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>cap, caps</td>
<td>Capsule</td>
<td>susp</td>
<td>Suspension</td>
</tr>
<tr>
<td>el, elix</td>
<td>Elixir</td>
<td>tab, tabs</td>
<td>Tablet</td>
</tr>
<tr>
<td>sup, supp</td>
<td>Suppository</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reading assignment: Chapter 2

Homework assignment: Chapter 2 Self Tests 1, 3, 4, 6 and 7
Objective 2:

Convert measurements between metric, apothecary and household systems.

There are three (3) systems of measurement: metric, apothecary and household. Most medication orders are written in metric terms. However, occasionally, household measures are used. You must memorize the following conversions:

<table>
<thead>
<tr>
<th>Metric, Apothecary and Household Conversions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Metric</strong></td>
</tr>
<tr>
<td>1 kg = 1,000 g</td>
</tr>
<tr>
<td>1 L = 1000 mL</td>
</tr>
<tr>
<td>1 g (gm, Gm) = 1,000 mg</td>
</tr>
<tr>
<td>1 mg = 1,000 mcg</td>
</tr>
<tr>
<td><strong>Apothecary</strong></td>
</tr>
<tr>
<td>1 oz = 30 mL</td>
</tr>
<tr>
<td><strong>Household</strong></td>
</tr>
<tr>
<td>1 tsp = 5 mL</td>
</tr>
<tr>
<td>1 qt = 1000 mL</td>
</tr>
<tr>
<td>1 tbsp = 15 mL</td>
</tr>
<tr>
<td>1 pt = 500 mL</td>
</tr>
<tr>
<td><strong>Weight Conversion</strong></td>
</tr>
<tr>
<td>2.2 lb = 1 kg</td>
</tr>
</tbody>
</table>
Conversions within the Metric System

Since the metric system is based on the decimal system and units of 1000, conversions are easy. There are two methods (rules) you can use to convert between units in the metric system.

The first method (rule) is:

Large to small → multiply by 1000
Small to large → divide by 1000

Ex: 1.5 g = ____________________ mg

A gram (g) is larger than a mg. Therefore you multiply by 1000 to convert the 1.5 g to mg.

1.5 g x 1000 = 1500 mg

Ex: 750 mg = ____________________ g

A milligram (mg) is smaller than a gram (g). Therefore you divide by 1000 to convert the 750 mg to g.

750 mg ÷ 1000 = 0.75 g

The second method (rule) is:

Large to small → move decimal 3 places to the right
Small to large → move decimal 3 places to the left

Ex: 0.5 mg = ____________________ mcg

A mg is larger than a mcg. Therefore you move the decimal 3 places to the right.

0.5 mg = 500 mcg

Ex: 200 mcg = ____________________ mg

A mcg is smaller than a mg. Therefore you move the decimal 3 places to the left.

200 mcg = 0.2 mg

Important point: Always place a zero in front of the decimal when the quantity is less than a whole number. Never place a 0 at the end.
Your knowledge of conversions will be tested in a variety of ways in this course. Most of the problems on the dosage proficiency exam will require at least one conversion. Some require multiple conversions.

Ex:  
Doctor’s order: Digoxin 250 mcg po daily  
Available: Digoxin 0.125 mg tab (scored)  
How many tab will you give?

To answer this question you must first convert to like weight measure. This means that you need to convert mcg to mg.

Step 1: Convert to like weight measure.  
mcg is smaller than mg, so move the decimal 3 places to the left (250 mcg = 0.25 mg)

Step 2: Solve the problem with your formula of choice.  
\[
\frac{0.25 \text{ mg}}{0.125} \times 1 = 2 \text{ tab}
\]

Ex:  
Doctor’s order: Ceclor oral suspension 1 g po qid  
Available: Ceclor oral suspension 250 mg/tsp  
How many mL will you give?

To answer this question, you must first convert g to mg, then tsp to mL.

Step 1: Convert to like weight measure.  
g > mg, so multiply by 1000 (1 g = 1000 mg)

Step 2: Convert tsp to mL (1 tsp = 5 mL)

Step 3: Solve the problem with your formula of choice.

\[
5 \text{ mL} : 250 \text{ mg} = X \text{ mL} : 1000 \text{ mg}
\]

\[
250 X = 5000
\]

\[
X = 20 \text{ mL}
\]
Another way that you will be tested on application of your conversions is with intake questions. You will be asked to calculate the total intake for a patient. Think of these questions as a series of conversions.

Ex: Your patient has had the following intake: ¼ pt of juice, 4 oz of cottage cheese, ½ container of jello (150 mL/container), IV of 0.9% NS @ 125 mL/hr x 5 hr and an 8 oz glass of green tea.

To answer this question, set it up like this to be sure you have completed all of the required conversions.

<table>
<thead>
<tr>
<th>Item</th>
<th>Calculation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Juice</td>
<td>¼ x 500 mL</td>
<td>125 mL</td>
</tr>
<tr>
<td>Jello</td>
<td>½ x 150 mL</td>
<td>75 mL</td>
</tr>
<tr>
<td>IV</td>
<td>125 mL x 5 hr</td>
<td>625 mL</td>
</tr>
<tr>
<td>Tea</td>
<td>8 oz x 30 mL</td>
<td>240 mL</td>
</tr>
</tbody>
</table>

Total = 1065 mL

Notice that the cottage cheese was not included in the total intake. Cottage cheese is not liquid at room temperature, so it is not included when calculating intake. Most intake problems will challenge your critical thinking by including at least 1 item that is not liquid.

Most intake problems include conversions related to pints and/or quarts. Be sure that you can distinguish between a pint and a quart in order to avoid errors in calculation.

*Important Point: Only items that are liquid at room temperature are calculated into intake. Ice cream and jello are liquid at room temperature and are calculated into intake. Pudding, cheese of any type, grits and fruit cocktail are examples of items that are not liquid at room temperature and are not calculated as intake.*
The final conversion that you will learn to do is the weight conversion.

To convert lb to kg, divide by 2.2. See the example below.

\[
120 \text{ lb} = \frac{54.54}{2.2} = 54.5 \text{ lb}
\]

To convert kg to lb, multiply by 2.2. See the example below.

\[
45.6 \text{ kg} \times 2.2 = 100.32 = 100.3 \text{ lb}
\]

**Important Points:** Always round weight conversions to the nearest 10\(^{th}\) and round at the point you convert.

**Reading assignment:** Chapter 2 (except pages 39 - 40, Apothecary System)

**Homework assignment:** Chapter 2 Self Tests 9 - Proficiency Test I (except # 20, and 34 - 40)
Objective 3:

Demonstrate a working knowledge of drug preparations and equipment to measure doses.

Drug Labels

Drug labels contain important information. Nurses must be able to read and understand drug labels in order to administer medications safely.

Look at the drug label below.

- The trade name (brand name) is Nebcin.
- The generic name, or official name as listed in the United States Pharmacopeia, is Tobramycin.
- 1.2 g is the total amount of drug in the container.
- Injection is the form of the drug.
- This drug is a powder that has to be reconstituted with 30 mL of Sterile Water.
- When reconstituted, the strength of the drug is 40 mg/mL.

Always read drug labels carefully before preparing a medication.

Drug Preparations (Forms)

Oral Route

<table>
<thead>
<tr>
<th>Forms</th>
<th>Nursing Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tablet</td>
<td>May be crushed if patient cannot swallow.</td>
</tr>
<tr>
<td>Scored Tablets</td>
<td>Only tablets that are scored can be broken (split).</td>
</tr>
<tr>
<td>Coated Tablets</td>
<td>Check with pharmacist before crushing.</td>
</tr>
<tr>
<td>Enteric Coated Tablets</td>
<td>Do not crush enteric coated tablets</td>
</tr>
<tr>
<td>Prolonged/Extended Release Tabs</td>
<td>Do not crush prolonged/extended release tabs</td>
</tr>
<tr>
<td>Sublingual Tablets</td>
<td>Patient to dissolve under tongue, not chew</td>
</tr>
</tbody>
</table>
Capsules       Avoid opening capsules
Elixirs        May be contraindicated in diabetic or alcoholic patient
Suspensions    Always shake the bottle well

**Parenteral Route**

ID (intradermal)

Sub Q (subcutaneous)

IM (intramuscular)

IV (intravenous) and IVPB (intravenous piggyback)

**Topical Route**

Aerosol Powders or Liquids       Used in nebulizers and inhalers

Powders                       Applied to the skin

Creams                        Semisolids for internal and external use

Ointments                     Semisolids in petroleum or lanolin base

Pastes                        Thick ointments

Suppositories                 Molded with a firm base for insertion into the rectum/vagina

Transdermal Medications       Patches

Topical Drops                 Usually for eyes, nose/ears
**Equipment to Measure Doses**

- Medicine cups may be paper or plastic. Paper medicine cups are used to dispense oral non-liquid medications like tablets and capsules. Plastic medicine cups are used to measure and dispense oral liquid medications. Notice that the plastic medication cup below delineates mL, oz, tbsp and tsp.

- Syringes are used for injections. They come in several different types and each serves a different purpose.

  Ex: Small capacity syringe is calibrated in tenths.

  Ex: 1 mL syringe is calibrated in hundredths.

  Ex: 1 mL insulin syringe is calibrated in units.
**Rounding Off Numbers**

There are two *general* (2) rules for rounding.

- When the last number is 5 or more, add one to the previous number.
  
  Ex:  
  
  1.56 becomes 1.6 when rounded to the nearest tenth
  
  0.999 becomes 1 when rounded to the nearest hundredth
  
  0.169 becomes 0.17 when rounded to the nearest hundredth

- When the last number is 4 or less, drop the number.

  1.54 becomes 1.5 when rounded to the nearest tenth
  
  0.993 becomes 0.99 when rounded to the nearest hundredth
  
  0.164 becomes 0.16 when rounded to the nearest hundredth

The rounding guidelines for solid and liquid oral medications, injections and intravenous infusions are summarized later under Objective 7 in this *PN Dosage Proficiency Study Guide.*

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*Reading assignment:* Chapter 3 Drug Labels (pages 58-60) and Chapter 5 (except pages 94 and 95)

*Homework assignment:* Chapter 4 Self Test 1 and Chapter 5 Self Tests 1, 2, 3, 4, 5 (except minims), 6 (except minims); Proficiency Test 1 (except # 2, 6 and 13)
**Objective 4:**

*Calculate solid and liquid oral medications using one of the following methods: formula method, proportion expressed as two ratios or proportion expressed as two fractions.*

There are three methods for solving solid and liquid oral medication calculation problems. Try each of them and determine which one is easiest for you. Once you know the method that is easiest for you, use it consistently to solve your problems.

**Important point:** Regardless of the method you use to solve calculation problems, always show your work and always label everything.

- **Method 1: Proportions Expressed as Two Fractions**

  Equivalent (what you have on hand) | Desired
  -----------------------------------|---------------------
  Supply (how the drug comes)        | X (what you want to give)
  Have (dosage amount)               | Desire (dosage you want to give)

  Ex: Order: Aspirin 600 mg po q 4 h prn headache
  Supply: tablets labeled 300 mg

  \[
  \frac{1 \text{ tab (supply)}}{300 \text{ mg (have)}} = \frac{X \text{ tab}}{600 \text{ mg (desire)}}
  \]
  Cross multiply: \(300 X = 600\) \(X = 2\) tabs

- **Method 2: Proportions Expressed as Two Ratios (Means and Extremes)**

  Ex: Order: Aspirin 600 mg po q 4 h prn headache
  Supply: tablets labeled 300 mg

  \[
  \frac{1 \text{ tab (supply): } 300 \text{ mg (have)}}{X \text{ tab: } 600 \text{ mg (desire)}} = 300 X = 600 \quad X = 2\ \text{tabs}
  \]

- **Method 3: Formula**

  Ex: Order: Aspirin 600 mg po q 4 h prn headache
  Supply: tablets labeled 300 mg

  \[
  \frac{600 \text{ mg (desire) \times 1 (supply)}}{300 \text{ mg (have)}} = 2 \text{tabs}
  \]

**Important Point:** “Supply” is how the drug comes. It is the same as “available”, the term used in many of the problems in the study guide and on the dosage proficiency exam.
**Important point:** Equivalents are not exact.

For example, Aspirin and Tylenol can be based on the equivalent of 65 mg = gr 1 or 60 mg = gr 1. Therefore, the label may indicate 325 mg or 300 mg. Both equivalents are correct.

Ex:  
Order: Tylenol 600 mg po now  
Supply: Tylenol caps 325 mg  

1 cap: 325 mg = X cap: 600 mg  

\[325 \times X = 600\]  

\[X = 1.84 \text{ caps} = 2 \text{ caps} \text{ (A capsule must be rounded to the nearest whole.)}\]

**Important point:** A needleless syringe or calibrated dropper can be used to give precise doses of liquid oral medications.

Ex:  
Order: Vantin Oral Suspension 135 mg po q 4 hr  
Supply: Vantin Oral Suspension 100 mg /5 mL  

5 mL : 100 mg = X mL : 135 mg  

\[100 \times X = 675 \text{ mg}\]  

\[X = 6.75 \text{ mL} = 6.8 \text{ mL} \text{ (Draw this amount up in a 10 mL syringe.)}\]

**Important point:** Always check to see if the order and supply are in the same weight measure. If not, convert to like weight measure. Then solve the problem.

Ex:  
Order: Nafcillin 500 mg po daily  
Supply: Nafcillin 1 g/tab (scored)  

Convert 500 mg to grams. Mg < g, therefore you are converting from smaller to larger. This means that you need to move the decimal three places to the left. 500 mg = 0.5 g.  

\[0.5 \text{ g (desired)} \times 1 \text{ tab (supply)} = 0.5 \text{ or } \frac{1}{2} \text{ tab}\]  

\[1 \text{ g (have)}\]

**Important point:** Only scored tablets or suppositories may be divided. Tablets or suppositories may be divided in halves or quarters. Tabs scored in \( \frac{1}{2} \) must be rounded to the nearest \( \frac{1}{2} \). Tabs scored in quarters must be rounded to the nearest \( \frac{1}{4} \).
**Important Points:** When calculating problems based on weight, always convert the weight first and then figure the dosage second. Round the weight to the nearest 10th before figuring dosage.

Ex: Order: Ciprofloxacin 12 mg/kg p.o. q 12 hours
Available: Ciproflaxin 1 g/10 mL
How many mL will you administer to a 55 lb patient?

Step I: Convert lb to kg
\[
\frac{55 \text{ lb}}{1} = \frac{25 \text{ kg}}{2.2}
\]

Step 2: Figure dosage
\[
12 \text{ mg} \times 25 \text{ kg} = 300 \text{ mg} \text{ (per dose)}
\]

Step 3: Convert to like measure
\[
\frac{1 \text{ G}}{1000 \text{ mg}} = \frac{X \text{ G}}{300 \text{ mg}} \quad 1000 \times X = 300 \quad X = 0.3 \text{ G}
\]

Step 4: Use your preferred formula to solve the problem
\[
0.3 \text{ G (desired)} \times 10 \text{ mL (supply)} = 3 \text{ mL}
\]

**Reading assignment:** Chapter 6

**Homework assignment:** Chapter 6 Self Assessments, Putting it Together and Proficiency Tests
Objective 5

Calculate liquids for injection using one of the following methods: formula method, proportion expressed as two ratios or proportion expressed as two fractions.

There are three methods for solving medication calculation problems related to liquids for injection. They are the same as for oral solids and liquids. Try each of them and determine which one is easiest for you. Once you know the method that is easiest for you, use it consistently to solve your problems.

**Important point:** Regardless of the method you use to solve calculation problems related to liquid injections, always show your work and always label everything.

- **Method 1: Proportions Expressed as Two Fractions**

  Supply (how the drug comes) \[ \frac{100 \text{ mg}}{2 \text{ mL}} \]
  Have (dosage amount) \[ \frac{50 \text{ mg}}{X \text{ mL}} \]
  Desire (dosage you want to give) \[ \frac{100 \text{ mg}}{50 \text{ mg}} \]

  Ex: Order: Demerol 50 mg IM q 4 h prn incision pain

  Supply: vial labeled 100 mg/2 mL

  \[
  \frac{2 \text{ mL} (\text{supply})}{100 \text{ mg} (\text{have})} = \frac{X \text{ mL}}{50 \text{ mg} (\text{desire})}
  \]

  Cross multiply: \[ 100X = 100 \]
  \[ X = 1 \text{ mL} \]

- **Method 2: Proportions Expressed as Two Ratios (Means and Extremes)**

  Ex: Order: Demerol 50 mg IM q 4 h prn incision pain

  Supply: vial labeled 100 mg/2 mL

  \[
  \frac{2 \text{ mL} (\text{supply})}{100 \text{ mg} (\text{have})} = \frac{X \text{ mL}}{50 \text{ mg} (\text{desire})}
  \]

  Multiply: \[ 100X = 100 \]
  \[ X = 1 \text{ mL} \]

- **Method 3: Formula**

  Ex: Order: Demerol 50 mg IM q 4 h prn incision pain

  Supply: vial labeled 100 mg/2 mL

  \[
  \frac{50 \text{ mg} (\text{desire})}{100 \text{ mg} (\text{have})} \times 2 \text{ mL (supply)} = 1 \text{ mL}
  \]

  \[ \frac{50 \text{ mg}}{100 \text{ mg}} \times 2 \text{ mL} = 1 \text{ mL} \]
**Important point:** Always check to see if the order and supply are in the same weight measure. If not, convert to like weight measure.

Ex:  Order: Neupogen 150 mcg Sub Q stat  
     Supply: Neupogen 0.3 mg/mL

Convert 150 mcg to mg. Mcg < mg, therefore you are converting from smaller to larger. This means that you need to move the decimal 3 places to the left. 150 mcg = 0.15 mg

\[
\begin{align*}
0.15 \text{ mg (desired)} & \times 1 \text{ mL (supply)} = 0.5 \text{ or } \frac{1}{2} \text{ mL} \\
0.3 \text{ mg (have)} & 
\end{align*}
\]

There are two (2) rules for rounding liquid dosages.

- **Important point:** For liquid dosages < 1 mL, round to the nearest hundredth.

  Look at the 1 mL syringe. Notice that it is calibrated in hundredths and can accommodate dosages rounded to the nearest hundredth.

  Ex:  Order: Codeine 25 mg IM now  
       Supply: vial labeled 60 mg/mL

  \[
  \begin{align*}
  25 \text{ mg (desired)} & \times 1 \text{ mL (supply)} = 0.416 \text{ mL} = 0.42 \text{ mL} \\
  60 \text{ mg (have)} & 
  \end{align*}
  \]

- **Important point:** For liquid dosages > 1 mL, round to the nearest tenth.

  Look at the 3 mL syringe. Notice that it is calibrated in tenths and can accommodate dosages rounded to the nearest tenth.

  Ex:  Order: Phenobarbital 60 mg IM tid  
       Supply: vial labeled 100 mg/2.1 mL

  \[
  \begin{align*}
  60 \text{ mg (desired)} & \times 2.1 \text{ mL (supply)} = 1.26 \text{ mL} = 1.3 \text{ mL (rounded to nearest tenth)} \\
  100 \text{ mg (have)} & 
  \end{align*}
  \]
**Important point:** When calculating dosage for a medication that has been reconstituted, look for the strength of the medication or the amount of medication / 1 mL, then solve the problem.

Ex: Order: Ancef 250 mg IM qid  
Directions: Add 2.5 mL of Sterile Water. Provides an approximate volume of 3.0 mL (330 mg/mL)

Once you know the mg/mL, solve the problem as usual.

\[
\frac{250 \text{ mg (desired)}}{330 \text{ mg (have)}} \times 1 \text{ mL (supply)} = 0.757 \text{ mL} = 0.76 \text{ mL}
\]

**Important point:** Assume that all questions are asked “per dose” unless otherwise specified.

Ex: Doctor’s order: Ativan 0.5 mg IM q 8 hr  
Available: Ativan 1 mg/mL

How many mL will you administer?

\[
1 \text{ mL : 1 mg} = X \text{ mL : 0.5 mg}
\]

\[
X = 0.5 \text{ mL}
\]

Notice that the problem above does not specify a timeframe, so you give the answer per dose.

Ex: Doctor’s order: Ativan 0.5 mg IM q 8 hr  
Available: Ativan 1 mg/mL

How many mL will you administer in 24 hr?

\[
1 \text{ mL : 1 mg} = X \text{ mL : 0.5 mg}
\]

\[
X = 0.5 \text{ mL/dose x 3 doses/day} = 1.5 \text{ mL/day}
\]

Notice that the problem above specifies a 24 hr timeframe. So, when you give a drug q 8 hr, you give it 3 times in a 24 hr period (24 hr ÷ 8 = 3 times/day). The answer is given according to the specified timeframe.

**Reading assignment:** Chapter 7 pages 141 – 144, 163 – 166

**Homework assignment:** Chapter 7 Self Tests 1 and Proficiency Test 1 (except # 4, 8, 10), Proficiency Test 2 (except # 5, 7, 8, 10) and Proficiency Test 3 (except 12, 14, 15, 17)
Objective 6

Calculate basic IV rates in gtt/min with micro and macrodrip tubing and mL/hr (on IV infusion pumps).

Intravenous (IV) therapy is a method to give fluids or medications directly into the vein. Nurses must be able to calculate and set the rate correctly in order to ensure safe IV administration.

Types of IV fluids include:

- D5W (5% dextrose in water)
- D5 0.9% NS (5% dextrose in 0.9% normal saline in water)
- 0.45 % NS (0.45% normal saline in water)

There are two types of IV calculations that you will learn in AHS 126.

- Calculating gtt/min using the drop factor for the IV tubing set
- Calculating mL/hr for flow rates on IV infusion pumps

Important point: Regardless of the formula you are using to calculate basic IV rates, always show your work and always label everything.

Calculating gtt/min Using the Drop Factor for the IV Tubing Set

The nurse will regulate drops per minute (gtt/min) based on the rate of IV fluids ordered and the drop factor of the tubing set. The tubing for these sets includes a roller clamp that you can open or close to regulate gtt/min.

Flow rates are often ordered in mL per unit of time, typically, mL per hour (mL/hr).

Ex: Doctor’s order: Infuse 1000 mL of Normal Saline IV @ 125 mL/hr

A formula is used to calculate how many drops per minute (gtt/min) to regulate the roller clamp. There is key information you need to know to use this formula.

- Volume: This is the total amount of mL to be infused.
- Time: This is the total time in minutes the fluid needs to be delivered.
- Drop factor: Each brand of IV tubing has a predetermined amount of fluid per drop (gtt). This amount of fluid is called the drop factor. Common drop factors include 10gtt/mL, 12gtt/mL, 15gtt/mL or 60gtt/mL.
The easiest formula for calculating drops per minute is:

\[
\text{volume in mL} \times \text{drop factor} = \frac{\text{# of minutes}}{\text{minutes}}
\]

Ex: Doctor’s order: Infuse 500 mL of NS IV over 4 hours.

Drop factor: 15gtt/mL

How many gtt/min will you regulate the IV?

Formula: \[
\frac{500 \text{ mL (volume)} \times 15 \text{ (drop factor)}}{4 \text{ hr x 60 minutes (must convert to minutes)}} = \frac{7500}{240} = 31.25 = 31 \text{ gtt/min}
\]

Notice that 31.25 is rounded to 31, the nearest whole number. This is a rounding rule that you must remember because drops cannot be administered in parts, only in whole drops.

Ex: Doctor’s order: Infuse 1000 mL of D5W at 100 mL/hr.

Drop factor: 10 gtt/mL

How many gtt/min will you regulate the IV?

Formula: \[
\frac{100 \text{ mL (volume)} \times 10 \text{ (drop factor)}}{1 \text{ hr x 60 minutes}} = \frac{1000}{60} = 16.666 = 17 \text{ gtt/min}
\]

Notice that when mL/hr is given in the problem, you use that as your total volume.

**Important point: When calculating gtt/min round to the nearest whole.**

### Calculating Gtt/min for IVPB Medications

There will also be times when you will need to use the gtt/min formula for intermittent intravenous medications often called piggybacks (IVPB). These IV medications will be in a certain volume of fluid and directions will be given to administer at a certain rate.

You will use the formula in the same way.

Remember the important parts of the formula. They are volume of fluid in mL, drop factor and minutes (time).

\[
\text{volume in mL} \times \text{drop factor} = \frac{\text{# of minutes}}{\text{minutes}}
\]
Ex: Doctor’s order: Cipro 2 g in 125 mL of NS IVPB over 30 minutes

   Drop factor: 15 gtt/mL

   How many gtt/min will you regulate the IVPB?

Formula: \[
\frac{125 \text{ mL (volume)} \times 15(\text{drop factor})}{30 \text{ min (conversion not needed)}} = 62.5 \text{ rounded to 63 gtt/min (must be a whole number)}
\]

Notice that when the order is given in minutes, you do not have to convert.

*Calculating mL/hr for Flow Rates on IV Infusion Pumps*

IV pumps can also deliver IV fluids based on how many mL/hr the IV fluid is ordered.

Ex: Doctor’s order: IV fluid of Normal Saline (NS) to be given at a rate of 125 mL/hr.

   What rate would you set the pump?

Since pumps deliver fluids mL/hr, you would set the pump at 125 mL/hr. The pump also asks for the volume to be infused to be set. This is the amount of fluid you have in your IV bag that needs to be delivered to the patient. If you hang a liter bag (1000 mL), then you would set the volume to be infused at 1000.

Sometimes you have to figure the rate (mL/hr) to be set on the IV pump.

The easiest formula to use for doing this is:

\[
mL/hr = \frac{\text{Volume in mL}}{\text{hour(s)}}
\]

Ex: Doctor’s Order: Cipro 1 gram in 100 mL of NS to infuse IVPB over 45 minutes

   How many mL/hr will you set on the IV pump?

In this case, 100 mL is the volume. You have to convert the 45 minutes into hours. This is calculated by dividing 45 (minutes) by 60 (number of minutes in an hour).

\[
100 \text{ mL (volume)} \div 0.75 \text{ hours} = 133.33 = 133.3 \text{ mL/hr}
\]

You will set the flow rate on the pump at 133.3 mL/hr.
You can also solve by setting this up as a fraction and converting the mL/hr to 60 minutes:

\[
\frac{100\text{mL}}{45\text{ min}} = \frac{x\text{mL}}{60\text{ min}}
\]

\[x = 133.3\ \text{mL/hr}\]

**Important point:** When calculating the flow rate (mL/hr) for an IV pump round to the nearest tenth.

In lieu of remembering how to convert minutes to hours you can, just memorize that 45 minutes = 0.75 hr, 30 minutes = 0.5 hr. and 15 minutes = 0.25 hr.

**Reading assignment:** Chapter 8 (pages 203-212, 215-217)

**Homework assignment:** Chapter 8 Self Test 1, 4, Putting it Together, Proficiency Test 1 (# 1 – 10)
Objective 7

*Apply the rounding guidelines when solving health calculation problems.*

Below is a summary of all of the rounding guidelines that you must memorize.

*Guideline 1:* Round answers for tablets and suppositories scored in half to the nearest half. Round to the nearest fourth if the tablet or suppository is scored in fourths.

*Guideline 2:* Rounds answers for capsules and enteric coated tablets to the nearest whole.

*Guideline 3:* Round answers for oral liquid medications and injections of greater than 1 mL to the nearest tenth.

**Important Point:** To round to the nearest 10\(^{th}\), carry the answer out two decimal places.

When the number representing hundredths is five or larger, the number representing tenths is increased by one.

Ex:  
1.57 is rounded to 1.6  
3.85 is rounded to 3.9  
5.96 is rounded to 6

When the number representing the hundredths is less than five, the number representing the hundredths is dropped.

Ex:  
1.84 is rounded to 1.8  
9.92 is rounded to 9.9  
3.61 is rounded to 3.6

*Guideline 4:* Round answers for oral liquid medications and injections of less than 1 mL to the nearest hundredth.

**Important Point:** To round to the nearest 100\(^{th}\), carry the answer out three decimal places.

When the number representing thousandths is five or larger, the number representing hundredths is increased by one.

Ex:  
0.399 is rounded to 0.4  
0.567 is rounded to 0.57  
0.995 is rounded to 1
When the number representing the thousandths is less than five, the number representing the thousandths is dropped.

Ex:  
0.654 is rounded to 0.65  
0.893 is rounded to 0.89  
0.992 is rounded to 0.99

**Guideline 5:** When converting from kilograms to pounds or pounds to kilograms round to the nearest tenth. *This is different from your text*, but to make it easier, this is the rule you are to follow for AHS 126.

**Guideline 6:** Round answers for drops per minute (gtt/min) IV infusion rates to the nearest whole number because a portion of a drop cannot be counted.

**Guideline 7:** Round answers for milliliter per hour (mL/hr) IV rates on IV infusion pumps to the nearest tenth.

**Important points:** 1) Rounding guidelines do not apply to conversions. 2) Wait until the end to round when you are solving a problem, except when the problem requires converting to pounds/kilograms. Convert weight at the time you need it to solve the problem.
Practice Test A-1

(Additional practice problems are available on the CD that accompanies your text)

Directions: Memorize the abbreviations, conversions and rounding guidelines before working these problems. Answers are available at the end.

Note: These are not actual/true dosages for medications. They are for practice only. Give answers per dose unless otherwise specified.

1. Doctor’s Order: Tylenol supp 1 g pr q 6 hr prn temp > 101
   Available: Tylenol supp 325 mg (scored)
   How many supp will you administer?
   Answer: _____________supp

2. Doctor’s Order: Nafcillin 500 mg po pc
   Available: Nafcillin 1 gm tab (scored)
   How many tab will you administer per day?
   Answer: _____________tab

3. Doctor’s Order: Synthroid 75 mcg po daily
   Available: Synthroid 0.15 mg tab (scored)
   How many tab will you administer?
   Answer: _____________tab
4. Doctor’s Order: Diuril 1.8 mg/kg po tid  
Available: Diuril 12.5 mg caps  
How many cap will you administer for each dose to a 31 lb child?  
Answer: ___________ cap  

5. Doctor’s Order: Cleocin Oral Susp 600 mg po qid  
Directions for mixing: Add 100 mL of water and shake vigorously. Each 2.5 mL will contain 100 mg of Cleocin.  
How many tsp of Cleocin will you administer?  
Answer: ___________ tsp  

6. Doctor’s Order: Sulfasalzine Oral Susp 500 mg q 6 hr  
Directions for mixing: Add 125 mL of water and shake well. Each tbsp will yield 1.5 g of Sulfasalzine.  
How many mL will you give?  
Answer: ________________ mL
7. Your patient has had the following intake: 2 ½ cups of coffee (240 mL/cup), 11.5 oz of grape juice, ¾ qt of milk, 320 mL of diet coke, 1 ¼ L of D5W IV and 2 oz of grits.

What will you record as the total intake in mL for this patient?

Answer: _______________mL

8. Your patient has had the following intake: 2- 8 oz glasses of iced tea, 3- 4 oz cartons of grape juice, ¾ pt of ice cream, 32 oz of juice, 1 ½ L of D5W IV and 6 oz of cottage cheese.

What will you record as the total intake in mL for this patient?

Answer: _______________mL

9. Doctor’s Order:  Kantamycin 7.5 mg/kg IM q 12 hr
Available: Kantamycin 0.35 Gm/ mL

How many mL will you administer for each dose to a 157 lb patient?

Answer: _______________mL
10. Doctor’s Order: Heparin 7,855 units Sub Q bid
Available:

How many mL will you administer?

Answer: _____________mL

11. Doctor’s Order: Demerol 50 mg IVP q 6 hr prn pain
Available: Demerol 75 mg/1.3mL

How many mL will you administer?

Answer: _____________mL

12. Doctor’s Order: Streptomycin 1.75 mg/ lb IM q 12 hr
Available: Streptomycin 0.35 g / 2.3 mL

How many mL will you administer a day to a 59 Kg patient?

Answer: _____________mL
13. Doctor’s Order: Bumex 0.8 mg IV bolus bid
Reconstitution instructions: Constitute to 1000 micrograms/3.1 mL with 4.8mL of 5% Dextrose Water for Injection.

How many mL will you administer?

   Answer: ________________mL

14. Doctor’s Order: Tazidime 0.3 g IM tid
Reconstitution instructions: For IM solution add 1.5 mL of diluent. Shake to dissolve. Provides an approximate volume of 1.8 mL (280 mg/mL).

How many mL will you give?

   Answer______________mL

15. Doctor’s Order: Infuse 50 mg of Amphotericin B in 250 mL NS over 4 hr 15 min
Drop factor: 12gtt/mL

What flow rate (mL/hr) will you set on the IV infusion pump?

   Answer: _______________mL/hr
16. Doctor’s Order: 1 ½ L of NS to be infused over 7 hours  
Drop factor: 15 gtt/mL  
What flow rate (mL/hr) will you set on the IV infusion pump?  

Answer: _______________mL/hr

17. Doctor’s Order: Mandol 300 mg in 50 mL of D5W to infuse IVPB 15 minutes  
Drop factor: 10 gtt/mL  
How many mL/hr will you set on the IV infusion pump?  

Answer: _______________mL/hr

18. Doctor’s Order: Infuse 1200 mL of 0.45% Normal Saline at 125 mL/hr  
Drop Factor: 12gtt/min  
How many gtt/min will you regulate the IV?  

Answer: _______________gtt/min
19. Doctor’s Order: Rocephin 0.5 grams in 250 mL of D5W to infuse IVPB 45 minutes
Drop Factor: 12gtt/min

How many gtt/min will you regulate the IVPB?

Answer: ___________ gtt/min

20. Doctor’s Order: ¼ L of D5W to infuse over 2 hr 45 min
Drop factor: 60 gtt/mL

How many gtt/min will you regulate the IV?

Answer________________ gtt/min
21. **Doctor’s Order:** Minipress 3000 mcg po ac  
   **Available:** Minipress tabs 2 mg (scored)  
   
   How many tab will you administer in 24 hr?  
   
   Answer: _______________tab

22. **Doctor’s Order:** Dilantin 0.75 gm po stat  
   **Available:** Dilantin 250 mg cap  
   
   How many cap will you administer?  
   
   Answer: _______________cap

23. **Doctor’s Order:** Digoxin 0.25 mg po daily  
   **Available:** Digoxin 125 mcg tabs (scored)  
   
   How many tab will you administer for this dose?  
   
   Answer: _______________tab
24. Doctor’s Order: Klotrix 0.35 mEq/lb po dissolved in 6 oz of oj at 8 am
   Available: Klotrix 8 mEq/mL

   How many mL of Klotrix will you add to the oj for a 20.5 Kg patient?
   Answer: ______________mL

25. Doctor’s Order: Megace Oral Suspension 160 mg po bid
   Directions for mixing: Add 100 mL of water and shake vigorously. Each 0.5 mL will contain 10.7 mg of Megace.

   How many tbsp of Megace will you administer?
   Answer: ______________tbsp

26. Doctor’s Order: Vistaril Oral Susp 10 mg q 4 hr prn anxiety
   Directions for mixing: Add 125 mL of water and shake well. Each tsp will yield 15 mg of Vistaril.

   How many mL will you give?
   Answer: ______________mL
27. Your patient had the following intake: 2 1/2 bowls of broth (180 mL/bowl), 1 can of tomato juice (4.5 oz/can), 4 oz of cottage cheese, 1 3/4 L of NS IV and ½ pt of ice cream.

What will you record as the total intake in mL for this patient?

Answer: _______________mL

28. Your patient has had the following intake: ½ cup of hot tea (240 mL/cup), 3/4 container of grapefruit juice (4 oz/container), 3/4 qt of milk, 1 pt of water, 125 mL of D5W IV x 8 hr and 2 oz of fruit cocktail.

What will you record as the total intake in mL for this patient?

Answer: _______________mL
29. **Doctor’s Order:** Tobramycin 1.25mg/Kg IM q 12 hr  
**Available:** Tobramycin 0.2 g / mL

How many mL will you administer to a 183 lb patient for each dose?  
Answer: _______________mL

30. **Doctor’s Order:** Heparin 4,390 units Sub Q bid

**Available:**

How many mL will you administer?  
Answer: _______________mL

31. **Doctor’s Order:** Penicillin G 223,500 units IM q 4 hr  
**Available:** Penicillin G 500,000 units /2.5 mL

How many mL will you administer?  
Answer: _______________mL
32. **Doctor’s Order:** Amikacin 5 mg/lb IM q 12 hr  
Available: Amikacin 0.9 gm/2 mL

How many mL will you administer to a 72.7 Kg patient?

Answer: _______________mL

33. **Doctor’s Order:** Fentanyl 0.05 mg IV bolus  
Reconstitution instructions: Constitute to Fentanyl 100 micrograms/2.3 mL with 2.4 mL of 5% Dextrose Water for Injection.

How many mL will you administer?

Answer: _______________mL

34. **Doctor’s Order:** Ancef 0.4253 Gm IM bid  
Reconstitution instructions: For IM solution add 1.25 mL of diluent. Shake to dissolve. Provides an approximate volume of 1.6 mL (240 mg/mL).

How many mL will you give?

Answer_________________mL
35. Doctor’s Order: Infuse 250 mL of platelets IV over 2 hr 30 min
   Drop factor: 10 gtt/mL

   What flow rate (mL/hr) will you set on the IV infusion pump?

   Answer: _____________mL/hr

36. Doctor’s Order: 1 ¼ L of D5 with Ringer’s lactate to be infused over 18 hours
   Drop factor: 20 gtt/mL

   What flow rate (mL/hr) will you set on the IV infusion pump?

   Answer: _____________mL/hr

37. Doctor’s Order: Zantac 150 mg in 175 mL of D5W to infuse IVPB over 45 minutes
   Drop factor: 12 gtt/mL

   How many mL/hr will you set on the IV infusion pump?

   Answer: _____________mL/hr
38. Doctor’s Order: Infuse 2750 mL of 0.45% Normal Saline at 150 mL/hr
   Drop Factor: 15 gtt/mL

   How many gtt/mL will you regulate the IV?

   Answer: ___________ gtt/min

39. Doctor’s Order: Cefoxin 0.5 Gm in 275 mL of D5W to infuse IVPB over 2 hours.
   Drop Factor: 60 gtt/mL

   How many gtt/min will you regulate the IV?

   Answer: ______________ gtt/min

40. Doctor’s Order: ¾ L of D5W to infuse over 5 hr 45 min
   Drop factor: 60 gtt/mL

   How many gtt/min will you regulate the IV?

   Answer______________ gtt/min
Practice Problems for PN Study Guide

Answers

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