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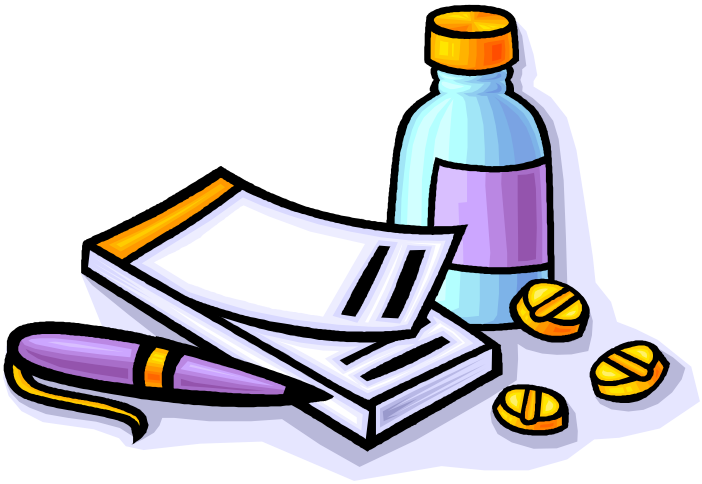

Dosage Calculation Packet
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Unit I – Basic Mathematics Review

This unit will review fractions, decimals, percentage, and ratio and proportion.

FRACTIONS

Definition: A fraction is a part of a whole number. A fraction has 2 parts, the top number is called the numerator and the bottom number is called the denominator.

Example: ½ = 1 is the numerator and 2 is the denominator.

There are 4 types of fractions:

1. **Proper fractions** – the numerator is less than the denominator and the fraction has a value of less than 1. Example: ½.

2. **Improper fractions** – the numerator is larger than or equal to the denominator and has a value of 1 or greater than 1. Example: 6/5

3. **Complex fractions** – the numerator or denominator may be either a fraction or a whole number. The value may be less than, greater than, or equal to 1.
   Example: $\frac{½}{2}$ or $\frac{½}{¾}$

4. **Mixed number** – there is a whole number and a fraction combined with a value greater than 1.
   Example: 3 ½.

   To change a mixed number to an improper fraction, multiply the whole number by the denominator and add the numerator.
   Example: $3\ ½ = \frac{(2 \times 3) + 1}{2} = \frac{7}{2}$

Practice Problems # 1

Reduce the following fractions to the lowest terms. The answers are on pages 29-31 of the dosage calculation packet.

1. 2/4=_____ 2. 2/8=_____ 3. 15/20= _____ 4. 3/9=_____ 5. 10/15 = _____

6. 7/49 = _____ 7. 64/128 = _____ 8. 20/28 = _____ 9. 14/98 = _____ 10. 24/36 = _____

Change the following improper fractions to mixed numbers and reduce to lowest terms.

1. 6/4=_____ 2. 7/5=_____ 3. 15/8= _____ 4. 3/2=_____ 5. 18/5 = _____

6. 60/14 = _____ 7. 13/8 = _____ 8. 35/12 = _____ 9. 112/100 = _____ 10. 30/4 = _____

Change the following mixed numbers to improper fractions and reduce to lowest terms.

1. 3 ½=_____ 2. 6 ½=_____ 3. 10 ½=_____ 4. 33 1/3= _____ 5. 1 4/25= _____

6. 4 2/8 = _____ 7. 4 ½ = _____ 8. 3 3/8= _____ 9. 15 4/5= _____ 10. 9 ¼ = _____

Adding Fractions:
To add fractions with the same denominator, add the numerators, place the sum over the denominator, and reduce to lowest terms. Example: $\frac{1}{6} + \frac{4}{6} = \frac{5}{6}$

To add fractions with different denominators, change fractions to their equivalent fraction with the lowest common denominator, add the numerators, write the sum over the common denominator, and reduce to lowest terms. Example: $\frac{1}{4} + \frac{1}{3} = \frac{3}{12} + \frac{4}{12} = \frac{7}{12}$

Subtracting Fractions:
To subtract fractions with the same denominator, subtract the numerators, and place this amount over the denominator. Reduce to lowest terms. Example: $\frac{5}{4} - \frac{3}{4} = \frac{2}{4} = \frac{1}{2}$

To subtract fractions with different denominators, find the lowest common denominator, change to equivalent fractions, subtract the numerators, and place the sum over the common denominator. Reduce to lowest terms.
Example: $\frac{15}{6} - \frac{3}{5} = \frac{75}{30} - \frac{18}{30} = \frac{57}{30} = 1\frac{27}{30} = 1\frac{9}{10}$

Multiplying Fractions:
Multiple the numerators and multiple the denominators and reduce to lowest terms.
Example: $\frac{3}{4} \times \frac{2}{3} = \frac{6}{12} = \frac{1}{2}$

Dividing Fractions:
Invert the second fraction and multiply and reduce to lowest terms.
Example: $\frac{1}{3}$ divided by $\frac{1}{2} = \frac{1}{3} \times \frac{2}{1} = \frac{2}{3}$

Practice Problems # 2
Add, Subtract, Multiply or Divide the fractions and reduce to lowest terms. The answers are on pages 29-31of the dosage calculation packet.

Add the following fractions and reduce to lowest terms.
1. 2/3 + 5/6 = _____ 2. $2^{1/8}$ + 2/3= _____ 3. $2^{3/10} + 4^{1/5}$ + 2/3 = ____ 4. $7^{2/5}$ + 2/3 = _____

5. $12^{½} + 10^{1/3}$ = _____ 6. ½ + 1/5 = _____ 7. ¼ + 1/6 + 1/8 = _____ 8. 2/5 + 1/3 + 7/10 = _

Subtract the following fractions and reduce to lowest terms.
1. 4/3 – 3/7 = _____ 2. $3^{3/8} - 1^{3/5}$ = _____ 3. 15/16 – ¼ = _____ 4. $2^{5/6} - 2^{¾}$ = _____

5. 1/8 – 1/12 = _____ 6. 4/9 – 3/9 = _____ 7. 4/5 – 1/6 = _____ 8. 4/7 – 1/3 = _____

Multiply the following fractions and reduce to lowest terms.

1. 2/3 x 1/8=_____ 2. 9/25 x 4/32=_____ 3. 1/3 x 4/12 = _____ 4. 5/4 x 2/4 = _____

5. 2/5 x 1/6 = _____ 6. 3/10 x 4/12 = _____ 7. 1/9 x 7/3 = _____ 8. 10/25 x 5/3 = _____

Divide the following fractions and reduce to lowest terms.

1. 1/3 ÷ ½ = _____ 2. 25 ÷ 12 ½ = _____ 3. 7/8 ÷ 2 ¼ = _____ 4. 6/2 ÷ ¾ = _____

5. 4/6 ÷ ½ = _____ 6. 7/8 ÷ 7/8 = _____ 7. 6 ÷ 2/5 = _____ 8. 1/60 ÷ ½ = _____

DECIMALS:

A decimal is a fraction that has a denominator that is a multiple of 10. The decimal point indicates place value. Numbers written to the right of the decimal represent a value of less than one. Numbers written to the left of the decimal represent a value of greater than one.

When there is no whole number before a decimal point, it is important to place a zero to the left of the decimal point to emphasize that the number has a value of less than one. **The Joint Commission's official "Do Not Use" List prohibits writing a decimal with a value of less than one without a leading zero preceding the decimal point. Example: 0.75 not .75**

When writing decimals, unnecessary zeros should not be placed at the end of the number to avoid misinterpretation of a value and overlooking a decimal point. **The Joint Commission's official "Do Not Use" List forbids the use of trailing zeros for medication orders or other medication related documentation. Example: 1 not 1.0**

Dividing Decimals:

1. Change the dividing number to a whole number by moving the decimal point to the right.
2. Change the number being divided by moving its decimal point the same number of places to the right.
3. Divide as usual.
4. Place the decimal point in the answer directly above the decimal point in the dividend.
5. To express the answer to the nearest tenth, carry the division to the hundredths place and round. To express the answer to the nearest hundredth, carry the division to the thousandths place and round.

Example:

```
          73.
0.03. 2.19.
      2 1
        09
         9
         0
```

The answer is 73

Practice Problems # 3

Divide the decimals. When necessary, round the answers to the hundredths place. The answers are on pages 29-31 of the dosage calculation packet

1. 0.75 ÷ 0.5=_____ 2. 0.2 ÷ 0.02=_____ 3. 140 ÷ 6=_____ 4. 140 ÷ 7.8= ___ 5. 2 ÷ 0.5 = ____

6. 1.4 ÷ 1.2 = _____ 7. 63.8 ÷ 0.9 = _____ 8. 39.6 ÷ 1.3 = ____ 9. 5.7 ÷ 0.9 = ____ 10. 3.75 ÷ 2.5 = _

Rounding Decimals:

To express an answer to the nearest tenth, carry the division to the hundredths place. If the number in the hundredths place is 5 or greater, add one to the tenths place. If less than 5, drop the number.
Example: 4.15 to the nearest tenth = 4.2
1.24 to the nearest tenth = 1.2

To express an answer to the nearest hundredth, carry the division to the thousandths place. If the number in the thousandths place is 5 or greater, add one to the hundredths place. If less than 5, drop the number.
Example: 0.176 to the nearest hundredth = 0.18
0.554 to the nearest hundredth = 0.55

Practice Problems # 4

The answers are on pages 29-31 of the dosage calculation packet

Round the decimal to the tenth place:
1. 0.75=_____ 2. 0.23=_____ 3. 0.98=_____ 4. 0.36= _____ 5. 3.57 = _____

6. 0.95 = ____ 7. 1.98 = ____ 8. 1.75 = _____ 9. 0.13 = _____ 10. 0.25 = _____

Round the decimal to the hundredth place:
1. 1.086=_____ 2. 0.456=_____ 3. 12.234=_____ 4. 19.014= _____ 5. 1.427 = _____

6. 0.147 = _____ 7. 3.550 = ____ 8. 0.607 = _____ 9. 0.738 = _____ 10. 1.268 = _____

PERCENTAGE:

A percentage is a part of 100.

Changing Percent to Fractions:

To change a percent to a fraction, drop the percent sign, place the number over 100, and reduce to lowest terms.

Example: 25% = $\frac{25}{100}$ = (25 ÷ 100) = ¼

Practice Problems # 5

Change each percent to a fraction. Reduce to lowest terms. The answers are on page 29-31 of the dosage calculation packet.

1. 10%=_____ 2. 45%=_____ 3. 75%=_____ 4. 25%= _____ 5. 1% = _____

6. 80% = _____ 7. 2% = _____ 8. 3% = _____ 9. 50%= _____ 10. 60% = _____

Changing Fractions to Percent:
Change the fraction to a percent, multiply by 100, and add the percent sign.

Example: ¼ = 1 ÷ 4 = 0.25 X 100 = 25%

Practice Problems # 6
Change each fraction to a percent. The answers are on pages 29-31 of the dosage calculation packet.

1. 1/2=_____ 2. 2/5=_____ 3. 1/4=_____ 4. 4/5= _____ 5. 11/4 = _____

6. 7/10 = _____ 7. 7/100 = ___ 8. 3/8 = _____ 9. 2/4= _____ 10. ¾ = _____

Changing Percent to a decimal:
To change a percent to a decimal, drop the percent sign, and move the decimal point two places to the left. **Remember to lead with a zero if needed, but not to trail with a zero**.
Example: 25% = $\frac{25}{100}$ = 0.25 not .25

Practice Problems # 7
Change each percent to a decimal. The answers are on pages 29-31 of the dosage calculation packet.

1. 10%=_____ 2. 45%=_____ 3. 75%=_____ 4. 25%= _____ 5. 14%= _____

6. 35%= _____ 7. 20%= _____ 8. 50%= _____ 9. 13%= _____ 10. 40%= _____

RATIO and PROPORTION:

Ratio:
A ratio expresses the relationship of one quantity to another. When solving dosage calculations, a ratio is composed of two numbers that are separated by a colon.

Examples: 2:4 or 4:16 or 1:50

Proportion:

A proportion shows the relationship etween two ratios that are equal.
Examples: 1 : 2 :: 2 : 4 or 2 : 8 :: 5 : 20

The first example is read like this: 1 is to 2 as 2 is to 4. You can see that these two ratios are equal. The way to demonstrate this mathematically is to multiply the two outer numbers (extremes) together and the two inner numbers together (means). The answers will be equal to one another.

Example: 2 : 8 :: 5 : 20
2 x 20 = **40** (outer numbers multiplied together)
8 x 5 = **40** (inner numbers multiplied together)

Ratio and proportions are used to solve dosage calculation problems when you do not know one of the four numbers. This is called solving for "X" or solving for the unknown.

Solving for "X":
Multiply the means by the extremes and solve for X.

Example: 3 : 5 :: 15 : X
3X = 75 (divide the equation by 3)
$\frac{3X}{3} = \frac{75}{3}$ X =25

To check your work, put the answer into the equation and multiply the outer numbers and the inner numbers and hey should be equal.

Example: 3 : 5 :: 15 : 25
3 x 25 = **75** (outer numbers multiplied together)
5 x 15 = **75** (inner numbers multiplied together)

Practice Problems # 8
Find the value of x. The answers are on pages 29-31 of the dosage calculation packet.

1. 2 : 3 :: 8 : x
2. x : 5000 :: 10 : 500
3. 2/3 : ¾ :: x : 21/24
4. 5 : x :: 20 : 30
5. 12.5 : 5 :: 24 : x
6. 1/300 : 3 :: 1/120 : x
7. 1.5 : 1 :: 4.5 : x
8. x : 12 :: 9 : 6
9. 20 : 40 :: x : 10
10. x : 9 :: 5 : 10

Unit II – Systems of Measurement and Conversion

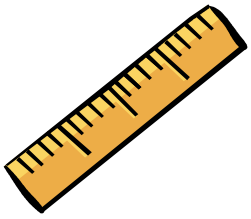
Nurses have the legal responsibility for administering the appropriate amount of medications. They must be able to interpret dosage instructions from manufacturers and doctors to administer doses accurately. They must also be able to provide patient/family education regarding home administration. There are three primary systems of measure that are currently used in medication administration: the metric system, the apothecary system, and the household system.

THE METRIC SYSTEM

The metric system is widely used in dosage calculations. It uses powers of 10 and the basic units of measure are the gram, liter, and meter. A **gram** measures weight, a **liter** measures fluid, and a **meter** measures length.

Gram:  measures weight. Gram may be written g.

Liter:  measures liquid. Liter may be written L.

Meter:  measures length. Meter may be written m.

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The metric system also uses prefixes to describe how much of the basic unit:

Kilo =1000 times the basic unit.
Centi =1/100 of the basic unit or 0.01.
Milli = 1/1000 of the basic unit or 0.001.
Micro =1/1,000,000 of the basic unit or 0.000001.

Metric System Rules:

1. Express parts of a unit or fractions of a unit as decimals. Example: 0.5 L not ½ L
2. Always write the quantity, whether in whole numbers or in decimals, before the abbreviation or symbol for a unit of measure. Example: 1,000 mg not mg 1,000
3. Use a full space between the numeral and abbreviation. Example: 2 mL not 2mL
4. Always lead with a zero but do not trail with a zero. Example: 0.75 mg not .75 mg, 2 mg not 2.0 mg
5. Do not use the abbreviation µg for microgram. It may be mistaken for mg. Write out the word microgram.
6. Do not use the abbreviation cc for mL. This abbreviation may be misinterpreted as zeros.
7. Avoid periods after the abbreviation for a unit of measure to avoid it being misread for the number 1 in a poorly handwritten order. Example: mg not mg.

8. Place commas in values at 1,000 or above to improve readability. Example: 25, 000 units not 250000 units
9. Do not add "s" on a unit of measure to make it plural as this could lead to misinterpretation. Example: mg not mgs.

METRIC BASIC EQUIVALENT

You must learn all conversions to be successful with dosage calculation!!!

Weight	Volume	Length
1 kg = 1,000 g	1 L = 1,000 mL	1 m = 100 cm
1 g = 1,000 mg	1 mL= 0.001 L	1 mm = 0.001 m
1 mg = 1,000 mcg		

Using Ratio and Proportion Within the Metric System

As stated earlier, nurses use ratios (1:2) to make comparisons, and proportions to show that two ratios are equal (1: 2 :: 2 : 4). This principle is used to exchange weights within the metric system.

RULES OF PROPORTION

1. Units of ratios must correspond within the same proportion.
2. Correct = g : kg :: g : kg
3. No more than 2 different units of measure can be used within the proportion.
4. Label all numbers with the appropriate unit of measure.

Example: 0.5 kg = _____ g

First, find the basic equivalent in the previous chart.
This would be, 1 kg = 1,000 g. Now you know 3 of the 4 numbers in the equation. Solve for "X" as you were taught in Unit I and utilize the above rules of proportion.

Set the problem up: 1 kg : 1,000 g :: 0.5 kg : X g
X = 500

Remember, you multiply the outside numbers and then the inside numbers and then divide. In this example, it was not necessary to divide.

What label comes after 500? Look up at your problem, it would be 500 g. The label will always be what follows the unknown "X". **To obtain credit for dosage calculation questions, you must correctly label the answer. NO EXCEPTIONS!!!**

Practice Problems # 9

Solve for "X". The answers are on pages 29-31 of the dosage calculation packet.

1. 250 g = X kg _____ 2. 15 mg = X mcg _____ 3. 3.5 L = X mL _____ 4. 5 g = _____ mg

5. 360 mg = _____ g 6. 4 mcg = _____ mg 7. 0.2 g = _____ mg 8. 500 mL = _____ L

THE APOTHECARY SYSTEM

The Apothecary System is another method of expressing units of measure. It is an old system and is not used exclusively because it is not standarized. That means that each measure is an approximate amount, not an exact amount. But, some doctors still order medicines using this system, and some labels contain this system as well. It is different from the metric system in the following ways:

The basic units of measure that are commonly used are the grain and ounce.

Grain: measures weight and is written gr. gr 1 = 60 mg. **Some tables state that gr 1 = 60 to 65 mg. When calculating Tylenol, aspirin, or iron use the equivalent gr 1 = 65 mg.**

Ounce: measures liquid amounts and is written like a cursive ℨ but with an extra hump on top.

Apothecary measures for dry weight are infrequently used. Therefore, the word "fluid" is generally dropped when referring to the ounce. The table below reflects apothecary measures for volume.

APOTHECARY BASIC EQUIVALENCES

You must learn all conversions to be successful with dosage calculation!!!

Weight	Volume
gr 1 = 60 or 65 mg	**1 ounce = 30 mL**
	16 ounces = 1 pint
	32 ounces or 2 pints = 1 quart
	4 quarts = 1 gallon

Apothecary System Rules:

1. The abbreviation or symbol for a unit of measure is written before the amount or quantity in lowercase letters. Example: six grains = gr 6
2. Roman numerals, as well as Arabic numbers, are used. When Roman numerals are used, they are written in lowercase letters. To prevent errors in interpretation, a line is sometimes drawn over lowercase Roman Numerals. A lowercase "i" is dotted above the line. Example: gr v
3. Fractions are used to express quantities that are less than one. Example: gr ¾
4. The symbol "ss" is used for the fraction ½ and it can be written as ss or ss with a line above.
5. A combination of Arabic numbers and fractions can also be used to express units of measure. Example: gr 7 ½.

Practice Problems # 10

Solve for "X" using ratio and proportion. The answers are on pages 29-31 of the dosage calculation packet.

1. 32 oz = X qt _____ 2. 2 qt = X pt _____ 3. 8 oz = X pt _____ 4. ½ pt = _____ oz

5. 90 mL = _____ oz 6. ½ oz = _____ mL 7. 1 qt = _____ oz 8. gr 15 = _____ mg

HOUSEHOLD MEASURE

The Household Unit of Measure is the most commonly recognized by laypeople in America. It includes drops, teaspoons, tablespoons, and cups. **Teaspoon** is written tsp or t., **tablespoon** is written T, tbsp and **cup** is written C. This system is not standardized either, it utilizes approximate measures.

HOUSEHOLD EQUIVALENTS

You must learn all conversions to be successful in dosage calculation!!!

1 tsp = 5 mL

1 tbsp = 15 mL

2 tbsp = 1 oz

1 c = 8 oz or 240 mL

2.2 lb = 1 kg

Practice Problems # 11

Solve for "X" using ratio and proportion. The answers are on pages 29-31 of the dosage calculation packet.

1. 5 T = X t _____ 2. 2 oz = X t _____ 3. 2 tsp = _____ mL 4. 45 mL = _____ tbsp

5. 1 oz = _____ mL 6. 1 c = _____ oz 7. 1 t = _____ mL 8. 3 t = _____ tbsp

Nurses must learn all three units of measure (metric, apothecary and household) because medicines are ordered or labeled using the metric system or apothecary system, and we tell patients how much medicine to take using the household system.

Conversion Between Systems

Now that you know the equivalences, it is time to learn how to convert values between systems or changing a measurement of one system to another system. Keep your charts of equivalences handy and refer back to them often.

Many times the physician will order a medication in one strength but the pharmacy stocks the medication in a different strength. By using ratio and proportion that you were taught in Unit I, you can determine how much of the medication that the pharmacy stocks will be needed to equal the amount ordered by the physician.

Always set up your problem in the following manner:

KNOWN UNIT OF MEASURE	:	KNOWN EQUIVALENT UNIT OF MEASURE	::	DESIRED UNIT OF MEASURE (X)	:	UNKNOWN EQUIVALENT

Example: How many grams are there in 500 mg?
(The known ratio is 1000 mg = 1 gm)

KNOWN UNIT OF MEASURE	:	KNOWN EQUIVALENT UNIT OF MEASURE	::	DESIRED UNIT OF MEASURE	:	X

1000 mg : 1 gm :: 500 mg : X gm

$1000X = 500$

$X = \frac{500}{1000}$

X = 0.5 gm (Remember to check your answer)

Practice Problems # 12

Solve for "X" using ratio and proportion. The answers are on pages 29-31 of the dosage calculation packet.

1. ¼ gr = X mg _____ 2. 55 lb = X kg _____ 3. 4 tsp = X mL _____ 4. 600 mL = _____ L

5. 0.16 kg = _____ g 6. 1,700 mL = _____ L 7. 180 mg = _____ g 8. 4 kg = _____ g

UNIT III – Simple Dosage Calculations

The focus of this unit is learning to interpret physician orders and read medication labels correctly. In addition, the administration of safe dosages of oral and parenteral medication will be discussed.

INTERPRETING PHYSICIAN ORDERS

In order to administer medications safely and correctly the nurse must first be able to interpret the physicians order. Components of an order are to have the patient's full name, date and time the order was written, name of the medication, dosage of the medication, route of administration, frequency of administration, and signature of the person writing the order. Special instructions or parameters must be clearly written. **If any component of the medication order is missing the order is not complete and not a legal medication order.**

Abbreviations, Acronyms, & Symbols Not to be Used When Writing Medication Orders

Do not use	Potential problems	Use instead
> <	**Misinterpreted as 7 or L** **Confused for one another**	**Write greater than** **Write less than**
Abbreviations for drug names	**Misinterpreted because of similar abbreviations for similar drugs**	**Write drug names in full**
Apothecary units	**Confused with metric units**	**Use metric units**
@	**Mistaken for the 2**	**Write at**
Cc	**Mistaken for units**	**Write mL or milliliters**
Mg	**Mistaken for mg**	**Write mcg or micrograms**
U	**Mistaken for 0, 4, or cc**	**Write units**

Name

Name of the medication may be ordered in the generic or brand name. The **trade or brand name** is the name under which the manufacturer markets the medication. The trade or brand name is followed by the registration symbol. The name will start with a capital letter or is all in capital letters. The generic name is usually in lowercase letters. It is the proper name, chemical name or nonproprietary name.

Nurses must be familiar with the trade and generic name for medications to prevent errors. Nurses must also be familiar with look alike sound alike medications to prevent errors. Example: Glyburide and Glipizide.

Dosage

Dosage must be written clearly with the correct abbreviation . **Never assume what an order states. Clarify an order when in doubt. If an order is not clear, or if essential components are omitted, it is not a legal order and should not be implemented. The nurse is accountable.**

Route

GT (gastrostomy tube), NGT (Nasogastric tube)

HHN (Hand held nebulizer), MDI (Meter dose inhaler)

p.o. (oral, by mouth), pr (rectum)

ID (Intradermal), IM (Intramuscular), IV (Intravenous), IVPB (Intravenous piggyback), IVP (Intravenous push)

SL (Sublingual), Sub Q (Subcutaneous), S & S (Swish & Swallow)

Time

Time Abbreviation	Meaning	Do Not Use
Ac	Before meals (7:30 am, 11:30 am, 4:30 pm)	
Pc	After meals (10 am, 2 pm, 6 pm)	
Daily	Everyday (9 am)	**q.d. or qd**
Bid	Twice a day (9 am, 9 pm)	
Tid	Three times a day (6 am, 2 pm, 10 pm)	
Qid	Four times a day (6 am, 12 pm, 6 pm, 12 am)	
Qh	Every hour	
at bedtime	At bedime	**hs or h.s.**
Qn	Every night	
Stat	Immediately	
q2h or q2^{o}	Every 2 hours (12 times in 24 h)	
q4h or q4^{o}	Every 4 hours (6 times in 24 h)	
q6h or q6^{o}	Every 6 hours (4 times in 24 h)	
q8h or q8^{o}	Every 8 hours (3 times in 24 h)	
q12h or q12^{o}	Every 12 hours (2 times in 24 h)	
Every other day	Every other day	**qod or q.o.d.**
Prn	As needed	
3 times weekly	3 times a week	**tiw or t.i.w.**
Biw	Twice per week	

Example: Zolpidem tartrate 10 mg p.o. at bedtime prn for sleep

What is the name of the medication? Zolpidem tartrate
What is the prescribed dosage? 10 mg
What is the route of administration? p.o. (by mouth)
When is the drug to be administered? At bedtime
Why is the drug to be administered? To help the patient sleep

Practice Problems # 13

For each of the MD orders interpret the following. If an error is noted with an order, list the error and what action the nurse would take. The answers are on pages 29-31 of the dosage calculation packet.

a. Medication name?
b. Prescribed dosage?
c. Route of administration?
d. Time of administration?
e. What other directions, if any, are given?

1. Potassium chloride 20 mEq p.o. in 120 mL orange juice bid
2. Zidovudine 200 mg po q4h
3. Gentamicin sulfate 45 mg IVPB q12h
4. Regular Humulin Insulin IM at 7:30 am
5. Synthroid 200 po daily
6. digoxin 0.125 po
7. Lasix 40 mg IM stat
8. Librium 50 mg po q4h prn for agitation
9. Tylenol 650 mg po q4h prn
10. Folic acid 1 mg po every day

INTERPRETING MEDICATION LABELS

Medication label information varies from one medication to another. However, most all labels contain the following information; brand name, generic name, dosage, route of administration and manufacturer. If a medication has to be reconstituted, the label will contain information regarding suitable diluents, amount of diluents to be added, concentration of medication after it is reconstituted and its stability. The label of a medication to be administered IV should tell what IV fluids are compatible with the medication. If the medication is in a multi-dose package it will give the total amount of the medication contained.

Practice Problems # 14

Identify the following for each of the medication labels. The answers are on pages 29-31 of the dosage calculation packet.

a. Brand name
b. Generic name
c. Route of administration or form
d. Dosage

1.

200 mg NDC 0108-5012-20	Store at controlled room temperature Dispense in a tight, light resistant container.
Tagamet	Dosage: See accompanying prescribing information.
Cimetidine tablets	Important: Use safety closures when Dispensing this product unless otherwise directed by physician or requested by purchaser.
100 tablets	Caution: Federal law prohibits Dispensing without prescription. SmithKline Beecham Pharmaceuticals

2.

5 mg/mL NDC 0007-3343-01	Store below 86 F. Do not freeze. Protect from light. Discard if discolored.
Compazine	Dosage: For deep IM or IV injection. See accompanying prescribing information.
Prochlorperazine	Caution: Federal law prohibits Dispensing without prescription. SmithKline Beecham Pharmaceuticals

CALCULATION OF ORAL DOSAGES

Oral dosage forms of medications include tablets, capsules, suspensions, lozenges, powders, emulsions, solutions, tinctures, syrups and elixirs. The liquid forms of oral medications are generally calculated to be administered in millimeters, cubic centimeters teaspoons, tablespoons and sometimes minims.

To calculate oral dosages you will use the previously discussed method of ratio and proportion. Set the problems up just as you did in Unit II. **To obtain credit for dosage calculation questions, you must correctly label the answer.**

When the exact number of tablets or capsules is determined and you find that administering the amount calculated is unrealistic or impossible, use the following rule to avoid an error in administration. No more than 10% variation should exist between the dosage ordered and the dosage administered. For example, you may determine that a patient is to receive 0.9 tablets. Administration of such a dose is impossible. Following the above stated rule, 1 tablet could be safely administered. This variation should only occur when conversions are made between apothecary and metric measurements because approximate equivalents are used.

Example: ORDERED: Amoxicillin 500 mg p.o.
AVAILABLE: Amoxicillin 250 mg tablets
How many tablets will the nurse administer?

250 mg : 1 tablet :: 500 mg : X tablets

250 X = 500

$X = \frac{500}{250}$ X = 2 tablets

Check your answer: 250 mg : 1 tab :: 500 mg : 2 tab

250 x 2 = **500**

1 x 500 = **500**

CALCULATION OF PARENTERAL DOSAGES

Parenteral means injection of drugs into the tissue or fluids of the body. The various routes for this include; Intradermal, Subcutaneous (Sub-Q or Sub Q), Intramuscular (IM) and Intravenous (IV). The calculation of these dosages is no different from oral dosage calculations. You will use ratio and proportion to solve the problems. Keep your conversion charts handy!

Practice Problems # 15

Calculate the correct amount of oral or parenteral medications to be administered. The answers are on pages 29-31 of the dosage calculation packet. **To obtain credit for dosage calculation questions, you must correctly label the answer. Round the answer to the appropriate amount that can be administered in the clinical area. For example: If the answer is less than 1 mL, round to the correct hundredths place. If the answer is greater than 1 mL, round to the correct tenths place.**

1. Order: doxepin HCl (Sinequan) 30 mg po at bedtime
   Available: doxepin HCl 10 mg per capsule
   How many capsules will the nurse administer?

2. Order: nitrostat 1/150 gr sublingual stat
   Available: nitrostat 0.4 mg per tablet
   How many tablets will the nurse administer?

3. Order: digoxin 0.25 mg IM daily
   Available: digoxin 0.5 mg/2 mL
   How many mL's will the nurse administer?

4. Order: atropine 0.3 mg IM stat
   Available: atropine 0.4 mg per mL
   How many mL's will the nurse administer?

5. Order: gr 1/300 of a medication
   Available: gr 1/150
   How many tablets will the nurse administer?

6. Order: Diabeta 5 mg po daily
   Available: Diabeta 2.5 mg tablets
   How many tablets will the nurse administer?

7. Order: Restoril 30 mg po at bedtime prn
   Available: Restoril 15 mg tablets
   How many tablets will the nurse administer?

8. Order: Keflex 0.5 g po qid
   Available: Keflex 250 mg capsules
   How many capsules will the nurse administer?

UNIT IV – ADVANCED DOSAGE CALCULATIONS

This unit will cover the following topics; reconstitution of powered drugs, insulin administration and calculating safe pediatric dosages of medications.

RECONSTITUTION OF POWDERED DRUGS

Reconstitution of powered drugs involves the addition of a sterile diluent, usually distilled water or normal saline, to a drug that is in the form of a powder. The pharmacist usually carries out this task, but in many areas of the hospital the task becomes that of the nurse's. The package insert or the container will contain the directions for reconstituting a particular drug. The diluent, as well as instructions for storage will be included. If the vial is a multi-use vial it is the nurse's responsibility to date and time the container.

Example: Ordered: Imipenem 750 mg IM.
Available: Imipenem 750 mg vial. Dissolve in 3ml of 1% lidocaine HCl solution.

How many ml of diluent should you add? 3mL
What amount of the medication will you administer? All that is in the vial. (The whole vial = 750 mg).

Example: Ordered: Cefazolin 250 mg IM.
Available: Cefazolin 1 gm vial. Add 3 mL of normal saline to obtain a concentration of 1gm per 4 mL.

How many ml of diluent should you add? 3 ml
What amount of medication will you administer?
1000 mg : 4 mL :: 250 mg : X mL
1000 X =1000 **X = 1 mL**

Practice Problems # 16

Solve the following reconstitution problems. The answers are on pages 29-31of the dosage calculation packet. **To obtain credit for dosage calculation questions, you must correctly label the answer. Round the answer to the appropriate amount that can be administered in the clinical area. For example: If the answer is less than 1 mL, round to the correct hundredths place. If the answer is greater than 1 mL, round to the correct tenths place.**

1. Order: Cefazolin sodium 0.3 g IM.
   Available: Cefazolin 500 mg powder. Add 2 mL of sterile water to obtain a concentration of 225 mg/mL.
   How many mL's will the nurse administer?

2. Order: Solu-Cortef 200 mg IV q6h for 1 week
   Available: Solu-Cortef 250 mg powder. Add 2 mL of sterile water to obtain a concentration of 250 mg/2 mL.
   How many mL's will the nurse administer?

INSULIN ADMINISTRATION

Insulin is a natural hormone produced by the pancreas to maintain the body's blood sugar within the normal range of 60-110 mg/dL. You will learn much more about this during lecture. The purpose of this unit is to teach you how to safely calculate and administer insulin to patients.

The insulin that is used for replacement therapy is obtained from animal and human sources. **However, within the United States beef and pork insulin is no longer available**. This is important for the nurse to know because the patient needs to remain on the same source of insulin between home care and hospitalization. The label on the insulin bottle will tell whether the insulin is from an animal source or human source.

In addition to various sources of insulin, there are different categories of insulin. The categories are short, intermediate, and long acting insulin and the bottles will be labeled accordingly. This means that the effect the insulin has on the body varies in terms of time. Once again, this will be taught in detail at a later time in the curriculum. The nurse needs to use caution that he/she is giving the correct type of insulin because a patient may be receiving more than one type of insulin at various times throughout the day.

Insulin is measured by a standard that is called USP units. It is supplied in concentrations of **100 units per milliliter.** (Learn this!) This is true for all sources and all categories of insulin.

An insulin syringe can only be used for measuring insulin. Units are not interchangeable. A unit of insulin is not the same as a unit of penicillin. Do not use a Tuberculin syringe to measure insulin. Insulin syringes are designed with less dead space in the hub of the syringe.

POINTS TO REMEMBER WHEN ADMINISTERING INSULIN

1. When mixing categories of insulin in the same syringe, always draw up the short-acting first.
2. Gently roll the bottle of insulin to mix it before drawing up the dose. Do not shake the bottle vigorously.
3. **Always have another nurse verify that you have drawn up the correct amount and type of insulin.**
4. Only Regular (short acting) insulin can be given intravenously.
5. **If not given correctly, insulin can be a lethal drug**.

Because insulin is supplied as 100 units/ml and the insulin syringe is measured in units/mL, there is no calculation required for insulin administration. If the order states 5 units Humulin Insulin R, you would administer 5 units of regular insulin via a 1 ml insulin syringe.

Many times the patient will receive a long-acting insulin once or twice daily, as well as a short acting insulin every 4 hours depending upon his blood sugar. To determine the amount of the short-acting insulin to administer, the nurse will have to refer to the physician's sliding scale order.

Example: Order: Regular insulin Sub-Q q 4 hr according to sliding scale below. The patient's blood sugar was 235. How much insulin will the nurse administer?

Blood Sugar (mg/dL)	Regular Insulin
0 – 150	No insulin
151 – 200	2 units
201 – 240	4 units
241- 280	6 units
281 – 330	8 units
over 330	Call MD

Based on the above sliding scale, you administer 4 units.

Practice Problems # 17

Use the sliding scale above to determine how much Regular insulin should be administered based on the following blood sugar results. The answers are on pages 29-31 of the dosage calculation packet. **To obtain credit for dosage calculation questions, you must correctly label the answer.**

1. 265 mg/dL = _____
2. 75 mg/dL = _____
3. 364 mg/dL = _____
4. 204 mg/dL = _____
5. 165 mg/dL = _____

CALCULATING SAFE PEDIATRIC DOSAGES

Infants and children require smaller quantities of drugs than adults. Their medications are commonly ordered in milligrams or micrograms per kilogram of body weight. Below are the steps to determine a safe pediatric medication dosage:

1. Weigh the child
2. Convert pounds to kilograms as you did in Unit II. **Round to the hundredths place**.
3. Calculate the ordered dose using ratio and proportion.
4. Determine if the dose is safe according to the manufacturers safe dosage range.

Example: Order: Meperidine 1.5 mg/kg IM. The child weighs 20 pounds.

Step 1: Convert pounds to kilogram

2.2 lb : 1 kg :: 20 lb : X kg

2.2 X = 20

X = 9.0909 **(Always round to the hundredth place for children)**

X = 9.09 kg

Step 2: Calculate the ordered dose of Meperidine.

1 kg : 1.5 mg :: 9.09 kg : X mg

X = 13.635 **(Always round to the hundredth place for children)**

X = 13.64 mg Meperidine

Now that you know how to determine the amount of medication to administer based on weight, you need to learn how to determine if that dose is within the safe range.
Drug manufacturers will include the safe pediatric ranges for medications. You have to insert the dosage for your pediatric patient into the equation and use ratio and proportion, to determine if it is a safe dose. If it is, you administer the drug. If it is not, you call the ordering physician. Many times a range will be given rather than one specific safe dosage amount.

Example: Order: Carbamazepine 400 mg po BID. The recommended dose is 15 – 20 mg/kg. The child weighs 55 lbs. Is the ordered dose a safe dose?

Step 1: Convert pounds to kilograms

2.2 lb : 1 kg :: 55 lbs : X kg

X = 25 kg

Step 2: Calculate to determine if the dose is safe.

1 kg : 15 mg :: 25 kg : X mg

X = 375 mg **and**

1 kg : 20 mg :: 25 kg : X mg

X = 500 mg

This tells you the safe range per dose is 375 – 500 mg.
As stated above, the MD ordered 400 mg. Since 400 falls within the safe range, you would determine that 400 mg is a safe dose. If, for example, the MD had ordered 600 mg Carbamazepine then you would determine that not to be a safe dose and you would notify the ordering physician.

Another variation of this principle, is that the nurse may have to determine if a dose is safe in terms of a 24 hour period. Some medications will list a 24-hour safe dose range and the nurse has to determine if the number of doses of a medication to be given in 24 hours falls within that range.

Example: Order: Erythromycin 62.5 mg, po q6 hr for an infant that weighs 11 lbs. Safe dose range is 30 – 50 mg/kg/24 hrs.

Step 1: Convert lbs to kg

2.2 lb : 1 kg :: 11 lbs : X kg

X = 5 kg

Step 2: Determine safe dose range for 24-hr period.

1 kg : 30 mg :: 5 kg : X mg

X = 150 mg

1 kg : 50 mg :: 5 kg : X mg

X = 250 mg

Safe dosage range for 24-hr period = 150 mg – 250 mg

Step 3: Determine if the ordered dosage for the 24-hr period is safe.

The ordered medication is ordered every 6 hours. The nurse determines that the child will receive 4 doses in a 24-hr period.

62.5 mg X 4 doses = 250 mg of Erythromycin in a 24-hr period. The nurse determines this to be a safe 24-hr period dose by comparing this number to the safe range in step 2.

Practice Problems # 18

Solve the following. The answers are on pages 29-31 of the dosage calculation packet. **To obtain credit for dosage calculation questions, you must correctly label the answer. Round the answer to the hundredths place.**

1. Order: Acetaminophen elixir 10 mg/kg po. Child weight is 10 pounds.
   Available: Acetaminophen elixir 160 mg/ 5ml. How much Acetaminophen will the nurse administer?

2. Order: Amoxicillin 100 mg po q6 hr. Child weighs 15 lbs. Safe range is 25 – 30 mg/kg/24 hr.
   a. What is the safe 24-hr range?
   b. Is the ordered dose safe for a 24-hr period?

3. Order: Digoxin 18 mcg po bid. Child weighs 7 lbs. The safe range is 10 – 12 mcg/kg/24 hrs.
   a. What is the safe 24-hr range?
   b. Is the ordered dose safe for a 24-hr period?
   c. If the medication is supplied 50 mcg/mL, how many mL will the nurse administer per dose?

4. Order: Phenytoin 40 mg po q 8 hr. Child weighs 27 lb. The safe range is 8–10 mg/kg/24 hr
   a. What is the safe 24-hr range?
   b. Is the dose safe for a 24-hr period?
   c. If the medication is supplied 125 mg/5 mL, how many mL will the nurse administer per dose?

UNIT V – Intravenous Preparation with Clinical Calculations

Intravenous fluids are used in health care settings to rehydrate patients or to give medicines. Calculation of IV flow rates ensures that fluids do not infuse too fast, which could overload the patient or too slowly, delaying treatment. This unit will explain how to calculate and administer IV fluids and medications. The topics to be discussed include; calculating flow rates for electronic and manual IV flow regulators, calculating hourly IV heparin dosages and calculating IV flow rates in order to administer a specific concentration of a medication per minute or hour.

ELECTRONIC IV FLOW REGULATORS

Electronic pumps are used in all health care settings. In some instances, it is mandatory policy to use these devises. Such is the case when administering narcotics, heparin or various heart medications via continuous IV drip. In addition, very small amounts of fluid can be infused over an extended period of time by using these electronic pumps.

The key concept to **memorize** about these electronic pumps is that they are designed to infuse the IV fluid/medication in **milliliters per hour** (some of the newer pumps can be set to administer tenths of a milliliter per hour). The physician will order the flow rate in milliliters (mL) per hour or specify the amount of time necessary to infuse the IV fluid/medication.

When the physician orders the specific mL per hour, the nurse simply hangs the correct IV fluid/medication and sets the pump to the ordered flow rate. There are NO calculations!!!

However, if the physician only specifies the duration of time to take to infuse an amount of IV fluid/medication and does not order mL per hour, the nurse must calculate the flow rate. You will use ratio and proportion to calculate the flow rate.

Example: Order: 1000 mL NS IV to infuse over 8 hrs.

8 hr : 1000 mL :: 1 hr : X mL

8X = 1000

X = 125 mL/hr This is the flow rate!

Shortcut: Actually all you have to do is divide the total amount of fluid by the number of hours.

If the infusion time is not in whole hours, you must calculate using 60 minutes rather than 1 hour.

Example: Order: Ondansetron 10 mg in 100 mL NS IVPB q 8 hr.
Infuse over 30 minutes.

30 min : 100 mL :: 60 min : X mL

30 X = 6000

X = 200 mL/hr

The nurse sets the electronic pump to deliver 200 mL/hr and after 30 minutes the 100 mL of medication would have been infused.

Note: The mg of medication has nothing to do with calculating the flow rate. Don't be confused and try to use this number in your calculation!

Practice Problems # 19

Calculate the flow rate when using an electronic pump. The answers are on pages 29-31 of the dosage calculation packet. **To obtain credit for dosage calculation questions, you must correctly label the answer mL/hr. Round the answer to the tenths place.**

1. Infuse1,000 mL D5W over 15 hours.
2. Infuse 600 mL LR over 3 hours.
3. Infuse 1,800 mL D5W over 24 hours.
4. Infuse 3,000 mL RL over 24 hours.
5. Infuse 500 mL D5W over 4 hours.
6. Infuse Cimetidine 300 mg IVPB mixed in 100 mL NS over 45 minutes.
7. Infuse Ampicillin 500 mg IVPB mixed in 50 mL NS over 10 minutes.
8. Infuse Kefzol 0.5 g IVPB mixed in 50 mL D5W over 30 minutes.
9. Infuse 50 mL of an antibiotic over 25 minutes.
10. Infuse 80 mL of an antibiotic over 40 minutes.

MANUAL IV FLOW REGULATORS

Nurses are using fewer and fewer manual IV flow regulators to administer IV fluids/medications in the health care setting. Another term used to describe these regulators is gravity drip IV infusions. This describes how manual flow regulators work. The rate of infusion is dependant upon the gravity of the bag of IV fluid/medication. The rate of these infusions will always be calculated in **drops (gtts) per minute.** (There will not be a pump!)

In order to calculate the accurate rate of infusion, the nurse must know the type of tubing or administration set to be used. Each type of administration set has a drop chamber with either a **macro** drop set that delivers 10, 15 or 20 drops per milliliter while the **micro** drop set always delivers 60 drops per milliliter. This is referred to as the drip factor. To prevent errors in calculating the infusion rate, always check the manufacturer's label to verify the drip factor of the administration set.

The nurse will have to manually regulate the flow of IV fluid/medication when using the above administration sets. There are two steps to this process. The first step is that the nurse must calculate the drop rate, which will always be gtts/min. The second step is that the nurse will adjust the roller clamp on the IV tubing and count the drops to insure accurate infusion. This type of infusion will have to be monitored frequently because kinked tubing or a change in arm position can slow or increase the rate of flow.

There are various formulas to use to calculate the flow rates for manual IV regulators. The following formula must be learned:

$$\frac{\text{Amount of fluid} \times \text{Drip factor}}{\text{Time (always in minutes)}}$$

Example: Order: 3000 mL NS IV over 24 hrs.
Drip factor of tubing: 15 gtts/mL.

$$\frac{3000 \text{ mL} \times 15 \text{ gtts/mL}}{24 \text{ hr} \times 60 \text{ min}} = \frac{45000}{1440} = 31.25 = 31 \text{gtts/min}$$

This number will have to be rounded to a whole number because a manual IV flow regulator cannot deliver a portion of a drop.

If the infusion time is less that one hour, you simply put this amount of time as the denominator.

Example: Order Ampicillin 500 mg IVPB in 100 mL NS to infuse over 30 min. Drip factor: 10 gtts/mL.

$$\frac{100 \text{ mL} \times 10 \text{ gtts/mL}}{30 \text{ min}} = \frac{1000}{30} = 33.33 = 33 \text{gtts/min}$$

Practice Problems # 20

Determine the infusion rate for the following. The answers are on pages 29-31 of the dosage calculation packet. **To obtain credit for dosage calculation questions, you must correctly label the answer gtt/min. Round the answer to the nearest whole number.**

1. Order: 1000 mL NS to infuse in 8 hours. Drip factor of administration set: 15 gtts/mL.

2. Order: 1000 mL NS to infuse in 6 hours. Drip factor of administration set: 20 gtts/mL.

3. Order: 500 mL NS to infuse in 4 hours. Drip factor of administration set: 15 gtts/mL.

4. Order: Famotidine 40 mg IVPB mixed in 100 mL NS to infuse over 30 minutes. Drip factor: 20 gtts/mL.

5. Order: 1,000 mL D5 0.45% NS to infuse in 3 hours. Drip factor of administration set: 20 gtt/mL.

6. Order: 1,500 mL NS to infuse in 12 hours. Drip factor of administration set: 10 gtt/mL.

7. Order: 2,000 mL D5W to infuse in 16 hours. Drip factor of administration set: 20 gtt/mL.

8. Order: 250 mL D5W to infuse in 10 hours. Drip factor of administration set: 60 gtt/mL.

9. Order: 500 mL D5W to infuse in 8 hours. Drip factor of administration set: 15 gtt/mL.

10. Order: 1,500 mL D5W in 24 hours. Drip factor of administration set: 15 gtt/mL.

CALCULATING HOURLY IV HEPARIN DOSAGES

The administration of continuous IV heparin is a common practice in the hospital setting. It is vital that the nurse know how to calculate an accurate infusion rate since the margin is very small and can easily result in death. IV heparin will always be administered via an electronic pump, thus it will be calculated in milliliters per hour. **Round the answer to the tenths place.** The dosage of heparin is measured in units. Ratio and proportion are used to calculate the dosage.

Example: Order: Heparin 800 units/hr via continuous IV infusion. Medication comes mixed from pharmacy: Heparin 25,000 units in 250 mL NS.

25,000 units : 250 mL :: 800 units : X mL

25,000 X = 200,000

$$X = \frac{200{,}000}{25{,}000} = 8 \text{ mL/hr}$$

Practice Problems # 21

Determine the flow rate (mL/hr) for the following. The answers are on pages 29-31 of the dosage calculation packet. **To obtain credit for dosage calculation questions, you must correctly label the answer. Round the answer to the tenths place.**

1. Order: Heparin 1,500 units per hr via IV infusion. Medication comes mixed from pharmacy: Heparin 25,000 units in 250 mL NS.

2. Order: Heparin 1,800 units per hr via IV infusion. Medication comes mixed from pharmacy: Heparin 20,000 units in 250 mL NS.

3. Order: Heparin 1,200 units per hr via IV infusion. Medication comes mixed from pharmacy: Heparin 25,000 units in 200 mL NS.

4. Order: Heparin 800 units per hr via IV infusion. Medication comes mixed from pharmacy: Heparin 20,000 units in 100 mL NS.

5. Order: Heparin 2,000 units per hr via IV infusion. Medication comes mixed from pharmacy: Heparin 25,000 units in 1,000 mL NS.

6. Order: Heparin 1,400 units per hr via IV infusion. Medication comes mixed from pharmacy: Heparin 40,000 units in 1,000 mL D5W.

7. Order: Heparin 850 units per hr via IV infusion. Medication comes mixed from pharmacy: Heparin 25,000 units in 500 mL D5W.

8. Order: Heparin 1,200 units per hr via IV infusion. Medication comes mixed from pharmacy: Heparin 20,000 units in 250 mL NS.

IV ADMINISTRATION BY CONCENTRATION

Usually IV fluids/medications are ordered to be infused at a certain rate or time period as has already been taught. However, some IV's, especially in the critical care areas, are ordered to be administered with a specific concentration of the medication per hour, per minute or per milliliter. These medications will be administered via an electronic infusion device. This is a difficult calculation to master, but if you will learn the basic steps of the calculation, and think about what the problem is asking, you will have no problems!

Below are the basic steps to these types of problems. Remember, you may not have to use all of the steps for each problem.

Step 1: Convert pounds to kilograms.

Step 2: Determine the correct dosage based on the patients weight (in kilograms).
Round weight to the hundredths place.

Step 3: Convert the ordered unit to the unit you have on hand.

Step 4: Calculate the # of mL/min to administer.

Step 5: Calculate the # of mL/hr to administer. **Round to the nearest tenths place**.

Remember, you may not always have to go through all 5 steps. Think through the problem and determine the steps needed!!!

Example: Order: Bretylium 5mcg/kg/min. Medication comes mixed 0.05 g in 50 mL NS. Patients weight is 187 lbs.

Step 1: Convert lbs to kg

2.2 lb : 1 kg :: 187 lb : X kg
X = 85 kg

Step 2: Determine the correct dosage based on pts weight

1 kg : 5 mcg :: 85 kg : X kg
X = 425 mcg

Step 3: Convert the ordered unit to the unit on hand.

1 g : 1,000,000 mcg :: 0.05 g : X mg
X = 50,000 mcg (there are 50,000 mcg in 50 mL NS)

Step 4: Calculate the # of mL/min to administer.

50,000 mcg : 50 mL :: 425 mcg : X mL
X = 0.425 mL/min

Step 5: Calculate the # of mL/hr to administer.

1 min : 0.425 mL :: 60 min : X mL
X = 25.5 mL/hr

Example: Order: Nitroglycerin 50 mg in 500 mL D5W
at 50 mcg/min. Set the pump at____mL/hr?

Step 1: Convert to kilograms. – NOT NEEDED!!!

Step 2: Determine the correct dosage based on the patients weight. - NOT NEEDED !!!

Step 3: Convert the ordered unit to the unit on hand.
1 mg : 1000 mcg :: 50 mg : X mcg
X = 50,000 mcg (50,000 mcg in 500 mL D5W)

Step 4: Calculate the # of mL/min to administer.
50,000 mcg : 500 mL :: 50 mcg : X mL
X = 0.5 mL/min

Step 5: Calculate the # of mL/hr to administer.
1 min : 0.5 mL :: 60 min : X mL
X = 30 mL/hr

Practice Problems # 22

Determine the rate **(mL/hr)** for the following. The answers are on pages 29-31 of the dosage calculation packet. **To obtain credit for dosage calculation questions, you must correctly label the answer. Round the answer to the tenths place.**

1. Order: Administer Clindamycin IV at a rate of 10 mg/min. Available: Clindamycin 900 mg in 100 mL NS.

2. Order: Administer Chlorothiazide at a rate of 15 mg/min. Available: Chlorothiazide 350 mg in 50 mL NS.

3. Order: Nitroprusside IV 0.5 mcg/kg/min. Weight = 125 lb. Available: Nitroprisside 10 mg in 100 mL D5W.

4. Order: Nipride 3 mcg/kg/min. Weight = 60 kg. Available: Nipride 50 mg in 250 mL D5W.

5. Order: Theophylline 0.7 mg/kg/hr. Weight = 73.5 kg. Available: Theophylline 800 mg in 500 mL D5W.

6. Order: Dobutrex 3 mcg/kg/min. Weight = 80 kg. Available: Dobutrex 250 mg in 500 mL D5W.

7. Order: Inocor 5 mcg/kg/min. Weight = 165 lb. Available: Inocor 250 mg in 250 mL NS.

8. Order: Esmolol 75 mcg/kg/min. Weight = 60 kg. Available: Esmolol 5,000 mg in 500 mL D5W.

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Answers to Practice Problems

Practice Problems # 1

Reduce the fractions

1. ½ 2. ¼ 3. 3/4 4. 1/3 5. 2/3 6. 1/7 7. ½ 8. 5/7 9. 1/7 10. 2/3

Improper fractions to mixed numbers

1. $1\frac{1}{2}$ 2. $1\frac{2}{5}$ 3. $1\frac{7}{8}$ 4. $1\frac{1}{2}$

Mixed numbers to improper fractions

1. 7/2 2. 13/2 3. 21/2 4. 100/3 5. 29/25 6. 17/4 7. 9/2 8. 27/8 9. 79/5 10. 37/4

Practice Problems # 2

Addition

1. $1\frac{1}{2}$ 2. $2\frac{19}{24}$ 3. $7\frac{1}{6}$ 4. $8\frac{1}{15}$ 5. $22\frac{5}{6}$ 6. $1\frac{13}{30}$ 7. 13/24 8. 7/10

Subtraction

1. 19/21 2. $1\frac{31}{40}$ 3. 11/16 4. 1/12 5. 1/24 6. 1/9 7. 19/30 8. 5/21

Multiplication

1. 1/12 2. 9/200 3. 1/9 4. 5/8 5. 1/15 6. 1/10 7. 7/27 8. 2/3

Division

1. 2/3 2. 2 3. $1\frac{1}{2}$ 4. $7\frac{1}{2}$ 5. 7/18 6. 1 7. 15 8. 1/30

Practice Problems # 3

1. 1.5 2. 10 3. 23.33 4. 17.95 5. 4 6. 1.17 7. 70.89 8. 30.46 9. 6.33 10. 1.5

Practice Problems # 4

Round to the tenths place

1. 0.8 2. 0.2 3. 1 4. 0.4 5. 3.6 6. 1 7. 2 8. 1.8 9. 0.1 10. 0.3

Round to the hundredths place

1. 1.09 2. 0.46 3. 12.23 4. 19.01 5. 1.43 6. 0.15 7. 3.55 8. 0.61 9. 0.74 10. 1.27

Practice Problems # 5

1. 1/10 2. 9/20 3. 3/4 4. ¼ 5. 1/100 6. 4/5 7. 1/50 8. 3/100 9. ½ 10. 3/5

Practice Problems # 6

1. 50% 2. 40% 3. 25% 4. 80% 5. 275% 6. 70% 7. 7% 8. 37.5% 9. 50% 10. 75%

Practice Problems # 7

1. 0.1 2. 0.45 3. 0.75 4. 0.25 5. 0.14 6. 0.35 7. 0.2 8. 0.5 9. 0.13 10. 0.4

Practice Problems # 8

1. 12 2. 100 3. 7/9 4. 7 ½ 5. 9.6 6. 15/2 7. 3 8. 18 9. 5 10. 4.5

Practice Problems # 9

1. 0.25 kg 2. 15,000 mcg 3. 3,500 mL 4. 5,000 mg 5. 0.36 g 6. 0.004 mg 7. 200 mg
8. 0.5 L

Practice Problems # 10

1. 1 qt 2. 4 pts 3. ½ pt 4. 8 oz 5. 3 oz 6. 15 mL 7. 32 oz 8. 900 mg

Practice Problems # 11

1. 15 t 2. 12 t 3. 10 mL 4. 3 tbsp 5. 30 mL 6. 8 oz 7. 5 mL 8. 1 tbsp

Practice Problems # 12

1. 15 mg 2. 25 kg 3. 20 mL 4. 0.6 L 5. 160 g 6. 1.7 L 7. 0.18 g 8. 0.004 g

Practice Problems # 13

1. Potassium chloride, 20 mEq, po, bid, in 120 mL of orange juice
2. Zidovudine, 200 mg, po, q4h
3. Gentamicin sulfate, 45 mg, IVPB, q12h
4. Regular Humulin Insulin, **No dosage (clarifiy), IM (clarify)**, 7:30 am
5. Synthroid, 200 **(No unit of measure, clarify)**, po, daily
6. Digoxin, 0.125 **(No unit of measure, clarify)**, po, **No frequency (clarify)**
7. Lasix, 40 mg, IM, stat
8. Librium, 50 mg, po, q4h prn, for agitation
9. Tylenol, 650 mg, po, q4h prn**, reason (clarify)**
10. Folic acid, 1 mg, po, every day

Practice Problems # 14

1. a. Tagamet
   b. Cimetidine
   c. Tablets
   d. 200 mg

2. a. Compazine
   b. Prochlorperazine
   c. Injection
   d. 5 mg/mL

Practice Problems # 15

1. 3 capsules
2. 1 tablet
3. 1 mL
4. 0.75 mL
5. ½ tablet
6. 2 tablets
7. 2 tablets

Practice Problems # 16

1. 1.3 mL
2. 1.6 mL

Practice Problems # 17

1. 6 units
2. No insulin
3. Call MD
4. 4 units
5. 2 units

Practice Problems # 18

1. 1.4 mL
2. 170.5 mg – 204.6 mg/day, No
3. 31.8 mcg-38.16 mcg, Yes, 0.36 mL
4. 98.16 mg-122.7 mg, Yes, 1.6 mL

Practice Problems # 19

1. 66.7 mL/hr
2. 200 mL/hr
3. 75 mL/hr
4. 125 mL/hr
5. 125 mL/hr
6. 133.3 mL/hr
7. 300 mL/hr
8. 100 mL/hr
9. 120 mL/hr
10. 120 mL/hr

Practice Problems # 20

1. 31 gtt/min
2. 56 gtt/min
3. 31 gtt/min
4. 67 gtt/min
5. 111 gtt/min
6. 21 gtt/min
7. 42 gtt/min
8. 25 gtt/min
9. 16 gtt/min
10. 16 gtt/min

Practice Problems # 21

1. 15 mL/hr
2. 22.5 mL/hr
3. 9.6 mL/hr
4. 4 mL/hr
5. 80 mL/hr
6. 35 mL/hr
7. 17 mL/hr
8. 15 mL/hr

Practice Problems # 22

1. 66.7 mL/hr
2. 128.6 mL/hr
3. 17 mL/hr
4. 54 mL/hr
5. 32 mL/hr
6. 28.8 mL/hr
7. 22.5 mL/hr
8. 27 mL/hr

Comprehensive Dosage Calculation Exam

To obtain credit for the following dosage calculation questions, the student must:

- **Correctly label the answer.**
- **Round the answer to the appropriate amount that can be administered in the clinical area. For example:**
  - **< 1mL round to the correct hundredths place.**
  - **> 1mL round to the correct tenth place.**
- **Round an IV pump answer to the correct tenth place.**
- **Round weight related answers to the hundredths.**
- **Pediatric questions should be rounded to the hundredths.**

1. gr 1/6 = _____ mg

1. Order: furosemide (Lasix) 15 mg
   Available: furosemide (Lasix) 20 mg/2 mL
   How many mL's will the nurse administer?

2. Order: phenytoin (Dilantin) 300 mg now and every morning
   Available: phenytoin (Dilantin) 200 mg tablets
   How many tablets will the nurse administer?

3. Order: ampicillin 100 mg/kg/day in four divided doses for a child weighing 31 lb.
   Available: ampicillin 250 mg/2 mL.
   How many mL's per dose will the nurse administer?

4. Order: D5W 600 mL to infuse over 8 hours. How many mL's/hr will the nurse set the IV pump to infuse?

5. Order: Vancomycin 500 mg in 250 mL of D5W to infuse over 2 hours. The drop factor is 10 gtts/mL. How many gtt/min will the nurse infuse?

6. Order: D5W 3000 mL to infuse over 24 hours. How many mL's/hr will the nurse set the IV pump to infuse?

7. Order: Doxycycline 200 mg IVPB in 100 mL NS to infuse over 30 min. The drop factor is 10 gtts/mL. How many gtt/min will the nurse infuse?

8. Order: Dopamine 5 mcg/kg/min. Patient weight 132 lb.
   Available: Dopamine 200 mg in 250 mL NS.
   How many mL's/hr will the nurse set the IV pump for?

9. Order: Aminophylline 0.5 mg/kg/hr. Patient weight 154 lb.
   Available: Aminophylline 500 mg in 1000 mL of D5W.
   How many mL's/hr will the nurse set the IV pump for?

Comprehensive Dosage Calculation Answers

1. 10 mg
2. 1.5 tablets
3. 1.5 mL
4. 75 mL/hr
5. 21 gtt/min
6. 125 mL/hr
7. 33 gtt/min
8. 22.5 mL/hr
9. 70 mL/hr