

Lurleen B. Wallace College of Nursing and Health Sciences
 NU-311 Calculation Examples

DOSAGE CALCULATIONS

1. Systems of Measurement

1.1 Metric System- has become the system of choice for dealing with the weights and measures involved in the calculation of drug dosages. All answers within the metric system need to be expressed as **decimals**, not as fractions (with exception of basic math assignment).

Rounding Rule: All steps of calculation problems should be rounded to the nearest tenth, unless otherwise specified.

1.11 Mass

1.12 Volume

1.13 The cubic centimeter (cc) and the milliliter (ml) are considered equivalent and are used interchangeably. Joint Commission of Accreditation Of Hospital Organizations (JCAHO) does not recommend use of the abbreviation cc due to errors in transcription.

1.14 Uses whole numbers and decimals

1.2 Household System

1.21 Household Measurements (teaspoon, pint, quart)

1.3 Apothecaries' System

1.31 Uses Roman Numerals

1.32 Common fractions (except one-half) are written using hindu-arabic numerals

1.33 Mass

2. Conversions within the Metric System

2.1 Certain prefixes identify the multiples of 10 that are being used. The four most commonly used prefixes of the metric system involved with the calculation of drug dosages are the following:

- Micro= 0.000001 or one millionth
 - Milli= 0.001 or one thousandth
 - Centi= 0.01 or one hundredth
 - Kilo= 1000 or one thousand (1,000)
- These prefixes may be used with any of the base units of weight (gram), volume (liter), or length (meter).

2.2 To change milligrams (mg) to Grams (G), or milliliters (ml) to liters (L), move the decimal point three places to the left.

Example: 750 mg. = 0.75 Gm.
500 mg. = 0.5 Gm.

2.2 Rule: To change Grams to milligrams or liters to milliliters, move the decimal three places to the right.

Example: 0.25 Gm. = 250 mg.
0.35 Gm. = 350 mg.

3. Conversions between the Household and Metric Systems

Note: Household measures are not accurate enough to be used by nurses in the calculation of drug dosages in the hospital.

Metric Conversion	Household Measurements
1000cc (1 liter)	1 quart
500 ml	1 pint
5 ml	1 teaspoon & 1 dram
15 ml	1 TBSP
30 ml	1 ounce
240 ml	8 ounces (a glass)
180 ml	1 Cup (c)
1 Kg (kilogram) or 1000 grams	2.2 pounds (lbs.) Example- A person who weighs 110 lbs weighs 50 Kg using the metric scale.
2.5 cm (centimeters)	1 inch
1 foot	12 inches
1 cc	1 ml

4. Conversion between the Apothecaries' and the Metric System

gr 1 = 60 mg.
gr 15 = 1 Gram

gr= Grain, however drug dosages are rarely expressed in grains.

1 dram= 5 ml= 1 teaspoon (dram rarely utilized as a form of measurement)

5. Household Measurements to Apothecaries'

5.1

Household Measurements	Apothecaries'
1 pint	16 fluid ounces (fl oz)
2 pints (pt) or 1 quart (qt)	32 fluid ounces (fl oz)
1 coffee cup	6 fluid ounces
1 medium size glass	8 fluid ounces

5.2 When writing orders in the apothecary system, physicians often use Roman numerals. All parts of a whole are expressed as a fraction except the fraction one half, which is commonly represented as ss. Only addition and subtraction may be performed in the Roman numeral system.

5.21 Addition is performed when a smaller numeral follows a larger numeral (xi = 11, x = 15) or when a numeral is repeated (iii = 3, xx = 20)

5.22 Subtraction is performed when a smaller numeral is placed before a larger numeral (ix = 9, iv = 4) or when a smaller numeral is placed between two larger numerals. The smaller numeral is subtracted from the larger numeral following the smaller numeral (xiv = 14, xxiv = 24)

6. Changing pounds to kilograms or kilograms to pounds

5.1 Example 2.2 lbs = 1 kg.

50 pounds is = how many kilograms?

50lbs divided by 2.2 kilograms = 22.7 kilograms

22.7 kilograms times 2.2 kilograms = 49.9 pounds

7. Preparing Medications from Powders and Granules

7.1 Example:

Physician ordered Geopen 0.5 Gm IM q 6 h. You have available a vial of Geopen containing 2 Gm. The directions read, "Add 4 ml of sterile water to yield a concentration of 1 Gm/ 2.5 ml Solution is stable at room temperature for 24 hours.

When 4 ml. of sterile water is added to the Geopen powder, it increases the volume to 5 ml. which is equal to 1 Gm./2.5 ml.

8. Most problems concerning drug dosage can be solved by a proportion problem. A proportion consists of two ratios of equal value. The ratios are connected by a double colon (::) which symbolizes the word as.

For example: $2 : 3 :: 4 : 6$ This is read as "Two is to three as four is to six."

In a proportion the product of the means equals the product of the extremes because the ratios are of equal value

(3 and 4 are the means; 2 and 6 are the extremes).

$$2 : 3 :: 4 : 6$$

$$3 \times 4 = 12 \text{ (product of the means)}$$

$$2 \times 6 = 12 \text{ (product of the extremes)}$$

If three terms are known and one term is unknown, an x is inserted in the space for the unknown term.

For example: $2 : 3 :: 4 : x$ $2x = 3 \times 4$

$$2x = 12$$

$$x = \frac{12}{2} \text{ therefore } x = 6$$

$$2$$

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Guide for Calculating Medications

Listed below are calculation examples using grains. It is important for you to understand this concept; however JCAHO recommendations state that unit of measurement contributes to medication errors and should not be used.

The physician ordered gr xv of a medication. The medication is available in tablets containing 0.25 Gm of medication. How many tablet(s) should you give?

1. Begin the solution to the problem by asking yourself: What is the amount of medication ordered to be given? What is the amount of the medication available for administration?

Amount Ordered: gr xv Amount Available: 0.25 Gm in 1 tablet

2. Next ask yourself: are the units of measurement the same for what is ordered and what is available?

Ordered: grains Available: Grams These are not the same!

3. If they are not in the same units of measurement, you have to change them to the same units before you can solve the problem.

Example: Change grains to grams: 15 gr. = 1 Gm.

Note 15 gr. = 1 Gm. is from the list of equivalencies.

4. Think! What do you know from the above problem? Write what you know first to set up ratio and proportion problem: 0.25 Gm : 1 tablet

The other side of the ratio must be written in the same order as the first side:

$$0.25 \text{ Gm.} : 1 \text{ tablet} :: \text{ ____ Gm.} : \text{ ____ tablet}$$

Next fill in blank spaces: 0.25 Gm. : 1 tablet :: 1 Gm. : X tablet

Multiply the extremes (numbers on ends of problem) times each other:

$$0.25 \times =$$

Multiply the means (numbers in center of problem) times each other:

$$1 \times 1 = 1$$

Place unknown value on left side of equal sign: 0.25X = 1

Divide each side of equal sign by number that precedes "X": $0.25 \text{ X} = 1.00$
 $0.25 \quad 0.25$

$$\text{X} = 4 \text{ tablets}$$

Oral Dosage of Drugs

Medications for oral administration are supplied in a variety of forms, such as tablets, capsules and liquids. It is safest and most accurate to give the fewest number of whole, undivided tablets as possible.

Simple Three-Step Approach to Dosage Calculations:

- Step 1: Convert: Ensure all measurements are in the same system of measurement and the same size unit of measurement. If not, convert.
- Step 2: Think: Estimate what is a reasonable amount of the drug to be administered.
- Step 3: Calculate: Apply the formula: $\frac{D}{H} \times Q = X$
 $\frac{D(\text{desired})}{H(\text{have})} \times Q(\text{quantity})$

Official “Do Not Use” Abbreviation List

DO NOT USE	POTENTIAL PROBLEMS	USE INSTEAD
U (unit)	Mistaken for “0” (zero), the number “4” (four) or “cc”	Write “unit”
Q.D., QD, q.d., qd (daily) Q.O.D., QOD, q.o.d., qod (every other day)	Mistaken for IV (intravenous) or the number 10 (ten)	Write “daily” Write “every other day”
Trailing zero (X.0 mg)* Lack of leading zero (.X mg)	Decimal point is missed	Write X mg Write 0.X mg
MS MSO4 and MgSO4	Can mean morphine sulfate or magnesium sulfate Confused for one another	Write “morphine sulfate” Write “magnesium sulfate”

Applies to all orders and medication-related documentation that is handwritten (including free-text computer entry) or on preprinted forms

Exception: a “trailing zero” may be used only where required to demonstrate the level of precision of the value being reported, such as for laboratory results, imaging studies that report size of lesions, or catheter/tube sizes. It may not be used in medication orders or other medication-related documentation period.

Additional Abbreviations, Acronyms and Symbols
(For possible future inclusion in the Official “Do Not Use” List)

DO NOT USE	POTENTIAL PROBLEMS	USE INSTEAD
> (greater than) < (less than)	Misinterpreted as the number “7” (seven) or the letter “L” Confused for the another	Write “greater than” Write “less than”
Abbreviations for drugs names	Misinterpreted due to similar abbreviations for multiple drugs	Write drug names in full
Apothecary units	Unfamiliar to many practitioners Confused with metric units	Use metric units
@	Mistaken for the number “2” (two)	Write “at”
Cc	Mistaken for U (units) when poorly written	Write “ml” or “milliliters”
µg	Mistaken for mg (milligrams) resulting in one thousand-fold overdose	Write “mcg” or “micrograms”

NU 311 Calculations Exam

Students make sure that you understand and can read drug labels, medication administration record (MAR), as well as calculate these basic problems. Remember to round to the nearest tenth, unless stated otherwise.

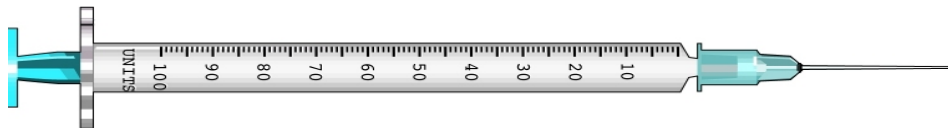
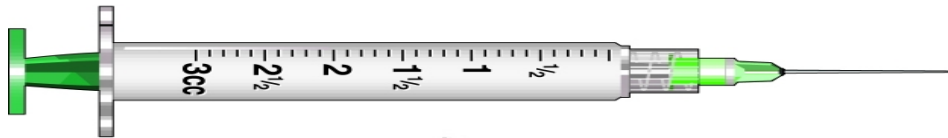
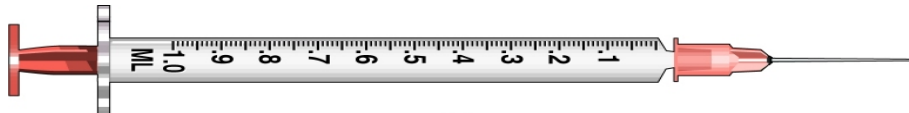
Practice Problems –Set I

Show work:

1. The physician ordered Phenobarbital 60 mg. You have on hand an ampule of Phenobarbital containing 60 mg per 5 ml. How many ml of medication will you give?

2. You have an order to give Atropine 1 mg. You have on hand to use an ampule of Atropine containing 0.4 mg per ml. How many ml will you give?

3. The physician ordered Morphine 4 mg IM. You have Morphine containing 10 mg in 2 ml. How many ml should you give? Chose the correct syringe and shade in the appropriate amount of medication.



4. The physician ordered 0.5Gm of Streptomycin IM. Available is a 3 ml vial of the drug containing 2 Gm. How many ml should you give?

5. Physician ordered ASA 650 mg. P.O. for a temperature above 101 F. Your patient develops a temperature of 102 F. How many tablets of ASA 325 mg

6. The label on a 5 ml. ampule of Quinine Hydrochloride reads, "100 mg. per ml.", and the doctor's order reads, "Give Quinine Hydrochloride 125 mg." How many ml. should the patient receive?

7. The physician orders 8 mg. of a medication. The medication is available in 1 ml. ampules containing 10 mg. How many ml. should you give?

8. The physician ordered Benadryl 50 mg. The medication on hand contains 0.025 Gm. per capsule. How many capsule(s) should the patient receive?

9. Ordered: Kantrex 300 mg. IM. Directions on bottle read "Add 2.7 ml. sterile water for injection to make 1 Gm. per 3 ml." After reconstitution, how many ml. will you give?

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10. A. Complete the following calculation problem.
 Medication order: Heparin sodium 3000 units deep Sub-Q q8h

Available: Heparin 10,000 units/mL

Answer _____

- B. Shade in the correct amount of medication to be administered.



11. Calculate the amount to administer (5points)
 Medication Order: Zofran 8 mg IM

<p>NDC 0173-0442-00</p> <p>Zofran® (ondansetron hydrochloride) Injection 2 mg/mL* Rx only</p> <p>40 mg in 20 mL</p> <p>For I.V. or I.M. Injection. Sterile 20-mL Multidose Vial</p>		<p>*Each 1 mL of aqueous solution contains ondansetron 2 mg as ondansetron hydrochloride dihydrate; sodium chloride 8.3 mg; citric acid monohydrate 0.5 mg and sodium citrate dihydrate 0.25 mg as buffers; methylparaben 1.2 mg and propylparaben 0.15 mg as preservatives. See package insert for Dosage and Administration. Store between 2° and 30°C (36° and 86°F). Protect from light.</p> <p>GlaxoSmithKline, Research Triangle Park, NC 27709 Made in England 4146317 Rev. 6/02</p>
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Answer: _____

Answers:

1. 5 mL
2. 2.5 mL
3. 0.8 mL

4. 0.8 mL
5. 2 tablets
6. 1.3 mL
7. 0.8 mL
8. 2 mL
9. 0.9 mL
10. 0.3 mL
11. 4 mL

