Many healthcare organizations require that nurses demonstrate the ability to calculate **IV drip rates** *(drops/minute)* in the event of an emergency that disables IV infusion pumps. Review the formula for calculating IV drip rate in drops per minute.

To calculate the infusion rate: IV drip rate in drops per minute = 
\[
\frac{\text{Volume to be infused (mL) over 1 hour}}{\text{Drop factor constant}} = 12 = 12 \text{ drops/min}
\]

Common drop factors | Drop factor constant
--- | ---
60 gtts/mL - minidrip set | 1
10 gtts/mL – regular drip set | 6
15 gtts/mL – regular drip set | 4

Common drop factors are also known as the clock method – drop factors are obtained by dividing 60 minutes by the number of gtts per mL that the IV set delivers.

Review correct **procedure and precautions** for the following routes of **administration**:
- Bottle feeding the infant who has a cleft palate
- Enteral feeding tube
- Eye drops
- IM injections
- IV therapy

Review **monitoring and precautions** related to **blood transfusion**

Review **monitoring and precautions** related to **medication allergy**

Review **indications, action of medications, adverse effects, monitoring, precautions, and patient teaching implications** related to:
- Albumin
- Analgesics
  - Acetaminophen (Tylenol®), also antipyretic use
    - Especially risks, maximum recommended dosage
  - Fentanyl
    - Especially adverse effects
  - Morphine
    - Especially adverse effects
Especially toxicity, signs/symptoms and treatment

- **Antibiotics, such as**
  - Amoxicillin
  - Erythromycin
  - Gentamicin (Garamycin®)
  - Penicillin G
    - Especially adverse effects
  - Vancomycin (Vancocin®)
    - Especially adverse effects

- **Anticoagulants, such as heparin**
  - Emphasis on safety

- **Anticonvulsants, uses such as**
  - Lorazepam (Ativan®)
    - Especially precautions
  - Phenobarbital
    - Especially indications

- **Asthma medications including Bronchodilators, such as**
  - Albuterol (Proventil®)
    - Especially adverse effects
    - Treatment of acute asthma

- **Cardiovascular Medications, such as digoxin**
  - Especially indications of toxicity and pertinent lab values

- **Diuretics, such as furosemide (Lasix®)**
  - Especially monitoring

- **Electrolytes such as**
  - IV potassium chloride (KCl)
    - Especially monitoring
  - 10% dextrose in water (D10W)
  - 12.5% dextrose in water (D12.5W)
  - 25% dextrose in water (D25W)

  Protocols for managing hypoglycemia

- **IV potassium chloride (KCl)**
  - Especially monitoring

- **Emergency medications, particularly indications and dosing, for medications such as:**
  - Epinephrine
Neonatal Intensive Care Unit Basic Medication Administration Examination (NICU BMAE)

Study Guide

- Dobutamine
- Dopamine
- Lidocaine

- **Famotidine (Pepcid®)**

- **Glucocorticosteroids, such as prednisone**
  - Especially adverse effects

- **Inhaled nitric oxide**
  - Especially action of the medication

- **Methylxanthine agents, such as caffeine**
  - Especially adverse effects

- **Milrinone**

- **Prostaglandin**
  - Especially action and indications

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

- **Surfactant**
  - Ventilator implications

Review **Calculations, including**

- IV drip rate
- mL/hr IV rate
- Number of milliliters to obtain ordered dose
- Fluid calculations
- Dosage and fluid 24-hour calculations

Review **laboratory tests used to monitor medication therapy**, including

- Hematocrit
- Peaks and troughs
- Serum bilirubin
- Serum electrolytes, particularly potassium
- 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

<table>
<thead>
<tr>
<th>Conversion</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milligram to Gram</td>
<td>1000 mg = 1 G</td>
</tr>
<tr>
<td>Microgram to milligram</td>
<td>1000 mcg = 1 milligram</td>
</tr>
<tr>
<td>Pounds to kilogram</td>
<td>2.2 pounds = 1 kg</td>
</tr>
<tr>
<td>Centimeter to inch</td>
<td>2.54 cm = 1 inch</td>
</tr>
<tr>
<td>Milliliter to Liter</td>
<td>1000 mL = 1L</td>
</tr>
<tr>
<td>mL (cc) to ounces</td>
<td>30 mL (cc) = 1 ounce</td>
</tr>
</tbody>
</table>

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 mg (=) 100 mg (\frac{1 \text{ mL}}{x \text{ mL}})</td>
<td>(100 \text{mg (dose desired)} \times \frac{1 \text{ mL}}{125 \text{ mg (dose on hand)}} = \frac{x \text{ mL}}{1 \text{ mL}})</td>
</tr>
<tr>
<td>Cross-multiply and solve for “x”.</td>
<td>Solve for “x”.</td>
</tr>
<tr>
<td>(\frac{125 \text{ mg}}{1 \text{ mL}} = \frac{100 \text{ mg}}{x \text{ mL}})</td>
<td>(\frac{100}{125} = x)</td>
</tr>
<tr>
<td>(125 \text{ “x” = 100})</td>
<td>(x = 0.8 \text{ mL})</td>
</tr>
<tr>
<td>(“x” = \frac{100}{125}; \text{ “x” = 0.8 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 covert 40 pounds into kilograms.

**Method #1: Ratio Proportion**

\[
\frac{1 \text{ kg}}{2.2 \text{ pounds}} = \frac{x \text{ kg}}{40 \text{ pounds}}
\]

Cross-multiply and solve for \( x \).

\[
\frac{1 \text{ kg}}{2.2 \text{ pounds}} \times 40 \text{ pounds} = x \text{ kg}
\]

\[
2.2x = 40
\]

\[
x = \frac{40}{2.2} = 18.18 \text{ kg}
\]

**Method #2: Formula Method**

\[
\frac{40 \text{ pounds}}{2.2 \text{ pounds}} \times \frac{1 \text{ kg}}{x \text{ kg}} = \frac{40 \text{ pounds}}{2.2 \text{ pounds}} \times \frac{1}{x}
\]

\[
x = 18.18 \text{ kg}
\]

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

\[
15 \text{ mg} \times 18.18 \text{ kg} = 272.7 \text{ mg}
\]

**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

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

Method #1: Ratio Proportion

\[
\frac{1 \text{ mL}}{1 \text{ mg}} = \frac{x \text{ mL}}{0.25 \text{ mg}}
\]

Cross-multiply and solve for x.

\[
\frac{1 \text{ mL}}{1 \text{ mg}} = \frac{x \text{ mL}}{0.25 \text{ mg}}
\]

\[
0.25x = 1
\]

\[
x = 0.25 \text{ mL}
\]

Method #2: Formula Method

\[
\frac{0.25 \text{ mg}}{1 \text{ mg}} \times 1 \text{ mL} = x \text{ mL}
\]

\[
x = 0.25 \text{ mL}
\]

Answer to problem #2

Method #1: Ratio Proportion

\[
\frac{75 \text{ mg}}{1 \text{ mL}} = \frac{60 \text{ mg}}{x \text{ mL}}
\]

Cross-multiply and solve for x.

\[
\frac{75 \text{ mg}}{1 \text{ mL}} = \frac{60 \text{ mg}}{x \text{ mL}}
\]

\[
75x = 60
\]

\[
x = 0.8 \text{ mL}
\]

Method #2: Formula Method

\[
\frac{60 \text{ mg}}{75 \text{ mg}} \times 1 \text{ mL} = x \text{ mL}
\]

Solve for x.

\[
x = 0.8 \text{ mL}
\]

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

### Method #1: Ratio Proportion

<table>
<thead>
<tr>
<th>0.125 mcg</th>
<th>=</th>
<th>0.25 mcg</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 tablet</td>
<td>x</td>
<td>mL</td>
</tr>
</tbody>
</table>

Cross-multiply and solve for x.

\[
0.125 \text{ mcg} = \frac{0.25 \text{ mg}}{x \text{ tablet}}
\]

\[0.125x = 0.25\]

\[x = \frac{0.25}{0.125} = 2\text{ tablets}\]

You will administer 2 tablets.

### Method #2: Formula Method

<table>
<thead>
<tr>
<th>0.25 mg</th>
<th>x 1 tablet</th>
<th>=</th>
<th>x tablet</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.125 mg</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Solve for x.

\[x = \frac{0.25}{0.125} = 2\text{ tablets}\]

You will administer 2 tablets.

## Answer to Problem #4

### Method #1: Drop Factor Constant

<table>
<thead>
<tr>
<th>60 mL/hr</th>
<th>=</th>
<th>x drops per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 (drop factor constant)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Divide and solve for x

\[60/4 = 15\]

\[x = 15\text{ drops per minute}\]

You will set rate at 15 drops per minute.

### Method #2: Calculation

\[
60 \text{ (mL/hr)} \times 15 \text{ (drops/mL)} = x \text{ drops per minute}
\]

Solve for x.

\[60 \times 15 = 15\]

\[\frac{60 \times 15}{60} = \frac{15}{60}\]

\[x = 15\text{ drops per minute}\]

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

You will set rate at 29 drops per minute