Objectives

- Perform accurate unit conversions across various measurement systems (Avoirdupois, apothecary, metric (SI), and household).
- Express the concentration of pharmaceutical liquids and powders using appropriate units and notation.
- Calculate appropriate doses accounting for patient-specific parameters and medical conditions.
- Perform accurate calculations for isotonic solution preparations.
- Determine the correct intravenous infusion rate based on prescription details.
- Calculate nutritional requirements for enteral and parenteral administration.
Introduction

- Over twenty years as a practicing pharmacist
  - Community and hospital settings
- Nine years consulting in formulation and quality for dietary supplement manufacturers and compounding pharmacies
- Eight years in academic teaching and research
  - Clinical Assistant Professor of Pharmaceutical Sciences at Nova Southeastern University College of Pharmacy
  - Pharmacy compounding, calculations, and formulation development

NAPLEX Questions – What to Expect

- 225 Total Questions
  - 200 = calculated score
  - 25 pretest questions
  - No skipping questions... must answer in the order given
  - Most questions are scenario-based
- Format
  - Multiple Choice
  - Constructed Response
  - Multiple Response
- No formulas will be provided
### NAPLEX Competency Statement

#### Area 4: Perform Calculations

<table>
<thead>
<tr>
<th>4.1</th>
<th>Patient parameters or laboratory measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2</td>
<td>Quantities of drugs to be dispensed or administered</td>
</tr>
<tr>
<td>4.3</td>
<td>Rates of administration</td>
</tr>
<tr>
<td>4.4</td>
<td>Dose conversions</td>
</tr>
<tr>
<td>4.5</td>
<td>Drug concentrations, ratio strengths, osmolarity, osmolality, or extent of ionization</td>
</tr>
<tr>
<td>4.6</td>
<td>Quantities of drugs or ingredients to be compounded</td>
</tr>
<tr>
<td>4.7</td>
<td>Nutritional needs and the content of nutrient sources</td>
</tr>
<tr>
<td>4.8</td>
<td>Biostatistics, epidemiological, or pharmacoeconomic measures</td>
</tr>
<tr>
<td>4.9</td>
<td>Pharmacokinetic parameters</td>
</tr>
</tbody>
</table>

14% of exam (≈28 questions of 200 total)

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### Supplies

- **Work our problems**
  - Scratch paper
  - Erasable note board

- **Calculator**
  - On-screen
    - Toggle scientific to 5-function mode
  - Handheld calculator
    - Must be requested
    - Only 5-function mode
    - No personal calculators allowed
Words of Wisdom

- Practice
  - Math takes practice & participation
    - Can not sit back and watch
  - Its not learned from “PowerPoint”

- Solving Problems
  - Often multiple ways to solve
  - Only 1 true “answer”

- Language
  - Unique Language for certain problems

NAPLEX

Summary of School First Time Pass Rates†

<table>
<thead>
<tr>
<th>Graduation Year</th>
<th>First Time Pass Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>81.3%</td>
</tr>
<tr>
<td>2022</td>
<td>77.1%</td>
</tr>
<tr>
<td>2023</td>
<td>77.5%</td>
</tr>
</tbody>
</table>

†Adapted from North American Pharmacist Licensure Examination Passing Rates for 2021-2023 Graduates
The Basics - Rounding

For Constructed Response Answers

- Round as Indicated in the Question
  - Examples
    - Nearest whole number, nearest tenths, two decimal places
    - Best to perform all calculations without rounding, round only your final answer
    - Under exam stress you tend to overlook or overthink
      - Round 47.944899 to two decimal places (is it 47.94 or 47.95)
      - Place only numeric value in your answer...no units

The Basics – Systems of Measure

- International System (SI)
  - Meter
  - Liter
  - Gram

- Avoirdupois System
  - 1 Ounce (oz) ≈ 28.35 g
  - 1 Pound (lb.) ≈ 454 g
  - 1 Grain (gr) ≈ 65 mg

- Apothecary System
  - 1 Fluid Ounce (fl.oz.) ≈ 30 mL
  - 1 Pint ≈ 473 mL
  - 1 Grain (gr) ≈ 65 mg

- Household System
  - Teaspoonful (tsp) - 5 mL
  - Tablespoonful (tbsp) - 15 mL
  - Gallon – 128 fl.oz.
The Basics - Nutrient Calories

### Nutrition Calculations Summary

<table>
<thead>
<tr>
<th></th>
<th>Enteral</th>
<th>Parenteral</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lipids</strong></td>
<td>9 kcal/g</td>
<td>1.1 kcal/mL (10% emulsion)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 kcal/mL (20% emulsion)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 kcal/mL (30% emulsion)</td>
</tr>
<tr>
<td><strong>Protein</strong></td>
<td>4 kcal/g</td>
<td>4 kcal/g</td>
</tr>
<tr>
<td><strong>Carbohydrates</strong></td>
<td>4.0 kcal/g</td>
<td>3.4 kcal/g</td>
</tr>
</tbody>
</table>

Outline – Question Categories

1. Systems of Measure
2. Concentration/Ratio Strength
3. Osmolarity/Osmolality
4. Density & Specific Gravity
5. Units of Activity
6. mOsmols & mEq
7. Infusion Rates/Parenterals
8. Nutritional Analysis
9. Day Supply
10. Compounding/Alligation
11. Sodium Chloride Equivalence
12. Patient Specific Parameters
Systems of Measure

Question 1

Based on the following patient chart information, what is the fasting blood glucose concentration in units of micrograms/milliliter?

- Weight: 132 lb.
- Fasting Blood Glucose: 72 mg/dL
- Urine Specific Gravity: 1.09

A. 7.2 mcg/mL
B. 72 mcg/mL
C. 720 mcg/mL
D. 7200 mcg/mL
Question 2

A suspension contains 10 gr of active ingredient in each $f_3$ of the preparation. How many milliliters of this suspension will contain 350 mg of the active ingredient?

- Round answer to two decimal places

16.15 or 15.92 mL depending on the value used for fluid ounce

Concentration/ Ratio
Strength
Question 3

How many grams of a commercially available 1:1000 dilution of levothyroxine will contain 2.5 mg of levothyroxine?

A. 0.025 g  
B. 0.25 g  
C. 2.5 g  
D. 25 g

Question 4

How would the concentration of a 0.05% alclometasone cream be expressed as a ratio strength?

A. 1:200  
B. 1:500  
C. 1:2,000  
D. 1:5,000
Question 5

A bottle of epinephrine injection is labeled with a concentration of 1:1000. Which one of the following concentrations may also appear on the label of this injection?

A. 1 mg/mL
B. 1%
C. 0.01%
D. 10 mg/mL

Question 6

How many mL of a 0.3% w/v ofloxacin solution can be prepared if you have only 45 mg of ofloxacin drug powder?

A. 4.0 mL
B. 6.7 mL
C. 13.5 mL
D. 15.0 mL
Question 7

A pharmacy technician mixed 16 mL of a 25% (w/v) dobutamine injection into a 250 mL bag of normal saline.

What would be the most appropriate concentration of dobutamine to place on the label before dispensing? [NOTE: assume volumes are additive]

A. 1.5% (w/v)
B. 1.7% (w/v)
C. 2.4% (w/v)
D. 2.8% (w/v)
Molality & Molarity

• Molality (m): number of moles of a solute per kilogram (kg) of solvent

\[ \text{Molality (m)} = \frac{\text{Number of Moles of Solute}}{\text{Weight of Solvent (kg)}} \]

• Molarity (M): number of moles of a solute per liter of solution

\[ \text{Molarity (M)} = \frac{\text{Number of Moles of Solute}}{\text{Volume of Solution (L)}} \]

Question 8

Approximately how many grams of KCl would be needed to prepare 750 mL of a 0.2 M KCl solution? (molecular weight of KCl = 74.55 g/mol)

A. 0.2 g  
B. 1.5 g  
C. 11.2 g  
D. 15.2 g
Question 9

If an aqueous solution of ferrous sulfate (FeSO₄) was prepared by adding 41.5 g of FeSO₄ to enough water to make 1,000 mL, what is the molarity of the final solution. (Molecular weight of FeSO₄ is 151.9)

\[
\text{Moles of FeSO₄} = \frac{41.5}{151.9} = 0.2732
\]

\[
M = 0.2732 \text{ moles/L} = 0.2732 \text{ M}
\]
Question 10

If the density of a cough syrup is 1.36 g/mL, how many grams would 4 fl. oz. weigh? (use practical pharmaceutical equivalent value for fl. oz.)

A. 244.6 g  
B. \textbf{163.2 g}  
C. 140.8 g  
D. 102.0 g

Units of Activity
Question 11

If a patient injects 0.90 mL of U-100 insulin once daily, how many milliliters of U-300 insulin would be required for the same daily dose?

A. 0.09 mL
B. 0.23 mL
C. **0.30 mL**
D. 0.45 mL

MOsmols & mEq
Question 12

What is the mOsmol/mL concentration of an 8.4% w/v sodium bicarbonate (NaHCO₃) solution? [NOTE; NaHCO₃ has a molecular weight of 84 g/mol, a valence of 1, and dissociates into 2 species]

A. 1 mOsmol/mL  
B. 2 mOsmol/mL  
C. 3 mOsmol/mL  
D. 4 mOsmol/mL

Question 13

A patient started receiving a slow intravenous infusion containing 25 mEq of potassium chloride in 500 mL of fluid.

If only 285 mg of potassium chloride is to be administered, approximately how many milliliters of the infusion should the patient receive? [Use MW of KCl = 75 g/mol]

A. 37 mL  
B. 41 mL  
C. 65 mL  
D. 76 mL
Question 14

A calcium chloride injection was made at a concentration of 4 mEq/10 mL. Based on this information what mg/mL concentration of calcium chloride would also appear on the label? [Molecular Weight of CaCl2 =110 g/mol]

A. 18 mg/mL  
B. 22 mg/mL  
C. 36 mg/mL  
D. 88 mg/mL

Infusion Rates/Parenterals
Question 15

Using an administration set that delivers 15 gtts/mL, what would be the most appropriate drip rate in drops per minute for the following medication order?

<table>
<thead>
<tr>
<th>MEDICATION ORDER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient: Mike Smith</td>
</tr>
<tr>
<td>Weight: 98 kg</td>
</tr>
<tr>
<td>Date</td>
</tr>
<tr>
<td>1/1/20xx</td>
</tr>
</tbody>
</table>

A. 25 gtts/min  
B. 50 gtts/min  
C. 150 gtts/min  
D. 200 gtts/min

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Question 16

A patient is receiving 900 mL of an intravenous lidocaine infusion at 45 gtts/min using an administration set that delivers 15 gtts/mL.

If the infusion was started at 4:00 p.m., at what military time will the infusion end?

A. 0700  
B. 0900  
C. 1900  
D. 2100
Question 17

A patient is to receive 150 mL of a medication by intravenous infusion over 6 hours. What is the approximate infusion rate in drops/minute if we assume 15 drops equals one mL?

A. 38 drops/minute
B. 25 drops/minute
C. 18 drops/minute
D. 6 drops/minute

Question 18

A patient weighing 24-lb is to receive ceftriaxone 50 mg/kg as a single intramuscular injection. The pharmacy stocks 1 g ceftriaxone vials that state adding 2.5 mL of sterile water will create a final reconstituted volume of 3 mL.

How many mL of the reconstituted vial would the patient receive?

A. 0.3 mL
B. 0.8 mL
C. 1.6 mL
D. 1.9 mL
A 72-year-old patient is receiving a 1-liter total parenteral nutrition (TPN) infusion containing 25% dextrose, 6% amino acids and 250 mL of a 10% lipid emulsion. How many total calories does this TPN provide from these components? [Note: the 10% lipid emulsion supplies 1.1 kcal/mL]

A. 980 Cal/L  
B. 1,090 Cal/L  
C. 1,365 Cal/L  
D. 1,515 Cal/L
Question 20

Each 250 mL can of Ensure® (an enteral nutrition shake) contains 6 g of fat, 40 g carbohydrates, and 9 g of protein.

If a patient consumed 1 fl. oz. of Ensure®, approximately how many total Calories were ingested from these three components? [NOTE: use practical pharmaceutical equivalent for fluid ounce]

A. 25 kcal  
B. 30 kcal  
C. 45 kcal  
D. 50 kcal

Question 21

Approximately how many mL of a 70% dextrose parenteral solution would be needed to provide 1,734 kcal from carbohydrates?

A. 357 mL  
B. 510 mL  
C. 619 mL  
D. 729 mL
A patient picked up a prescription for five prefilled pens of Tresiba® (a U-100 insulin) with directions to inject 75 units under the skin once daily.

What is the approximate days supply of this prescription if each prefilled pen contains 3 mL?

A. 20 days
B. 23 days
C. 28 days
D. 34 days
Question 23

Based on the following prescription, how many tablets should be dispensed to provide the 21-day course of therapy?

**Rx:**

- Amiodarone 200 mg tablets
- Sig: 4 tablet p.o. b.i.d. x 7 days, then 2 tablets t.i.d. x 14 days

\[ \text{X tablets (enter WHOLE number of tablets)} \]

140 tab

---

Question 24

Based on the prescription below, how many days would you tell a patient the bottle being dispensed should last? (Assume the bottle is calibrated to 20 drops/mL)

**Rx:**

- Vyzulta® 0.024% ophthalmic solution
- Sig: 1 gtt. o.u. q.hs.
- Disp: 5 mL bottle

A. 25 days  
B. 30 days  
C. 45 days  
D. 50 days
Compounding/ Alligation

Question 25

How many mL of a 10% w/v acetylcysteine aqueous solution should be mixed with sterile water to make 120 mL of a 2% w/v acetylcysteine aqueous solution?

A. 12 mL
B. 20 mL
C. 24 mL
D. 60 mL
Question 26

You are asked to make 30 mL of a 4% tetracycline compounded suspension using tetracycline capsules as the source of the drug.

What is the minimum number of tetracycline 250 mg capsules needed to compound this amount of the suspension?

A. 3 capsules
B. 4 capsules
C. 5 capsules
D. 6 capsules

Question 27

You receive a prescription to compound 45 g of a 0.1% gentamicin ointment by mixing 0.3% gentamicin ointment with plain ointment base.

How many grams of the plain ointment base would be needed?

A. 30 g
B. 22.5 g
C. 20 g
D. 15 g
Sodium Chloride Equivalent

Question 28

How many grams of sodium chloride would be required to make the following compounded tetracaine [E=0.18] ophthalmic solution isotonic?

A. 0.117 g
B. 0.140 g
C. 0.243 g
D. 0.384 g

Rx:
Tetracaine 0.5%
Sodium Chloride qs
Purified water q.s. ad. 30 mL

Make solution isotonic
Disp: 30 mL
A 38-year-old female who is 5 feet 4 inches tall is ordered acyclovir 15 mg/kg/day. Using Ideal Body Weight (IBW), what is the approximate total daily dose of acyclovir she should receive?

Formulas for Reference:

- IBW (kg) for male = 50 kg + 2.3 (inches over 5 feet)
- IBW (kg) for female = 45.5 kg + 2.3 (inches over 5 feet)

A. 717 mg
B. 784 mg
C. 821 mg
D. 888 mg
Question 30

Based on the information below, what dosing of allopurinol would be most appropriate for a 75-year-old male weighing 61.4 kg with a serum creatine (Scr) of 3.2 mg/dL?

A. 50 mg p.o. t.i.d
B. 100 mg p.o. b.i.d
C. 300 mg p.o. q.d.
D. 75 mg p.o. q.i.d

\[
\text{CrCl (mL/min)} = \frac{(140 - \text{age in years}) \times \text{Weight in kg}}{(72) \times \text{Scr in mg/dL}}
\]

<table>
<thead>
<tr>
<th>Allopurinol Dosing Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrCl (mL/min)</td>
</tr>
<tr>
<td>&gt;20</td>
</tr>
<tr>
<td>10-20</td>
</tr>
<tr>
<td>3-10</td>
</tr>
</tbody>
</table>

\[
\frac{(140 - 75)(61.4 \text{ kg})}{(72)(3.2)} = \frac{3991}{230.4} = 17.322 \text{ CrCl}
\]

Question 31

If the drug 5-fluorouracil is dosed at 750 mg/m²/day, how many grams of the drug would a 185 cm tall patient weighing 71 kg receive over 5 days?

A. 3.1 g
B. 7.2 g
C. 12.7 g
D. 13.8 g

\[
\text{BSA (m}^2) = \sqrt{\frac{\text{Height (cm)} \times \text{Weight (kg)}}{3600}}
\]
Question 32

What is the body mass index (BMI) of a male patient who weighs 90.1 kg and is 6 feet 1 inches tall?

\[
BMIm = \frac{Weight\ (kg)}{Height\ (m)^2} \quad \text{or} \quad BMIm = \frac{Weight\ (lb)}{Height\ (inches)^2} \times 703
\]

\( \times \) \( kg/m^2 \) (round final answer to nearest WHOLE number)

\[
26\ kg/m^2
\]

Summary

• Practice, Practice, Practice
• Think about how to approach the problem first and then start to perform calculations
• Be familiar with commonly used calculation formulas (e.g., creatine clearance, BMI, IBW, BSA) in addition to pharmacokinetic formulas (e.g., half life, loading dose)
• Learn equivalent amounts (e.g., 30 mL = 1 fl.oz., tsp= 5 mL) needed for interconversion of units
• Recall valence (charges) and number of dissociation species of common electrolytes compounds
• Utilize references (e.g., study guides, class notes and exams, online resources and forums)

Remember: this content is not an exhaustive list, and other formulas and calculations you’ll need to know for the NAPLEX exam.

Make sure to review your study materials thoroughly to ensure that you’re well-prepared for the calculations section of the exam.