Math Competency Review Guide

The Math Competency is based on material from the *Calculate with Confidence* (2014) textbook by Deborah Gray Morris. Please note that the review guide recommends reviewing content from chapters in the text and completing practice problems/review to assist with your focus for studying.

Chapters 14-16: Dosage Calculations

- Focus on using one of the following methods to complete dosage calculations. You do not need to know all of the methods—choose which method works best for you.
  - Ratio and Proportion Method
  - Formula Method
  - Dimensional Analysis Method

Chapter 17: Calculation of Oral Medications

- Read the problem carefully and identify known and unknown factors
- Eliminate unnecessary information
- Check that what is ordered and what is available are in the same system of measurement (i.e. Grams, mg)
- If conversion is needed, convert what is ordered into what is available
- Utilize the dosage calculation of choice from Chapters 14-16---Be consistent!
- Be sure to label the final answer appropriately
- Remember to round appropriately
  - Capsules cannot be divided, so round up or down as appropriate (i.e. 0.9 capsule = 1 capsule)
  - Tablets can be divided into ½ or ¼, so round up or down appropriately (i.e. 0.67 tablets = ¾ tablet)
  - Suspensions can be divided into tenths, so round up or down appropriately (i.e. 1.26mL = 1.3mL)
- It is unusual for a patient to be prescribed more than 3 tablets/capsules per dose—recheck your math if you find that you are calculating a high dose!

Chapter 18: Calculation of Parenteral Medications

- Read the problem carefully and identify known and unknown factors
- Eliminate unnecessary information
- Check that what is ordered and what is available are in the same system of measurement
  - Be sure to read the label carefully!
- If conversion is needed, convert what is ordered into what is available
- Utilize the dosage calculation of choice from Chapters 14-16
- 3mL syringes are calibrated in 0.1 mL increments—Round to the nearest tenth (i.e. 1.65mL = 1.7mL)
- 1mL syringes are calibrated in 0.01 mL increments—Round to the nearest hundredth (i.e. 0.774mL = 0.77mL)
- 5mL and 10mL syringes are calibrated in 0.2 mL increments—Round to the nearest tenth for administration (i.e. 3.85mL = 3.9mL)
Chapter 19: Reconstitution of Solutions

- Always read the medications label and instructions
- Evaluate type and amount of solution needed to reconstitute medication
  - May be different based on route (IV vs IM vs SQ).
- Concentration should be listed on vial
  - Be sure to read the label carefully! Often, the powder displaces the liquid as it dissolves and increases the volume and the concentration may not be what is expected (see review PowerPoint).
- Be sure to use the correct diluents (i.e. 0.9%NS, sterile H20, D5)
- Determine:
  - Type of diluents
  - Amount of diluents to add
  - Strength/Concentration of medication after reconstitution

Chapter 20: Insulin Administration

- Know how to accurately read the syringe
- In a 50 unit syringe, each calibration = 1 unit
- In a 100 unit syringe, each calibration = 2 units, therefore an odd number of units is measured between even calibrations
- Always be sure to utilize and appropriate Insulin syringe which is marked in Units, not mL

Chapter 21: Calculate the Percentage of Solute in IV Fluids

- Solution strength is expressed as a percentage is equal to the grams of solute per 100mL of fluid
- D5 IV fluid has 5% dextrose and 5 grams of dextrose per 100mL of IV fluid
  - Example: 1 Liter of D5W
    - \( \% = \text{grams per 100mL} \)
    - 5% Dextrose = 5 grams Dextrose per 100mL
    - 50 grams Dextrose in 1L bag of D5W
  - Example: 1 Liter of \( \frac{1}{2} \) NS + 20 mEq KCl @125mL/hour
    - How many mEq KCL is this patient receiving per hour?
      - 20mEq KCl in 1000mL
      - \( \frac{? \text{ mEq KCl}}{125\text{mL}} \)
      - \( \frac{20\text{mEq KCl}}{1000\text{mL}} = \frac{? \text{ mEq KCl}}{125\text{mL}} \)
      - \( (20\text{mEq KCl})(125\text{mL}) = (?\text{mEq KCl})(1000\text{mL}) \)
      - \( \frac{2500 = (1000)(?)}{1000} \)
      - \( ? = 2.5 \text{ mEq KCl per hour} \)
- Know the components (definition) of the following:
  - NS: 0.9% normal saline
  - \( \frac{1}{2} \) NS
  - \( \frac{1}{4} \) NS
  - LR
  - D5NS
  - D51/2NS : 5% dextrose in 0.45% normal saline
  - D51/4NS
D5W: 5% dextrose in water
D10W
D5LR
D5/2NS with 20 mEq KCl: 5% dextrose in 0.45 NS with 20 milliequivalents potassium chloride
D5/2NS with 10 mEq KCL

Chapter 22: Intravenous Calculations

- When calculating IV flow rate using an IV pump in mL/hour, always round to the nearest whole number—IV pumps CANNOT be set at decimal points, only whole numbers
  - Example: Calculation determines that pump should be set at 24.8 mL/hour → 25 mL/hour
  - There is some newer equipment that will allow you to infuse in tenths. **However, for the purposes of this exam, all flow rates must be rounded to a whole number!!**
- When calculating IV flow rate when an IV pump is NOT AVAILABLE, and the rate is calculated in drops/minute, always round to the nearest whole number—it is NOT POSSIBLE to count drops as decimal points, only whole numbers
  - Example: Calculation determines that one cannot count 33.3 drops/minute → 33 drops/minute
- To determine flow rates for a pump (mL/hr)
  - mL/hr = Total mL order ÷ total hours ordered
- If infusion time is less than 1 hour, use ratio & proportion or dimensional analysis to determine mL/hr.
  - 60 min = 1 hr
    - Alternative method:
      - mL/hr = (total mL to infuse ÷ number of minutes to infuse) ÷ 60 min/hr
- Determine infusion time from volume and hourly rate ordered: total number of mL divided by the rate in mL/hr
  - Total infusion time = total number of mL to infuse ÷ mL/hr infusion rate
  - Once infusion time is calculated, you can use this information to determine the time the infusion will be completed.
    - Ex. If infusion time is 6 hours and the infusion starts at 0800, the infusion will end at 1400

Chapter 23: Heparin Calculations

- Read the problem carefully and identify known and unknown factors
- Eliminate unnecessary information
- Check that what is ordered and what is available are in the same system of measurement: **heparin is dosed in units, a heparin gtt maybe be ordered in units/hour or in units/kg/hour**
- If conversion is needed, convert what is ordered into what is available.
- If weight conversion is needed, this must be completed FIRST. Weights should be rounded to the nearest tenth **at the beginning of the problem.**
- Subcutaneous administration: Utilize the dosage calculation of choice from Chapters 14-16
- Heparin infusions are always administered on a pump
  - Calculate units/hour or mL/hr using the ratio and proportion method or dimensional analysis method
  - Calculate bolus dose and units/kg/hour.
    - First: convert lb to kg (2.2 lbs = 1 kg)
    - Second: calculate the heparin bolus dose
      - Example: your patient weighs 150 lbs and you must administer a 40 unit/kg bolus of heparin prior to beginning the infusion. You will bolus from the bag of which the concentration is 25,000 units in 250 mL. You will administer the bolus over 15 minutes through the IV pump.
        - 150 lbs = 68.2 kg
Third: calculate the heparin infusion rate
- Example: this patient will then receive a continuous infusion of 18 units/kg/hour
  - 18 units/kg/hour x 68.2 kg = 1,227.6 units/hour

Fourth: calculate the rate in which to set the IV pump
- Calculate the mL/hour using the ratio and proportion method or dimensional analysis method (answer = 12.3 mL/hour = 12 mL/hour)

Heparin gtt titration is related to the heparin gtt protocol provided and may include a bolus dose and rate increase or a rate decrease/stoppage based on the patient’s aPTT.
- Determine if the dose is safe! Heparin is a high alert medication.

**tPA infusions may be calculated the same way as weight based heparin infusions with a bolus dose**

**Chapter 24: Critical Care Calculations**

- Calculations are similar to mL/hr or mg/hr, but will require more steps!
  - Remember g to mg, mg to mcg conversions
  - Remember hour to minute conversions
  - Problems may ask for:
    - mL/hr
    - mcg/kg/min
    - mcg/min
  - Weight must be converted first, and rounded to the nearest tenth at the beginning of the problem
  - After you round the weight, CLEAR YOUR CALCULATOR!

- Calculate mg/hour dosages based on infusion information
  - Example: A patient is receiving Dopamine 800mg in 1000mL D5W at a rate of 30mL/hour
    - Dopamine 800mg in 1000mL = 0.8mg Dopamine /mL
    - 0.8mg x 30mL/hour = 24mg/hour

- Calculate mg/min or mcg/min based on infusion information
  - Example: A patient is receiving Pronestyl 2 g in 500 mL D5W at a rate of 60 mL/hour
    - Pronestyl 2 g in 500 mL = 4 mg/mL
    - 4 mg/mL x 60 mL/hour = 240 mg/hour
    - 240 mg/hour ÷ 60 minutes = 4 mg/min

- Calculate mg/kg/min or mcg/kg/min based on infusion information
  - Example: A patient is ordered Dopamine 4 mcg/kg/min. On hand is Dopamine 400 mg in 250 mL and the patient weighs 175 lb.
    - 175 lbs = 79.5 kg
    - 79.5 kg x 4mcg/kg/min = 318 mcg/min
    - 318 mcg/min x 60 minutes = 19,080 mcg/hour
    - 19,080 mcg/hour ÷ 1000 = 19.08 mg/hour
    - Dopamine 400 mg in 250 mL = 1.6mg/mL
    - Calculate mL/hour using the ratio and proportion method or dimensional analysis method (answer = 12 mL/hour)
Chapter 25: Pediatric and Adult Dosage Calculation Based on Weight

- Calculate dosages based on body weight
- Remember 2.2 lbs = 1 kg
- Total daily dose is the dosage obtained by multiplying the weight in kg by the total dose (mg/kg or g/kg)
- Divided doses are the amount given each time the medication is administered.
  - Ex. Q 8 hours = 3 times per day
  - Total daily dose can be determined by multiplying the dose given x 3
- Process:
  - Convert weight in lbs to kg FIRST – round to the nearest tenth.
  - Calculate recommended dose/day or dose as ordered
    - The problem may ask for a safe dose range. Range = 2 numbers!
  - Determine if dosage is safe
    - A dose is NOT safe if: It is above the recommended dose or dose range (toxic) or below the recommended dose or dose range (subtherapeutic).