Calculations Review
Saturday - 10:30am - 12:30pm

Speakers: Dana McDougall, PharmD, originally from Dunkerton, Iowa, received a Doctor of Pharmacy from the University of Iowa in Iowa City, IA in May 2011. He has been involved with the American Society of Health-System Pharmacists as well as research projects at the University of Iowa College of Pharmacy. Dr. McDougall’s areas of interest include ambulatory care, cardiology, and diabetes. He would like to pursue a career in clinical pharmacy and obtain BCPS certification.

Jordan Ruestman, PharmD, originally from Minonk, Illinois, received a Doctor of Pharmacy from the Drake University in May 2011. She has been involved with the American Society of Health-System Pharmacists, American College of Clinical Pharmacy, American Pharmacists Association and Iowa Pharmacy Association. Dr. Ruestman’s areas of interest include ambulatory care, pediatrics, and oncology. She would like to pursue a PGY2 or a career in clinical pharmacy and obtain BCPS certification.

Sara Wormley, PharmD, originally from Oswego, Illinois received a Doctor of Pharmacy degree from the University of Illinois at Chicago in Chicago, IL in May 2011. She has been involved with the American Society of Health-System Pharmacists, Iowa Pharmacy Association, and Illinois Pharmacy Association, as well as a research project about medication therapy management at Osterhaus Pharmacy in Maquoketa, IA. Dr. Wormley’s areas of interest include ambulatory care, infectious disease, and pediatrics. She would like to pursue a career in clinical pharmacy in an ambulatory care setting and continue to teach and precept pharmacy students.
Faculty Disclosure

- Dana McDougall reports he has no actual or potential conflicts of interest associated with this presentation.
- Jordan Ruestman reports she has no actual or potential conflicts of interest associated with this presentation.
- Sara Wormley reports she has no actual or potential conflicts of interest associated with this presentation.

Learning Objectives

- Upon completion of this program students will be able to:
  - State the required calculations according to the NAPLEX Blueprint
  - Recognize and successfully complete a variety of pharmacy calculations that appear on the NAPLEX examination including:
    - Conversions (metric, weight, measurements, compounding); Percentage error; Sensitivity requirements; Rates and proportions; Specific gravity/density; Concentrations (% strength, ratio strength, mEq, mM, mOsmol); Flow rates; Patent Dosing (GFR, BMI, etc.); Dilutions; Calculations (alcohol, acids, triturations, alligations); Intermixing, Buffers, IVP, and Miscellaneous pharmacy questions.

NAPLEX: Calculation Expectations

- 185 questions total on exam
- 150 count for score
- 35 for future use

NAPLEX Blueprint as of March 1, 2011:
- The Blueprint tells you the topics that will be on the examination to help you prepare.
- Calculations are covered in Area 2 (approximately 33% of test)

Required Calculations

Assess Safe & Accurate Preparation & Dispensing of Medications

- 2.1.0: Demonstrate the ability to perform calculations required to compound, dispense, and administer medication.
- 2.1.1 Calculate the quantity of medication to be compounded or dispensed; reduce and enlarge formulation quantities and calculate the quantity or ingredients needed to compound the proper amount of the preparation.

- 2.1.2 Calculate nutritional needs and the caloric content of nutrient sources.
- 2.1.3 Calculate the rate of drug administration.
- 2.1.4 Calculate or convert drug concentrations, ratio strengths, and/or extent of ionization.
Tools you can use (provided at site):

- Calculator
- There will be one on computer OR you may ask for one to use from testing site.
- 5 functions (+ - * / √) only!
- You **cannot** bring your own.
- Whiteboard and marker provided.
- NO reference sheets, cheat sheets, or any other papers/equation sheets.

Study Suggestions:

- **START STUDYING EARLY!**
- Practice, Practice, Practice!
- Focus mostly on your weakest areas and keep in mind what is covered on the exam
- Don’t make the questions harder than they are.
- Use Study references (see next slide).

Study References:

- Class notes
- NABP website for blueprint, etc.
- Pharmacy Calculations book
- Access Pharmacy:
  - Pharmacology: Examination & Board Review 9e
  - Pharmacy Student Survival Guide, Chapter 9
- ASHP’s Pharm Prep (no separate calculations, they are built into cases)
- APHA’s Complete Review for Pharmacy
- Kaplan NAPLEX Review
- IPA EXPO Calculations
- Pre-NAPLEX exam ($50 for 50 questions) that gives an estimated score for real test

Testing Suggestions:

- Watch the time, but take your time!
- Read each question carefully and understand what it is asking.
- Use the white board and marker! (if you fill it up, raise your hand for a new one)
- Do a quick DOUBLE CHECK: when you have your answer, plug it back into the question.
- Don’t study the night before.
- Good luck!

Pre-Assessment Questions

1. If 500 mL of ferric chloride solution weighs 650 g, what is its specific gravity?

   A) 0.769 g/mL  
   B) 0.769  
   C) 1.300 g/mL  
   D) 1.100

Specific gravity = \( \frac{\text{Density of Substance (g/mL)}}{\text{Density of H2O (1g/mL)}} \)

\[ X = \frac{650 \text{ g}}{500 \text{ mL}} = 1.300 \text{ (D)} \]

Good to remember: When density is measured as g/mL, it is equivalent to the Specific Gravity except specific gravity is reported without units.
Pre-Assessment Questions

2. What weight of triamcinolone should be used in compounding 45 g of a cream containing triamcinolone at a concentration of 1:2500?

A) 0.018 g triamcinolone
B) 11250 g triamcinolone
C) 180 mg triamcinolone
D) 0.01125 g triamcinolone

Pre-Assessment Questions

3. What is the molarity concentration of a 0.9% (w/v) sodium chloride solution (GMW=58.5)?

A) 0.15 mol/kg
B) 0.15 mmol/L
C) 0.15 mol/L
D) 0.015 mol/L

Pre-Assessment Questions

4. How many mL of 95% (v/v) alcohol (and how much water) should be used in compounding the following prescription?

Rx: Boric Acid 1.0 g
    Alcohol 70% 30.0 mL
    Sig: Ear drops

A) 8 mL of 95% alcohol
B) 19 mL of 95% alcohol
C) 24 mL of 95% alcohol
D) 22 mL of 95% alcohol
Pre-Assessment Questions

5. What weight of a 10% (w/w) colchicine trituration is required to prepare 30 doses of 0.25 mg each of colchicine?

- A) 0.75 mg
- B) 7.5 mg
- C) 75 mg
- D) 750 mg

30 \times 0.25 \text{ mg} = 7.5 \text{ mg colchicine needed}

10 \text{ mg} = \frac{7.5 \text{ mg}}{X}

- A) 0.75 mg
- B) 7.5 mg
- C) 75 mg
- D) 750 mg

Pre-Assessment Questions

6. What is the pH of a buffer solution prepared with 0.08 M sodium borate and 0.008 M boric acid? Boric acid pKa = 9.24.

- A) 9.3
- B) 10.24
- C) 19.3
- D) 19.24

Weak acid, so:

\[
pH = pK_a + \log\left(\frac{\text{salt}}{\text{acid}}\right)
\]

\[
9.24 + \log\left(\frac{0.08}{0.008}\right)
\]

\[
9.24 + \log 10
\]

\[
9.24 + 1
\]

- A) 9.3
- B) 10.24
- C) 19.3
- D) 19.24

Pre-Assessment Questions

7. How many pints are there in 7 gallons?

- A) 14
- B) 65
- C) 56
- D) 77

7 \text{ gal} \times 4785 \text{ mL} \times \frac{1 \text{ pint}}{473 \text{ mL}} = 56 \text{ pints}

- A) 14
- B) 65
- C) 56
- D) 77
Pre-Assessment Questions

8. A diltiazem drip order calls for a rate of 5 mg/hr. Your IV diltiazem concentration is 2 mg/mL. How many liters will your patient receive in 24 hours?

- A) 60
- B) 2
- C) 0.006
- D) 0.06

5 mg x 24 hr = 120 mg x 1 ml = 60 mL
60 mL = 0.06 L

Pre-Assessment Questions

9. You are preparing an IV vancomycin 1 g dose. You only have 200 mg vials. How many vials do you need?

- A) 5
- B) 1
- C) 15
- D) 0.5

1 g = 1000 mg
1000 mg x 1 vial = 5 vials
200 mg

Pre-Assessment Questions

10. If a Lantus insulin pen contains 100 units/mL, how many mL would you need for a 20 unit dose?

- A) 2 mL
- B) 0.2 mL
- C) 0.5 mL
- D) 2.5 mL

20 units x 1 mL = 0.2 mL
100 units
Outline

- Conversions
- % Error
- Sensitivity Requirement
- Ratios
- Proportions
- Specific Gravity
- Density
- Concentrations
  - % Strength
  - Ratio strength
- mEq
- mM
- mOsmol
- Flow Rates
- Patient Dosing
  - IBW
  - BSA
  - CrCl
- Dilutions
  - Alcohols
  - Acids
  - Triturations
  - Alligations
- Isotonicity
  - Buffers
  - TPN

Conversions: Volume, Length, Mass, Average Adult

- Volume
  - 1 teaspoon (tsp) = 5 mL
  - 1 tablespoon (tbs) = 15 mL
  - 1 fl oz = 30 mL
  - 1 pint = 473 mL
  - 1 gallon = 3785 mL

- Length
  - 1 inch = 2.54 cm
  - 1 foot = 0.305 m

- Mass
  - 1 kilogram = 2.2 lbs
  - 1 ounce = 28.35 g
  - 1 pound = 454 g
  - 1 pound = 16 oz
  - 1 fluid oz = 31.1 g
  - 1 gram = 64.9 mg

- Average Adult
  - BSA = 1.73 m²
  - Weight = 70 kg

Example:

Convert the following patient’s weight from lb to kg. The patient weighs 182 lbs.

182 lb x \( \frac{1 \text{ kg}}{2.2 \text{ lb}} \) = 82.7 kg

Conversions: Volume, Length, Mass, Average Adult

Example:

A hospital pharmacist prepares an IV infusion of argatroban 1 mg/mL to run at 2 mcg/kg/min. If the patient weighs 100 kg, how many mL will the patient need for 30 min?

100 kg x \( \frac{2 \text{ mcg}}{1 \text{ kg/min}} \) x 30 min = 6000 mcg

Conversions: Metric System

- Example:
  - A hospital pharmacist prepares an IV infusion of argatroban 1 mg/mL to run at 2 mcg/kg/min. If the patient weighs 100 kg, how many mL will the patient need for 30 min?

  100 kg x \( \frac{2 \text{ mcg}}{1 \text{ kg/min}} \) x 30 min = 6000 mcg

- Remember:
  - Many of the small, few of the large.
  - “Basic” units:
    - Length = meter
    - Volume = liter
    - Weight = gram

Conversions: Metric System

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Symbol</th>
<th>SI Unit</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>10^12</td>
<td>Tera</td>
<td>T</td>
<td>1/1,000,000,000,000</td>
</tr>
<tr>
<td>10^9</td>
<td>Giga</td>
<td>G</td>
<td>1/1,000,000,000</td>
</tr>
<tr>
<td>10^6</td>
<td>Mega</td>
<td>M</td>
<td>1/1,000,000</td>
</tr>
<tr>
<td>10^3</td>
<td>Kilo</td>
<td>k</td>
<td>1/1,000</td>
</tr>
<tr>
<td>10^2</td>
<td>Hecto</td>
<td>h</td>
<td>1/100</td>
</tr>
<tr>
<td>10^1</td>
<td>Deka</td>
<td>da</td>
<td>1/10</td>
</tr>
<tr>
<td>10</td>
<td>Deci</td>
<td>d</td>
<td>1/10</td>
</tr>
<tr>
<td>10^-1</td>
<td>Centi</td>
<td>c</td>
<td>1/100</td>
</tr>
<tr>
<td>10^-2</td>
<td>Mili</td>
<td>m</td>
<td>1/1,000</td>
</tr>
<tr>
<td>10^-3</td>
<td>Micro</td>
<td>μ</td>
<td>1/1,000,000</td>
</tr>
<tr>
<td>10^-6</td>
<td>Nano</td>
<td>n</td>
<td>1/1,000,000,000</td>
</tr>
<tr>
<td>10^-12</td>
<td>Pico</td>
<td>p</td>
<td>1/1,000,000,000,000</td>
</tr>
</tbody>
</table>

Remember:

- Many of the small, few of the large.
- “Basic” units:
  - Length = meter
  - Volume = liter
  - Weight = gram

Conversions: Temperatures

- \( °C = (°F - 32) \times \frac{5}{9} \)
- \( °F = (9/5 \times °C) + 32 \)

Estimating temperature conversion:

- \((°C \times 2) + 20 = °F\)
- \((°F \div 2) - 10 = °C\)

**Always estimate, compute and check conversion!**
Conversions: Temperatures

- Example:
  - What is the °C of 101.5 °F?
    °C = (°F – 32) * 5/9
    (101.5 – 32) * 5/9
    = 38.6 °C
  - What is the °F of 42 °C?
    °F = (9/5 * °C) + 32
    (9/5 * 42) + 32
    = 107.6 °F

Sensitivity Requirement & Percentage Error

- When weighing pharmaceutical components, regulations state that the maximum percentage error must be \textbf{equal to or less than} 5%.
- **MWQ**: Minimum weighable quantity (limited by this regulation)
  - Must know the sensitivity of the balance to calculate MWQ
  - Class A prescription balance, sensitivity requirement = 6 mg
  - MWQ = (SR / % error) x 100%
  - % Error = (SR / MWQ) x 100%

Sensitivity Requirement

- The sensitivity requirement helps ensure the pharmacist that he/she is using the proper weighing balance.
- A Class A prescription balance should be used in the compounding of prescriptions.
  - This type of balance has a sensitivity requirement (SR) of 6 mg or less.
  - In order to have a +/- 5% error, the minimum weighable quantity would be 120 mg (the pharmacist could not weigh less than this amount)

Percentage Error

- Example:
  - What is the percentage error of a balance with a SR of 8 mg and MWQ of 100 mg?
    % Error = (SR / MWQ) x 100%
    (8 / 100) x 100%
    = 8%
  - (Note: Is this an acceptable error of weighing? Answer: No! Must be +/- 5%)}

Ratios

- Ratio: a relationship between two quantities
  - Expressed as quotient of one divided by the other
  - As a fraction, first term = numerator, second = denominator
- Example:
  - Ratio of 10 to 8 is written 10:8 or 10/8
  - If ratios have the same value, they are equivalent (1:4 = 5:20 with a value of 0.25, numerators are 1 and 5, denominators are 4 and 20)
  - Arithmetic rules for fractions apply!
    - If both numerator and denominator are multiplied by same number, the value of the ratio remains the same.
Proportions
- Proportion: a relationship between two ratios
- a : b = c : d can also be written as a/b = c/d
- In order for them to work:
  - You must set up the proportion correctly!
  - Ratios must be equal to one another and remain constant.
  - Dimensions must remain same on both sides of the proportion.
  - Must convert to same units.

Example:
If 200 mL of a solution contains 60 g of active drug, how much active drug is in 1000 mL?

\[
\frac{60 \text{ g}}{200 \text{ mL}} = \frac{X \text{ g}}{1000 \text{ mL}}
\]

\[
(60 \times 1000) / 200 = 300 \text{ grams}
\]

Specific Gravity and Density
- Density is defined as mass per unit volume of a substance
  - Commonly expressed as g/mL.
  - Specific Gravity is a ratio of the density of a substance relative to the density of water
    - Specific Gravity = \( \frac{\text{Density of Subsctie} \text{ (g/mL)}}{\text{Density of H}_2\text{O} \text{ (g/mL)}} \)
    - Density of water = 1 g/mL; SG of water = 1
  - Specific Gravity is unit-less

Example:
Glycerin Suppository Formula (to prepare 50)

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycerin</td>
<td>72.8 mL</td>
</tr>
<tr>
<td>Sodium Sterate</td>
<td>9 g</td>
</tr>
<tr>
<td>H\textsubscript{2}O</td>
<td>5 mL</td>
</tr>
</tbody>
</table>

Glycerin has a specific gravity of 1.25. How many grams of glycerin will be required to prepare 36 suppositories?

\[
\text{A) 65.5 g} \\
\text{B) 91 g} \\
\text{C) 262 g} \\
\text{D) 326 g}
\]

\[
1.25 \text{ g/mL} = x/72.8 \text{ mL} \\
91 \text{ g} / 50 \text{ supp} = x/36 \text{ supp}
\]

Answer: \text{65.5 g (A)}

Concentrations
- Measure of how much of a given substance there is mixed with another substance
- Frequently expressed using:
  - Percent strength
  - Ratio strength
  - Parts per million or parts per billion
  - Milliequivalents per liter
  - Molarity or molality
  - Milliosmolarity
Concentrations: Percent Strength

- Percent weight-in-volume = % (w/v)
  - Grams of ingredient in 100 mL of product
  - Assumed for solutions of solids in liquids
- Percent volume-in-volume = % (v/v)
  - Milliliters of ingredient in 100 mL of product
  - Assumed for solutions or mixtures of liquids
- Percent weight-in-weight = % (w/w)
  - Grams of ingredient in 100 grams of product
  - Assumed for mixtures of solids and semisolids

Example 1 - % (w/v)
- How much hydrocortisone powder is needed to make a 2.5% solution in 8 fl oz of lotion?
  - 8 fl oz = 8 oz * 30 mL/oz = 240 mL.
  - 2.5 g/100 mL = x g/240 mL.
  - (2.5 * 240)/100 = 6 g
  - Answer = 6 g

Example 2 - % (v/v)
- How much propylene glycol is added to normal saline to make 30 mL of a 2.5% solution?
  - 2.5 mL/100 mL = x mL/30 mL.
  - (2.5 * 30)/100 = 0.75 mL.

Example 3 - % (w/w)
- How much triamcinolone powder is needed in 480 g of Cetaphil to make a 0.025% cream?
  - 0.025 g/100 g = x g/480 g.
  - (480 * 0.025)/100 = 0.12 g.

Concentration: Ratio Strength or Parts

- Commonly used when the active ingredient is highly diluted
  - Written as a ratio (example: 1:2500)
- Parts per million (ppm) and parts per billion (ppb) are special cases of ratio strength
  - ppm – number of parts of ingredient per million parts of mixture or solution
  - (equal to x:1,000,000)
  - ppb – number of parts of ingredient per billion parts of mixture or solution
  - (equal to x:1,000,000,000)

Example – ppm to % strength
- Express 5 ppm of iron in water in percent strength and ratio strength
  - 5 ppm = 5 parts in 1,000,000 parts
  - Ratio strength: 5:1,000,000
  - 5/1,000,000 = x/100
  - x = 0.0005
  - Percent strength = 0.0005%

Concentrations: Percent Strength

- mg%:
  - Mg of ingredient in 100 mL of product
  - The units of ingredient are changing but not the 100 mL of product
  - Equal to mg/dL
  - mg/dL used for blood glucose values
  - Example: Goal blood sugar 2 hours post meal for people with diabetes is <140 mg/dL (per ACE Guidelines)
Concentration: Ratio Strength or Parts

- Example – ratio strength to % strength
  - Express 1:4000 as a percentage strength
    - \( \frac{1}{4000} \) = \( \frac{x}{100} \)
    - \( (1 \times 100) / 4000 = x \)
    - \( x = 0.025 \)
    - Answer = 0.025%

- Example – % strength to ratio strength
  - Express 0.02% as a ratio strength
    - 0.02/100 = \( \frac{1}{x} \) parts
    - \( (100 \times 1)/0.02 = x \)
    - \( x = 5000 \)
    - Answer = 1:5000

Concentrations: Understanding Milliequivalents

- Refers to the chemical activity of an electrolyte
- Milliequivalents (mEq) are often seen in situations involving TPN and electrolyte solutions
- As a concentration you will typically see the expression mEq/L

- Equivalent weight – the atomic weight divided by the absolute value of its valence
  - \( \text{Eq weight} = \frac{\text{atomic weight}}{l \text{ valence } l} \)
  - Typically expressed as g/Eq
- Milliequivalent weight – one thousandth of an equivalent weight
  - 1 equivalent weight = 1000 milliequivalent weights
  - Typically expressed as mg/mEq

Concentrations: Understanding Milliequivalents

- Molecules
  - Equivalent weight is equal to the gram molecular weight (formula weight) divided by the total cation OR total anion charge
  - Non-dissociating molecule (dextrose, tobramycin) – the equivalent weight is equal to the formula weight

- Example
  - A 250 mL bottle contains 5.86 g of KCl. How many mEq of KCl are present? (molecular weight of KCl is 74.5 g)
    - Equivalent weight = 74.5 g / 1 = 74.5 g/Eq
    - 75.4 g / 1 Eq = 5.86 g / x Eq
    - \( x = 0.078 \) Eq
    - 0.078 Eq \times 1000 \text{ mEq}/Eq = 78 \text{ mEq}
Concentrations: Understanding Milliequivalents

- **Example**
  - What is the concentration, in g/mL, of a solution containing 4 mEq of CaCl₂ per mL (molecular weight of Ca = 40 and Cl₂ = 71)
    
    - Equivalent weight = \( \frac{111}{2} = 55.5 \) g/ Eq
    - \( \frac{55.5}{4} = 13.875 \) g/ mEq
    - \( x = 0.222 \) g/mL

Concentrations: Molarity

- **Example**
  - What is the millimolar concentration of a solution consisting of 0.9 g of NaCl (molecular weight = 58.5 g/mole) in 100 mL of water?
    
    - 0.9 g in 100 mL = 9 g in 1 L
    - \( \frac{58.5}{1} = \frac{9}{x} \) mole
    - \( x = 0.154 \) mole
    - 0.154 mmol/L

Concentrations: Osmotic Expressions

- **Osmotic concentration** – a measure of the total number of PARTICLES in solution and is expressed in milliosmoles
- **Milliosmolarity** – milliosmoles per liter of solution (mOsm/L)
- **Milliosmoldity** – milliosmoles per kilogram of solution (mOsm/kg)

Concentrations: Molarity

- **Example**
  - What weight (mg) of MgCl₂, formula weight = 95.3, is required to prepare 350 mL of a 6.0 millimolar solution?
    
    - 6 mmol / 1 L = x mmol / 0.350 L
    - \( x = 2.1 \) mmol
    - 2.1 mmol = 0.0021 mole
    - \( \frac{x}{1} = \frac{0.0021}{1} \) mole
    - \( x = 0.2 \) g
    - Answer = 200 mg

Concentrations: Osmotic Expressions

- **Milliosmoles** – based on the total number of cations and total number of anions
- **The osmolarity of a solution is the SUM of the osmolarities of the SOLUTE components of the solution**
- In the absence of other information – assume salts dissociate completely (“ideal” osmolarity)
Concentrations:
Osmotic Expressions

- Example
  - What is the milliosmolarity for normal saline, knowing Na weighs 23 g, and Cl weighs 35.5 g, and normal saline is 0.9% (w/v)?
    - 0.9 % = 0.9 g NaCl / 100 mL = 9g / 1 L
    - 58.5 g / 1 mole NaCl = 9 g / x mol NaCl
    - x mol = 0.154 mol
    - 0.154 mol = 154 mmol
    - NaCl dissociates into 2 ions
    - 154 mmol * 2 = 308 mOsmol
    - Answer = 308 mOsmol/L

- Example
  - How many milliosmole are represented by 500 mL of a 3% hypertonic NaCl solution? (molecular weight of NaCl = 58.5)
    - 3% solution = 3 g / 100 mL
    - 3 g / 100 mL = 15 g / 500 mL
    - 15 g * 1 mol / 58.5 g = 0.256 mol
    - NaCl dissociates to 2 particles, therefore 0.256 mol = 0.512 osmol
    - 0.512 osmoles = 512 mOsmols
    - Answer = 512 mOsmols

Flow Rates

- Infusion flow rates are expressed as an amount or volume per unit time
- Physicians can specify the rate of flow of IV fluids in: mg/hr, drops/min, ml/min

- Example 1: A KCl solution of 20 mEq/250 ml is run over 4 hours. What is the flow rate in mEq/hr? What is the approximate flow rate in ml/min?
  - Solution:
    - 20 mEq/4 hours = 5 mEq/hr
    - 5 mEq * 1 hour * 250 mL = ~1 mL/min
      - hr 60min 20mEq

- Example 2: The infusion rate for IV insulin is 0.1 units/kg/hr. If the insulin is prepared in 250 ml normal saline at a concentration of 0.5 units/ml, what infusion rate (ml/hr) should be set for a 270 lb patient?
  - Solution:
    - 270 lb * 1 kg/2.2 lb = 122.7 kg
    - 122.7 kg * 0.1 units * 1 mL = 24.5 mL/hr
      - 2.2 lb kg/hr 0.5 units

Patient Dosing

Patient weight:
- Actual body weight
- Ideal body weight (in kg)
  - Determined by patient’s height and sex
  - For males
    - 50 kg + (2.3 x inches above 60)
  - For females
    - 45.5 kg + (2.3 x inches above 60)
Patient Dosing

**Patient weight:**
- Example: The adult daily dosage for tobramycin in adults with normal renal function is 3 mg/kg IBW given in 3 divided doses. What would the daily dose be for a male patient weighing 185 lb and 5 ft 9 in tall?
  - \( \text{IBW} = 50 \text{ kg} + (2.3 \times 9) = 70.7 \text{ kg} \)
  - Daily dose = 3 mg/kg x 70.7 kg = 212 mg/day

**BSA:**
- Pediatric patients and chemotherapy dosing for cancer patients
  - \( \text{BSA} = \frac{\text{H} \times \text{W}}{3600} \)
    - Remember: Height in cm and weight in kg
  - The average BSA of an adult = 1.73 m²
  - Pediatric dose calculation based on body surface area:
    \[ \text{Approximate Peds Dose} = \text{adult dose mg} \times \frac{\text{Child’s BSA m}^2}{1.73 \text{ m}^2} \]

**CrCl:**
- CrCl may be calculated for a patient using the Cockcroft-Gault equation:
  - For males: \( \left( \frac{140 - \text{age}}{72} \right) \times \frac{\text{ideal body weight in kg}}{\text{SrCr in mg/dL}} \)
  - For females: 0.85 x CrCl for males

**Dilutions**
- To Dilute: means to diminish the strength of a preparation by adding solvent
- To Concentrate: means to increase the strength of a preparation by reducing the solvent
  - Inverse proportionality used:
    - Concentration1 x Quantity1 = C2 x Q2
    - \[ \frac{C_1}{C_2} = \frac{Q_2}{Q_1} \]
    - C1/C2 = Q2/Q1 OR \[ \frac{C_1}{Q_1} = \frac{C_2}{Q_2} \]
    - C2 Q1
Dilutions

Simple Dilutions:
- A desired concentration is obtained by adding more diluent (or solvent) to the preparation.
- In simple dilutions, you can assume that the solute and solvent volumes are reasonably additive.
- Inverse proportionality:
  \[ C_1 \cdot Q_1 = C_2 \cdot Q_2 \]

Example: How many mL of water should be added to a pint of a 5% w/v solution to make a 2% w/v solution?

- \[ C_1 \cdot Q_1 = C_2 \cdot Q_2 \]
- \[ 5 \cdot 473 \text{ mL} = 2 \cdot Q_2 \]
- \[ Q_2 = \text{final volume} = (5 \cdot 473)/2 = 1182.5 \text{ mL} \]
- \[ \text{Final volume} - \text{initial volume} = \text{amount of diluent to add} \]
  - \[ 1182.5 \text{ mL} - 473 \text{ mL} = 709.5 \text{ mL} \]

Alcohols:
- For dilutions of concentrated ethyl alcohol (ethanol) in water, a noticeable contraction in volume occurs upon mixing.
- The precise volume of water to be added cannot be calculated as \( Q_2 - Q_1 \).
- You have to calculate the final volume \( Q_2 \) and specify that sufficient water be added to reach the final volume of the diluted alcohol solution.

Example: How much water should be added to 100 mL of 95% (v/v) ethanol to make 50% (v/v) ethanol?

- \[ C_1 \cdot Q_1 = C_2 \cdot Q_2 \]
  - \[ (\text{concentrated}) \rightarrow (\text{dilute}) \]
  - \[ 95\% \cdot 100 \text{ mL} = 50\% \cdot Q_2 \]
  - \[ 0.95 \cdot 100)/0.5 = 190 \text{ mL} \text{ (final total volume)} \]
  - Thus, add sufficient water to the 100 mL of 95% ethanol to make 190 mL.

Acids:
- Concentrated acids are manufactured by bubbling the pure acid gas into water to make a saturated solution.
- Concentration of acids is listed as % (w/w) and need to be converted to % (w/v) using the specific gravity when diluting.
- Specific Gravity = \[ \frac{\text{Density of Substance (g/mL)}}{\text{Density of H}_2\text{O (g/mL)}} \]

Example: What volume of 35% (w/w) concentrated HCl, specific gravity 1.20, is required to make 500 ml of 5% (w/v)?

Steps for Solution:
1. Determine the weight of HCl required for the dilute solution:
   \[ 5 \text{ g/100 mL} \cdot 500 \text{ ml} = 25 \text{ g of HCl needed} \]
2. Determine how many grams of the concentrated HCl is needed to get weight needed (25 g HCl):
   \[ \text{mass}(\text{concentrated}) = \frac{100\%}{35\%} \cdot 25 \text{ g} \]
   - \[ 0.3 \cdot Q_1 = 100\% \cdot 25 \text{ g} \]
   - \[ Q_1 = 71.4 \text{ g of concentrated solution needed} \]
3. Use the specific gravity to find the volume of concentrated HCl solution needed:
   \[ \text{Specific gravity of 1.2} = \frac{\text{Density of HCl (g/mL)}}{\text{Density of water (g/mL)}} \]
   - \[ 1.2 = \frac{\text{Density of HCl (g/mL)}}{1.0} \]
   - \[ 71.4 \cdot \frac{1}{1.2} = 59.5 \text{ ml of concentrated HCl needed} \]
Dilutions

Triturations:
- Triturations (used as a noun) are dilutions of potent medicinal substances
  - NOTE: This is different from trituration (used as a verb), which is the process of reducing substances to fine particles through grinding in a mortar and pestle
- They are used when amounts needed are smaller than a reasonable measured quantity
- Often defined as a 10% (w/w) finely powdered mixture of a drug in an inert substance

Example: How many milligrams of a 1:10 (w/w) trituration are required to make 100 capsules, each containing 0.25 mg of the active drug?

0.25 mg x 100 capsules = 25 mg drug needed

10 mg of trituration contains 1 mg active drug

\[ X = \frac{25}{10} \times 250 \text{ mg} \]

Dilutions

Alligations Medial:
- Used to find the final concentration of a solution obtained by mixing specified quantities of two or more stock solutions
- Final concentration is determined by:
  - Multiplying percentage strength of each component by its corresponding volume
  - Sum of the those components divided by the total volume and multiplied by 100 will give the percentage strength of the mixture

Example: What is the percentage strength of zinc oxide in an ointment prepared by mixing 300 g of a 20% ointment, 100 g of 10% ointment, and 200 g of 5% ointment

\[ \begin{align*}
0.20 \times 300 & = 60 \\
0.15 \times 100 & = 15 \\
0.075 \times 200 & = 15 \\
\text{Totals:} & = 900 \text{ g} \\
90 & / 900 & \times 100 & = 10 \%
\end{align*} \]

Dilutions

Alligations Alternate:

\[ \begin{align*}
\text{starting conc} & \quad \text{final conc} & \quad \text{parts of each needed} \\
A & \quad [C-B] & \quad \text{parts of A} \\
C & \quad \text{from} & \quad A-C = \text{(A-C) parts of B} \\
\text{minus} & \quad \text{to} & \quad 20 \% = 20 \text{ parts of } 90 \% \\
B & \quad \text{from} & \quad 70 \% \\
\text{Relative amounts} & \quad 20:20 \quad \text{or } 1:1 & \quad 50 \% \quad \text{to } 20 \% = 20 \text{ parts of } 50 \%
\end{align*} \]
**Dilutions Alligations Alternate:**

- Example: What volume of water should be mixed with 70% dextrose solution to prepare 700 ml of a 25% dextrose solution?

  70% (concentration of stock A)  \[ \frac{1}{24} \] = 25 parts of A
  25% (desired concentration)  \[ \frac{1}{45} \] = 25 parts of water

  70 parts total

  \[ \frac{45 \text{ parts of water}}{70 \text{ parts total}} = \frac{x}{700 \text{ ml total}} \]

  \[ x = 450 \text{ ml of water (B)} \]

**Isotonicity Sodium Chloride Equivalents**

- Sodium chloride equivalent is the number of grams of sodium chloride that would produce the same tonicity effect as 1 gm of the drug.

- Used when preparing isotonic solutions to account for the tonicity contribution of the drug.

  - 0.9% NaCl is isotonic.

- Sodium chloride equivalents are usually given.

  - Can be calculated using the molecular weights and dissociation factors of sodium chloride and the drug in question.

  \[ E = \frac{0.9 \text{ x}(\text{MW of drug})(1.8)}{\text{MW of sodium chloride}} \]

**Isotonicity Sodium Chloride Equivalents**

- To make an isotonic drug solution:

  1. Calculate the weight of NaCl (alone) required to make the total volume of isotonic solution (x).
  2. Using the weight of drug to be incorporated in the solution and its sodium chloride equivalent, calculate the weight of NaCl that would correspond to the weight of the drug (y).
  3. Subtract (x - y) to find the weight of additional NaCl needed to be added to make the solution isotonic.

**Buffers**

- Solutions used to reduce pH fluctuations associated with the introduction of small amounts of strong acids or bases.

- Maintain solution pH at a relatively constant level.

- Composed of a weak acid or weak base plus a salt of the acid or base.

- Henderson-Hasselbalch equation is used to calculate the solution pH when a buffer is used.

\[ pH = pK + \log \left( \frac{[A^-]}{[HA]} \right) = pK + \log \left( \frac{[\text{conjugate base}]}{[\text{conjugate acid}]} \right) \]
Buffers

- Remember there is no log function on the calculator used for NAPLEX
- Helpful to memorize:
  - \( \log 1 = 0 \)
  - \( \log 10 = 1 \)
  - \( \log 100 = 2 \)
  - \( \log 1/10 = -1 \)
  - \( \log 1/100 = -2 \)

Buffers

% Ionization of weak acids:

- Example: What is the pH of a buffer solution prepared with 0.08 M sodium borate and 0.008 M boric acid? Boric acid pKa is 9.24.
  - Weak acid so:
    - \( \text{pH} = \text{pKa} + \log \left( \frac{\text{salt}}{\text{acid}} \right) \)
    - \( = 9.24 + \log \left( \frac{0.08}{0.008} \right) \)
    - \( = 9.24 + \log 10 \)
    - \( = 9.24 + 1 \)
    - Answer: 10.24

Buffers

% Ionization of weak bases:

- Example: Codeine Sulfate has a pKa=7. When the drug is present in the intestines (pH=5), what is the ratio of ionized to unionized molecules?
  - Weak base
    - \( \text{pH} = \text{pKa} + \log \left( \frac{\text{unionized}}{\text{ionized}} \right) \)
    - \( 5 - 7 = \log \left( \frac{\text{unionized}}{\text{ionized}} \right) \)
    - \( -2 = \log \left( \frac{\text{ionized}}{\text{unionized}} \right) \)
  - Antilog \( -2 \) = unionized/ionized
  - \( \text{Antilog} \ (-2) = 1/100 \) (unionized=1 ionized=100)
  - Answer: 100:1 (ratio of ionized to unionized)

Buffers

% Ionization of weak acids:

- Weak acid (different ways to write it)
  - \( \text{pH} = \text{pKa} + \log \left( \frac{\text{SALT}}{\text{ACID}} \right) \)
  - \( \text{pH} = \text{pKa} + \log \left( \frac{\text{HA}}{\text{[A-]}} \right) \)
  - \( \text{pH} = \text{pKa} + \log \left( \frac{\text{[B-]}}{\text{[HB]}} \right) \)
  - \( \text{pH} = \text{pKa} \pm \log \left( \frac{\text{ionized}}{\text{unionized}} \right) \)
  - As pH increases, ionization increases
  - A weak acid is more ionized when its pH is above its pKa

Buffers

% Ionization of weak bases:

- Weak base (different ways to write it)
  - \( \text{pH} = \text{pKa} + \log \left( \frac{\text{B}}{\text{HB+}} \right) \)
  - \( \text{pH} = \text{pKa} + \log \left( \frac{\text{unionized}}{\text{ionized}} \right) \)
  - \( \text{pH} - \text{pKa} = \log \left( \frac{\text{unionized}}{\text{ionized}} \right) \)
  - \( \text{As pH increases, ionization decreases} \)
  - A weak base will be more ionized when pH is below its pKa

Total Parenteral Nutrition (TPN or PN)

- Caloric content of the three macronutrients:
  - Glucose (Dextrose/Carbs) = 3.4 kcal/g
  - Protein (Amino Acids) = 4 kcal/g
  - Fat (Lipids) = 9 kcal/g
  - When fat is obtained from fat emulsions, some calories come from phospholipids and glycerol
  - Can be given 3 in 1 (all three in 1 bag) or lipids separate, 2 in 1
  - 10% provides 1.1 kcal/mL
  - 20% provides 2 kcal/mL
Total Parenteral Nutrition (TPN or PN)

Example:

You receive the following TPN order. What is the total daily caloric intake?

Amino acids: 120 g
NaCl: 100 mEq
Dextrose: 150 g
K Acetate: 100 mEq
Intralipid: 60 g
K Phos: 20 mM
MagSO4: 10 mEq
Ca Glu: 10 mEq

Rate: 80 mL/hour for 24 hours
Central line formula
Multivitamin 10 mL

Will there be a precipitate in this TPN?

Total K = 130 mEq
100 mEq from K Acetate
30 mEq from K Phos (1.5 mEq K per 1 mM phosphate)

Additional Calculations

Tapering:

How many tablets do you need to fill this prescription?

Prednisone 5 mg
Sig: Take 50 mg x 6 days, then 40 mg x 5 days, then 30 mg x 4 days, then 20 mg x 3 days, then 10 mg x 2 days, then 5 mg x 2 days.

Answer: (10 x 6) + (8 x 5) + (6 x 4) + (4 x 3) + (2 x 2) + (1 x 2) = 142

Additional Calculations

Titration:

How many capsules are needed to fill this prescription?

Amiodarone 200 mg
Sig: Take Amiodarone 400 mg BID x 7 days, then take 400 mg QD x 7 days, then 200 mg QD x 1 month.

Answer: (2 x 2 x 7) + (2 x 7) + (1 x 30) = 72

Post-Assessment Questions

1. If 50 glycerin suppositories are made from the following formula, how many milliliters of glycerin, having a specific gravity of 1.25, would be used in the preparation of 96 suppositories?

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glycerin</td>
<td>91 g</td>
</tr>
<tr>
<td>Sodium Stearate</td>
<td>9 g</td>
</tr>
<tr>
<td>Purified Water</td>
<td>5 g</td>
</tr>
</tbody>
</table>

A) 120 g
B) 140 g
C) 175 g
D) 218 g

1. 91 g/50 supp = 1.82 g/supp * 96 supp = 174.72 g of glycerin needed.

SG = 1.25 so Density = 1.25 g/mL

Set up the proportion:

174.72 g / x mL = 1.25 g/mL

x = 139.776 mL ~ 140 mL (B)
Post-Assessment Questions

2. A solution has a ratio strength of 1:4300 (v/v). What is the concentration of the solution expressed as % (v/v)?

A) 0.023% (v/v)
B) 0.23% (v/v)
C) 2.3% (v/v)
D) 2.3 mL / 100mL

Remember % (v/v) represents the number of mL active ingredient in 100 mL of solution.
Set up a proportion: 1 mL / 4300 mL = x mL / 100 mL.
x = 0.023 mL, thus the solution is 0.023% (v/v) (A).

Post-Assessment Questions

3. What weight of MgSO₄ (GMW = 120), is required to prepare 1 liter of a solution that is 25 mEq/L in Mg²⁺?

A) 3000 mg MgSO₄
B) 1500 mg MgSO₄
C) 1000 mg MgSO₄
D) 750 mg MgSO₄

You need 25 mEq of MgSO₄ to obtain 25 mEq Mg²⁺.
Valence of Mg is 2⁺ so the equivalent wt is 120/2.
Simply put: 1 Eq MgSO₄ = 60 g MgSO₄
or 1 mEq MgSO₄ = 60 mg.
Set up a proportion: 60 mg/1 mEq = X mg/25 mEq.
X = 1500 mg MgSO₄ (B).

Post-Assessment Questions

4. How many grams of 1% hydrocortisone cream must be mixed with 0.5% hydrocortisone cream if the pharmacist wishes to prepare 60 g of a 0.8% (w/w) preparation?

A) 6 g
B) 12 g
C) 24 g
D) 36 g

This question can be answered by the alligation alternate method:

1% 0.3 parts of 1% solution

0.8% 0.2 parts of 0.5% solution

0.3 parts / 0.5 parts total = x / 60 g
x = 36 g of 1% cream (D).
Post-Assessment Questions

5. What weight of sodium chloride would be required to prepare 50 mL of an isotonic solution containing 500 mg of pilocarpine nitrate (sodium chloride equivalent = 0.23)?

A) 44.89 mg
B) 44.89 g
C) 335 mg
D) 335 g

5. Isotonic saline requires 0.9 g/100 mL, so 50 mL of isotonic saline will require 0.45 g (450 mg). The 500 mg of pilocarpine nitrate will correspond to (500 mg * 0.23 = 115 mg of NaCl).

Subtract the two to find the sodium chloride needed to make the solution isotonic: 450 mg – 115 mg = 335 mg NaCl (C)

Post-Assessment Questions

6. What molar ratio (ratio of ionized to unionized molecules) of salt/acid is required to prepare a sodium acetate-acetic acid buffer solution with a pH of 5.76? The pKa value of acetic acid is 4.76 at 25°C. pH – pKa = log (salt/acid)

A) 1:10
B) 1:100
C) 10:1
D) 100:1

pH – pKa = log (salt/acid)
Or pH - pKa = log [ionized] / [unionized]
5.76 – 4.76 = log (salt/acid)
1 = log (salt/acid)
Antilog of 1 = salt/acid
10 = salt/acid or a ratio of 10 ionized molecules to 1 unionized molecule (C)
This makes sense because a weak acid is more ionized when its pH is above its pKa.

Post-Assessment Questions

7. An Rx calls for 0.5 g of one ingredient, 62 mg of another and ___ of a third ingredient to make a total of 12 g. How many mg of the third ingredient is required?

A) 114.38
B) 14.38
C) 11,438
D) 114,380

Convert to one unit:
12 grams = 12,000 mg
- 0.5 grams = 500 mg
- 62 mg

11,438 mg

A) 114.38
B) 14.38
C) 11,438
D) 114,380
Post-Assessment Questions

8. If an albuterol inhaler contains 200 metered inhalations, how many days will this inhaler last a child using it four times daily?
   - (A) 30 days
   - (B) 50 days
   - (C) 14 days
   - (D) 20 days

9. Each lortab tablet contains 500 mg of APAP and 5 mg of hydrocodone. If a patient’s Rx says to take 4 tablets each day, how many mg of each drug will the patient have taken in 5 days?
   - (A) 10,000 mg hydrocodone, 100 mg APAP
   - (B) 100 mg hydrocodone, 10,000 mg APAP
   - (C) 1,000 mg APAP, 100 mg hydrocodone
   - (D) 1,000 mg hydrocodone, 1,000 mg APAP

10. A prescription costs a patient $65.79 for 30 pills x 12 months. How much does the patient pay per pill? For the whole year?
    - (A) $2.19 per pill, $789.48 per year
    - (B) $0.219 per pill, $835.50 per year
    - (C) $1.29 per pill, $987.85 per year
    - (D) $5.67 per pill, $1,467 per year
Thank you!
• Practice until you feel confident!
• Remember, you’ve already come this far— you can do it!

Continuing Pharmacy Education
• Go to www.GoToCEI.org click on My Portfolio
• Scroll down to Take Exam – Enter Access Code: (casenensitive)

Pharmacists - __________
Technicians - __________
**Calculations Review**

*Pre-Assessment Questions:*
If 500 mL of ferric chloride solution weighs 650 g, what is its specific gravity?

What weight of triamcinolone should be used in compounding 45 g of a cream containing triamcinolone at a concentration of 1:2500?

What is the molarity concentration of a 0.9% (w/v) sodium chloride solution (GMW=58.5)?

How many mL of 95% (v/v) alcohol (and how much water) should be used in compounding the following prescription?
Rx: Boric Acid 1.0 g
    Alcohol 70% 30.0 mL
Sig. Ear drops

What weight of a 10% (w/w) colchicine trituration is required to prepare 30 doses of 0.25 mg each of colchicine?

What is the pH of a buffer solution prepared with 0.08 M sodium borate and 0.008 M boric acid? Boric acid pKa =9.24.
How many pints are there in 7 gallons?

A diltiazem drip order calls for a rate of 5 mg/hr. Your IV diltiazem concentration is 2 mg/mL. How many liters will your patient receive in 24 hours?

You are preparing an IV vancomycin 1 g dose. You only have 200 mg vials. How many vials do you need?

If a Lantus insulin pen contains 100 units/mL, how many mL would you need for a 20 unit dose?

Conversions:
Convert the following patient’s weight from lb to kg. The patient weighs 182 lbs.

A hospital pharmacist prepares an IV infusion of argatroban 1 mg/mL to run at 2 mcg/kg/min. If the patient weighs 100 kg, how many mL will the patient need for 30 min?

What is the °C of 101.5 °F?
What is the °F of 42 °C?

Sensitivity Requirement & Percentage Error:
A balance in your pharmacy has a sensitivity of 6 mg. What is the least amount of drug that you can weigh if you want an accuracy of 5%?

What is the percentage error of a balance with a SR of 8 mg and MWQ of 100 mg?

Proportions:
If 200 mL of a solution contains 60 g of active drug, how much active drug is in 1000 mL?

Specific Gravity & Density:
Glycerin Suppository Formula (to prepare 50)
Glycerin                72.8 mL
Sodium Sterate          9 g
H₂O                           5 mL
Glycerin has a specific gravity of 1.25. How many grams of glycerin will be required to prepare 36 suppositories?

Concentrations – Percent Strength:
How much hydrocortisone powder is needed to make a 2.5% solution in 8 fl oz of lotion?
How much propylene glycol is added to normal saline to make 30 mL of a 2.5% solution?

How much triamcinolone powder is needed in 480 g of Cetaphil to make a 0.025% cream?

*Concentrations – Ratio Strength or Parts:*
Express 5 ppm of iron in water in percent strength and ratio strength.

Express 1:4000 as a percentage strength.

Express 0.02% as a ratio strength.

*Concentrations – Millequivalents:*
A 250 mL bottle contains 5.86 g of KCl. How many mEq of KCl are present? (molecular weight of KCl is 74.5 g)

What is the concentration, in g/mL, of a solution containing 4 mEq of CaCl₂ per mL? (molecular weight of Ca = 40 and Cl₂ = 71)
**Concentrations – Molarity:**
What is the millimolar concentration of a solution consisting of 0.9 g of NaCl (molecular weight = 58.5 g/mole) in 100 mL of water?

What weight (mg) of MgCl₂, formula weight = 95.3, is required to prepare 350 mL of a 6.0 millimolar solution?

**Concentrations – Osmotic Expressions:**
What is the milliosmolarity for normal saline, knowing Na weighs 23 g, and Cl weighs 35.5 g, and normal saline is 0.9% (w/v)?

How many milliosmoles are represented by 500 mL of a 3% hypertonic NaCl solution? (molecular weight of NaCl = 58.5)

**Flow Rates:**
A KCl solution of 20 mEq/250ml is run over 4 hours. What is the flow rate in mEq/hr? What is the approximate flow rate in ml/min?

The infusion rate for IV insulin is 0.1 units/kg/hr. If the insulin is prepared in 250 ml normal saline at a concentration of 0.5 units/ml, what infusion rate (ml/hr) should be set for a 270 lb patient?
**Patient Dosing:**
The adult daily dosage for tobramycin in adults with normal renal function is 3 mg/kg IBW given in 3 divided doses. What would the daily dose be for a male patient weighing 185 lb and 5 ft 9 in tall?

If the dose of a drug is 17.5mg/m²/day, how many milligrams of the drug should be administered daily to a patient weighing 65 lb and measuring 3’6” in height?

Determine the CrCl for a 80-year-old female patient who weighs 65 kg and has a serum creatinine of 1.3 mg/dL.

**Dilutions:**
How many mL of water should be added to a pint of a 5% w/v solution to make a 2% w/v solution?

How much water should be added to 100 mL of 95% (v/v) ethanol to make 50% (v/v) ethanol?

What volume of 35% (w/w) concentrated HCl, specific gravity 1.20, is required to make 500 ml of 5% (w/v)?
How many milligrams of a 1:10 (w/w) trituration are required to make 100 capsules, each containing 0.25 mg of the active drug?

What is the percentage strength of zinc oxide in an ointment prepared by mixing 300 g of a 20% ointment, 100 g of 10% ointment, and 200 g of 5% ointment?

What volume of water should be mixed with 70% dextrose solution to prepare 700 ml of a 25% dextrose solution?

**Isotonicity:**
What weight of sodium chloride should be used in compounding the following prescription for ephedrine sulfate (sodium chloride equivalent = 0.23)?
Rx: Ephedrine sulfate 0.25 g
    Sodium chloride qs
    Purified water ad 30 mL
    Make isotonic solution

**Buffers:**
What is the pH of a buffer solution prepared with 0.08 M sodium borate and 0.008 M boric acid? Boric acid pKa is 9.24.

Codeine Sulfate has a pKa=7. When the drug is present in the intestines (pH=5), what is the ratio of ionized to unionized molecules?
**TPN:**
You receive the following TPN order. What is the total daily caloric intake?

- **Amino acids:** 120 g
- **NaCl:** 100 mEq
- **Dextrose:** 150 g
- **K Acetate:** 100 mEq
- **Intralipid:** 60 g
- **K Phos:** 20 mM
- **MagSO4:** 10 mEq
- **Ca Gluc:** 10 mEq
- **Rate:** 80 mL/hour for 24 hours
- **Central line formula**
- **Multivitamin 10 mL**

**Tapering:**
How many tablets do you need to fill this prescription?

- **Prednisone 5 mg**
  - Sig: Take 50 mg x 6 days, then 40 mg x 5 days, then 30 mg x 4 days, then 20 mg x 3 days, then 10 mg x 2 days, then 5 mg x 2 days.

How many capsules are needed to fill this prescription?

- **Amiodarone 200 mg**
  - Sig: Take Amiodarone 400 mg BID x 7 days, then take 400 mg QD x 7 days, then 200 mg QD x 1 month.

**Post-Assessment Questions:**
If 50 glycerin suppositories are made from the following formula, how many milliliters of glycerin, having a specific gravity of 1.25, would be used in the preparation of 96 suppositories?

- **Glycerin:** 91 g
- **Sodium Stearate:** 9 g
- **Purified Water:** 5 g
A solution has a ratio strength of 1:4300 (v/v). What is the concentration of the solution expressed as % (v/v)?

What weight of MgSO₄ (GMW = 120), is required to prepare 1 liter of a solution that is 25 mEq/L in Mg²⁺?

How many grams of 1% hydrocortisone cream must be mixed with 0.5% hydrocortisone cream if the pharmacist wishes to prepare 60 g of a 0.8% (w/w) preparation?

What weight of sodium chloride would be required to prepare 50 mL of an isotonic solution containing 500 mg of pilocarpine nitrate (sodium chloride equivalent = 0.23)?

What molar ratio (ratio of ionized to unionized molecules) of salt/acid is required to prepare a sodium acetate-acetic acid buffer solution with a pH of 5.76? The pKa value of acetic acid is 4.76 at 25°C. HINT: pH – pKa = log (salt/acid)

An Rx calls for 0.5 g of one ingredient, 62 mg of another and ___ of a third ingredient to make a total of 12 g. How many mg of the third ingredient is required?

If an albuterol inhaler contains 200 metered inhalations, how many days will this inhaler last a child using it four times daily?
Each lortab tablet contains 500 mg of APAP and 5 mg of hydrocodone. If a patient’s Rx says to take 4 tablets each day, how many mg of each drug will the patient have taken in 5 days?

A prescription costs a patient $65.79 for 30 pills x 12 months. How much does the patient pay per pill? For the whole year?