Essential Rules and Guidelines to
Basic Medication Dosage Calculations

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Developed Spring 2014
I. Introduction
Periodically student nurses, from both the ADN and LPN programs, have questioned the rationale behind the need to be proficient at medication dosage calculations. The reasoning is quite simple: patient safety. Medication administration is one of the primary roles of all nurses. Although medication calculations errors are not the only concern, research over the last several decades has established incorrect dosage calculations as a major source of medication errors causing patient injury or death. This is why medication calculation questions are present on both the LPN and RN NCLEX exams.

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) has had safe medication administration as a National Patient Safety Goal for many years. While there have been improvements in medication administration safety this goal continues to remain at the top of JCAHO’s list of a broad range of safety initiatives.

Currently, systems that scan the medication and the patient prior to medication administration have helped reduce the number of errors by indicating the drug, strength, and the amount to administer. But what if the scanning system is not functioning?

Most medical facilities provide unit dose medications specific for the patient. However, medication dosage orders may be written in one unit of measure while the pharmacy may dispense the prescription in a different unit of measure. The nurse must be able to calculate if the amount on the drug labeling is the same as what is ordered?

Most long-term care facilities provide pre-printed medication administration records (MAR). Each medication ordered indicates the amount of the medication in tablets, capsules, milliliters, and so on to be administered with each dose. But, what about medication orders written after change over each month?

Furthermore, though many facility computer systems have dose calculators available, there are circumstances when those resources may not be accessible.

Passing medication calculations exams may require getting only 90% of test problems correct, but coming up with the right answer only nine out of ten times is not good enough when real patients are at risk. The nurse is the patient’s last line of defense against receiving an inappropriate dose of medication. Thus, the ability to calculate the dosage of medications accurately is fundamental to safe nursing practice in any clinical setting.

This tutorial is written for the student nurse beginning the journey of nursing education and for those students who are already a member of the nursing profession and just need a review of how to calculate medications. What is contained in this tutorial comes from available resources and experience in clinical practice. It is meant to assist the student nurse in determining the correct dosage of medications. It is imperative this information be taken seriously and practiced until there is a complete understanding of how to calculate medication dosages accurately.
Medication calculations are simple math problems consisting, primarily, of addition, subtraction, multiplication, and division. Thus, this tutorial presumes the individual student’s ability to work simple mathematical calculations and contains practice problems at the end of each section in order to further familiarize the student with what was just presented in that section. But, before looking at how to calculate medication dosages there are several fundamental rules that are absolutely essential to know and follow when calculating medication dosages.
II. Medication Calculations Guidelines

a. Find a formula comfort level with one formula and stick to it.
   There are multiple formulas that can be utilized to reach the same answer. Become comfortable with one and stick to it.

b. It is acceptable to use a calculator.
   However, while in nursing school it is unacceptable to use a calculator on a phone device.

c. It is always, always, always acceptable to utilize a colleague or a pharmacist to assist in double checking the calculation if unsure (except in class).
   It is better to have someone check to make sure the calculation than place the patient in jeopardy, particularly if the medication calculation is complex.

d. Does my answer make sense with the information provided? If the answer is no, recheck the calculation. If still unsure ask a colleague or pharmacist for assistance.

e. Always show your work and label everything in the appropriate units. It is difficult to help if there is nothing to establish where possible miscalculations may be.

f. Memorize equivalents and conversions
   There is no way around it; memorize the equivalents and conversions.

g. Always convert the desired dose to the available unit of measurement. When doing calculations, it is essential that the calculations are done in the same unit of measurement.
   - Example: Ordered 0.5 grams. Medication available in mg strength. Convert 0.5 mg to 500 mg

h. Per JCAHO medication safety guidelines. When writing fractional decimal numbers always include a leading zero if the answer is less than a whole number.
   - Example: 0.2
     Do not leave any trailing zeros to the right.
   - Example: 0.20 is INCORRECT
     0.2 is correct
i. **Units of measure must be included in answers.** The answer informs the amount of what is being administered. But the units state the what; mg, mL, mcg. That information is just as important as the amount calculated.

III. **Rounding Rules in Medication Calculations** (These Rounding Rules are a requirement for you to know in testing and nursing practice.)

a. If the number to the right of the desired place is equal to or greater than 5, round up by adding 1 to the number in the desired place.

   Example: 3.56 rounds to 3.6.

b. If the number to the right of the desired place is less than 5, round down by dropping the number to the right of the desired place.

   Example: 3.54 rounds to 3.5

c. **Only round the final answer. Do not round in the middle of the calculation.**
   Rounding in the middle of the calculation can make a significant difference in the answer, particularly when working in small amounts. The only exception to this is when converting weights. Always convert weights and round as appropriate before performing the medication calculation.

d. **Use whole numbers and/or fractions (i.e., ½ or ¼) with tablets. Use only whole numbers with capsules.**
   - Examples: 1 tablet
     1½ tablet
     2 Capsules
   i. **Only scored tablets may be divided.** Otherwise round tablets to the nearest whole tablet.
   ii. **Capsules must be administered intact unless formulated to be opened.**
       An example is depakote sprinkles. They are capsules that can be given whole or opened. If unsure, always check with the pharmacist.

e. **Weights** - When converting body weight from pounds (lbs) to kilograms (kg), calculate to hundredths and round to tenths.
   - Examples: 8.27 kg = 8.3 kg
     9.96 kg = 10 kg
     14.22 kg = 14.2 kg.
f. **Fluid Volume**
   i. If final volume is less than 1 mL, calculate to thousandths and round to hundredths
      - **Use a Tuberculin syringe which is calibrated in hundredths**
   ii. If the final volume is greater than 1 mL, round all fluid measurements to tenths
      - **Use a 3cc or larger syringe which is calibrated in tenths**

g. **IV flow rates**
   i. Using an IV pump (mL/hour)
      - **Round to the whole number.** Most maintenance and piggy back IV fluids are normally infused in whole number rate in mL/hour.
   ii. Using drip rate (gtt/min)
      - **Round to the nearest whole number** (Drops cannot be fractionated)

h. When calculating weight-based dosage (i.e., mg/kg or mcg/kg, etc.), round the weight (see III e) but do not round the dose calculation until the final result. Round only at the end of the calculations.

IV. **Systems of Measurement**

There exists in the United States three systems of measure used in medicine: metric, household, and apothecary. They have units of measure that are approximately related to each other, but not exactly equal. It is inherent upon the nursing student to understand how to work with and within each system accurately.

a. **Metric system - the main system used for medication doses.**
   The metric system is the most commonly used, most accurate, and easiest to use of all the measuring systems. The metric system uses the gram as the basic unit of weight. The liter is the basic unit of volume, and the meter is the basic unit of length. All pharmaceutical companies use the metric system for labeling medications. The metric system is based on units of 10, 100, and 1000.
   i. 1000 mg = 1 gram
   ii. 1 mg = 1000 mcg
   iii. 3 Liters = 3000 mL

b. **Apothecary system - a system of units used chiefly in compounding and dispensing liquid drugs.** The apothecary system has been almost completely phased out of use and replaced with the metric system. Per JCAHO patient safety guidelines the apothecary measurements of *minims* and *drams* are not used in medication prescriptions. However, nurses need to distinguish the metric and apothecary systems in case a prescriber writes an order in the apothecary system. The basic unit of measurement in this system is the grain which is a unit...
of weight measurement. You will need to know the following conversion equivalents from apothecary to metric.

- i. 1 grain (gr) = 60 mg
- ii. 15 drops (gtt) = 1 mL
- iii. 1 ounce (oz) = 30 mL
- iv. 2 quart (qt) = 1 liter (l)

Yes, many household measurements, such as ounce, pint, quart, and gallon are actually based on the apothecary system.

c. **Household system - used for some medications taken at home, primarily liquids.** The household system has generally been replaced with the metric system. Measuring volume using the household measure is less accurate than using other systems because the measuring utensils can vary in size (not all teaspoons are of equal size). Nevertheless, household volume measure may be used in community pharmacy practice when dispensing drugs that will be administered in the patient’s home because patients may not have other measuring devices at home. Labels instructing patients on how to take a medication often use household measure units for this reason. Nurses need to know the metric-household equivalents for patient and family teaching.

V. **Essential Equivalents**

It does not matter which system (metric, apothecary, household) one starts with. However, converting measurements from one system to another requires memorization of equivalents between and within systems, along with their unit abbreviations. Many errors on calculation exams and in medication administration are due to not knowing equivalents and unit abbreviations. The effort placed in learning the equivalents and abbreviations are essential in correct calculation for safe medication administration, not just exam questions.

- **a. Weight Equivalents**
  - i. 1 grain (gr) = 60 milligrams (mg)
  - ii. 1 kilogram (kg) = 2.2 pounds (lbs)
  - iii. 1 lb = 16 ounces (oz)
  - iv. 1 gram (g) = 1000 mg
  - v. 1 kg = 1000 gm
  - vi. 750 mg = 10 milliequivalents (mEq) — often used in potassium and mineral replacement therapy

- **b. Length Equivalents**
  - i. 1 inch (in) = 2.54 centimeters (cm)
  - ii. 1 meter (m) = 100 cm
  - iii. 1 m = 1000 millimeters (mm)
  - iv. 10 mm = 1 cm
c. **Volume or Liquid Equivalents**
   i. 1 liter (L) = 1000 mL – (Liter is always capitalized as L – as lower case L looks like a 1).
   ii. 1 mL = 1 cubic centimeter (cc) – often used interchangeably
   iii. 1 oz = 30 mL
   iv. 1 teaspoon (tsp) = 5 mL
   v. 3 tsp = 1 tablespoon (tbsp)
   vi. 1 tbsp = 15 mL
   vii. 2 tbsp = 30 mL
   viii. 4 oz = 120 mL
   ix. 8 oz = 1 cup = 240 mL
   x. 2 cups = 1 pint (pt)
   xi. 2 pt = 1 quart (qt)
   xii. 2 qts = 1 L = 1 kg = 2.2 pounds

VI. **Converting Within the Metric System**
The metric system is the most widely used method around the world for measuring dosages of medications. Understanding how to convert within the metric system is important because it provides a uniform and standard structure for calculating medication dosages.

The metric unit is based on multiples of 10. It is simply a matter of identifying the unit the student nurse has, the unit the student wants to convert to, and simply move the decimal place to the left or right.

Think about this mnemonic and memorize it.
King Henry Died By Drinking Chocolate Milk . . Merrily
Now look below.

By Base Unit

<table>
<thead>
<tr>
<th>King</th>
<th>Henry</th>
<th>Died</th>
<th>Drinking</th>
<th>Chocolate</th>
<th>Milk</th>
<th>Merrily</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kilo 1000</td>
<td>Hecto 100</td>
<td>Deka 10</td>
<td>Gram Deci 0.1</td>
<td>Centi 0.01</td>
<td>Milli 0.001</td>
<td>Micro 0.000001</td>
</tr>
<tr>
<td>Liter Meter 1.0</td>
<td></td>
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</tbody>
</table>

a. Large to small → Move the decimal point to the right. Each movement of the decimal point is multiplication by 10
Look at this equivalent – 1 g = 1000 mg
Start at the base unit (Gram) and move the decimal right 3 places.
1 g x 10 = 10 dg – first decimal
10 dg x 10 = 100 cg – second decimal
100 cg x 10 = 1000 mg – third decimal

b. Small to large ← Move the decimal point to the left. Each movement of the decimal point is division by 10

Look at this equivalent – 1000 mg = 1 g
Start at milligram and move the decimal 3 places to the left.
1000 mg ÷ 10 = 100 cg – first decimal
100 cg ÷ 10 = 10 dg – second decimal
10 dg ÷ 10 = 1 g – third decimal
c. Most medications are prescribed, dispensed, and administered in just a few metric units – gram, liter, milligram, milliliter, and microgram. That means most
conversions within the metric system occur to the right of the base units (See Below).

Look at this equivalent

3 mg = 0.003 g

**Answer** \(0.0003 \text{ g} = 0.003 \text{ g}\)

A point to remember - 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.

d. **Converting to micro.** Micro is a small number. It is 1000 times small than milli. That means if converting from gram to microgram move the decimal 3 places to the right to get to milligram and then another 3 places to the right to get to microgram. If going from microgram to gram move the decimal left 3 places to get to milligram. Then, another 3 places to get to gram.

\[1.5 \text{ g} = 1,500,000 \text{ mcg}\]
Start at the base unit (Gram) and move the decimal right 3 places.

1.5 g x 10 = 15 dg – first decimal
15 dg x 10 = 150 cg – second decimal
150 cg x 10 = 1500 mg – third decimal
1500 mg x 1000 = 1,500,000 – fourth, fifth, and sixth decimal

Practice with these conversions – answers are at the end of this tutorial

1) 3000 mg = ______g
2) 15.6 g = _______mg
3) 198 g = _______ mg
4) 7.6 mg = _______mcg
5) 25 g = _______mg
6) 1050 mL = _____ L
7) 10 mg = _____g
8) 65 ml = _______ L
9) 19 g = _____mg
10) 8.3 mg = _____ g
11) 500 g = _____mcg
12) 7 L = _______ mL

VII. Medication Calculation Equations

Drug calculation problems are simply story problems. You have to develop a mathematical problem from the information that is provided. As stated before there are several mathematical methods to reach the same answer. Find the formula you are comfortable with and stick to it.

a. Dimensional Analysis

Dimensional analysis is also referred to as the factor-label method. Dimensional analysis involves simple multiplication and division and is accomplished in three basic steps.

Equation: Starting factor $\times$ $\frac{\text{equivalent}}{\text{equivalent}} = \text{answer}$

Example:

Your patient has an order for cephalexin, one 500 mg capsule bid. The pharmacy has supplied you with 0.25 g capsules. How many capsules do you administer?

Step 1: Determine the starting factor, or amount ordered. This is the first item in the equation and its form is used in the answer (tablet, capsule, or mL).

500 mg capsules
Step 2: Identify equivalents in different units of measure. Remember the guideline: Always convert the desired dose to the available unit of measurement. In the equation note the dose on hand and the dose ordered are in different units of measurement. Convert 0.25 g (dose ordered) to mg (dose on hand or supplied) before going on to step 3.

\[0.25 \text{ g} = 250 \text{ mg}\]

Step 3: Solve the equation. First, cancel the same units of measurement and multiply.

\[
500 \text{ mg} \times \frac{1 \text{ capsule}}{250 \text{ mg}} = \frac{500}{250} = x \text{ capsules}
\]

\[
\frac{2}{1} = x \text{ capsules}
\]

\[x = 2 \text{ capsules}\]

b. Ratio and Proportion
A ratio shows the relationship between numbers; a proportion contains two ratios. Ratio and proportion is the oldest method used for drug calculations. It involves four basic steps. When using ratio and proportion either a fraction or a colon format is utilized to set up the equation. The left side of the equation represents the known quantities. The right side of the equation represents the desired dose and the amount to be given.

i. Fraction equation format:
H (dose on hand) = D (dose ordered)
Q (quantity on hand) x (amount to administer)

Example:
Your patient has an order for amoxicillin oral suspension 0.5 g. The pharmacy supplied you with amoxicillin oral suspension 250 mg/tsp. How many teaspoons do you administer?

Step 1: Determine the dose you have on hand

\[
\frac{250 \text{ mg}}{1 \text{ tsp}}
\]

Step 2: Determine the dose you have to administer (note the dose on hand and dose ordered are in different units of measurements. Convert 0.5 mg to mg before going to step 3.

\[0.5 \text{ g} = 500 \text{ mg}\]
Step 3: Drop the same units of measurement and cross multiply.

\[
\frac{250 \text{ mg}}{1 \text{ tsp}} \times \frac{500 \text{ mg}}{x} = 250x = 500 \text{ tsp}
\]

\[
x = \frac{500 \text{ tsp}}{250} = 2 \text{ tsp}
\]

ii. Colon Equation Format:

H: Q = D: XH (dose on hand)
Q (quantity on hand) = D (dose desired): X (amount to administer)

Example:

Your patient has an order for furosemide (Lasix) 180 mg PO. The pharmacy has supplied you with furosemide 40 mg tablets. How many tablets do you administer?

Step 1: Determine the dose you have on hand
40mg tablets

Step 2: Determine the dose you have to administer
180 mg

Step 3: Multiply the means (two inner numbers) and extremes (two outer numbers) and drop the similar units of measurement.

\[
\frac{40 \text{ mg}}{1 \text{ tablet}} = \frac{180 \text{ mg}}{x}
\]

\[
40x = 180 \text{ tablet}
\]

\[
x = \frac{180 \text{ tablet}}{40} = 4 \frac{1}{2} \text{ tablets}
\]

c. Formula Method or Basic Formula

This formula is often used and is a quick and easy way to perform dosage calculations. It uses four basic steps.

Equation: \( \frac{\text{Dose Ordered}}{\text{Dose On hand}} \times \text{Amount} = \text{Dose to administer} \)
Example: Your patient is rating his pain an 8 on a 0-to-10 scale. You received an order for morphine 2 mg IV STAT. The pharmacy has supplied you with morphine 10 mg/mL. How many mL do you administer?

Step 1: Determine the dose ordered.
2 mg

Step 2: Determine the dose on hand
10 mg

Step 3: Determine the unit or quantity of the medication that contains the dose on hand
1 mL

Step 4: Solve the equation
- Cancel similar units
\[
\frac{2 \text{ mg}}{10 \text{ mg}} \times 1 \text{ mL} = x
\]

- Reduce the numbers to their lowest terms
\[
\frac{2}{10} \times 1 \text{ mL} = x
\]

- Convert to a decimal by dividing the numerator (top number) by the denominator (bottom number) and multiply the result by the amount in the equation
\[
\frac{1}{5} \times 1 \text{ mL} = 0.2 \times 1 \text{ mL} = x \text{ mL}
\]

\[
x = 0.2 \text{ mL}
\]

Practice these calculations. Use any method you wish. Suggest you attempt each formula at least once before choosing which is best for you – answers are at the end of this tutorial.

1. Penicillin VK 137 mg po q 6 h ordered. Available is Penicillin VK 125 mg per 5 mL. How many mLs will be administered?

2. Vistaril 35 mg IM is ordered. Available is a vial labeled 25mg /mL. How many mL will be administered?

3. Phenobarbitol 120 mg po q 12 h ordered. Available is Phenobarbitol 60 mg tabs. How many tablets will be administered?
4. Ordered is Ancef 250 mg IM q8h. On hand is Ancef 1 g/3 mL vial. How many mL will be administered?

5. A nurse must administer 150 mg of a medication. The drug is available as 100 mg scored tablets. How many tablets will the nurse administer?

6. A provider prescribes heparin 8,000 units subcutaneously, Q12 hr. The amount available is 5,000 units/mL. How many mL should the nurse administer? Round to the nearest tenth.

VIII. Dosage By Weight
Medications may be prescribed in daily amounts per kg of body weight such as “5 mg/kg/day,” which is then divided into doses given throughout the day. The same process as for calculating oral dosages is used, but first the nurse must determine the client’s weight in kg, the total daily dose, and the amount per dose. Also incorporated in many weight-based calculations is the safe dosage range, which must be calculated to determine if the ordered dose is safe to administer. These types of calculations are a typical of pediatric dosage calculations and some adult medications.

a. Formula: Weight in kg x dose per kg = needed dose

b. Example: A doctor orders 200 mg of Rocephin to be taken by a 15.4 lb infant every 8 hours. Rocephin comes in 500mg/1.8 mL. The medication label shows that 75-150 mg/kg/day is the appropriate dosage range. Is this order within the desired range? How many mL will be administered?

   Step 1: Convert 15.4 lb to kg.
   \[
   15.4 \text{ lb} \div 2.2 = 7 \text{ kg}
   \]

   Step 2: Determine the safe range
   \[
   7 \text{ kg} \times 75 \text{ mg/kg/day} = 525 \text{ mg/day} \text{ (minimum daily dose)}
   \]
   \[
   7 \text{ kg} \times 150 \text{ mg/kg/day} = 1050 \text{ mg/day} \text{ (maximum daily dose)}
   \]

   Step 3: Determine if ordered dose is within the safe range
   Dose ordered is 200 mg every 8 hours (three times in 24 hours)
   \[
   200 \text{ mg} \times 3 = 600 \text{ mg/day} \text{ – dose is within safe range of 525 mg and 1050 mg}
   \]

   Step 4: Determine the amount of medication to be administered
   \[
   \frac{200 \text{ mg}}{500 \text{ mg}} \times 1.8 \text{ mL} = 0.4032 \times 1.8 \text{ mL} = 0.72576 \text{ mL} = 0.73 \text{ mL}
   \]
**Practice these calculations – answers are at the end of this tutorial.**

1) Order: Keflex 125 mg p.o. q.6h for a 44 lb child. If the recommended dosage is 25 mg/kg/day in four divided doses, is this a dosage safe? Keflex is available in an oral suspension of 250 mg per 5 mL. If the dosage is safe, give _______mL/dose.

2) If the safe dose range of fentanyl IV preoperatively is 1 to 2 mcg/kg/dose, how many milligrams of fentanyl could a child weighing 40 lb receive per dose (minimum and maximum)?

3) The physician orders tobramycin (Nebcin) 10 mg IM q8h. The neonate weighs 4,000 g. The recommended dosage of tobramycin is 2.5 mg/kg/dose IM q.8h. Is this dosage safe? Tobramycin is packaged in 40 mg/mL vials. How many mL is administered?

4) A 5-year-old child weighing 40 lb is ordered penicillin G (benzyl penicillin) to be given IV every 4 hours for the treatment of a severe respiratory infection. The recommended dose of penicillin G for a severe infection is 60 mg/kg/dose every 4 hours. How many mg would be administered?

**IX. IV Flow Rates**

Nurses are expected to be able to deliver I.V. fluids and medications accurately. Today, with an emphasis on patient safety nurses need to calculate I.V. drip rates themselves. There are several methods to administer IV fluids and medications: Electronic IV pumps and Manual Infusions.

a. **Electronic IV pumps**
   i. Flow rates on IV infusion pumps are set in whole mL/hr. The pump regulates the number of gtt/min based on this mL/hr setting.

   ii. While IV infusion pumps are usually programmed for whole numbers, most pumps are able to accept decimal flow rates. This option is usually reserved for use in the critical care setting or for pediatric clients where precise dosing is essential.

   iii. When the time in hr is known, use the following formula:

   \[
   \frac{\text{volume (mL)}}{\text{time (hour)}} = \text{flow rate per hour (mL/hr)}
   \]

   Example: The provider prescribes dextrose 5% in water 500 mL IV to infuse over the next 4 hr. The nurse should set the IV infusion pump to deliver how many mL/hr?
Step 1: What volume is to be infused?
500 mL

Step 2: What time frame is the infusion to ordered to run?
4 hours

Step 3: Set up the equation and solve
\[
\frac{500 \text{ mL}}{4 \text{ hrs}} = 125 \text{ mL/hr} - \text{pump setting}
\]

Practice these calculations – answers are at the end of this tutorial

1) How many ml/hr would a patient receive if they were to have 500ml of fluid infused over 6 hours?

2) Order: 100 ml IV antibiotic to infuse in 30 min via infusion pump. What is the flow rate?

3) Order: Ampicillin 500 mg dissolved in 200 mL D5W IV to run for 2 h. What is the flow rate?

4) Order: 3 L 0.9% saline over 24 hours. What is the rate to set the pump?

b. Manual Infusions

When infusion pumps are not used, IV fluid flows via gravity. The flow rate for these infusions is set by counting the number of drops per minute in the drip chamber of the tubing. The flow rate is increased or decreased by adjusting the roller clamp on the tubing.

i. The flow rate for manual IVs is based on drops per minute.
   - Drops per minute is expressed as gtt/min

ii. Flow rate is calculated using “drop factors” found on each manufacturer’s IV tubing.
   - The drop factor is the number of drops per mL of liquid that an IV tubing set will drip into its drip chamber. Drops per mL is expressed as gtt/mL.

iii. Flow rates for manual IV rates can be expressed by using this formula:

\[
\text{Flow rate (gtt/min)} = \frac{\text{volume to be infused (mL)}}{\text{time in minutes}} \times \text{tube drop factor (gtt/mL)}
\]

Example: The provider prescribes Lactated Ringer’s 250 mL IV to infuse at 75 mL/hr. The drop factor on the manual IV tubing is 20 gtt/mL. The nurse should set the IV flow rate to deliver how many gtt/min.
Step 1: What volume is to be infused?
75 mL

Step 2: How long is the infusion to run?
1-hour = 60 minutes

Step 3: What is the IV tubing drop factor?
20 gtt/mL

Step 4: Set up the equation and solve
\[ \frac{75 \text{ mL}}{60 \text{ min}} \times \frac{20 \text{ gtt}}{1 \text{ mL}} \]
cancel mL, leave gtt and min in equation and multiply across
\[ \frac{1500 \text{ gtt}}{60 \text{ min}} = 25 \text{ gtt/min} \]

Practice these calculations – answers are at the end of this tutorial

1) The doctor orders an IV of 250 ml DSNS with 1 ampule of MVI to run in 3 hours. The drop factor on the tubing is 20 gtts per ml.

2) Order: 500 mL D5W 0.45% Saline IV to infuse @ 165 mL/h Drop factor: 10 gtt/mL. What is the drip rate?

3) A physician orders Ampicillin 500 mg. It is dissolved in 200 mL D5W IV and is to run over 2 h. Drop factor: 10 gtt/mL. What is the flow rate (gtt/min)?

4) The physician orders one 350 mL unit of PRBC to be infused over 4 h. The drip chamber is 10 gtt/mL. What is the infusion rate?

X. Conclusion
Unlike those days when the nurse was responsible only for answers on a piece of paper, nurses are responsible for the promotion of health, safety, and well-being of patients in all clinical settings. Consequently, in order to provide safe and appropriate medication administration, nursing students need to feel confident, and be competent in solving medication dosage problems during the medication administration process. The aim of this tutorial has been to set forth the fundamentals of medication calculations that every nursing student and practicing nurse need to know and follow. It is essential the nursing student practice using the formulas until there is a complete understanding of how to calculate medication dosages accurately.
XI. References


Answers Section V
1) 3g
2) 15,600 mg
3) 198,000 mg
4) 7,600 mcg
5) 25,000 mg
6) 1.05 L
7) 0.01 g
8) 0.065 L
9) 19000
10) 0.0083 g
11) 500,000,000 mcg
12) 7000 mL

Answers Section VII
1) 5.48 mL = 5.5 mL
2) 1.4 mL
3) 2 tablets
4) 0.75 mL
5) 1½ tablets
6) 1.6 mL

Answers Section VIII
1) Yes, 2.5 mL
2) 18.2 mg to 36.4 mg
3) Yes, 0/25 mL
4) 1092 mg

Answer Section IX-a
1) 83 mL/hr
2) 200 mL/hr
3) 100 mL/hr
4) 125 mL/hr

Answer Section IX-b
1) 28 gtt/min
2) 28 gtt/min
3) 17 gtt/min
4) 15 gtt/min