

## Pharmacy Calculations test

9/1/2017

Pharm tech

# Calculations Review for Pharmacy Technicians

## Financial Disclosure

# Objectives

## Self-Assessment Question

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Complete the following conversions:

## Self-Assessment Question

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A 49-year old, 132-lb man is being started on octreotide for variceal bleeding. He is getting 50 mcg/hr and the drip contains 500 mcg of octreotide in 100 mL NS. What is the flow rate in mL/hr?

- A. 1 mL/hr
- B. 10 mL/hr
- C. 50 mL/hr
- D. 100 mL/hr

## Topics to Cover

AGENDA

- 1. Units of measure and conversions**
2. Ratio, proportions and percent strength
3. Stock solutions and dilution
4. Clinical-based calculations
5. Parenteral calculations

## Roman Numerals

UNITS + CONVERSIONS

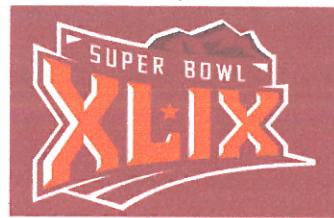
- Reading Roman numerals:
  - Lower number after high number = add | XII
  - Lower number before higher = subtract | IX
  - Smaller number between two larger | XIX
  - Avoid repetition of > 3 occurrences of the same letter | IIIIII → VII
  - Power of 10 | IC → XCIX
  - Use only one smaller number before a larger number | IIX → VIII

Number	Roman Numeral
1	I or i
5	V or v
10	X or x
50	L
100	C
500	D
1000	M

## Practice Problem #1

UNITS + CONVERSIONS

What number Super Bowl is represented in the image below?



## Systems of Measurement

UNITS + CONVERSIONS

Metric	Avoirdupois	Apothecary
-International System of Units -Standard for USP -Use prefixes to indicate numeric value	-British-based system -Primarily used for mass measurements	-Used in healthcare -Household measurements in United States (volume)
Commonly seen units:	Commonly seen units:	Commonly seen units:
Millimeter, centimeter	Ounce	Grain, dram, scruple
Milliliter, liter	Pound	Fluid ounce
Milligram, gram, kilogram	Grain	Pint, quart, gallon

## Household Measurements

UNITS + CONVERSIONS

Household Unit	Equivalent
<b>VOLUME</b>	
1 teaspoonful (tsp)	5 milliliters (mL)
1 tablespoonful (tbsp)	15 mL
1 fluid ounce (fl oz)	30 mL
1 cup	8 fl oz
1 pint (pt)	16 fl oz
4 quarts (qt)	1 gal
1 gallon (gal)	3.785 L
<b>WEIGHT</b>	
1 pound (lb)	16 oz

## Other Conversions

UNITS + CONVERSIONS

Measurement	Equivalent
1 pound (lb)	454 g
1 kilogram (kg)	2.2 lbs
1 grain (gr)	65 mg*
1 dram	5 mL

## Practice Problem #2

UNITS + CONVERSIONS

Complete the following conversions:

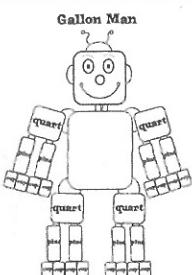
1. 5 gr = \_\_\_\_\_ mg

2. 8 oz = \_\_\_\_\_ mL

3. 210 lbs = \_\_\_\_\_ kg

## Tips on Remembering

UNITS + CONVERSIONS

Image source: <http://www.purplemath.com>

## Challenge! ☺

UNITS + CONVERSIONS

- Drug written?
- Quantity to dispense in mL?
- Amount patient should take per dose?

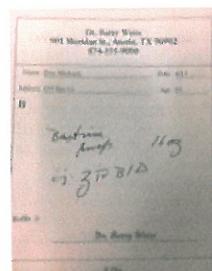


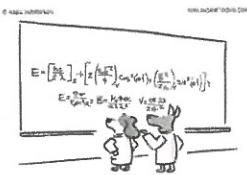
Image source: Relyea P. Patient Care Management Lab - 2nd Edition.

## Key Points

UNITS + CONVERSIONS

- Pharmacy practice uses principles from all three systems of measurement

- Knowing household equivalents and other conversions is crucial for pharmacy practice



## Topics to Cover

AGENDA

1. Units of measure and conversions
2. **Ratio, proportions and percent strength**
3. Stock solutions and alligation
4. Clinical-based calculations
5. Parenteral calculations

## Basic Refresher

RATIOS + PROPORTIONS

- **Ratio** is comparison of two like quantities
  - Fraction ( $\frac{A}{B}$ ) or ratio strength (2:3)
  - Very common in drug strength notation
- **Proportion** is when two ratios are equal
  - Generally set up as:  $\frac{A}{C} = \frac{B}{D}$
- 3 Rules to Follow:
  1. Numerators should have same units
  2. Denominators should have same units
  3. Three of the four "spots" should be known

## Practice Problem #3

RATIOS + PROPORTIONS

A prescription is written for a 300mg dose of an oral solution. The pharmacy stocks a 250mg /5mL stock bottle. How much of the stock solution should be taken per dose?

## Concentrations

RATIOS + PROPORTIONS

- Weight / weight (w/w)
  - Represented as GRAMS PER 100 GRAMS
  - Used for solids, semisolids
- Volume / volume (v/v)
  - Represented as MILLILITERS PER 100 MILLILITERS
  - Not used very often in practice; chemicals?
- Weight / volume (w/v)
  - Represented as GRAMS PER 100 MILLILITERS
    - Example: 5% = 5 grams / 100 mL
  - Most common way to express concentration in practice

## Ratio Strength

RATIOS + PROPORTIONS

- Written as X:Y, where X is usually 1
- Often used to show the concentration of "weak" preparations
  - Example: 0.2% (w/v) = 1:500 (w/v)
- Same rules as percent strength for units
- Used frequently in hospital practice



## Converting Between

RATIOS + PROPORTIONS

- If given in percent strength...

$$4\% \text{ (w/v)} \rightarrow \frac{4 \text{ g}}{100 \text{ mL}} = \frac{1}{X} \quad X = 25 \text{ (1:25)}$$

- If given as ratio strength...

$$1:80 \text{ (w/w)} \rightarrow \frac{1}{(1.25\%)} = \frac{X \text{ g}}{80} \quad X = 1.25$$

## Practice Problem #4

RATIOS + PROPORTIONS

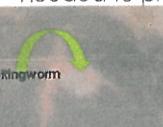
You dispense 50 mL of 1.5% w/v ibuprofen suspension with the following SIG:  
2 tsp QD

How many milligrams of ibuprofen are in each dose?

## Challenge! ☺

RATIOS + PROPORTIONS

A formula for tinea capitis shampoo contains 1:62.5 (w/v) selenium sulfide. How many capsules, each containing 350 mg of selenium sulfide, would be needed to prepare 1 pint of shampoo?




## Key Points

RATIOS + PROPORTIONS

- Remember to always match your units when setting up proportions
- Percent strength is represented as "\_\_\_\_\_ per 100"
- Whether using ratio or percent strength, you can always solve for quantity needed by setting up proportions

## Topics to Cover

AGENDA

- Units of measure and conversions
- Ratio, proportions and percent strength
- Stock solutions and alligation**
- Clinical-based calculations
- Parenteral calculations

## Stock Solutions

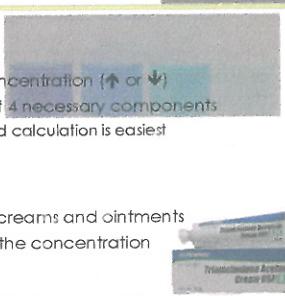
STOCK SOLN + ALLIGATION

- Concentrated solutions used to prepare weaker ones
- Diluting gives smaller concentration in higher volume for easier dosing
- General Rules:
  - Working with percent strength is typically easiest
  - May require multiple steps to be the most accurate

## Liquids vs. Solids

STOCK SOLN + ALLIGATION

- Liquid Dilutions:
  - Changes the concentration ( $\uparrow$  or  $\downarrow$ )
  - Usually know 3 of 4 necessary components
  - Proportion-based calculation is easiest
- Solid Dilutions:
  - Adding base to creams and ointments
  - Usually lowering the concentration



## Using Proportions

STOCK SOLN + ALLIGATION

$$\frac{\text{volume of stock}}{\text{desired \% strength}} = \frac{\text{volume needed}}{\% \text{ strength of stock}}$$

OR

$$\frac{\% \text{ strength of stock}}{\text{desired \% strength}} = \frac{\text{volume of stock}}{\text{volume needed}}$$

### Practice Problem #5

How many milliliters of 1:500 w/v solution is needed to make 3 L of a 1:2000 w/v solution?

### Using Algebra

$$C_1 \times V_1 = C_2 \times V_2$$

- $C$  = strength (concentration)
- $V$  = volume (quantity)
- Usually set up as HAVE = WANT
- Any units work as long as they match on either "side"
- KEY CONCEPT: base has a strength of 0%

### Practice Problem #6

If 200 mL of an 8% w/v potassium chloride solution is diluted to 1500 mL, what is the new percent strength of the diluted solution?

### Alligation

- Two different types:
  - Medial → for determining new % strength when combining multiple strengths of same ingredient
    - Completely math based
  - Alternate → for determining volume needed to get new % strength
    - Visual/grid based

### Alligation Medial

- Two ways to tackle
  1. Use total volume of solutions, total grams of ingredients in solution and set up proportion
  2. Convert percent strength into decimals and multiply by their volumes, then calculate new strength
- Both methods produce same answer ☺

### Alligation Medial

What is the new percent strength when 100 mL of 50% dextrose is mixed with 250 mL of 40% dextrose and 450 mL of 70% dextrose?

1. Proportion:
2. Decimals:

## Alligation Alternate

- Think of it as math "tic-tac-toe"

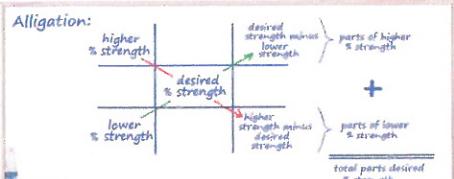


Image source: <http://www.pharmacy-test-test.com/pharmacy-math-alligation.html>

## Practice Problem #7

How much 85%  
alligatormycin must be  
added to 150 mL of 60%  
alligatormycin to make  
an 80% solution?



Image source: <http://image.google.com>

## Key Points

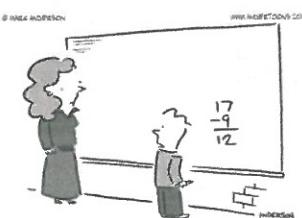
- When working with stock solutions, using percent strength is generally easiest
- When using alligation alternate, correct set-up is key to success!
- Units and conversion factors apply to almost every scenario ☺



Image source: <http://image.google.com>

## BRAIN BREAK!

STAND UP AND STRETCH ☺



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## Topics to Cover

1. Units of measure and conversions
2. Ratio proportions and percent strength
3. Stock solutions and alligation
- 4. Clinical-based calculations**
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AGENDA

## Clinical Calculations

- Factors to consider:
  - Age
  - Weight
  - Body surface area (BSA)
  - Key organ function (liver, kidneys, etc)
- Common scenarios/drugs encountered:
  - Antibiotics
  - Chemotherapy

CLINICAL BASED CALCS

## Pediatrics

- Anyone under age of 18

Category	Age Range
Neonate	Birth - 1 month
Infant	1 month - 2 years
Child	2 years - 12 years
Adolescent	13 - 17 years

- 3 Common Mechanisms for Dosing:
  - Clark's Rule
  - Young's Rule
  - Weight-based dosing

## Clark's and Young's Rule

- Clark's Rule

• **Weight** of patient and adult dose

$$\frac{\text{weight (lbs)} \times \text{adult dose}}{150} = \text{child dose}$$

- Young's Rule

• **Age** of patient and adult dose

$$\frac{\text{age}}{\text{age} + 12} \times \text{adult dose} = \text{child dose}$$

## Practice Problem #8

A 6-year-old child weighs 42 lbs. The adult dose of an antibiotic is 375 mg. What is the child's dose?

Calculate using both Clark's and Young's Rule

## Weight-Based Dosing

- Given as **dose** per **body weight** of patient

• Examples: milligrams per kilogram  
grams per pound

- Most accurate way to dose for any patient

• May be mg/kg/day OR mg/kg/dose

- Pay attention to units and use conversions ☺

## Practice Problem #9

A dose of enoxaparin sodium is 1 mg/kg Q 12h SC. If a prefilled syringe containing 80mg/0.8 mL is used, how many milliliters should be administered per dose to a 154-lb patient?

## Day Supply

- How long a prescription will last the patient

$$\frac{\text{maximum amount used in 1 day}}{\text{total amount dispensed}}$$

- What do you do in practice when the day supply ends up NOT being a whole number?

- **Round up?**
- **Round down?**

## Day Supply

- What about prescriptions for topicals?
  - Fingertip unit (FTU)
- What about ear and eye drops?
  - 1 mL = ?? drops



## Practice Problem #10

A patient has the following directions for their insulin:  
15 units AC, 10 units QHS

You are dispensing two (2) 10-mL vials of insulin. How long will the vials last the patient?

## Key Points

- PEDIATRICS DOSING
  - Clark's and Young's Rules can be used to estimate doses but may be inaccurate
- WEIGHT-BASED DOSING
  - Double check units of dosing before calculating
  - Always the most accurate dosing mechanism

## Topics to Cover

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2. Ratio, proportion and percent strength
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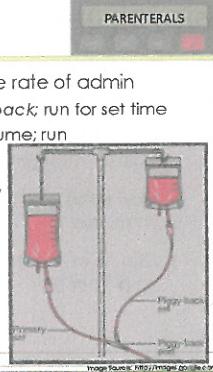
## Common Calculations

- Flow rates
    - Given in milliliters per time (hour/min)
  - Volume (mL) = Rate  
Time (hr)
  - Drop sets
    - Given in drops per time (hour/min)
- Use same equation above but multiply calibration (drops/ml)

PARENTERALS

## Flow Rate

- Intravenous fluids must have rate of admin
  - Volume < 250mL = IV piggyback; run for set time
  - Volume ≥ 500mL = large volume; run continuously
- Your role= determining how many IV bags to make to last the patient
  - Usually for 24-hour period in hospital



**Practice Problem #11**

PARENTERALS

A 49-year old, 132-lb man is being started on octreotide for variceal bleeding. He is getting 50 mcg/hr and the drip contains 500 mcg of octreotide in 100 mL NS. What is the flow rate in mL/hr?

**Challenge! ☺**

PARENTERALS

A 1liter IV runs from 0700 to 1500.

- What is the flow rate in mL/hr?
- How much of the solution is remaining after 5 hours?
- What is the drop rate (in mins) for a 15 gtt/mL tubing set?

**Drop Set**

PARENTERALS

- Iv solutions given via tubing set
  - Each set has specific number of drops in 1 mL

**Common Tubing Set Drop Rates**

10 gtt/mL	15 gtt/mL
20 gtt/mL	60 gtt/mL (microdrip)

$$\text{gtts/min} = \frac{(\text{volume/hr}) \times \text{drop rate}}{60 \text{ min / hour}}$$

**Practice Problem #12**

PARENTERALS

An IV is being administered at 75 mL/hr. What is the drip rate in minutes for a 20 gtt/mL tubing set?

**Key Points**

PARENTERALS

- Institutional pharmacy uses *military time* for medication administration and duration
  - 0000 = midnight      1200 = noon      1800 = 6PM
- Flow rates are generally given in mL per hr
- Drip rates are generally given in gtt per min

**Self-Assessment Question**

PARENTERALS

Complete the following conversions:

$$5 \text{ gr} = \underline{\hspace{2cm}} \text{ mg}$$

$$8 \text{ oz} = \underline{\hspace{2cm}} \text{ mL}$$

$$210 \text{ lbs} = \underline{\hspace{2cm}} \text{ kg}$$

### Self-Assessment Question

You dispense 50 mL of 1.5% w/v ibuprofen suspension with the following SIG:  
2 tbs QD

How many milligrams of ibuprofen are in each dose?

- A. 0.15 mg
- B. 0.45 mg
- C. 150 mg
- D. 450 mg

### Self-Assessment Question

How much 85% *alligatormycin* must be added to 150 mL of 60% *alligatormycin* to make an 80% solution?

- A. 450 mL
- B. 600 mL
- C. 750 mL
- D. 800 mL

### Self-Assessment Question

A 49-year old, 132-lb man is being started on octreotide for variceal bleeding. He is getting 50 mcg/hr and the drip contains 500 mcg of octreotide in 100 mL NS. What is the flow rate in mL/hr?

- A. 1 mL/hr
- B. 10 mL/hr
- C. 50 mL/hr
- D. 100 mL/hr

### Questions?



### References

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