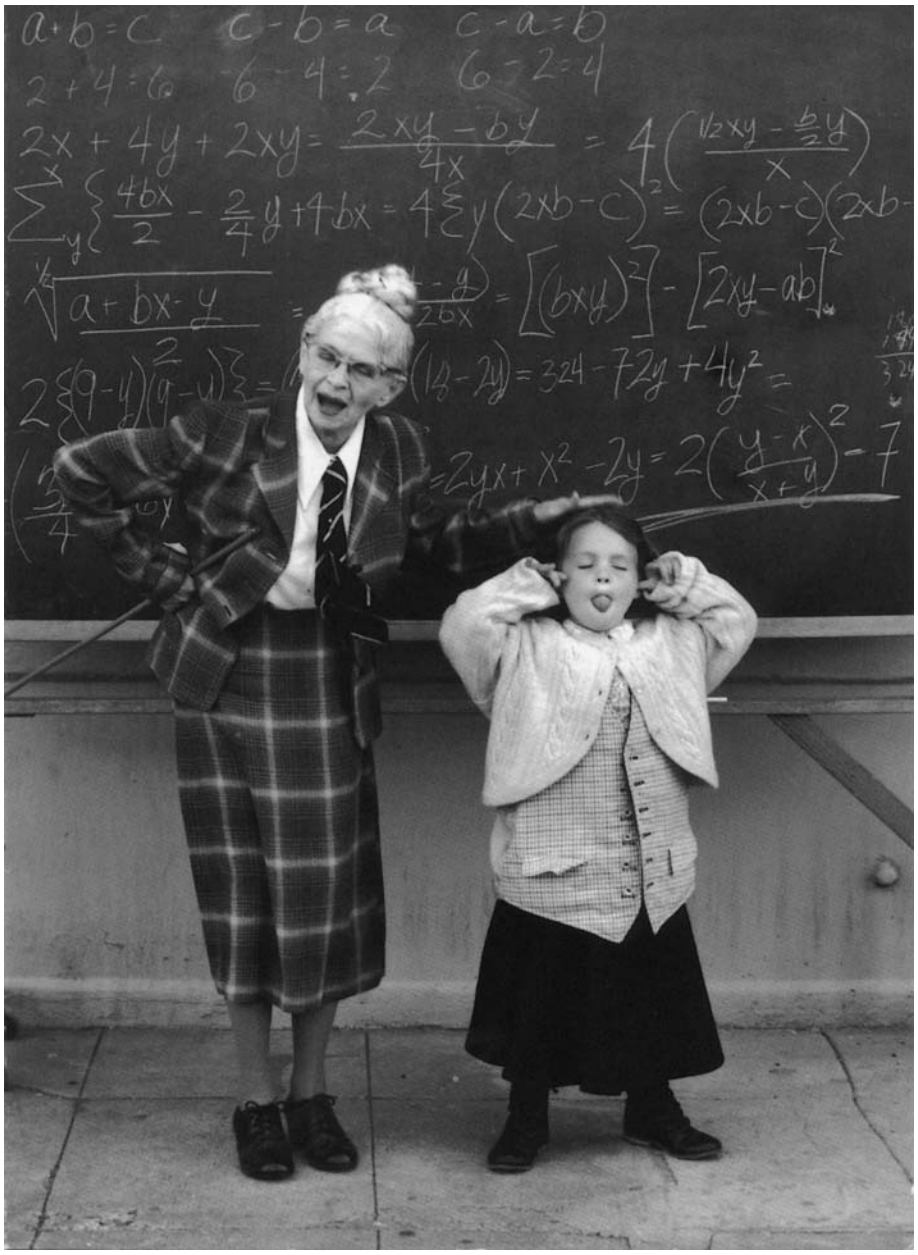
Department of Veterans Affairs

RN Dosage Calculation Study Guide



Minneapolis VA Medical Center

VA Midwest Health Care Network

Unit 1
Metric Conversions
Study sheet RN and LPN

Medications are measured in one of these 6 metric units:

Measures of weight:	Measures of Volume:
kg (kilogram)	
gm or g (gram)	ml (milliliters) or cc (cubic centimeters)
mg (milligram)	these are interchangeable
mcg or µg(microgram)	L (liter)

Note: the unit mEq (milliequicalents) is a chemical, not a metric, unit of measure.

Metric conversion is used when the 2 parts of a problem are stated in different metric units. For example:
The doctor ordered Atropine 400 **mcg** IM.
The bottle reads Atropine .4 **mg** per ml.

To calculate how much to give, you must first convert mcg to mg OR mg to mcg. In other words, the two units of measure must match.

To convert the units you need to know the following equations:

Weight	Volume
1mg = 1000 mcg	1000ml = 1 L
1gm = 1000 mg	
1 kg = 1000 gm	

The metric system is a decimal system. Note that for all of the equations used, only the numbers 1 and 1000 are used. To convert, you multiply or divide by 1000. This can be done by simply moving the decimal point.

To convert from a smaller unit to a larger unit, you divide by 1000 or move the decimal point 3 spaces to the LEFT. For Example.

1500 mg = _?_ gm **OR** Move the decimal point:
1500 mg ÷ 1000 = 1.5 gm 1.500

To convert from a larger unit to a smaller unit you multiply by 1000 or move the decimal point 3 places to the right. For example:

2 gm = _?__ mg move the decimal point:
2 gm x 1000 = 2000 mg **OR** 2.000

Now try a few conversions:

1. 0.5 gm = _____ mg
2. 500 ml = _____ L
3. 600 mg = _____ gm
4. 5 mcg = _____ mg
5. 100 mg = _____ gm
6. 400 mcg = _____ mcg
7. 400 mcg = _____ mg
8. .3 gm = _____mg
9. 0.25 gm = _____ mg
10. 500 mcg = _____ mg
11. 5 mcg = _____ mg
12. 0.5 L = _____ ml
13. 100 mcg = _____ mg
14. 1000mcg = _____ mg
15. 5.5 mg = _____ gm
16. 25mg = _____ gm
17. 0.05 gm = _____ mg
18. 0.2 mg = _____ mcg

Memory tip: when converting **to** a **L**arger unit, move decimal **L**eft (both start with L)
When converting **to** a smaller unit, move decimal right.

Answers:

1. 500mg
2. .5 L
3. .6 gm
4. .005 mg
5. .1 gm
6. 400,000 mcg
7. .4 mg
8. 300 mg
9. 250 mg
10. .5 mg
11. .005 mg
12. 500 ml
13. .1 mg
14. 1 mg
15. .0055 gm
16. .025 gm
17. 50 mg
18. 200 mcg

Unit II
Dosage Calculation
Study Sheet RN and LPN

A simple proportion formula can be used to calculate any dosage.

This formula will work every time, with all forms of medication, if set up correctly.
Always follow these steps:

1.) Set up the proportion: Put what you know on the left of the equal sign (=) and what you need to know on the right of the equal (=) sign.

For example: You know a medication comes in 250 mg tablets, and want to give 750 mg. To find out how many tablets to give, the set up is:

YOU KNOW		*YOU WANT*
250 mg		750 mg
1 tablet	=	X tablets

2.) Cross multiply: Multiply the numerator of each side by the denominator of the other side.

$$\frac{250 \text{ mg}}{1 \text{ tablet}} = \frac{750 \text{ mg}}{X \text{ tablets}} \qquad \text{which is} \qquad 250 \cdot X = 750$$

3.) Isolate X: Divide both sides of the equation by the number on the "X" side.

$$\frac{250\,X}{250} = \frac{750}{250}$$

$$X = \frac{750}{250}$$

4.) Solve for X: Divide the numbers on the right side of the equation.

X = 750 divided by 250

X = 3 tablets therefore, give 3 tablets

Note: A proportional formula is only used when the answer is not readily apparent. Obviously, this one could have been done "in your head".

Let's try another. A liquid medication comes in 30 mg per 5 ml. You want to give 300 mg.

1.) Set up proportion:

YOU KNOW		*YOU WANT*
$\frac{30 \text{ mg}}{5 \text{ ml}}$	=	$\frac{300 \text{ mg}}{X \text{ ml}}$

2.) Cross multiply:

$30X = 300 \cdot 5$

$30X = 1500$

3.) Isolate X:

$$\frac{30X}{30} = \frac{1500}{30}$$

$$X = \frac{1500}{30}$$

4.) Solve for X:

$X = 1500 \div 30$

$X = 50$ therefore, give 50 ml

Now try some on your own. You may have to do metric conversion first (see Unit I), to be sure the units of measure match.

1.) The order is for .25 mg of Digoxin. You have an ampule labeled 500 mcg per 2 ml. How many ml's will you give ?

2.) The order is for Dilantin liquid 150 mg per NG tube. You have a bottle with 30 mg per 5 ml. How many ml's will you give?

3.) The order is for 50 mg of a drug. The dose available in stock is 25 mg. How many tablets will you give?

4.) The order is for 15 mEq of KCl per NG tube. The bottle contains 20 mEq per 15 ml. How many ml's will you give?

5.) The order is for 500 mg of a drug. The dose available is 200mg per 10 ml. How many ml's will you give?

6.) The order is for Prednisone 12.5 mg. You have 2.5 mg tablets of Prednisone. How many tablets will you give?

7.) The order is for Lactulose 25 gm. The bottle contains 10 gm. per 15 ml. How many ml's will you give?

8.) The order is for Digoxin 250 mcg. You have tablets of 0.25 mg of Digoxin. How many tablets will you give?

Answers:
1. 1ml 3. 2 tablets 5. 25ml 7. 37.5 ml
2. 25ml 4. 11.25 ml 6. 5 tablets 8. 1 tablet

Unit III
Dosage Calculations for Injectables
Study Sheet RN and LPN

The proportional formula found in Unit II works just the same for injectable drug calculations. Here's an example: 8 mg of morphine is ordered. You have a supply of 10 mg per ml morphine.

1.) Set up proportion: $\frac{10\text{ mg}}{1\text{ ml}} = \frac{8\text{ mg}}{X\text{ ml}}$

2.) Cross multiply: $10X = 8$

3.) Isolate X: $\frac{10X}{10} = \frac{8}{10}$ $\qquad X = \frac{8}{10}$

4.) Solve for X: $X = 8 \div 10$ $\qquad X = .8$ ml

If you have an injectable powdered drug to which you are going to add a diluent, the directions on the vial tell you how much diluent to add. The vial will also state the concentration of the drug after the diluent is mixed. It is this concentration that is used in the proportional formula for dosage calculation. The amount of diluent added does not figure into the dosage calculation.

For example: The order is for 1 gm of Cefadyl (Cephapirin). The directions on the vial read: "Add 2 ml sterile water for injection. Each 1.2 ml contains 500 mg. of cephapirin. How many ml's do you give?

First, convert 500 mg to .5 gm, so that the units match.

Then set up the proportion, and solve, using the concentration given on the vial.

$$\frac{.5\text{ gm}}{1.2\text{ ml}} = \frac{1\text{ gm}}{X\text{ ml}}$$

$$.5X = 1.2$$

$$X = 2.4\text{ ml}$$

Here are some practice problems for injectable dosage calculation.

1.) The order is for 2 gm of the drug. The vial reads: Add 8.6 ml of diluent to contents of vial. Each ml will contain 500 mg. How many ml's will you give?

2.) You have an ampule of Digoxin labeled 500 mcg/2 ml. The order is for .25 mg of Digoxin. How many ml's will you give?

3.) The order is for Haloperidol 2 mg. It is supplied in a 5 mg/ml vial. How many ml's will you give?

4.) The order is for 0.5 gm Amoxicillin. The directions read: Add 3.5 ml of diluent. Resulting solution contains 250 mg Amoxicillin per ml. How many ml's will you give?

5.) The order is for naloxone (Narcan) 0.3 mg. The cartridge is labeled 0.4 mg/ml. How many ml's will you give?

6.) The order is for furosemide (Lasix) 20 mg. The vial is labeled 100mg/10 ml. How many ml's will you give?

7.) The order is for penicillin G 300,000 U. The vial directs you to add 4.2 ml of normal saline to make a concentration of 3 million units per 5 ml. How many ml will you give?

Answers:
1. 4 ml
2. 1 ml
3. .4 ml
4. 2 ml
5. .75 ml
6. 2 ml
7. .5 ml

Unit IV
Calculation of IV Drip Rates
Study Sheet RN

When you calculate the IV drip rate, you are calculating the **number of drops per minute** at which you will administer IV fluids.

To do this calculation you need three pieces of information. They are:

A. VOLUME (in ml or cc)

B. DROP FACTOR OF THE IV TUBING (found on tubing package)

C. TIME TO RUN (In minutes, for the volume being administered)

Using these three numbers, the formula for calculating the drip rate is:

$$\frac{\text{A. (VOLUME)} \bullet \text{B. (DROP FACTOR)}}{\text{C. (MINUTES for above volume to run)}} = \text{DROPS PER MINUTE}$$

Most tubing used at the MVAMC have drop factors of either:
15 drops/ml: "macrodrip" or "regular" tubing
60 drops/ml: "minidrip" tubing
Always check the drop factor on the tubing package.

EXAMPLES:

A. The IV order is for D_5W to run at 125 ml/hour.
Using regular macrodrip tubing, the problem is set up as follows:

$$\frac{125 \text{ (volume)} \bullet 15 \text{ (tubing drop factor)}}{60 \text{ (minutes)}} = \frac{1875}{60} = 31+ \text{ drops/minute}$$

OR if you reduce the numbers: $\frac{125 \bullet \cancel{15}^{1}}{\cancel{60}_{4}} = \frac{125}{4} = 31+ \text{ drops/minute}$

B. The hourly rate of the IV is 90 ml. Using minidrip tubing:

$$\frac{90 \cdot 60}{60} = \frac{5400}{60} = 90 \text{ drops/min} \quad \text{OR} \quad \frac{90 \cdot \cancel{60}^{1}}{\cancel{60}_{1}} = 90$$

Note that in this example, you are taking an hourly volume of 90, multiplying by 60 and then dividing the product by 60, which is unnecessary. When using an **hourly** volume and **minidrip** tubing, the hourly volume and the drops per minute are the same.

C. You are to give Amikacin 1 gm in 50 ml D_5W with minidrip tubing to run over one hour.

$$\frac{50 \cdot 60}{60} = 50 \text{ drops per minute} \quad \text{OR} \quad \frac{50 \cdot \cancel{60}^{1}}{\cancel{60}_{1}} = 50$$

As noted in example "B", the drops per minute and the ml per hour are the same.

D. However, if your were to run the previous piggyback in 30 minutes, your calculation would change to:

$$\frac{50 \cdot 60}{30} = \frac{3000}{30} = 100 \text{ drops/min} \quad \text{OR} \quad \frac{50 \cdot \cancel{60}^{2}}{\cancel{30}_{1}} = 100$$

Remember to always adjust the minutes to the time ordered.

Now try a few on your own:

1. The order is for 1000 ml of D_5½NS with 20 mEq KCl to run over 8 hours.

   a. The hourly rate for this IV is _____ .

   b. Using macrodrip tubing (15 drops/ml), the drip rate is _____ .

   c. If you used minidrip tubing (60 drops/ml), the drip rate is _____ .

2. The order is for 1 liter of D_5NS to run over 10 hours.

   a. The hourly rate is _____ .

   b. Using regular tubing (15 drops/ml), the drip rate is _____ .

   c. Using minidrip tubing (60 drops/ml), the drip rate is _____ .

3. The order is for Vancomycin 1000 mg, diluted in 250 ml of NS. You want to run this piggyback over 2 hours.

   a. Using regular tubing, the drip rate is _____ .

   b. If you use minidrip tubing, the drip rate is _____ .

4. 250 ml of packed red blood cells (PRBC's) is to run over 3 hours. The blood tubing delivers 15 drops per ml. The drip rate is _____ .

5. An IVPB of Ceftizoxime 1 gm in 50 ml of NS is to run in 30 minutes. If you use minidrip tubing, the drip rate is _____ .

6. If the IVPB in #5 were to run over 20 minutes, the drip rate is _____ .

Part 2: Drip Rate Calculation for Medication by Continuous IV Infusion

Medications that are administered by continuous IV infusion include heparin and morphine.
The medications are ordered in an hourly rate of units or milligram. For example :

"heparin 1100u/hour" "morphine sulfate IV 3 mg/hour"

Calculating the drip rate that will deliver the prescribed hourly rate of medication requires two steps: calculating the concentration of drug and calculating the drip rate.

STEP ONE: Calculating the concentration
Pharmacy labels the IV bag with the total amount of medication in the bag. Calculating the concentration means you are finding out the amount of medication in each ml. It is calculated by setting up a proportional formula as follows:

YOU KNOW		*YOU WANT TO KNOW*
$\frac{\text{Total mg or units in bag}}{\text{ml in bag}}$	=	$\frac{\text{X mg or units}}{\text{1 ml}}$

Then solve for "X", which will be the concentration, or amount of medication per ml.
Review Unit II of this packet for the steps in solving for "X".

EXAMPLES OF STEP ONE:

A. Heparin infusion is premixed at 25,000 units in 500 ml of D_5W.
To calculate the concentration, set up the proportion:

$$\frac{\text{25,000 units}}{\text{500 ml}} = \frac{\text{X units}}{\text{1 ml}}$$

Cross multiply: $500\ X = 25{,}000$

Solve for X: $25{,}000 \div 500 = 50$ units per ml

B. Morphine sulphate is mixed in one of three concentrations:

250 mg. morphine in 250 ml of D_5W
250 mg. morphine in 500 ml of D_5W
250 mg. morphine in 1000ml of D_5W

To calculate the concentration for a 500 ml bag with 250 mg of morphine, set up the proportion:

$$\frac{250 \text{ mg}}{500 \text{ ml}} = \frac{X \text{ mg}}{1 \text{ ml}}$$

Cross multiply: $500 X = 250$

Solve for X: $250 \div 500 = .5$ mg per ml

STEP TWO: Calculating the rate (ml per hour). This is the rate at which the infusion pump is set. These medications are always infused through a pump to ensure accuracy of rate.
This calculation is also set up as a proportion:

YOU KNOW (from step one) *YOU WANT*

$$\frac{\text{\# of units or mg}}{1 \text{ ml}} = \frac{\text{\# of units or mg ordered per hour}}{X \text{ ml per hour (set pump at this rate)}}$$

EXAMPLES OF STEP TWO:

A. From example A above you know the concentration is 50 units of heparin in 1 ml. The order is for 1100 units per hour. To calculate the rate (ml per hour), set up the proportion:

$$\frac{50 \text{ u}}{1 \text{ ml}} = \frac{1100 \text{ u}}{X \text{ ml per hour}}$$

Cross multiply: $50 X = 1100$

Solve for X: $1100 \div 50 = 22$ ml per hour

B. From example B above you know the concentation of morphine is .5 mg in 1 ml. The order is for 3 mg per hour. To calculate the rate (ml per hour), set up the proportion:

$$\frac{.5 \text{ mg}}{1 \text{ ml}} = \frac{3 \text{ mg}}{X \text{ ml per hour}}$$

Cross multiply: $.5 X = 3$

Solve for X: $3 \div .5 = 6$ ml per hour

Try a couple on your own:

7. The order is for morphine by continuous infusion at 4 mg per hour. The pharmacy sends a 500 ml bag of D_5W with 250 mg of morphine.

   a. How much morphine is in each ml?

   b. To deliver 4 mg an hour, the IV pump will be programmed at _____ ml per hour.

8. The order is for Heparin 1300 u per hour. The pharmacy sends a 500 ml bag of D_5W with 25,000 units of heparin.

   a. How much heparin is in one ml?

   b. How many ml per hour will you give to deliver 1300 u per hour?

   c. The dose is changed to 1150 u per hour. What rate will deliver this dose?

Answers:

1. a. 125 ml/hr
   b. 31 drops
   c. 125 drops
2. a. 100 ml/hr
   b. 25 drops
   c. 100 drops
3. a. 31 drops
   b. 125 drops
4. 21 drops
5. 100 drops
6. 150 drops
7. a. .5 mg/ml
   b. 8 ml/hr
8. a. 50 u/ml
   b. 26 ml/hr
   c. 23 ml/hr

Unit V
Gastric Replacement
Study Sheet RN

Patients with nasogastric suction (NG) tubes in place frequently have orders to replace the gastric output at regular intervals with IV fluids. NG replacement is done every 2, 4 or 8 hours, and output is replaced "cc for cc" or "½ cc for cc".

The output in the canister is measured at the ordered intervals. All fluids or liquid medications that were administered into the tube are subtracted from the output, so that only the true amount of output is replaced. Usually, a separate IV bag is used to administer the replacement.

EXAMPLES:

A. The order is: Replace NG output cc for cc with D_5½NS every 2 hours.

After 2 hours, the NG canister contains 175 cc. You would administer 175 cc IV fluids.

B. The order is: Replace NG output ½ cc for cc with NS every 4 hours.
Mylanta 30 cc q 2 hours.

After 4 hours, the NG canister contains 100 cc, and you have given Mylanta 30 cc twice.
Take the 100 cc, subtract 60 cc for the Mylanta, and divide by 2 (for ½ cc for cc replacement).

100 - 60 = 40 40 ÷ 2 = 20 cc

You would administer 20 cc replacement.

C. The order is: Replace NG output cc for cc with D_5W every 4 hours
Irrigate NG tube q 2 hours with 60 cc NS.

After 4 hours, the NG canister contains 250 cc. You have irrigated the NG tube twice with 60 cc NS, and aspirated and discarded 20 cc each time. Calculate the replacement.

First, subtract the amount you discarded from the total you gave through the NG tube.

120 cc - 40 cc = 80 cc.

Then, take the 250 cc output and subtract the 80 cc to obtain the true output.

250 cc - 80 cc = 170 cc. This is the amount you replace.

Try a few on your own:

1. The order is: Replace NG output cc for cc with D_5W every 4 hours.
Give Mylanta 30 cc q 2 hours.

After 4 hours, there is 325 cc in the canister. The patient has received Mylanta twice followed by a 30 cc saline flush each time to clear the tube. How much replacement do you give?

2. The order is: Replace NG output ½ cc for cc with D_5NS every 2 hours.
Irrigate tube with 30 cc NS every hour.

After two hours, there is 100 cc in the canister. The tube has been irrigated twice with 30 cc NS and 10 cc has been aspirated and discarded with each irrigation. How much IV replacement do you give?

3. The order is: Replace NG output cc for cc with NS every 4 hours.
Mylanta 30 cc per NG q 2 hours.
Irrigate NG q 2 hours with 60 cc NS.

Since the last replacement was done at 9 am, you have irrigated the tube twice, aspirating and discarding 40cc each time, and have given Mylanta twice. At replacement time, there is 275 cc of drainage in the canister. How much do you replace?

Answer:

1. 205 cc
2. 30 cc
3. 175 cc

Notes