Introduction to Basic Drug Calculations

This packet is intended to give you a start on preparing for drug calculations. It is NOT intended to be all inclusive.

Every effort has been made to assure the accuracy of the information presented. If errors are noted, it is the users' responsibility to notify the instructor so correction/clarification can be made.

References


This material is intended for use by students at Jefferson State Community College.
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Pre-Test
These are the types of medication administration problems you will encounter in your nursing practice. If you don’t know how to calculate some of these, don’t worry—you will learn how! So see how well you can do....

1) The healthcare provider (HCP) has ordered 1mg tablet (tab) of a medication. You have 500mcg tabs. How many tabs will you give?

2) You are to give 30mg from a vial that has 12.5mg/mL. How many mL will you give? (Round to tenths)

3) You are to give 250mg of a medicine. You have 1g in 10mL. How many mL will you give? (Round to tenths)

4) You are to give 4mg/kg. Pt weighs 176 lbs. You have 1g in 2mL. How many mL will you give? (Round to tenths)

5) You are to give 100mL IV antibiotic over 20 mins. How many mL/hour is this?

6) Patient weighs 132 lbs. HCP ordered 10 mg/kg/day in equally divided doses q 6hrs. Available as 1g in 2 mL. How many mL of drug/day? _______ How many mL of drug/dose? _______ (Round both problems to tenths)

7) Give 1000mL IV fluid in 8 hrs. There are 20 gtt/mL (drop factor). How many gtt/min? _______. (Drops are whole numbers)

8) Ordered: 400,000 units. Available: 600,000 units per 2mL. (Round to tenths)

9) Give 1000mL at 125mL/hr. Infusion began at 0920. How much is left in the bag at 1350? (Round to whole number)

10) Give 125 mg of Ampicillin in 100 mL IV solution. How many mL/hr will you give to deliver this dose in 45 min? (Round to whole number)

Answers

1) 2 tabs
2) 2.4 mL
3) 2.5 mL
4) 0.6 mL
5) 300 mL/hr
6) 1.2 mL/day; 0.3 mL/dose
7) 42 gtt/min
8) 1.3 mL
9) 438 mL
10) 133 mL/hr

NOTE: There is more information in a correct HCP order. For calculation practice purposes, some REQUIRED information necessary to administer the medication safely may be absent. This lack of additional correct information does not change the answer.
**Introduction**

This packet will not address the correct methods to ADMINISTER medications, nor the information you need to use the equipment properly. This packet is intended to strictly address dosage calculations.

To safely and correctly calculate medication dosages, you must be proficient in basic math, including:

- Adding
- Subtracting
- Multiplying
- Dividing
- Fractions
- Percentages
- Decimals
- Reducing/Canceling
- Proper method to round a number

Basic math will not be addressed in this packet. We suggest if you need to review, you find a basic math book or look online for resources that will help you become proficient.

Use any method you are comfortable with to calculate the answer. However, this booklet will teach using the formula and/or dimensional analysis method.

**General Guidelines**

1) For an order to be correct, it must contain a) the drug; b) the amount; c) the route; d) the time to be administered or how often; and e) the signature of the prescriber. For calculation practice purposes, some REQUIRED information necessary to administer the medication safely may be absent. This lack of additional correct information does not change the answer.

2) After arriving at an answer, ask yourself if the answer makes sense. Estimate what you think the answer should be. If it is entirely unreasonable, recalculate (i.e. answer is 10,000 mL/hr—which is impossible)

3) Follow instructions for each question regarding how to round.

4) Unless otherwise indicated, tablets, capsules, caplets, etc are either half or whole number.

5) Drops are always whole numbers.

6) Do not place a trailing zero after decimal
   - Incorrect: 10.0 mL  Correct: 10 mL

7) Always place a zero before a decimal
   - Incorrect: .25 mL  Correct: 0.25 mL

8) Do not use: μ (micro-); cc (cubic centimeter); gm (gram)
9) Only small letters should be used when designating units of measure, except liter (L) and tablespoon (T). Do not add “s” indicating multiple (i.e. drop or drops is “gtt”).

10) Military time is used in medication administration, which has no colons or a.m. /p.m. designations. To convert:

a. **Standard to Military**

   **Midnight to noon**: use a 4-digit number (place zero in front as necessary)
   
   Example: 4:10 a.m. = 0410
              11:30 a.m. = 1130

   **Noon – 11:59 p.m.**: add 1200 to the time
   
   Example: 10:25 p.m. = 1025 + 1200 = 2225
              4:08 p.m. = 408 + 1200 = 1608

b. **Military to Standard**:

   **Midnight to 11:50 a.m.**: Insert colon, add a.m. and delete any zero before number
   
   Example: 0625 = 6:25 a.m.
              1019 = 10:19 a.m.

   **Noon – 11:59 p.m.**: subtract 12, insert colon, and add p.m.
   
   Example: 2200 = 2200 - 12 = 10:00 p.m.
              1340 = 1340 - 12 = 1:40 p.m.

**Conversions**

It is imperative that you learn conversions amongst and between systems. You will use conversions in many medication calculations. You must know the metric and household systems. The apothecary system is rarely used, but make sure to review this.

**Easy metric-to-metric conversion chart**

Move the decimal to right or left depending upon what you are converting. Always move 3 spaces (except for cm/mm — jump 1 space).

<table>
<thead>
<tr>
<th></th>
<th>k</th>
<th>(h)</th>
<th>(d)</th>
<th>Base (d)</th>
<th>c</th>
<th>m</th>
<th>x</th>
<th>x</th>
<th>mc</th>
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<tbody>
<tr>
<td>5 g = x mg</td>
<td></td>
<td></td>
<td></td>
<td>5 g</td>
<td>50</td>
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<td></td>
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<td>10kg</td>
<td>100</td>
<td>1,000</td>
<td>10,000 g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.5 mg = x mcg</td>
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<td></td>
<td></td>
<td>Move decimal to the right</td>
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<td>65</td>
<td>650</td>
<td>6,500mcg</td>
<td></td>
</tr>
<tr>
<td>1.2 g = x kg</td>
<td>0.0012</td>
<td>0.012</td>
<td>0.12</td>
<td>1.2</td>
<td>Move decimal to the left</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: the shaded columns are not used in drug calculations.

Another method is to make a larger number smaller, multiply by 1000. To make a small number larger, divide by 1000.
Approximate equivalents

<table>
<thead>
<tr>
<th>Approximate equivalents</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>1 kg</td>
<td>2.2 lb</td>
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<tr>
<td>2.5 cm</td>
<td>1 inch</td>
</tr>
<tr>
<td>5 mL</td>
<td>1 t</td>
</tr>
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<td>15 mL</td>
<td>1 T</td>
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<tr>
<td>30 mL</td>
<td>1 oz</td>
</tr>
<tr>
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<td>1 cup</td>
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<td>500 mL*</td>
<td>1 pint</td>
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<td>1,000 mL*</td>
<td>1 qt</td>
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<td>3 teaspoons (t)</td>
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<td>1 milliliter (mL)</td>
</tr>
<tr>
<td>1,000 mL</td>
<td>1 liter (L)</td>
</tr>
<tr>
<td>1 kilogram (kg)</td>
<td>1,000 grams (g)</td>
</tr>
<tr>
<td>1 gram (g)</td>
<td>1,000 milligrams (mg)</td>
</tr>
<tr>
<td>1 milligram (mg)</td>
<td>1,000 micrograms (mcg)</td>
</tr>
</tbody>
</table>

*although these are listed as equivalents, it is better to use the 30 mL = 1 oz equivalent.
(1 pint = 16 oz; 16 oz = 480 mL)   (1 qt = 32 oz; 32 oz = 960 mL)

Test Yourself

1) 50 kg = _______ lb
2) 60 mL = _______ oz
3) 16 mL = _______ oz (round to 10ths)
4) 132 lb = _______ kg
5) 4" = _______ cm
6) 163.8 lb = _______ kg (round to 10ths)
7) 2.9 mg = _______ mcg
8) 900 mL = _______ L
9) 1 pt = _______ mL
10) 1 qt = _______ mL
11) 50 mm = _______ cm
12) 6 oz = _______ T
13) 8 oz = _______ mL
14) 0.6 g = _______ mg
15) 440 mL = _______ oz (round to 10ths)
16) 16 oz/day = _______ mL/week
Answers

1) 110 lb  
2) 2 oz  
3) 0.5 oz  
4) 60 kg  
5) 10 cm  
6) 74.5 kg  
7) 2900 mcg  
8) 0.9 L  
9) 480 mL  
10) 960 mL  
11) 5 cm  
12) 12 T  
13) 240 mL  
14) 600 mg  
15) 14.7 oz  
16) 3360 mL/week

Intake and Output

You will often be required to calculate your patient’s intake and output (I&O). This will likely involve converting household measurements to metric (oz, cups, etc. to mL). As stated previously, you must know the conversions! But you also have to know what is considered intake and output.

**Intake** is anything that is liquid or liquid-like at room temperature. For example, juice, cola, tea, coffee, jello, popsicles, pudding, milk shake, broth, and the like. IV fluids are also considered intake and added in the total intake, but often is listed separately. What is NOT considered intake: pureed foods, oatmeal, grits, or mashed potatoes (no matter how thin they are). Irrigation fluid is also not considered intake.

**Output** is what liquid comes out of the body (not counting irrigation). **Bowel movements are not counted as output, unless they are liquid stools.**

To calculate I&O, you simply add the numbers together. For example:

Your patient consumed the following: (1) 8-oz of soda; 1 cup of coffee; (3) 4-oz juice, toast, and 1 cup of oatmeal. What is the total (mL) of intake for this period?

\[8 \text{ oz soda} = 240 \text{ mL}, \ 1 \text{ cup (8 oz) coffee} = 240 \text{ mL}, \ 3 \times 4 \text{ oz juice} = 360 \text{ mL} = \boxed{840 \text{ intake}}\]

Your patient had for the day: (2) 12 oz Monster drinks; (2) pints of milk; (2) 4 oz juices; and (3) 8-oz glasses of tea. She also had 1200 mL of IV fluid. She voided amounts of urine: 250 mL; 400 mL, 350 mL, and 500 mL, and 600 mL. What is her total I&O? How much of a positive/negative balance does she have?

Intake: (2) 12 oz Monster drinks = (24 oz) 720 mL; (2) pints of milk = (32 oz) = 960 mL; (2) 4 oz juices = (8 oz) = 240 mL; and (3) 8-oz glasses of tea = (24 oz) = 720 mL. She also had 1200 mL of IV fluid. **TOTAL INTAKE: 3840 mL** **TOTAL OUTPUT: 2100 mL** This is 1740 mL positive balance.

You will later learn the significance of I&O and what to consider with fluid overload and deficit.
Basics of the Formula Method
NOTE: unit(s) of measure will be abbreviated (UOM).

1) You must KNOW the formula, which is:

\[
\text{Desired} \times \text{Quantity or Volume} = x \quad \frac{D}{H} \times Q \text{ or } V = x
\]

In this formula, Q refers to solids like tablets or capsules; volume refers to medication in liquid state. For simplicity sake, Q or V may be used interchangeably in the instructions.

2) UOM must be the same. If the order and what is available are in different UOM, you must convert to be the same. Suggestion: if you have decimals involved, try to convert to the UOM that does not have these. For example: “Give 0.2 mg and you have 200 mcg”, convert the 0.2 mg to micrograms so you lessen the risk of a decimal error. However, note that converting 200 mcg to 0.2 mg is also correct.

3) Calculate the answer, canceling the units of measure as appropriate.

4) Evaluate your answer for the “Does It Make Sense test” (DIMS test)

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Units of measure must be the same

Formula method: Desired \times Quantity = x \quad \frac{D}{H} \times Q = x

Example: Ordered to give 60 mg (desired) of Cymbalta. One tablet (quantity) has 30 mg (have). How many tablets will you administer?

\[
\frac{60 \text{ mg}}{30 \text{ mg}} \times 1 \text{ tablet} = 2 \text{ tablets}\]

Example: Ordered 0.25 mg of alprazolam oral solution. Your bottle contains 1 mg/2mL. How many mL will you administer?

\[
\frac{0.25 \text{ mg}}{1 \text{ mg}} \times 2 \text{ mL} = 0.5 \text{ mL}\]

Example: Ordered 750 mg of ampicillin. You have 1 g/2 mL. How many mL will you administer?

\[
\frac{750 \text{ mg}}{1,000 \text{ mg}} \times 2 \text{ mL} = 1.5 \text{ mL}\]

OR

\[
\frac{0.75 \text{ g}}{1 \text{ g}} \times 2 \text{ mL} = 1.5 \text{ mL}\]
```

Units of measure must be the same
It doesn’t matter what the unit of measure is or if you have never heard of it.

Example: Give 2 kunos of pixie dust. You have on hand 5 kunos of pixie dust/mL. How many mL will you give?

\[
\frac{2 \text{ kunos of pixie dust}}{5 \text{ kunos of pixie dust}} \times 1 \text{ mL} = 0.4 \text{ mL}
\]

Example: Give (desired) 320,000 units of heparin. You have 100,000 units/10 mL

\[
\begin{align*}
\text{desired} & \quad 320,000 \text{ units} \times 10 \text{ mL} = 32 \text{ mL} \\
\text{have} & \quad 100,000 \text{ units}
\end{align*}
\]

You could also reduce your zeros

\[
\frac{320,000 \text{ units}}{100,000 \text{ units}} \times 10 \text{ mL} = 32 \text{ mL}
\]

Example: The doctor writes an order for 3.5 mEq (milliequivalent) of a medication. The vial you have contains 7.5 mEq/2mL. How many mL will you administer? (Round to 100ths)

\[
\frac{3.5 \text{ mEq}}{7.5 \text{ mEq}} \times 2 \text{ mL} = 0.93 \text{ mL}
\]

Test Yourself

1) Ordered: Divalproex sodium 0.25g po qd. It is available in 125mg delayed-release tablets. How many tablets will you give?

2) Codeine is available in 15mg/2mL. Give 0.06g. How many mL will you give? (whole #)

3) On hand: 25mg/5mL of drug. Dr. ordered 25mg. How many mL will you give? (whole #)

4) You have 250 mg capsules. Doctor ordered 1 g. How many caps will you give?

5) Ordered 20 mg. You have 40 mg tablets. How many tabs will you give?

6) A dosage of 25mg has been ordered. The solution strength available is 12.5mg in 1.5 mL. How many mL will you give? (whole #)

7) The order is for 130 mg and the single-use ampule is labeled 0.1 g per 2mL. How many mL will you give? (tenths)

8) A dosage of 10mg has been ordered. You have available a strength of 4000 mcg/5mL. How many mL will you give? (tenths)

9) You have drug 0.25 mg tablets. You need to give 0.75 mg. How many tabs will you give?

10) Doctor ordered 650 mg. Available 325 mg per tablet. How many tabs will you give?
1. **Dimensional Analysis uses equivalency of measure.** For example, $60 \text{ sec}$ and $1 \text{ min}$ are equal statements.

2. **When a non-zero quantity is divided by the same amount or equivalent, the result is 1.**
   
   For example:
   
   \[
   \frac{60 \text{ sec}}{1 \text{ min}} = 1 \quad \frac{3 \text{ ft}}{1 \text{ yard}} = 1 \quad \frac{1 \text{ g}}{1000 \text{ mg}} = 1
   \]

3. **When a quantity is multiplied by 1, the quantity is unchanged.**
   
   \[
   1 \text{ hour} \times \frac{60 \text{ sec}}{1 \text{ minute}} = 1 \text{ hour}
   \]
   
   Because these are equal, they become $\frac{1}{1}$

4. **The order of a multiplication problem does not matter; you will still get the same answer.**
   
   For example, $3 \times 2 = 6$ and $2 \times 3 = 6$. Therefore, when writing your problem, the order in which you put your equivalents doesn’t matter.

5. **To eliminate a UOM in the numerator, the same UOM must be in the denominator.**

6. **UOM must be aligned so the desired UOM is in the correct location (numerator vs denominator), then cancelled to leave desired UOM.**

7. **If your first set of numbers do not reduce to the desired UOM, you must add additional sets of equivalencies until you are only left with the desired UOM.**

8. **Always write first what UOM you are looking for.** Then make sure the numerator and denominator have these units in the correct location. For example, if the question asks mL/hr, the problem must be set up with mL in the numerator and hr in the denominator.

Example 1: Ordered to give 75 mg indomethacin oral suspension. You have a bottle with 25 mg/5mL. How many **teaspoons** will you give?

We are looking for teaspoons, so I know (t) will need to be in the numerator. I also know $1 \text{ t} = 5 \text{ mL}$ (equivalency).

\[
\frac{1 \text{ t}}{5 \text{ mL}} \times \frac{5 \text{ mL}}{25 \text{ mg}}
\]

Can’t stop here because this leaves UOM as t/mg. I must continue to cancel until I am left with t.

So I must add another “dimension” using the info I have in the problem.
Continue with how many Tablespoons will this be?

\[
\frac{1 \text{ T}}{5 \text{ mL}} \times \frac{5 \text{ mL}}{25 \text{ mg}} \times \frac{75 \text{ mg}}{1 \text{ T}} = \frac{1 \text{ T}}{3 \text{ f}}
\]

And then how many oz?

\[
\frac{1 \text{ f}}{5 \text{ mL}} \times \frac{5 \text{ mL}}{25 \text{ mg}} \times \frac{75 \text{ mg}}{1 \text{ f}} \times \frac{1 \text{ oz}}{3 \text{ f}} = \frac{0.5 \text{ oz}}{2 \text{ f}}
\]

Example 2: The patient must take 5 mL every 6 hours of a medication from a bottle which contains 2 mg/5 mL. How many mg/week will this be?

Ordered: 5 mL/ every 6 hrs (4 times/day) = 20 mL/day

Have: 2 mg/5 mL

Want to know how many mg/week

First we are going to write what we are looking for:

\[\frac{2 \text{ mg}}{5 \text{ mL}} \times \frac{20 \text{ mL}}{1 \text{ day}} = \frac{??? \text{ mg}}{1 \text{ week}}\]

I know that mg must be in my numerator and week in the denominator.

I will take the information I know and assure the correct placement of mg and of week.

\[\frac{2 \text{ mg}}{5 \text{ mL}} \times \frac{20 \text{ mL}}{1 \text{ day}} = \frac{=? \text{ mg}}{1 \text{ week}}\]

I am looking for mg/week and this is reduced to mg/day, so I must continue...

\[\frac{2 \text{ mg}}{5 \text{ mL}} \times \frac{20 \text{ mL}}{1 \text{ day}} \times \frac{7 \text{ days}}{1 \text{ week}} = \frac{?? \text{ mg}}{1 \text{ week}}\]

YES!

Now do the math!

If the patient takes 5 mL every 6 hours of a medication from a bottle which contains 2 mg/5 mL, the patient will take \(56 \text{ mg/week}\) of the medication.
Suppose you wanted to now know how many mg/month. We can continue by adding another “dimension” and “analyzing” it.

\[
\frac{2}{5} \text{ mg} \times \frac{20 \text{ mL}}{1 \text{ day}} \times \frac{7 \text{ days}}{1 \text{ week}} \times \frac{4 \text{ weeks}}{1 \text{ month}} = \frac{224 \text{ mg}}{1 \text{ month}}
\]

Example 3: You have 200 mg of Drug A in 500 mL infusing at 30 mL/hr. How many mg/hr? How many mg/min?

We want to end with mg/hr and mg/min. We know the mg needs to be in the numerator and the a) hr; b) min needs to be in the denominator. Here is what our formula would look like.

\[
\frac{200 \text{ mg}}{500 \text{ mL}} \times \frac{30 \text{ mL}}{1 \text{ hr}} = \frac{mg}{hr}
\]

We do the math and the answer is: \(12 \text{ mg/hr}\)

Now let’s find out how many mg/min this is:

\[
\frac{200 \text{ mg}}{500 \text{ mL}} \times \frac{30 \text{ mL}}{1 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ mins}} = \frac{mg}{mins}
\]

We do the math and the answer is: \(0.2 \text{ mg/min}\)

**Test Yourself**

1) You are to administer a medication of 10 units/100 mL. The medication is infusing at 9 mL/hr. How many units/hr is the patient receiving? How many mU/hr is the patient receiving?

2) Administer 4,000 units heparin subcut q 12 hr. Your vial contains heparin 10,000 units/1 mL. How many mL will you give?

3) Give regular insulin 15 units/hr. Your IV bag contains 50 units of regular insulin in 250 mL fluids. How many mL/hr will this be?

4) Your patient is receiving 60 mL/hr of a regular insulin infusion. The 500 mL IV bag contains 75 units of regular insulin. How many units/hr is your patient receiving?

5) Give 3 mg of Ativan IV push, not to exceed 2 mg/min. You have available Ativan 4 mg/mL. How many mL will you prepare? (Round to 100ths). What would be the fastest time to administer the ordered medication?

6) Administer 75 mg of Tamiflu p.o. Available 6 mg/mL. How many mL will you administer?

7) Administer 15 mg of a drug. The vial contains 2 mL of 20 mg. How many mL will you administer?
8) Calculate total intake and output:

<table>
<thead>
<tr>
<th>4 oz of orange juice</th>
<th>1650 mL urine</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2) 6 oz cups of coffee</td>
<td>50 mL emesis</td>
</tr>
<tr>
<td>20 oz of Sprite</td>
<td>100 mL liquid stool</td>
</tr>
<tr>
<td>160 mL of water</td>
<td></td>
</tr>
<tr>
<td>75 mL of IV antibiotics</td>
<td></td>
</tr>
<tr>
<td>525 mL of IV fluid</td>
<td></td>
</tr>
</tbody>
</table>

9) Administer 7,500 units of heparin; Available 10,000 units of heparin in 1 mL. How many mL will you administer?

10) You have a vial of medication labeled 300,000 units per mL. You need to administer 500,000 units. How many mL will you give? *(Round to 10ths)*

**Answers**

1. 0.9 units/hr; 900 mU/hr  
2. 0.4 mL  
3. 75 mL/hr  
4. 9 units/hr  
5. 0.75 mL; 1.5 min  
6. 12.5 mL  
7. 1.5 mL  
8. In: 1840 mL; Out: 1800  
9. 0.75 mL  
10. 1.7 mL

**Finding Dosage Rates**

_This is accomplished using the same formulas we have been over. Just remember to put the desired UOM in the right place._

Example 1: Give cefoxitin 1 g IVPB (IV piggyback) over 30 minutes. You have a vial of 1 g/50 mL. How many g/hr is the patient to receive?

\[
\frac{1\text{ g}}{30\text{ min}} \times \frac{60\text{ min}}{1\text{ hr}} = \frac{2\text{ g}}{1\text{ hr}}
\]

Example 2: An IV bag contains 1,000 mL fluid with 500 mg of a drug. It is infusing at 12 gtt/min, with a drop factor of 10. How many mg/min are infusing?

\[
\frac{12\text{ gtt}}{1\text{ min}} \times \frac{500\text{ mg}}{1\text{ mL}} \times \frac{1\text{ mL}}{10\text{ gtt}} = 0.6\text{ mg/min}
\]

*Remember it doesn’t matter which order I put these in, as long as I have the UOM in the correct spot.*
**IV Infusion Calculations**

When administering IV fluids (with or without additives), you will most likely deliver this using a pump. However, there may be occasions when you administer IV fluids “by gravity”. Therefore, you need to know how to set the correct rate or gtt/min via both methods.

**By gravity (free-flowing) is always how many gtt per min.**

**Small Volumes Given Over 60 Min or Less**

\[
\frac{\text{mL} \times \text{df}}{\text{min}} = \frac{\text{gtt}}{\text{min}}
\]

Drop factor (df) = # of gtt/mL

Example 1: Give 50 mL over 30 min. df is 15. How many gtt/min will you give?

\[
\frac{50 \times 15}{30} = 25 \text{ gtt/min (simplified)}
\]

\[
\frac{50 \text{ mL} \times 15 \text{ gtt}}{30 \text{ min} \times 1 \text{ mL}} = 25 \text{ gtt} \quad \text{(actually worked out)}
\]

Example 2: Give 100 mL over 45 min. df is 20. How many gtt/min will you give?

\[
\frac{100 \times 20}{45} = 44.44 \rightarrow 44 \text{ gtt/min}
\]

Example 3: You are to administer 250 mL over 60 minutes using tubing which delivers 15 gtt/mL. How many gtt/min will you give?

\[
\frac{250 \times 15}{60} = 62.5 \text{ gtt/min} \rightarrow 63 \text{ gtt/min}
\]

**Small Volumes Given by IV Pump**

\[
\frac{\text{mL} \times 60 \text{ min}}{\text{min}} = \frac{\text{mL}}{1 \text{ hr}}
\]

Example 1: Give 100 mL over 45 min. How many mL/hr?

\[
\frac{100 \text{ mL} \times 60 \text{ min}}{45 \text{ min} \times 1 \text{ hr}} = 133 \text{ mL/hr}
\]

Example 2: Give 20 mL over 25 min. How many mL/hr?

\[
\frac{20 \text{ mL} \times 60 \text{ min}}{25 \text{ min} \times 1 \text{ hr}} = 48 \text{ mL/hr}
\]

**NOTE:** If you are asked to answer “how do you set the pump”, or “what will the pump deliver”, etc (anything about a pump), it will **always** be mL/hr.
Example 3: Give 20 mL in 8 min. How many mL/hr?

\[ \frac{20 \text{ mL}}{8 \text{ min}} \times 60 \text{ min} = 150 \text{ mL/hr} \]

Larger Volumes Given by Pump

Example 1: Give 500 mL over 6 hrs. How many mL/hr?

\[ \frac{500 \text{ mL}}{6 \text{ hr}} = 83.33 \approx 83 \text{ mL/hr} \]

Notice this is a simple division problem because what you are looking for in the numerator and denominator require no conversion or reduction.

Example 2: Give 1000 mL over 5 hrs. How many mL/hr?

\[ \frac{1000 \text{ mL}}{5 \text{ hrs}} = 200 \text{ mL/hr} \]

Example 3: Give 250 mg in 500 mL over 4 hrs. How many mL/hr?

\[ \frac{500 \text{ mL}}{4 \text{ hr}} = 125 \text{ mL/hr} \]

NOTE: 250 mg not in equation. If I tried to place this number, I would have no UOM to cross out.

Test Yourself
(round to whole numbers)

1) Give 600 mL over 2.5 hrs. How many mL/hr?

2) Give 1000 mL over 6 hrs. How many mL/hr?

3) Give 200 mL over 45 min. You have a df of 10. How many gtt/min?

4) Give 20 mL over 25 min with tubing delivering 60 gtt/mL. How many gtt/min?

5) Give 1 g of Rocephin (mixed with 100 mL IV fluids) over 1 hour. How would you set the pump?

6) Give 50 mL over 5 min. How many mL/hr?

7) Give 420 mL over 6 hrs. How many mL/hr?

8) Give 750 mL over 4 hrs. How would you set the pump?

9) Give 9 mL over 30 min. How would you set the pump?

10) Give 50 mL over 20 min. How would you set the pump?
11) Give 300 mg in 300 mL over 1 hour. DF is 10. How many gtt/min will you infuse?

12) Give 20 mg of a drug in 300 mL of IV fluid over 6 hours. You have a vial with 50 mg/10 mL. DF is 60. How many gtt/min will you infuse?

13) You must give 800 mg of a drug IV push. You have 1g/4mL.  a) How many mL will you need to give? b) If you were ordered to give this amount over 2 minutes, how many mL would you infuse every minute? c) How much would you give every 15 seconds?

14) An IV is running at 17 gtt/min through a tubing with df 15. How many mL will the patient receive in 8 hrs?

15) Give 50 mL over 30 min. How many mL/hr?

**Answers**

1) 240 mL/hr
2) 167 mL/hr
3) 44 gtt/min
4) 48 gtt/min
5) 100 mL/hr
6) 600 mL/hr
7) 70 mL/hr
8) 188 mL/hr
9) 18 mL/hr
10) 150 mL/hr
11) 50 gtt/min
12) 50 gtt/min
13) 3.2 mL/1.6 mL/0.4 mL
14) 544 mL
15) 100 mL/hr

**Converting mL/hr to gtt/min**

This is simply your dimensional analysis formula...

Example 1: Give 75 mL/hr with df 10. How many gtt/min.

\[
\frac{75 \text{ mL}}{1 \text{ hr}} \times \frac{10 \text{ gtt}}{1 \text{ mL}} = 13 \text{ gtt/min}
\]

Example 2: Give 10 mL/hr with df 15. How many gtt/min?

\[
\frac{10 \text{ mL}}{1 \text{ hr}} \times \frac{15 \text{ gtt}}{1 \text{ mL}} = 3 \text{ gtt/min}
\]
Here is a shortcut, but remember, the denominator MUST BE IN MINUTES!

\[
\text{Volume to infuse} \times \text{DF} = \text{gtt/min} \\
\text{Time (MINS ONLY)}
\]

Example 3: Give 100 mL over 1 hr with df 15. How many gtt/min?

\[
\frac{100 \text{ mL} \times 15}{60 \text{ MINS}} = 25 \text{ gtt/min}
\]

Example 4: Give 250 mL over 4 hrs with df 20. How many gtt/min?

\[
\frac{250 \text{ mL} \times 20}{240 \text{ MINS}} = 21 \text{ gtt/min}
\]

Example 5: Your tubing has df of 15 with 1000 mL infusing over 8 hrs. How many gtt/min?

\[
\frac{1000 \times 15}{480 \text{ min}} = 31 \text{ gtt/min}
\]

**Calculating Amount/hr**

Example 1: Give 50,000 units in 1 L to infuse at 80 mL/hr. How many units/hr?

\[
\frac{80 \text{ mL} \times 50,000 \text{ units}}{1 \text{ hr} \times 1000 \text{ mL}} = 4000 \text{ units/hr}
\]

Example 2: Give Heparin 1,440 units/hr. You have 25,000 units in 1000 mL. How many mL/hr? (whole #)

\[
\frac{1000 \text{ mL} \times 1,440 \text{ units}}{25,000 \text{ units} \times 1 \text{ hr}} = 58 \text{ mL/hr}
\]

Example 3: Give 400 mg in 500 mL at 35 mL/hr. How many mg/hr? (whole #)

\[
\frac{400 \text{ mg} \times 35 \text{ mL}}{500 \text{ mL} \times 1 \text{ hr}} = 28 \text{ mg/hr}
\]

**Infusion Time**

Example 1: Give 500 mL at 125 mL/hr. How long to infuse?

\[
\frac{500 \text{ mL} \times 1 \text{ hr}}{125 \text{ mL}} = 4 \text{ hrs}
\]
Example 2: Give 500 mL at 150 mL/hr. How long to infuse?

\[
\frac{500 \text{ mL} \times 1 \text{ hr}}{150 \text{ mL}} = 3.33 \text{ hrs (3 hrs and 20 minutes)}
\]

\[
0.33 \times 60 \text{ mins} = 19.8 \text{ mins.}
\]

**Completion Time**

To calculate completion time, you must first calculate infusion time.

**Start time + infusion time = completion time**

Example 1: IV 1000 mL infusing at 125 mL/hr was started at 0800. When will this infusion be completed?

\[
\frac{1000 \text{ mL} \times 1 \text{ hr}}{125 \text{ mL}} = 8 \text{ hrs}
\]

0800 (start time) + 8 hrs (infusion time) = 1600 (completion time)

Example 2: IV of 500 mL was started at 1415 and is infusing at 200 mL/hr. When finished?

\[
\frac{500 \text{ mL} \times 1 \text{ hr}}{200 \text{ mL}} = 2.5 \text{ hrs}
\]

1415 (start time) = 2.5 hrs (infusion time) = 1645 (completion time)

**Amount Infused**

**Time elapsed \times rate/hr**

Example 1: IV of 500 mL is infusing at 100 mL/hr. The infusion was started at 1100. At 1330, how much infused?

From 1100 to 1330, 2.5 hours has elapsed.

\[
2.5 \text{ hrs (time elapsed)} \times 100 \text{ mL/hr (rate/hr)} = 250 \text{ mL (amount infused)}
\]

Example 2: IV of 1000 mL is infusing at 150 mL/hr. The infusion was started at 0700. How much has infused by 1500?

\[
8 \text{ hrs (time elapsed)} \times 150 \text{ mL/hr (rate/hr)} = 1200 \text{ mL (amount infused)}
\]
**Amount Remaining**

**Beginning amount - amount infused**

Example 1: 500 mL at 100 mL/hr. Started at 1100. At 1330, how much remaining?
500 mL (beginning amount) – 250 mL (2.5 hrs x 100 mL/hr) = 250 mL remaining

Example 2: Give 1000 mL at 125 mL/hr. Started at 0700. How much is remaining at 1100?
1000 – 500 (125 mL/hr x 4 hr) = 500 mL remaining

**Test Yourself**

1) Order: 10 units of regular insulin per hour. There are 50 units in 250 mL IV fluid. How many mL/hr should be infused?

2) IV infusing at 20 gtt/min. with DF of 60. How many hours will it take for 100 mL to infuse?

3) IV of 500 mL is to infuse at 60 mL/hr. a) How long will it take for this infusion to be complete? b) If the infusion were started at 2200, when would it be complete?

4) Infuse IV of 250 mL at 80 mL/hr. a) How long will it take to infuse? b) If the IV was started at 0200, when would the infusion be complete?

5) Infuse 500 mL at 75 mL/hr started at 0800. a) What time will the infusion be complete? b) How much will have infused at 0915? c) How much will be remaining at 1200?

6) An IV of 700 mL was begun at 1100 and is running at 100 mL/hr. a) What time will the infusion be complete? b) At 1300 the nurse notices there are only 300 mL left. What would be the new mL/hr to finish at the originally scheduled time?

7) An IV of 500 mL was ordered to infuse over 10 hr at a rate of 13 gtt/min with a DF of 15. After 3 hrs, you notice that 300 mL is left. What would be the recalculated rate in gtt/min for the remaining solution to complete on time?

**Answers**

1) 50 mL/hr
2) 5 hrs
3) a) 8 hrs 20 min; b) 0620
4) a) 3 hrs 7(or8) mins; b) 0507 or 0508
5) a) 1440; b) 112.5 mL; c) 200 mL
6) a) 1800; b) 60 mL/hr
7) 11 gtt/min
**Dosages Based on Weight**

Many pediatric medications are ordered based on body weight (kg). Once you know the kg weight, you calculate these the same way as other problems. Note: this applies to ANY problem you have that is weight based, not just pediatrics.

**Example 1:** Give 10 mg/kg of a medication. Patient weighs 90 kg.

\[
10 \text{ mg} \times \frac{90 \text{ kg}}{1 \text{ kg}} = 900 \text{ mg}
\]

**Example 2:** Give 7.5 mg/kg of a medication to a patient weighing 16 kg.

\[
7.5 \text{ mg} \times \frac{16 \text{ kg}}{1 \text{ kg}} = 120 \text{ mg}
\]

**Example 3:** Give 0.1 mg/kg to a patient weighing 160 lb. (Round to 10ths).

\[
0.1 \text{ mg} \times \frac{1 \text{ kg}}{2.2 \text{ lb}} \times \frac{160 \text{ lb}}{1 \text{ kg}} = 7.3 \text{ mg}
\]

I could have converted the lb to kg and then put into the problem:

\[
160\text{#/2.2kg} = 72.7 \text{ kg}
\]

\[
0.1 \text{ mg} \times 72.7 \text{ kg} = 7.3 \text{ mg}
\]

**Example 4:** Give 10 mg/kg of a medication to a patient weighing 32 kg. You have the medication available as 250 mg/2 mL. How many mg will you give? How many mL will you give? (Round to 10ths)

\[
10 \text{ mg} \times \frac{32 \text{ kg}}{1 \text{ kg}} = 320 \text{ mg}
\]

\[
\frac{320 \text{ mg}}{250 \text{ mg}} \times 2 \text{ mL} = 2.6 \text{ mL}
\]

**Example 5:** Give 3 mg/kg to a patient weighing 42 lb. You have available 30 mg/5 mL. How many mg will you give? (Round to 10ths) How many g will you give? (Round to 100ths) How many mL will you give? (Round to 10ths)

\[
3 \text{ mg} \times \frac{1 \text{ kg}}{2.2 \text{ lb}} \times \frac{42 \text{ lb}}{1 \text{ kg}} = 57.3 \text{ mg}
\]

\[
\frac{3 \text{ mg}}{1 \text{ kg}} \times \frac{42 \text{ lb}}{1 \text{ kg}} \times \frac{1 \text{ g}}{1000 \text{ mg}} = 0.06 \text{ g}
\]

I could have moved the decimal three spaces to the left (0.06) (rounded)

\[
\frac{57.3 \text{ mg}}{30 \text{ mg}} \times 5 \text{ mL} = 9.6 \text{ mL}
\]

**Example 6:** Give 2 mg/kg of Vistaril po to patient weighing 15 kg. You have Vistaril 50 mg/5 mL. How many mL will you give?

\[
\frac{15 \text{ kg}}{1 \text{ kg}} \times \frac{2 \text{ mg}}{50 \text{ mg}} \times 5 \text{ mL} = 3 \text{ mL}
\]
Note re: Pediatric calculations
Agency may require you to round DOWN for all pediatric doses; HOWEVER, for testing purposes at JSCC, you always follow the general principles of rounding and instructions in the question.

Range of Doses and Safe Dose

Ranges of doses mean you have an upper and a lower limit that is ordered or that is considered safe. Calculations are done exactly as before.

Example 1: The recommended dosage range for a child weighing 16 kg is 10 – 12 mg/kg. What is the recommended range?

    Lower dosage: 16 kg x 10 mg = 160 mg
    Upper dosage: 16 kg x 12 mg = 192 mg

Example 2: Administer 0.5 mg – 1.2 mg/kg of a medication to a child weighing 37.6 kg. What is the ordered dosage range?

    Lower dosage: 37.6 kg x 0.5 mg = 18.8 mg
    Upper dosage: 37.6 kg x 1.2 mg = 45.1 mg

Safe range of a medication just asks the question: Is the ordered dose within the calculated range?

In example 1 above, if the ordered dose was 250 mg, this would be considered unsafe because the range is between 160 mg and 192 mg. In example 2 above, if the recommended dose was 15 – 50 mg, this order would be considered safe.

Example 1: Give 500 mg of a drug to a patient weighing 56.8 kg. Recommended range is 3 – 6 mg/kg. What is the range of the dosage? Is this safe? Why or why not?

    Lower dosage: 56.8 kg x 3 mg = 170.4 mg
    Upper dosage: 56.8 kg x 6 mg = 340.8 mg

This is not safe, because the ordered dosage (500 mg) is outside of the recommended range of 170.4 mg – 340.8 mg.

Example 2: Give 10 mg of a drug every 8 hrs to a child weighing 23 kg. Recommended range is 0.8-2 mg/kg/day in 3 divided doses. You have available 20 mg/5 mL. What is the range/day? What is the range/dose? Is this safe?

    Lower dosage: 23 kg x 0.8 mg/day = 18.4 mg/day (6.1 mg/dose)
    Upper dosage: 23 kg x 2 mg/day = 46 mg/day (15.3 mg/dose)

This is safe because the ordered dosage (10 mg every 8 hrs [3 times/day] or 30 mg/day) is within the recommended range of 18.4-46 mg/day (6.1-15.3 mg/dose).
Test Yourself

1) Give 25 mg/kg to a patient weighing 190lb. How many g will you give? (Round to 10ths)

2) Give 30 mg/kg to a patient weighing 3500 g. How many mg will you give?

3) Give 2 mg/kg to a patient weighing 10 lb. How many mg will you give?

4) Give 180 mg po q 8 hrs to a patient weighing 10 lbs. The recommended dosage is 20-40 mg/kg/day. What is the actual recommended dosage (based on weight) ordered? Is this safe?

5) Give 60 mg q 8 hr to a child who weighs 60lb. The recommended dosage is 6-7.5 mg/kg/day in 3 divided doses. What is the actual recommended dosage (based on weight) ordered per day? Is this order safe?

6) (Based on question #5) You have 80 mg/2 mL. How many mL will you give per dose?

7) Valium 3.75 mg is ordered for a child weighing 33 lb. The recommended dosage is 0.2-0.5 mg/kg up to a maximum of 5 mg. What is the actual recommended dosage (based on weight) ordered? Is this safe?

8) (Based on question #7) The label on the vial read 5 mg/mL. How many mL will you give?

9) Give 75 mg q 12 hrs of a drug to a child weighing 40 kg. Recommended dosage is 6-10 mg/kg/day every 6 hours. What is the actual recommended ordered dosage (based on weight) per day? Is this safe?

10) Administer 7 mg/kg of Omnifig q 12 hrs to a child weighing 22 kg. Your bottle contains 100 mL with a concentration of 125 mg/5 mL. How many days will this bottle last? (round to whole number)

Answers

1) 2.2 g
2) 105 mg
3) 9 mg
4) 91 – 182 mg/day; (30.3 – 60.6 mg/every 8 hrs); No, this is not safe because the ordered dose of 180 mg every 8 hr is outside the range.
5) 163.6-204.5 mg/day; yes because the ordered dose per day is 180 mg, which is within the recommended range.
6) 1.5 mL
7) 3-7.5 mg; yes
8) 0.75 mL
9) 240 – 400 mg/day; no, because the ordered dose per day is 150 mg.
10) 8 days
Reading Drug Labels

CECLOR®
CEFACLOR FOR
ORAL SUSPENSION
USP
250 mg
per 5 mL
CAUTION—Federal (U.S.A.)
law prohibits dispensing
without prescription.

75 mL (When Mixed) M-5058

Lilly

Volume of solution in bottle

Trade or Brand name

Generic name

Concentration

Route

Dosage

How to store

Usual Dose—Children, 20 mg per kg a day (40 mg per kg in otitis media) in three divided doses. Adults, 250 mg three times a day. See literature for complete dosage information.

Contains Cefaclor Monohydrate equivalent to 3.75 g anhydrous Cefaclor in a dry pleasantly flavored mixture.

Prior to Mixing, Store at Controlled Room Temperature 59° to 86°F (15° to 30°C)

Directions for Mixing—Add 45 mL of water in two portions to the dry mixture in the bottle. Shake well after each addition.

Each 5 mL (Approx. one teaspoonful) will then contain:

Cefaclor Monohydrate equivalent to 250 mg anhydrous Cefaclor.

SHAKE WELL BEFORE USING. Overseize bottle provides extra space for shaking. Store in a refrigerator. May be kept for 14 days without significant loss of potency.

Keep Tightly Closed Discard unused portion after 14 days.

PROFESSIONAL PACKAGE NOT TO BE SOLD

WV 5041 AMX

Mfd. by Eli Lilly Industries, Inc.
Carolina, Puerto Rico 00985, a subsidiary of
Eli Lilly & Co., Indianapolis, IN, U.S.A.
Expiration Date/Control No.
Give: 250 mg po. How many mL? How many doses in the bottle? (10 mL; 7.5 doses)
Reconstitution

Reconstitution refers to adding a solution to a powder to change the vial of medication to a solution for injection. You will be given info about how much and what to inject into the vial to produce a specific concentration.

Example 1: Administer 100 mg of a medication IM now. The vial indicates to mix the powder (the medication) with sterile water (diluent) to obtain the following concentrations:

<table>
<thead>
<tr>
<th>Volume of Diluent</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 mL diluent = 200 mg/mL</td>
<td>100 mg/mL</td>
</tr>
<tr>
<td>4 mL diluent = 100 mg/mL</td>
<td>50 mg/mL</td>
</tr>
</tbody>
</table>

**NOTE:** the smaller the amount of diluent, the stronger the concentration

If we add 2 mL, our vial will contain 200 mg/mL. The order is to give 100 mg. How many mL will we administer?

\[
\frac{100 \text{ mg}}{200 \text{ mg}} \times 1 \text{ mL} = 0.5 \text{ mL}
\]

If we add 4 mL, our vial will contain 100 mg/mL. The order is to give 100 mg. How many mL will we administer?

\[
\frac{100 \text{ mg}}{100 \text{ mg}} \times 1 \text{ mL} = 1 \text{ mL}
\]

If we add 6 mL, our vial will contain 50 mg/mL. The order is to give 100 mg. How many mL will we administer?

\[
\frac{100 \text{ mg}}{50 \text{ mg}} \times 1 \text{ mL} = 2 \text{ mL}
\]

Notice the amount of diluent added is NOT figured in the problem. In other words, once you make the powder a solution, the concentration is the only thing you are concerned about.

Example 2: Add 2.6 mL of NS to a 3 mL vial of Metronide to yield 25 mg/mL. Administer 50 mg IM now. How many mL will you have in your syringe?

\[
\frac{50 \text{ mg}}{25 \text{ mg}} \times 1 \text{ mL} = 2 \text{ mL}
\]

Example 3: Administer 250 mg Isiporonol IM now. You have a vial of powder labeled 100 mg with instructions to add sterile water obtain these concentrations:

<table>
<thead>
<tr>
<th>Volume of Diluent</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 mL diluent = 100 mg/mL</td>
<td>75 mg/mL</td>
</tr>
<tr>
<td>2 mL diluent = 75 mg/mL</td>
<td>50 mg/mL</td>
</tr>
<tr>
<td>2.5 mL diluent = 50 mg/mL</td>
<td></td>
</tr>
</tbody>
</table>

Which of these concentrations would you use? Why did you choose that particular dilution?

If we add 1.5 mL, our vial will contain 100 mg/mL. The order is to give 250 mg. How many mL will we administer?

\[
\frac{250 \text{ mg}}{100 \text{ mg}} \times 1 \text{ mL} = 2.5 \text{ mL}
\]

If we add 2 mL, our vial will contain 75 mg/mL. The order is to give 250 mg. How many mL will we administer?

\[
\frac{250 \text{ mg}}{75 \text{ mg}} \times 1 \text{ mL} = 3.3 \text{ mL}
\]

If we add 2.5 mL, our vial will contain 50 mg/mL. The order is to give 250 mg. How many mL will we administer?

\[
\frac{250 \text{ mg}}{50 \text{ mg}} \times 1 \text{ mL} = 5 \text{ mL}
\]
Our choices are to administer 2.5 mL, 3.3 mL, or 5 mL. Since this is an IM injection, the best choice would be to dilute with 1.5 mL sterile water to administer 2.5 mL of medication. The other two choices are too much to be given IM in one injection.

Again note, the 1.5 mL, 2 mL, and 2.5mL were not used in the calculation of the problem to determine how much we would administer.

Another way to think about it: I want to eat some Cup-o-Soup but I must limit my sodium (Na) intake. The instructions are to add 8 oz of H2O which will yield 350 mg Na/oz. If I ate 3 oz of the soup, how many mg Na would I consume?

\[
\frac{350 \text{ mg Na}}{1 \text{ oz}} \times \frac{3 \text{ oz}}{} = 1050 \text{ mg Na.}
\]

Notice the 8 oz is NOT included in the problem.

Concentration is the only important number after reconstitution

**Test Yourself**

1) Add 0.6 mL of diluent to yield 15 mg/0.5 mL. You are to give 30 mg IM. How many mL will you give?

2) Give 450 mg of medication from a vial that is reconstituted with 3 mL of sterile water to yield 300 mg/mL. How many mL will you give?

3) Administer 250 mg of a medication from a vial that is reconstituted with 5 mL of normal saline to yield 50 mg/mL. How many mL will you give?

4) How much sterile water will you add to the bottle? If you had to administer 400 mg, how many mL will you administer? (round to 10ths)
5) How much water will you add to the bottle? You must administer 250 mg. How many mL will you give?

1) 1 mL  
2) 1.5 mL  
3) 5 mL  
4) 2 mL H20; 1.8 mL  
5) 55 mL of H20; 10 mL

**Titration**

Titration means an order will be given to change dosage based up patient condition or situation. This means you have to calculate more than one dosage, BUT IT IS SET UP THE EXACT SAME WAY.

Example 1: Administer 300 mg of Drug X in 500 mL NS at 10 mcg/min as an initial dose. *Increase the rate by 2 mcg/min every hour until BP is stable.* How many mL/hr is the initial dose? How many mL/hr is the next possible dose (additional 1 mcg/min)? (**tenths**)

$$\frac{500 \text{ mL}}{300 \text{ mg}} \times \frac{1 \text{ mg}}{10 \text{ mcg}} \times \frac{10 \text{ mcg}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}} = \text{1 mL/hr}$$

This is our initial rate

If we titrate the medication by 2 mcg/min (add 2 mcg to the current 10 mcg), we will give

$$\frac{500 \text{ mL}}{300 \text{ mg}} \times \frac{1 \text{ mg}}{1000 \text{ mcg}} \times \frac{12 \text{ mcg}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}} = \text{1.2 mL/hr}$$

This is our next possible flow rate
Example 2: Administer Pitocin (1mL = 10 mU) to start at 1 mU/min. Increase by 1 mU/min q 15 mins to a max of 10 mU/min. What is the initial pump setting? **Assuming the rate is increased consistently as described,** how many mL will the pump be set at after infusing for 1-1/2 hours? How long after the initiation of the infusion will the maximum be reached?

\[
\frac{1 \text{ mL}}{10 \text{ mU}} \times \frac{1 \text{ mU}}{1 \text{ min}} \times 60 \text{ min} = 6 \text{ mL}
\]

This is our initial rate

Let's build a **titration table** to calculate the next answers.

<table>
<thead>
<tr>
<th>Time</th>
<th>Dosage Rate</th>
<th>Flow Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>1 mU/min</td>
<td>6 mL/hr</td>
</tr>
<tr>
<td>00:15</td>
<td>2 mU/min</td>
<td>12 mL/hr</td>
</tr>
<tr>
<td>00:30</td>
<td>3 mU/min</td>
<td>18 mL/hr</td>
</tr>
<tr>
<td>00:45</td>
<td>4 mU/min</td>
<td>24 mL/hr</td>
</tr>
<tr>
<td>1 hr</td>
<td>5 mU/min</td>
<td>30 mL/hr</td>
</tr>
<tr>
<td>1:15</td>
<td>6 mU/min</td>
<td>36 mL/hr</td>
</tr>
<tr>
<td>1:30</td>
<td>7 mU/min</td>
<td>42 mL/hr</td>
</tr>
<tr>
<td>1:45</td>
<td>8 mU/min</td>
<td>48 mL/hr</td>
</tr>
<tr>
<td>2 hrs</td>
<td>9 mU/min</td>
<td>54 mL/hr</td>
</tr>
<tr>
<td>2:15</td>
<td>10 mU/min</td>
<td>60 mL/hr</td>
</tr>
</tbody>
</table>

After 1-1/2 hours, the pump will be delivering 42 mL/hr (7 mU/min). The maximum rate will be reached at 2 hrs 15 minutes after initiation, **assuming steadily increase as ordered.**

**Comprehensive Post test**

1. You have drug 0.25 mg tablets. You need to give 0.75 mg. How many tabs will you give?

2. You have 250 mg capsules. Doctor orders 1 g. How many caps will you give?

3. A dosage of 25mg has been ordered. The solution strength available is 12.5mg in 1.5 mL. How many mL will you give? (whole #)

4. A dosage strength of 1000 units per 1.5mL is available. Prepare a 1250 unit dosage. How many mL will you give? (tenths)

5. The strength available is 80mEq per 5mL. Prepare 30 mEq. How many mL will you give? (tenths)

6. A dosage of 10mg has been ordered. You have available a strength of 4000 mcg/5mL. How many mL will you give? (tenths)
7. An IV of 750 mL is to infuse in 8 hr using a 10gtt/mL set. How many gtt/min?

8. Infuse 500 mL in 3 hr using a 15 gtt/mL set. How many gtt/min?

9. Deliver 30 mL over 5 min. How many mL/hr? (whole #)

10. Give 150 mL in 20 min. Set delivers 10 gtt/mL. How many gtt/min?

11. Give Rocephin 1 g in 75 mL of 0.9% saline over 30 minutes. How many mL/hr? (whole #)

12. IV 1000 mL infusing at 75 mL/hr. Started at 1500. a) How many mL have infused at 2300? b) How many mL are remaining?

13. Your patient weighs 60.2 kg. You are to administer 5mg/kg/day in 2 divided doses. a) How many mg per day? (whole #) b) How many mg per dose? (tenths)

14. Give 12 mU/min of a medication. Your IV bag has 10 units in 500 mL. How many mL/hr will you give? (whole #)

15. The patient is receiving lidocaine at 40 mL/hr. The concentration of this drug is 1 g/500 mL of IV fluid. How many mg/min is the patient receiving? (tenths)

16. Administer 50 mg SQ of medication. You have a powered vial labeled 100 mg with instructions to dilute with normal saline to obtain the following concentrations: 1 mL = 50 mg/mL; 1.5 mL = 37.5 mg/mL; 2 mL = 25 mg/mL.

   a) How many mL of NS will you use? b) How many mL will you administer? (whole #)

17. The order is for Tegopen (cloxacillin) oral suspension 600 mg po q 6 hrs. You have Tegopen 125 mg/5 mL, with a recommended dose of 12.5 mg – 25 mg/kg/q6hrs. Child weighs 40 kg.
   a) What is the range of recommended dosage per dose in mg? b) Is this safe to give? c) If so, how many mL/dose will you administer? (whole #)

18. Give Streptomycin sulfate 600 mg IM daily to a child weighing 35 kg. The recommended dosage is 10-15 mg/kg/day once daily. a) What is the range of recommended dosage per dose in mg? b) Is this safe to give?
19. Give 750 mg po now. How many mL will you give?

20. Give 1.5 g nafcillin. How many mL will you give?

Answers

1) 3 tabs
2) 4 caps
3) 3 mL
4) 1.9 mL
5) 1.9 mL
6) 12.5 mL
7) 16 gtt/min
8) 42 gtt/min
9) 360 mL/hr
10) 75 gtt/min
11) 150 mL/hr
12) a) 600 mL; b) 400 mL
13) a) 301 mg/day; b) 150.5 mg/dose
14) 36 mL/hr
15) 1.3 mg/min
16) a) 1 mL NS; b) 1 mL administered
17) a) 500-1000 mg; b) yes; c) 24 mL/dose
18) a) 350 – 525 mg; b) no too high
19) 15 mL
20) 6 mL
Medical Terminology Basics

The following are terms/abbreviations that are essential for you to know and recognize. This is not a comprehensive list, you will continue to learn medical terminology throughout the program. You will find these items on exams and used in the clinical setting. It is wise to study this sheet and become familiar with common terms you will use as you progress through the program.

<table>
<thead>
<tr>
<th>Prefixes</th>
<th>Root Words</th>
<th>Suffixes</th>
</tr>
</thead>
<tbody>
<tr>
<td>a = without</td>
<td>Cephal/o = head</td>
<td>-ectomy = surgical removal</td>
</tr>
<tr>
<td>bi = two</td>
<td>Rhin/o = nose</td>
<td>-gram = record or picture</td>
</tr>
<tr>
<td>dys = abnormal, difficult, painful</td>
<td>Hepat/o = liver</td>
<td>-itis = inflammation</td>
</tr>
<tr>
<td>inter = between</td>
<td>Gastr/o = stomach</td>
<td>-logy = study of</td>
</tr>
<tr>
<td>post = after</td>
<td>My/o = muscle</td>
<td>-megaly = enlarged</td>
</tr>
<tr>
<td>sub = under, beneath</td>
<td>Oste/o = bone</td>
<td>-pathy = disease</td>
</tr>
<tr>
<td>hypo = below, insufficient</td>
<td>Arthr/o = joint</td>
<td>-osis = abnormal condition</td>
</tr>
<tr>
<td>hyper = excessive</td>
<td>Crani/o = skull</td>
<td>-plasty = surgical repair</td>
</tr>
<tr>
<td>supra = above</td>
<td>Muscul/o = muscle</td>
<td>-emesis = vomiting</td>
</tr>
<tr>
<td>brady = slow</td>
<td>Pulmon/o = lung</td>
<td></td>
</tr>
<tr>
<td>Tachy = fast</td>
<td>Pneum/o = lung/air</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cyst/o = bladder</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nephr/o = kidney</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ren/o = kidney</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hem/o= blood</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hemat/o = blood</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Neur/o = nerve</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ot/o = ear</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ophthalm/o = eye</td>
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</tr>
</tbody>
</table>

For example:
Cardio = heart, logy = study of  → Cardiology is the “study of the heart”
Myo = muscle, gram = record or picture  → Myogram is a record or picture of a muscle