Review correct **procedure and precautions** for the following routes of **administration**:

- Ear drops
- Enteral feeding tube
- Eye drops
- IM, subcut injections
- IV therapy, including IVP and IVPB
- Long-acting (SR, XR) medications
- Medications that cause gastrointestinal irritation such as oral potassium chloride and prednisone
- PCA Pump
- Rectal Suppository
- Transdermal Patch

Review **monitoring and precautions** related to:

- Medication Allergy
- Drug/Disease Interactions
- Drug/Food Interactions

Review **indications, action of medications, adverse effects, monitoring, precautions, and patient teaching implications** related to:

- **Analgesics, such as** morphine
- **Antibiotics, such as**
  - Aminoglycosides, gentamicin
  - Levofoxacin (Levaquin®)
  - Vancomycin (Vancocin®)
- **Anticoagulants, such as**
  - Heparin
  - Enoxaparin (Lovenox®)
  - Warfarin (Coumadin®)
- **Anticonvulsants, such as**
  - Divalproex (Depakote®)
  - Gabapentin (Neurontin®), also used to treat peripheral neuropathy
  - Phenytoin (Dliantin®)
- **Bronchodilators, such as** albuterol (Proventil®)
- **Cardiovascular Medications, such as**
  - Atorvastatin (Lipitor®)
  - Beta blockers such as labetalol (Normodyne®) and metoprolol (Lopressor®)
  - Clonidine (Catapres®)
  - Digoxin (Lanoxin®)
  - Diltiazem-SR (Cardizem®-SR)
Diabetic Medications, such as
- Insulin preparations, including lispro (Humalog®)
- Metformin (Glucophage®)

Glucocorticosteroids, such as prednisone

Iodinated contrast media (ICM)

Psychoactive Medications, such as fluoxetine (Prozac®)

Reversal Agents/Antidotes, such as
- Flumazenil (Romazicon®)
- Naloxone (Narcan®)
- Protamine sulfate

Sedatives/Anxiolytics, such as
- Long-acting benzodiazepines
- Lorazepam (Ativan®)
- Midazolam (Versed®)

Review IV Therapy monitoring, such as
- Potassium chloride, maximum safe rate
- Recognizing infiltration, extravasation, phlebitis
- Troubleshooting the IV infusion pump

Review Calculations, including
- IV drip rate
- Pounds to kilograms
- Number of tablets, or number of milliliters to obtain ordered dose
- Use of protocols such as insulin sliding scale and heparin protocol

Review laboratory tests used to monitor medication therapy
- Activated partial thromboplastin time (aPTT)
- Prothrombin time (PT)
- International normalized ratio (INR)
- Liver Function Tests
- Peaks and troughs
- Serum creatinine
- Serum electrolytes
- Serum glucose
Calculation Review

Why are calculations included in our exams?

Although most facilities have pharmacy calculate and deliver unit dose medications, and have IV pumps to calculate IV rates, the nurse remains responsible for the delivery of the correct dose of medications and IVs. Nurse Directors from our client facilities have indicated that they consider calculations to be a critical part of our evaluation process.

Conversions

- Milligram to Gram: $1000 \text{ mg} = 1 \text{ G}$
- Microgram to milligram: $1000 \text{ mcg} = 1 \text{ milligram}$
- Pounds to kilogram: $2.2 \text{ pounds} = 1 \text{ kg}$
- Centimeter to inch: $2.54 \text{ cm} = 1 \text{ inch}$
- Milliliter to Liter: $1000 \text{ mL} = 1 \text{ L}$
- mL (cc) to ounces: $30 \text{ mL (cc)} = 1 \text{ ounce}$

Medication Calculations

You have an order to administer phenytoin (Dilantin) oral suspension 100 mg TID per feeding tube.

Dilantin oral suspension is supplied to you in a 5 mL bottle which contains 125 mg/mL. How many mL per dose will you administer?

You can use either method below (or an alternate method) to determine the answer.

<table>
<thead>
<tr>
<th>Method #1: Ratio Proportion</th>
<th>Method #2: Formula Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>$125 \text{ mg}$ $1 \text{ mL}$ $= 100 \text{ mg}$ $“x” \text{ mL}$</td>
<td>$100 \text{ mg (dose desired)}$ $x$ $1 \text{ mL}$ $= “x” \text{ mL}$ $125 \text{ mg (dose on hand)}$</td>
</tr>
<tr>
<td>Cross-multiply and solve for “x”.</td>
<td>Solve for “x”.</td>
</tr>
<tr>
<td>$125 \text{ mg}$ $1 \text{ mL}$ $= 100 \text{ mg}$ $“x” \text{ mL}$</td>
<td>$100/125 = “x”$</td>
</tr>
<tr>
<td>$125 “x” = 100$</td>
<td>“x” $= 0.8 \text{ mL}$</td>
</tr>
<tr>
<td>“x” $= 100/125$; “x” $= 0.8 \text{ mL}$</td>
<td></td>
</tr>
</tbody>
</table>

You will administer $0.8 \text{ mL}$.
Your 4 year old pediatric patient weighs 40 pounds. She is febrile. You need to administer acetaminophen (Tylenol) 15mg/kg. How many mg will you administer?

First convert 40 pounds into kilograms.

<table>
<thead>
<tr>
<th>Method #1: Ratio Proportion</th>
<th>Method #2: Formula Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{1 \text{ kg}}{2.2 \text{ pounds}} = \frac{x \text{ kg}}{40 \text{ pounds}} )</td>
<td>( \frac{40 \text{ pounds}}{2.2 \text{ pounds}} \times \frac{1 \text{ kg}}{x} = \frac{x \text{ kg}}{40 \text{ pounds}} )</td>
</tr>
<tr>
<td>Cross-multiply and solve for x.</td>
<td>( x = 18.18 \text{ kg} )</td>
</tr>
<tr>
<td>( \frac{1 \text{ kg}}{2.2 \text{ pounds}} \times \frac{x \text{ kg}}{40 \text{ pounds}} = \frac{2.2x}{40} )</td>
<td>( x = 18.18 \text{ kg} )</td>
</tr>
<tr>
<td>( 2.2x = 40 )</td>
<td></td>
</tr>
<tr>
<td>( x = 18.18 \text{ kg} )</td>
<td></td>
</tr>
</tbody>
</table>

Since you will administer 15mg of acetaminophen per 1 kg, you will multiply 15mg with the weight of 18.18 kg.

\( 15\text{mg} \times 18.18\text{kg} = 272.7 \).

**You will administer 272.7 mg.**

Need more practice? Check out practice calculations in the Critical Thinking: Nursing Calculations Part 2 course on [www.RN.com](http://www.RN.com).
IV Rate Calculations

Each method below gives the same result. Use the one most familiar to you.

Method #1

Use drop factor constant

<table>
<thead>
<tr>
<th>Common Drop Factors</th>
<th>Drop Factor Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 gtt/mL – minidrip set</td>
<td>1</td>
</tr>
<tr>
<td>10 gtt/mL – regular drip set</td>
<td>6</td>
</tr>
<tr>
<td>15 gtt/mL – regular drip set</td>
<td>4</td>
</tr>
</tbody>
</table>

IV drip rate in drops per minute = \( \frac{\text{Volume to be infused (mL) over 1 hour}}{\text{Drop factor constant}} \)

Example:

Rate is 100 mL/hr. You have a regular drip set – 10 gtt/mL. Drop factor constant is 6.
At how many drops per minute will you set the rate?
\[ \frac{100 \text{ mL}}{6 \text{ (drop factor constant)}} = \frac{100}{6} = 16.66 \text{ (round to 17) drops per minute} \]

Method #2

Determine the rate per hour
Multiply the rate per hour by the drip rate
Divide the total by 60 (minutes) – converts rate per hour to rate per minute.

Example:

Rate is 125 mL/hr
IV set delivers 15 drops per mL

\[ 125 \text{ mL/hr} \times 15 \text{ drops/mL} = 31.25, \text{ rounded to 31 drops per minute} \]
60 minutes
Sample Problems

Problem #1
Your patient has an order for terbutaline (Brethine) 0.25 mg subcut. The pharmacy delivers a syringe with 1mg/mL. What is the correct volume to deliver to the patient? (See next page for answer.)

Problem #2
You receive an order for 60 mg of meperidine (Demerol) IM for your post surgical patient. The injection syringe is pre-packaged with 75 mg/mL. How much will you administer? (See next page for answer.)

Problem #3
Your patient has been receiving digoxin (Lanoxin) 125 mcg Q AM. Today his doctor writes a new order:

   Digoxin 0.25 mg PO Q AM start now

How many 125 mcg tablets will you administer? (See next page for answer.)

Problem #4
An IV is ordered to run at 60 mL/hr. The IV drip set delivers 15gtt/mL. How many drops per minute will you set the IV at? (See next page for answer.)

Problem #5
An IV is ordered to run at 175/hr. The IV drip set delivers 10 gtt/mL. How many drops per minute will you set the IV at? (See next page for answer.)
### Answer to Problem #1

<table>
<thead>
<tr>
<th>Method #1: Ratio Proportion</th>
<th>Method #2: Formula Method</th>
</tr>
</thead>
</table>
| \[
\frac{1 \text{ mL}}{1 \text{ mg}} = \frac{x \text{ mL}}{0.25 \text{ mg}}
\]
| \[
0.25 \text{ mg} \times \frac{1 \text{ mL}}{1 \text{ mg}} = \frac{x \text{ mL}}{1 \text{ mg}}
\]
| Cross-multiply and solve for \( x \). | \( x = 0.25 \text{ mL} \) |
| \[
\frac{1 \text{ mL}}{1 \text{ mg}} = \frac{x \text{ mL}}{0.25 \text{ mg}}
\]
| \[
75 \text{ mg} \times 1 \text{ mL} = \frac{60 \text{ mg}}{1 \text{ mL}} \times x \text{ mL}
\]
| 0.25 \( x \) = 1 | Solve for \( x \). |
| \( x = 0.25 \text{ mL} \) | \( x = 0.8 \text{ mL} \) |

You will administer 0.8 mL.
**Answer to Problem #3**

<table>
<thead>
<tr>
<th>Method #1: Ratio Proportion</th>
<th>Method #2: Formula Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.125 mcg = 0.25 mcg</td>
<td>0.25 mg x 1 tablet = x tablet</td>
</tr>
<tr>
<td>1 tablet</td>
<td>0.125 mg</td>
</tr>
<tr>
<td>Cross-multiply and solve for x.</td>
<td>Solve for x.</td>
</tr>
<tr>
<td>0.125 mcg = 0.25 mg</td>
<td>x = 0.25</td>
</tr>
<tr>
<td>1 tablet</td>
<td>0.125</td>
</tr>
<tr>
<td>0.125x = 0.25</td>
<td>x = 2 tablets</td>
</tr>
<tr>
<td>x = 0.25/0.125</td>
<td></td>
</tr>
<tr>
<td>x = 2 tablets</td>
<td></td>
</tr>
</tbody>
</table>

You will administer 2 tablets.

**Answer to Problem #4**

<table>
<thead>
<tr>
<th>Method #1: Drop Factor Constant</th>
<th>Method #2: Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 mL/hr = x drops per minute</td>
<td>60 (mL/hr) x 15 (drops/mL) = x drops per minute</td>
</tr>
<tr>
<td>4 (drop factor constant)</td>
<td>60 (minutes)</td>
</tr>
<tr>
<td>Divide and solve for x</td>
<td>Solve for x.</td>
</tr>
<tr>
<td>60/4 = 15</td>
<td>60 x 15 = 15</td>
</tr>
<tr>
<td>x = 15 drops per minute</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>x = 15 drops per minute</td>
</tr>
</tbody>
</table>

You will set rate at 15 drops per minute
<table>
<thead>
<tr>
<th><strong>Method #1: Drop Factor Constant</strong></th>
<th><strong>Method #2: Calculation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>175 mL/hr = x drops per minute / 6 (drop factor constant)</td>
<td>175 (mL/hr) x 10 (drops/mL) / 60 (minutes)</td>
</tr>
<tr>
<td>Divide and solve for x</td>
<td>Solve for x.</td>
</tr>
<tr>
<td>175/6 = 29.16</td>
<td>175 x 10 / 60 = 29.16</td>
</tr>
<tr>
<td>x = 29 drops per minute</td>
<td>x = 29 drops per minute</td>
</tr>
</tbody>
</table>

You will set rate at 29 drops per minute