Metric System Calculations

Many of the calculations needed in nursing practice relate to the metric system. Below are two simple ways to remember some of the key calculations

GRAMS – MILLIGRAMS – MICROGRAMS

For converting grams to milligrams to micrograms follow these simple rules

1. Determine which amount is larger

   (Gram is larger than milligram is larger than microgram

2. The difference between each amount is a factor of **1000 - or 3 decimal places.**

3. So moving the decimal to the right or the left (3 spaces) will give you the correct answer

1 milligram (mg) = 1,000 micrograms (mcg or µg)
1 gram (g) = 1,000 milligrams (mg)
1 kilogram (kg) = 1,000 grams (g)

3 grams = 3000 milligram = 3,000,000 micrograms

5 micrograms = 0.005 milligrams = 0.000005 grams
(Remember there is
decimal point after
the "5".)

KILOGRAMS TO POUNDS

Most people know that the factor for converting pounds to kilogram is "2.2". But sometimes it is confusing as to whether you multiply or divide.

Remember, the number of pounds is always a greater number than the weight in kilograms. So look carefully at your calculation and see if the conversion "makes sense.

1 kilogram is 2.2 pounds

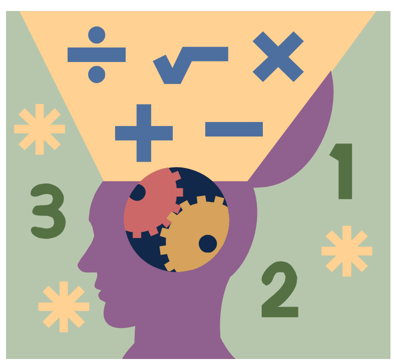
WHAT IS THE QUESTIION ASKING?

Read the question carefully to determine if the question is providing you with information for the DAILY dose, but asking you to calculate the amount given every 4, 6, or 8 hours.

The following material was created by Kaiser to help prepare you for the Medication Math Test. We strongly encourage you to review the entire packet and take advantage of the practice calculations before taking the calculation test.

Kaiser Permanente
NCAL
Medication Math Toolkit

Math Review & Practice Questions



Medication Math Toolkit

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Introduction

According to the Institute of Medicine of the National Academies, “Medication errors are among the most common medical errors, harming at least 1.5 million people every year.” The impact on the health of patients as well as the staff involved in such errors is significant both financially and emotionally.

This medication math review and assessment focuses on one aspect of safe medication administration--right dose. Determining the right dose frequently requires the nurse to calculate how much of the drug to give based on physician order and the medication available. It is estimated that 42% of medication errors are due to errors in administration, one step of which is drug dose calculation.

The enclosed materials are intended to provide the opportunity to review the principles of drug dose calculation, provide the opportunity to practice drug dose calculations, and complete an assessment of your ability to perform this skill.

It is important to continually reinforce and practice the skills necessary for accurate drug dose calculation.

Math Review & Practice Questions

Common Conversions

1 gm = 1000 mg	To convert grams (gm) to milligrams (mg), move decimal point **3 places to <u>right</u>** 1.0 → 1000.0 **or** <u>multiply</u> grams (gm) by 1000
1 mg = 0.001 gm	To convert milligrams (mg) to grams (gm), move decimal point **3 places to the <u>left</u>** 1.0 → 0.001 **or** <u>divide</u> milligrams (mg) by 1000
1 mg = 1000 mcg	To convert milligrams (mg) to micrograms (mcg), move decimal point **3 places to <u>right</u>** 1.0 → 1000.0 **or** <u>multiply</u> milligrams (mg) by 1000
1 mcg = 0.001 mg	To convert micrograms (mcg) to milligrams (mg), move decimal point **3 places to the <u>left</u>** 1.0 → 0.001 **or** <u>divide</u> micrograms (mcg) by 1000
1 kg = 2.2 lb	To convert kilograms (kg) to pounds (lb), <u>multiply</u> kg by 2.2 To convert pounds (lb) to kilograms (kg), <u>divide</u> lb by 2.2
1 tsp = 5 mL or ½ tsp = 2.5 mL	To convert teaspoon (tsp) to milliliters (mL), <u>multiply</u> tsp by 5
1 gr = 60 mg ½ gr = 30 mg	To convert grains (gr) to milligrams (mg) <u>multiply</u> by 60 To convert mg to grains (gr) <u>divide</u> grains by 60

Notes: This table will be provided during the test. Trailing zeroes are for illustration purposes only and should <u>NOT</u> be used in clinical practice.

Calculating Drug Dosage
Ratio and Proportion

A **ratio** is composed of two numbers that are related to each other. In health care, medications are often expressed as a ratio. For example:

- 125 mg per 1 tablet → read as 125 mg/1 tablet.
- 250 mg per 10 mL → read as 250 mg/10 mL.

A **proportion** shows two ratios that are equal, like this: $\frac{4}{12} = \frac{1}{3}$

Calculating Dosages

METHOD #1: Basic Ratio & Proportion Calculation
When the dose on hand is not the same as the desired per ordered dose, the **ratios** can be expressed as a **proportion:**

$$\frac{\text{Dose on hand}}{\text{Quantity on hand}} = \frac{\text{Desired dose (Drug order)}}{\text{Quantity desired } (\boldsymbol{X})}$$

For Example: 500 mg is ordered. It is available in 250 mg capsule(s).

Solve for X to get the number of capsule(s) to give.

1. Set up the proportion between the ratios:

$$\frac{\text{Dose on hand (250 mg)}}{\text{Quantity on hand (1 capsule)}} = \frac{\text{Desired dose (500 mg)}}{\text{Quantity desired } (\boldsymbol{X} \text{ capsule(s))}}$$

Units of measure in the numerator must be the same on both sides of the equation. Units of measure in the denominator must be the same on both sides of the equation.

2. Cross multiply the ratios: multiply the numerator of one ratio by the denominator of the other ratio and do the same for the other two values

$$\frac{\text{250 mg}}{\text{1 capsule}} = \frac{\text{500 mg}}{\boldsymbol{X} \text{ capsule(s)}}$$

resulting in an equation:

$$\text{250 mg} \times \boldsymbol{X} \text{ capsule(s)} = \text{1 capsule} \times \text{500 mg}$$

3. **Solve for X (quantity desired)** by dividing the multiplier of X into the right side of the equation

$$X \text{ capsule(s)} = \frac{1 \text{ capsule} \times 500\ \cancel{mg}}{250\ \cancel{mg}} \rightarrow X \text{ capsule(s)} = \frac{500}{250} \rightarrow = 2 \text{ capsule(s)}$$

METHOD #2: Calculation of medication in solution

For example: 5000 units are ordered. It is available in a vial containing 10,000 units/mL.

Solve for X to get the number of mL to give.

1. Set up the ratio between the proportions:

$$\frac{10{,}000 \text{ Units}}{1 \text{ mL}} = \frac{5000 \text{ Units}}{X \text{ mL}}$$

2. **Cross multiply the proportions:** multiply the numerator of one ratio by the denominator of the other ratio and do the same for the other two values

$$\frac{10{,}000 \text{ Units}}{1 \text{ mL}} = \frac{5000 \text{ Units}}{X \text{ mL}}$$

resulting in an equation:

$$10{,}000 \text{ Units} \times X \text{ mL} = 1 \text{ mL} \times 5000 \text{ Units}$$

3. **Solve for X (quantity desired)** by dividing the multiplier of X into the right side of the equation

$$X \text{ mL} = \frac{1 \text{ mL} \times 5000\ \cancel{Units}}{10{,}000\ \cancel{Units}} \rightarrow X \text{ mL} = \frac{5000}{10{,}000} \rightarrow = 0.5 \text{ mL}$$

METHOD #3: Another method of calculating medication in solution

$$\text{Volume to be administered} = \frac{\text{Dose ordered}}{\text{Available concentration in 1 mL}}$$

For example: 8 mg is ordered. It is available as 10 mg/mL.

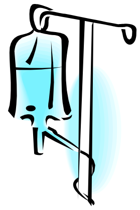
$$\text{Volume to be administered} = \frac{\text{Dose ordered (8}\ \cancel{mg})}{\text{Available concentration in 1 mL (10}\ \cancel{mg}\text{/mL)}}$$

$$= \frac{8}{10 \text{ mL}}$$

$$= 0.8 \text{ mL}$$

*** If concentration is not available for 1 mL, you must calculate the concentration for 1 mL by taking the total dose and dividing it by the total volume to calculate dose per mL.

For example: If you have 30 mg of a drug in 100 mL, the calculation would be 30 divide by 100 = 0.3 mg/mL



Calculating IV Flow Rates

To find the flow rate stated in mL per hour (if not given in the order), solve for *X* which is the number of mL to infuse per hour

For example: 1000 mL IV solution ordered to infuse over 8 hours

1. Set up the ratio between the proportions:

$$\frac{1000 \text{ mL}}{8 \text{ hr}} = \frac{\boldsymbol{X} \text{ mL}}{1 \text{ hr}}$$

2. **Cross multiply the proportions:** multiply the numerator of one ratio by the denominator of the other ratio and do the same for the other two values

$$\frac{1000 \text{ mL}}{8 \text{ hr}} = \frac{\boldsymbol{X} \text{ mL}}{1 \text{ hr}}$$

resulting in an equation:

$8 \text{ hr} \times \boldsymbol{X} \text{ mL} = 1000 \text{ mL} \times 1 \text{ hr}$

3. **Solve for *X* (quantity desired)** by dividing the multiplier of *X* into the right side of the equation

$$\boldsymbol{X} \text{ mL} = \frac{1000 \text{ mL} \times 1 \cancel{\text{hr}}}{8 \cancel{\text{hr}}}$$

$\boldsymbol{X} \text{ mL} = 125 \text{ mL/hr}$

Calculating a Drip Rate using an IV tubing Drip Factor

The **Drip Rate** is the number of drops (gtts) per min to be infused (gtts/min).

The **Drip Factor** of the IV tubing is determined by the manufacturer. This information can be found on the IV tubing packaging. The **Drip Factor** is the number of drops that equal 1 mL of solution.

Example of a Drip Factor:
A Drip Factor of 15 gtts/mL means it will take 15 gtts of the IV solution to deliver 1 mL of the IV solution.

To Calculate an IV Drip Rate:

$$\text{IV drip rate (gtts/min)} = \frac{\text{Volume to be infused (ml) x Drip Factor of tubing gtts/mL}}{\text{time (in min) to be infused}}$$

For example: 1000 mL of D5W ordered to be administered over 8 hours
The IV tubing drip factor is 10 gtts/mL.

1. **Convert hours to minutes.**
   The IV infusion is ordered to be administered over 8 hours
   There are 60 minutes in 1 hour
   8 hours x 60 minutes = 480 minutes

2. **Set up the calculation to determine gtts/min using the following information:**
   Volume to be infused is: 1000 mL
   The Drip factor is: 10 gtts/mL
   Time is: 480 minutes

$$\text{The IV drip rate (gtts/min)} = \frac{1000\ \cancel{\text{mL}} \text{ x } 10\ \text{gtts}/\cancel{\text{mL}}}{480\ \text{min}}$$

$$\text{The IV drip rate} = \frac{10000\ \text{gtts}}{480\ \text{min}}$$

10000 gtts ÷ 480 min = 20.83 gtts/min

Rounded to nearest whole number = 21 gtts/min

Calculating Units per hour

For example:
Patient is receiving 1000 units in 10 mL at 100 mL/hr. How many units is the patient receiving per hour.

1. **Write a fraction to describe the known solution strength (units of drug divided by milliliters of solution):**

$$\frac{1000 \text{ units}}{10 \text{ mL}}$$

2. **Set up the second fraction with the flow rate in the denominator and the unknown dose in the numerator:**

$$\frac{\boldsymbol{X} \text{ units}}{100 \text{ mL}}$$

3. **Write these fractions into a proportion:**

$$\frac{1000 \text{ units}}{10 \text{ mL}} = \frac{\boldsymbol{X} \text{ units}}{100 \text{ mL}}$$

4. **Solve for x by cross multiplying:**

$$10 \text{ mL} \times \boldsymbol{X} \text{ units} = 1000 \text{ units} \times 100 \text{ mL}$$

5. **Divide each side of the equation by 10 mL and cancel units that appear in both the numerator and denominator:**

$$\frac{\cancel{10 \text{ mL}} \times \boldsymbol{X} \text{ units}}{\cancel{10 \text{ mL}}} = \frac{100 \cancel{\text{mL}} \times 1000 \text{ units}}{10 \cancel{\text{mL}}}$$

$$\boldsymbol{X} = \frac{100{,}000 \text{ units}}{10}$$

$$\boldsymbol{X} = \mathbf{10{,}000 \text{ units}}$$

With a flow rate of 100 mL per hour. The patient is receiving 10,000 units per hour.

Math Review Practice Questions

Below is a set of sample test questions for you to practice. During the *proctored* test:

- You will have 60 minutes to complete 20 questions.
- You may use the calculator, conversion table, and scratch paper provided.
- Personal cell phones, PDAs (Blackberries, iPhones), or any other electronic devices will not be allowed.
- You will be expected to show your calculations for each question on the test and write your answer on the line provided.
- Minimum passing score is 90%.
- Relax and take a deep breath.

1. Convert 99 lb to kg

_______kg

2. Convert 4 mg to mcg

_______mcg

3. Convert 2 gm to mg

_______mg

4. Convert 300 mg to gm

_______gm

5. Convert 2500 mcg to mg

_______mg

6. Ordered: 40 units
   Available: 100 units/mL
   How many mL should the nurse give?

_______mL

7. Ordered: 0.125 mg
   Available: 0.25 mg/tablet
   How many tablet(s) should the nurse give?

_______tablet(s)

Math Review Practice Questions *cont.*

8. Ordered: 0.5 mg
   Available: 2 mg/mL
   How many mL should the nurse give?

_______mL

9. Ordered: 0.3 gm
   Available: 300 mg/tablet
   How many tablet(s) should the nurse give?

_______tablet(s)

10. Ordered: 0.03 gm
    Available: 6 mg/8 mL
    How many mL should the nurse give?

_______mL

11. Ordered: 80 mg
    Available: 100 mg/mL
    How many mL should the nurse give?

_______mL

12. Ordered: 250 mg
    Available: The bottle says add 9.5 mL of sterile water to the vial to yield 0.5 gm/mL
    How many mL should the nurse give?

_______mL

13. Ordered: 100,000 units
    Available: 250,000 units/mL
    How many mL should the nurse give?

_______mL

Math Review Practice Questions *cont.*

14. Ordered: 75 mg
    Available: 50 mg/mL
    How many mL should the nurse give?

_______mL

15. Ordered: 70 mEq
    Available: 200 mEq/10 mL
    How many mL should the nurse give?

_______mL

16. Ordered: 0.6 mg
    Available: 250 mcg/mL
    How many mL should the nurse give?

_______mL

17. Ordered: 20 mg/kg for a patient who weighs 36 lb
    Available: 100 mg/mL
    How many mL should the nurse give?

_______mL

18. If your patient took 1 tsp of liquid every 15 minutes for 3 hours, how much total liquid was consumed in mL?

_______mL

19. Ordered: 25 mL every 2 hours. How many mL will be given in 8 hours?

_______mL

20. Ordered: 4 mg/kg for patient who weighs 55 kg
    Available: 90 mg in 10 mL
    How many mL should the nurse give?

_______mL

Math Review Practice Questions *cont.*

*** LVNs who are NOT IV certified should stop here. All other nurses may want to practice #21 through #24.**

21. Ordered: 120 mL to be infused over 30 minutes.
    At what rate (mL/hr) should the nurse set the infusion pump?

_______ mL/hr

22. Ordered: IV solution to run at 100 mL/hr. The IV tubing has a drip factor of 15 gtts/mL. How many gtts/min will need to be delivered?

_______gtts/min

23. Ordered: 1000 mL D5W with 0.45% N/S in 6 hours
    How fast should the nurse run the IV in gtts/min if they are using tubing that delivers 15 gtts/mL?

_______gtts/min

24. Ordered 20,000 units in 1000 mL to run at 30 mL/hour.
    How many units per hour is the patient receiving?

_______units/hr

Math Review Practice Questions (Answer Key)

1. **Convert 99 lb to kg**

   99 lbs ÷ 2.2 =

   45 kg

2. **Convert 4 mg to mcg**

   4 mg x 1000 =

   4000 mcg

3. **Convert 2 gm to mg**

   2 gm x 1000 =

   2000 mg

4. **Convert 300 mg to gm**

   300 gm ÷ 1000 =

   0.3 gm

5. **Convert 2500 mcg to mg**

   2500 mcg ÷ 1000 =

   2.5 mg

6. **Ordered: 40 units**
   Available: 100 units/mL
   How many mL should the nurse give?

   $$\frac{100 \text{ units}}{1 \text{ mL}} = \frac{40 \text{ units}}{\boldsymbol{X} \text{ mL}}$$

   100 units x ***X*** mL = 40 units x 1 mL

   $$\boldsymbol{X} \text{ mL} = \frac{40 \cancel{\text{units}} \text{ x } 1 \text{ mL}}{100 \cancel{\text{units}}}$$

   0.4 mL

Math Review Practice Questions (Answer Key) *cont.*

7. **Ordered: 0.125 mg**
   Available: 0.25 mg/tablet
   How many tablet(s) should the nurse give?

$$\frac{0.25 \text{ mg}}{1 \text{ tablet}} = \frac{0.125 \text{ mg}}{\boldsymbol{X} \text{ tablet(s)}}$$

$$0.25 \text{ mg} \times \boldsymbol{X} \text{ tablet(s)} = 1 \text{ tablet} \times 0.125 \text{ mg}$$

$$\boldsymbol{X} \text{ tablet(s)} = \frac{1 \text{ tablet} \times 0.125 \cancel{\text{mg}}}{0.25 \cancel{\text{mg}}}$$

__0.5__ tablet(s)

8. **Ordered: 0.5 mg**
   Available: 2 mg/mL
   How many mL should the nurse give?

$$\frac{2 \text{ mg}}{1 \text{ mL}} = \frac{0.5 \text{ mg}}{\boldsymbol{X} \text{ mL}}$$

$$2 \text{ mg} \times \boldsymbol{X} \text{ mL} = 1 \text{ mL} \times 0.5 \text{ mg}$$

$$\boldsymbol{X} \text{ mL} = \frac{1 \text{ mL} \times 0.5 \cancel{\text{mg}}}{2 \cancel{\text{mg}}}$$

__0.25__ mL

9. **Ordered: 0.3 gm**
   Available: 300 mg/tablet
   How many tablet(s) should the nurse give?

$$0.3 \text{ gm} \times 1000 = 300 \text{ mg}$$

$$\frac{300 \text{ mg}}{1 \text{ tablet}} = \frac{300 \text{ mg}}{\boldsymbol{X} \text{ tablet(s)}}$$

$$300 \text{ mg} \times \boldsymbol{X} \text{ tablet(s)} = 1 \text{ tablet} \times 300 \text{ mg}$$

$$\boldsymbol{X} \text{ tablet(s)} = \frac{1 \text{ tablet} \times 300 \cancel{\text{mg}}}{300 \cancel{\text{mg}}}$$

__1__ tablet(s)

Math Review Practice Questions (Answer Key) *cont.*

10. **Ordered: 0.03 gm**
    Available: 6 mg/8 mL
    How many mL should the nurse give?

$0.03 \text{ gm} \times 1000 = 30 \text{ mg}$

$$\frac{6 \text{ mg}}{8 \text{ mL}} = \frac{30 \text{ mg}}{\boldsymbol{X} \text{ mL}}$$

$6 \text{ mg} \times \boldsymbol{X} \text{ mL} = 8 \text{ mL} \times 30 \text{ mg}$

$$6 \text{ mg} = \frac{8 \text{ mL} \times 30 \cancel{\text{mg}}}{6 \cancel{\text{mg}}}$$

__40__ mL

11. **Ordered: 80 mg**
    Available: 100 mg/mL
    How many mL should the nurse give?

$$\frac{100 \text{ mg}}{1 \text{ mL}} = \frac{80 \text{ mg}}{\boldsymbol{X} \text{ mL}}$$

$100 \text{ mg} \times \boldsymbol{X} \text{ mL} = 1 \text{ mL} \times 80 \text{ mg}$

$$\boldsymbol{X} \text{ mL} = \frac{1 \text{ mL} \times 80 \cancel{\text{mg}}}{100 \cancel{\text{mg}}}$$

__0.8__ mL

Math Review Practice Questions (Answer Key) *cont.*

12. **Ordered: 250 mg**
Available: The bottle says add 9.5 mL of sterile water to the vial to yield 0.5 gm/mL
How many mL should the nurse give?

0.5 gm = 500 mg

$$\frac{500\text{ mg}}{1\text{ mL}} = \frac{250\text{ mg}}{\boldsymbol{X}\text{ mL}}$$

500 mg x ***X*** mL = 1 mL x 250 mg

$$\boldsymbol{X}\text{ mL} = \frac{1\text{ mL} \times 250\ \cancel{\text{mg}}}{500\ \cancel{\text{mg}}}$$

__0.5__ mL

13. **Ordered: 100,000 units**
Available: 250,000 units/mL
How many mL should the nurse give?

$$\frac{250{,}000\text{ units}}{1\text{ mL}} = \frac{100{,}000\text{ units}}{\boldsymbol{X}\text{ mL}}$$

250,000 units x ***X*** mL = 1 mL x 100,000 units

$$\boldsymbol{X}\text{ mL} = \frac{1\text{ mL} \times 100{,}000\ \cancel{\text{units}}}{250{,}000\ \cancel{\text{units}}}$$

__0.4__ mL

14. **Ordered: 75 mg**
Available: 50 mg/mL
How many mL should the nurse give?

$$\frac{50\text{ mg}}{1\text{ mL}} = \frac{75\text{ mg}}{\boldsymbol{X}\text{ mL}}$$

50 mg x ***X*** mL = 1 mL x 75 mg

$$\boldsymbol{X}\text{ mL} = \frac{1\text{ mL} \times 75\ \cancel{\text{mg}}}{50\ \cancel{\text{mg}}}$$

__1.5__ mL

Math Review Practice Questions (Answer Key) *cont.*

15. **Ordered: 70 mEq**
Available: 200 mEq/10 mL
How many mL should the nurse give?

$$\frac{200 \text{ mEq}}{10 \text{ mL}} = \frac{70 \text{ mEq}}{\boldsymbol{X} \text{ mL}}$$

$$200 \text{ mEq} \times \boldsymbol{X} \text{ mL} = 10 \text{ mL} \times 70 \text{ mEq}$$

$$\boldsymbol{X} \text{ mL} = \frac{10 \text{ mL} \times 70 \cancel{\text{mEq}}}{200 \cancel{\text{mEq}}}$$

__3.5__ mL

16. **Ordered: 0.6 mg**
Available: 250 mcg/mL
How many mL should the nurse give?

0.6 mg x 1000 = 600 mcg

$$\frac{250 \text{ mcg}}{1 \text{ mL}} = \frac{600 \text{ mcg}}{\boldsymbol{X} \text{ mL}}$$

$$250 \text{ mcg} \times \boldsymbol{X} \text{ mL} = 1 \text{ mL} \times 600 \text{ mcg}$$

$$\boldsymbol{X} \text{ mL} = \frac{1 \text{ mL} \times 600 \cancel{\text{mcg}}}{250 \cancel{\text{mcg}}}$$

__2.4__ mL

17. **Ordered: 20 mg/kg for a patient who weighs 36 lb**
Available: 100 mg/mL
How many mL should the nurse give?

36 lb ÷ 2.2 = 16.36 kg (rounded down to 16 kg or rounded up to 16.4 kg)
20 mg x 16.36 kg = 327.2 mg

$$\frac{100 \text{ mg}}{1 \text{ mL}} = \frac{327.2 \text{ mg}}{\boldsymbol{X} \text{ mL}}$$

$$100 \text{ mg} \times \boldsymbol{X} \text{ mL} = 1 \text{ mL} \times 327.2 \text{ mg}$$

$$\boldsymbol{X} \text{ mL} = \frac{1 \text{ mL} \times 327.2 \cancel{\text{mg}}}{100 \cancel{\text{mg}}}$$

__3.27__mL (*Rounds to 3.3 mL)*

Math Review Practice Questions (Answer Key) *cont.*

18. **If your patient took 1 tsp of liquid every 15 minutes for 3 hours, how much total liquid was consumed in mL?**

1 tsp x 5 = 5 mL
3 hours x 60 = 180 min

$$\frac{5\text{ mL}}{15\text{ min}} = \frac{\boldsymbol{X}\text{ mL}}{180\text{ min}}$$

15 min x ***X*** mL = 5 mL x 180 min

$$\boldsymbol{X}\text{ mL} = \frac{5\text{ mL} \times 180\ \cancel{\text{min}}}{15\ \cancel{\text{min}}}$$

__60__ mL

19. **Ordered: 25 mL every 2 hours. How many mL will be given in 8 hours?**

$$\frac{25\text{ mL}}{2\text{ hrs}} = \frac{\boldsymbol{X}\text{ mL}}{8\text{ hrs}}$$

2 hrs x ***X*** mL = 25 mL x 8 hrs

$$\boldsymbol{X}\text{ mL} = \frac{25\text{ mL} \times 8\ \cancel{\text{hrs}}}{2\ \cancel{\text{hrs}}}$$

__100__ mL

20. **Ordered: 4 mg/kg for patient who weighs 55 kg**
Available: 90 mg in 10 mL
How many mL should the nurse give?

4 mg x 55 kg = 220 mg

$$\frac{90\text{ mg}}{10\text{ mL}} = \frac{220\text{ mg}}{\boldsymbol{X}\text{ mL}}$$

90 mg x ***X*** mL = 10 mL x 220 mg

$$\boldsymbol{X}\text{ mL} = \frac{10\text{ mL} \times 220\ \cancel{\text{mg}}}{90\ \cancel{\text{mg}}}$$

__24.44__mL (*Rounds to 24.4 mL)*

Math Review Practice Questions (Answer Key) *cont.*

*** LVNs who are NOT IV certified should stop here. All other nurses may want to practice #21 through #24.**

21. **Ordered: 120 mL to be infused over 30 minutes. At what rate (mL/hr) should the nurse set the infusion pump?**

$30 \text{ min} \div 60 = 0.5 \text{ hr}$

$$\frac{120 \text{ mL}}{0.5 \text{ hr}} = \frac{\boldsymbol{X} \text{ mL}}{1 \text{ hr}}$$

$0.5 \text{ hr} \times \boldsymbol{X} \text{ mL} = 120 \text{ mL} \times 1 \text{ hr}$

$$\boldsymbol{X} \text{ mL} = \frac{120 \text{ mL} \times 1 \cancel{\text{hr}}}{0.5 \cancel{\text{hr}}}$$

__240__ mL/hr

22. **Ordered: IV solution to run at 100 mL/hr. The IV tubing has a drip factor of 15 gtts/mL. How many gtts/min will need to be delivered?**

$1 \text{ hour} \times 60 = 60 \text{ mins}$

$$\boldsymbol{X} = \frac{\text{Volume to be infused} \times \text{Drip Factor of tubing}}{\text{time (in min) to be infused}}$$

$$\boldsymbol{X} \text{ gtts/min} = \frac{100 \cancel{\text{mL}} \times 15 \text{ gtts/}\cancel{\text{mL}}}{60 \text{ min}}$$

__25__ gtts/min

23. **Ordered: 1000 mL D5W with 0.45% N/S in 6 hours How fast should the nurse run the IV in gtts/min if they are using tubing that delivers 15 gtts/mL?**

$6 \text{ hours} \times 60 = 360 \text{ min}$

$$\boldsymbol{X} = \frac{\text{Volume to be infused} \times \text{Drip Factor of tubing}}{\text{time (in min) to be infused}}$$

$\boldsymbol{X} \text{ gtts/min} = \underline{1000 \cancel{\text{mL}} \times 15 \text{ gtts/}\cancel{\text{mL}}}$

$$\overline{360 \text{ min}}$$

$\underline{\quad 41.6 \;\; \text{gtts/min}}$ (*Rounds to 42 gtts/min)*

Math Review Practice Questions (Answer Key) *cont.*

24. **Ordered 20,000 units in 1000 mL to run at 30 mL/hour. How many units per hour is the patient receiving?**

$$\frac{20{,}000 \text{ units}}{1000 \text{ mL}} = \frac{\boldsymbol{X} \text{ units}}{30 \text{ mL}}$$

$$1000 \text{ mL} \times \boldsymbol{X} \text{ units} = 20{,}000 \text{ units} \times 30 \text{ mL}$$

$$\boldsymbol{X} \text{ units} = \frac{20{,}000 \text{ units} \times 30 \cancel{\text{mL}}}{1000 \cancel{\text{mL}}}$$

$$\boldsymbol{X} \text{ units} = \frac{600{,}000 \text{ units}}{1000}$$

$\underline{\quad 600 \quad}$units/hr

Medication Math Resources

Chocked full of basic to more advanced math review questions and answers:

1. Schilling, J. (2009). Dosage Calculations an Incredibly Easy Workout. Lippincott, Williams & Wilkins. Philadelphia.

2. A web site with basic medication calculation concepts.
   http://www.dalesplace.net/introduc.php

3. Take practice quizzes on equivalencies, abbreviations, basic ratio & proportion, IV infusion rates, OB dosage and IV quizzes, pediatric quizzes, and titration for critical care nurses.
   http://www.accd.edu/SAC/NURSING/math/mathindex.html

4. A web link to register for a 45 contact hour extensive review course in medical math. Cost is $189.00 and the learner may take up to 4 months to complete the course.
   http://www.ed2go.com/cgi-bin/oic3/newcrsdes.cgi?name=larpd&aw=ggg&course=8e8

5. A self study module on Fundamentals of Mathematics for Nursing.
   http://www.adn.eku.edu/doc/Math.pdf

6. Luz Martinez de Castillo, S., Werner-McCullough, M. (2007). Student Workbook to Accompany Calculating Drug Dosages: An Interactive Approach to Learning Nursing Math, 2nd Ed. F.A. Davis, Philadelphia.

   Includes a CD with modules on a variety of medication review topics from basics to titration of IV's with quizzes.

7. Website with nursing medication calculators.
   http://www.manuelsweb.com/nrs_calculators.htm

8. Practice with everyday math including fractions, decimals and ratio and proportion
   http://www.math.com/practice/EverydayMath.html

Bibliography

1. Baiyasi, S., Constan, Dewey, E. (2001) Math for Nursing and Allied Health. Delta College: Teaching & Learning Center. Retrieved July 22, 2008 from:
   http://www3.delta.edu/tlc/TLCStudySupport/Math%20for%20Nursing%20and%20Allied%20Health.PDF

2. California Community Colleges: Regional Health Occupations Resource Center (2004). Strategies for Student Success in Health Occupations: A Model Curriculum. Chancellor's Office of California Community Colleges.

3. McAlister, C., Shapiro, S. (2006). Fundamentals of Mathematics for Nursing. Retrieved July 22, 2008 from:
   http://www.adn.eku.edu/doc/Math.pdf

4. Schilling, J. (2009). Dosage Calculations an Incredibly Easy Workout, Lippincott, Williams & Wilkins. Philadelphia.

5. Schilling, J. (2005). Dosage Calculations Made Incredibly Easy, 3rd Ed. Lippincott, Williams & Wilkins. Philadelphia.

Common Conversions

1 gm = 1000 mg	To convert grams (gm) to milligrams (mg), move decimal point **3 places to <u>right</u>** 1.0 → 1000.0 **or** <u>multiply</u> grams (gm) by 1000
1 mg = 0.001 gm	To convert milligrams (mg) to grams (gm), move decimal point **3 places to the <u>left</u>** 1.0 → 0.001 **or** <u>divide</u> milligrams (mg) by 1000
1 mg = 1000 mcg	To convert milligrams (mg) to micrograms (mcg), move decimal point **3 places to <u>right</u>** 1.0 → 1000.0 **or** <u>multiply</u> milligrams (mg) by 1000
1 mcg = 0.001 mg	To convert micrograms (mcg) to milligrams (mg), move decimal point **3 places to the <u>left</u>** 1.0 → 0.001 **or** <u>divide</u> micrograms (mcg) by 1000
1 kg = 2.2 lb	To convert kilograms (kg) to pounds (lb), <u>multiply</u> kg by 2.2 To convert pounds (lb) to kilograms (kg), <u>divide</u> lb by 2.2
1 tsp = 5 mL or ½ tsp = 2.5 mL	To convert teaspoon (tsp) to milliliters (mL), <u>multiply</u> tsp by 5
1 gr = 60 mg ½ gr = 30 mg	To convert grains (gr) to milligrams (mg) <u>multiply</u> by 60 To convert mg to grains (gr) <u>divide</u> grains by 60

Notes: Trailing zeroes are for illustration purposes only and should NOT be used in clinical practice.