Pharmacology Math

Notes and Practice Tests

These notes and practice tests are designed to prepare Associate Degree Nursing (ADN) students with the instruction and practice they need to succeed in properly calculating medication. The notes explain how to perform the mathematical operations while the practice problems give the students an example of the questions on the pharmacology math tests.

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If students do not understand any of the instructions or could use more help in any way, please contact the Learning Lab. The staff there is familiar with these tests and would be happy to help you. Study groups can be organized in the Learning Lab to help groups of students with similar needs.
Need Help?

Get help in the Learning Lab.

We offer a variety of help in math, metrics, reading, and study skills.

Tutors
Classes
Computer Programs
Additional Problems
Metric Demonstrations
Pharmacology Demonstrations
Decimals

a. Comparing Decimals
   Compare the left-most non-zero place value.
   
ex.  45 vs. 51  \( (4 \text{ is less than } 5, \text{ therefore, } 45 \text{ is less than } 51) \)  
   0.023 vs. 0.04  \( (4 \text{ is more } 2, \text{ therefore, } 0.04 \text{ is more than } 0.023) \)  
   0.0084 vs. 0.02  \( (2 \text{ is more than } 0, \text{ therefore, } 0.02 \text{ more than } 0.0084) \)  
   0.37 vs. 0.365  \( (3 = 3, \text{ 7 is more than } 6, \text{ therefore, } 0.37 \text{ is more than } 0.365) \)

Note - Since the symbols below are often confused they should not be used, but should be written out.
<  means “Less than” - note it looks like the letter “L”
>  means “More than”

b. Adding and Subtracting Decimals
   Write Vertically and make sure the place values are lined up vertically, add zeros if it helps.
   
   \[
   \begin{array}{c}
   3.1 - 0.48 = \\
   - 0.48 \\
   \hline
   2.62 \\
   \end{array}
   \]

   \( 2.62 \)

c. Multiplying Decimals
   1. Multiply as if there were no decimals
   2. Write vertically
   3. The number of decimals in your answer is equal to the total number of decimal places in the numbers you are multiplying.
   
   \[
   \begin{array}{c}
   0.13 \times 0.2 = \\
   \times 2 \\
   \hline
   0.026 \\
   \end{array}
   \]
   \( 0.026 \)
d. Multiplying by 10, 100, or 1,000
Move the decimal point to the right by the number of zeros.

ex. $0.43 \times 1,000 = (3 \text{ zeros} = 3 \text{ places to the right}) \quad 430$


e. Dividing Decimals
Move the decimal place in both numbers to the right, the same number of places, so you are dividing by a whole number.

\[
\begin{array}{r}
3.6 \div 0.02 = \quad (\text{move both decimals } 2 \text{ places to the right}) \quad 180 \\
\hline
360
\end{array}
\]

\[
2 \big| 360
\]

\[
180
\]

f. Dividing by 10, 100, or 1,000
Move the decimal point to the left by the number of zeros.

ex. $0.57 \div 10 = \quad (\text{one zero} = 1 \text{ place to the left}) \quad 0.057$

Fractions

a. Finding the Lowest Common Denominator (LCD)
Find the lowest multiple of the highest denominator, (bottom number), that can be evenly divided by the other denominator(s)

ex. \[
\begin{array}{c}
\frac{1}{6} \quad \frac{3}{8}
\end{array}
\]

\text{Multiples of 8: 8, 16, 24, 32, 40, 48, etc.}

\text{Multiples of 6: 6, 12, 18, 24, 30, 36, etc.}

24 is the lowest multiple of 8 that can be evenly divided by 6

\text{LCD} = 24
b. Changing Fractions with Different Denominators to Fractions with the Same Denominators

Multiply the numerator, (top number), and the denominator by the same number that makes the denominator the LCD

\[
\begin{align*}
\text{ex. } & \frac{1}{6} \times \frac{3}{8} \quad 1 \times 4 = \frac{4}{24} \quad 3 \times 3 = \frac{9}{24} \\
\end{align*}
\]

\[
\begin{align*}
\text{ex. } & \frac{6}{8} \div 2 = \frac{3}{4} \\
\text{ex. } & \frac{15}{25} \div 5 = \frac{3}{5}
\end{align*}
\]

c. Reducing Fractions

Divide numerator and denominator by the same whole number

\[
\begin{align*}
\text{ex. } & \frac{6}{8} \\
6 \div 2 & = \frac{3}{4}
\end{align*}
\]

d. Changing Mixed Fractions to Improper Fractions

(Needed to multiply and divide fractions)

1. Multiply the denominator by the whole and add to numerator
2. Express this sum over the denominator

\[
3 \frac{1}{2} = 3 \times 2 = 6 \quad 6 + 1 = 7 \quad \frac{7}{2}
\]

e. Changing Improper Fractions to Proper Fractions

(Answers should not be Improper Fractions - They're “Top-Heavy”)

1. Use Long Division (The number on top goes in the box - “Box Top”)
2. The quotient is the whole number

The remainder is the numerator and the divisor is the denominator

\[
\begin{align*}
\frac{13}{4} \quad 4 \longdiv{13} \quad 3 \quad 1 \\
\frac{12}{1} \quad 3 \quad 4
\end{align*}
\]
f. Comparing Fractions

If the denominator is the same...
the fraction with the larger top number is the larger fraction

ex. \( \frac{1}{4} \) vs. \( \frac{3}{4} \)  
(3 more than 1  therefore, \( \frac{3}{4} \) more than \( \frac{1}{4} \))

If the top number is the same...
the fraction with the smaller denominator is the larger fraction

ex. \( \frac{3}{4} \) vs. \( \frac{3}{8} \)  
(4 less than 8  therefore, \( \frac{3}{4} \) more than \( \frac{3}{8} \))

If the both numbers are different...
make the denominators the same, and then compare

ex. \( \frac{1}{6} \) vs. \( \frac{3}{8} \)    \( \frac{4}{24} \) vs. \( \frac{9}{24} \)
\[ \frac{9}{24} \text{ or } \frac{3}{8} \text{ is larger} \]

g. Add and Subtract Fractions only when the denominators are the Same

If not,  
1. Find LCD 
2. Raise the fractions so that all have LCD 
3. Add or Subtract as usual 
4. Change improper fractions into mixed numbers 
   and reduce to lowest terms

ex. 1 \( 2 \frac{1}{3} \) \( + 1 \frac{3}{4} \) 
\( \frac{2}{12} \) 
\( + \frac{9}{12} \) 
\[ \frac{3}{13} \text{ or } \frac{1}{12} \text{ is larger} \]
h. Borrowing in Subtracting Fractions

1. Decrease the whole number by 1
2. Add the numerator to the denominator and express over the denominator

\[
\begin{array}{c}
\text{ex. 1 } \frac{4}{8} - \frac{9}{8} \\
\hline
- 1 \frac{3}{8} \\
\hline
\frac{5}{8} \quad \frac{1}{8} \\
\hline
\frac{2}{8} = 2 \frac{1}{2}
\end{array}
\]

ex. 2 One patient is 68½" tall, another patient is 59¾" tall. What is the difference in their height?

\[
\begin{array}{c}
\frac{68}{2} - \frac{59}{4} \\
\hline
\frac{3}{4} \quad \frac{3}{4} \\
\hline
\frac{2}{4} = 8 \frac{3}{4}
\end{array}
\]

i. Multiplying Fractions

1. Convert Mixed Fractions to Improper Fractions
2. Cancel common factors diagonally, if possible
3. Multiply numerators and multiply denominators

\[
\begin{array}{c}
\text{ex. 1 } \frac{1\frac{3}{8}}{5/6} = \frac{9}{8} \times \frac{6}{1} = \frac{54}{8} = 6 \frac{6}{8} \\
\hline
\frac{3}{2}
\end{array}
\]

\[
\begin{array}{c}
\text{ex. 2 } \frac{3\frac{3}{8}}{6} = \frac{27}{4} \times \frac{6}{1} = \frac{162}{4} = 18 \frac{3}{4}
\end{array}
\]

j. Dividing Fractions

1. Convert Mixed Fractions to Improper Fractions
2. Invert (flip) the fraction you are dividing by
3. Multiply as usual

"Ours is not to reason why, just invert and multiply!"

\[
\frac{3}{8} \div \frac{1}{4} = \frac{3}{8} \times \frac{4}{1} = \frac{3}{2} = 1\frac{1}{2}
\]
Proportionalities

a. **Old Form Proportionalities**  \( a:b::c:d \)
   
   “\( a \) is to \( b \) as \( c \) is to \( d \)”
   
   The product of the means is equal to the product of the extremes
   
   In other words...
   
   If you multiply the inside numbers, you should get the same number if you multiplied the outside numbers together.

**To solve Old Form Proportionalities**:

1. Multiply the insides or outsides together and
2. Divide by the remaining number.

\[ \begin{align*}
3:4::12:X & \quad 4 \times 12 = 48 \\
3 & \quad \frac{16}{30} \\
X & \quad \frac{48}{18} \end{align*} \]

b. **Fractional Proportionalities**  \( \frac{a}{b} = \frac{c}{d} \)

An old proportionality, \( (a:b::c:d) \), can be written as a fractional proportionality...

\[ \frac{a}{b} = \frac{c}{d} \]

**To Solve Fractional Proportionalities**:

1. Cross multiply the numbers that are diagonal to each other.
2. Divide by the number by the remaining number.

\[ \begin{align*}
3 & \quad \frac{18}{X} \quad \times 18 \\
4 & \quad \frac{24}{72} \\
X & \quad \frac{72}{12} \end{align*} \]

**Shortcuts may be used when using fractional proportions**...

a. Reduce fractions

or

b. Divide or multiply top and bottom by the same number to get the number on the right.

Use the method that works for you, but know enough to use either method.
SHOW ALL OF YOUR WORK

PART ONE  (Decimals)

1. Which is larger?  
   a. 1.25  
   b. 1.5

2. Which is smaller?  
   a. 0.125  
   b. 0.25

3. If you have medication tablets whose strength is 0.2 mg and you must give 0.1 mg, you will need:
   a. 1 tablet  
   b. less than 1 tablet  
   c. more than one tablet

4. You are to give your patient one tablet labeled 0.2 mg and one labeled 0.25 mg. What is the total dosage?

5. You are to give two tablets with a dosage strength of 5.0 mg each. What is the total dosage?

6. Your patient is to receive a dosage of 7.5 mg and you have only one tablet labeled 2.25 mg. How many more mg must you give?

7. You are to give three tablets with dosage of 3.75 mg each. What total dosage are you giving?

8. Lasix 2 g is prescribed over the next 18 hours, divided into four equally spaced doses. How much should the nurse give the patient for each dose?

9. Calculate the amount of solution and the amount of aminophylline given each hour to a client when 250 mg of aminophylline in 100 mL is given for 10 hours.

10. \( \frac{3.2}{18} = \frac{1}{5} \)

11. \( \frac{1,000}{240,000,000} = \frac{1}{240,000} \)

12. \( 0.42 \times 28 = 11.76 \)

13. \( 1,000 \times 34,000 = 34,000,000 \)
PART TWO  (Fractions)

14. If you had some tablets whose strength was 1/8 and you had to give 1/6, would you need:
   a. 1 tablet    b. less than one tablet    c. more than one tablet

15. A box contains 240 syringes. 6 patients require 15 syringes each. What fraction of the syringes will be used?

16. Which is larger? 17. Which is smaller?
   a. 1/250  a. 1/4
   b. 1/100  b. 1/6

18. A patient drank 1¾ glasses of milk, 2½ glasses of soda pop, and 1½ glasses of water. How many glasses of fluids did the patient drink?

19. Multiply: 1/100 × 250 = _____________

20. 3 ½ × ¾ = _____________

21. ¾ ÷ 1 ½ = _____________

22. 1/1000 ÷ 4 = _____________

PART THREE  (Ratios)

23. 1 : 100 :: 3 : X

24. 1 ½ : 1 :: 4 ½ : X

25. 7 / 10 = 0.5 / X

26. X / 15 = 10 / 6

Answers
1) b   2) a   3) b   4) 0.45 mg   5) 10.0 mg   6) 5.25 mg   7) 11.25 mg   8) 0.5 g
9) 25 mg, 10 mL   10) 5.63   11) 240,000   12) 11.8   13) 34,000,000   14) c
15) 3/8   16) b   17) b   18) 5 7/12   19) 2.5 or 2½   20) 2 ½ or 2.33
21) 0.5 or ½   22) 1/4000 or 0.000 25   23) 300   24) 3   25) 5/7 or 0.714   26) 25
Using the Computer to Calculate

You are allowed to use a calculator when you take the nursing math tests at BTC. The National Council for Licensing Examination (NCLEX) does not allow the use of a calculator, but does allow the use of a drop down calculator on the computer screen. The drop down calculator is very similar to the calculator that comes with Microsoft Windows®. It is recommended that you practice calculations using the Microsoft Windows® calculator to develop skills needed for the NCLEX test. If you do not practice, you risk wasting valuable time on this part of the exam. Even though you can use a calculator on the nursing math tests, it is still important that you have the ability to calculate without this convenience.

1. Click on the “Start” button.

2. Click on the “Programs” button.

3. Click on the “Accessories” button.

4. Click on the “Calculator” button.

You can click and drag the calculator to any part of the screen. If you click anywhere off the calculator, the calculator will disappear. To make the calculator appear again, click on the calculator icon located on the bottom bar of the computer screen. The “Standard” calculator shown is adequate for all nursing math calculations. If you need to change from the “Scientific” calculator to the “Standard” calculator, click on “View” and select “Standard”.

You can enter numbers using the keyboard or clicking on the calculator buttons with the mouse. When you are done, click the "X" box in the upper right corner.

Perform the following calculations:

1. 34 × 5.6 = ________________
2. 165 ÷ 2.2 = ________________
3. 8.4 × 76 = ________________
4. (1.8 × 38) + 32 = ________________
5. (329 - 32) ÷ 1.8 = ________________
6. 4.6 + (8.1 × 38) = ________________

Answers: 1) 190.4  2) 75  3) 638.4  4) 100.4  5) 165  6) 312.4
24-Hour Clock
(Military Time)

To avoid confusing 1:00 a.m. and 1:00 p.m. (“customary time” or the “12-hour clock”), hospitals often use the “24-hour clock”, or “military time”, to tell time. The 24-hour clock also clears up the question whether noon is 12:00 a.m. or 12:00 p.m. (it’s 12:00 p.m.). The 24-hour clock is used for prescriptions, medical records, and working hours. All time is expressed as a 4 digit number. The first two digits represent the hour and the next two digits represent the minutes. The hours are numbered 00 to 24. Midnight is 00, (or some say 24, depending on protocols). Hours in the a.m. stay the same, while 12 is added to the hours in the p.m.. Noon and midnight are treated differently, as you can see below. The hours and the numbers are written without punctuation, for example: 0230.

<table>
<thead>
<tr>
<th>24-Hour Clock</th>
<th>12-Hour Clock</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000 or 2400</td>
<td>12:00 a.m. (Midnight)</td>
</tr>
<tr>
<td>0030</td>
<td>12:30 a.m.</td>
</tr>
<tr>
<td>0807</td>
<td>8:07 a.m.</td>
</tr>
<tr>
<td>1129</td>
<td>11:29 a.m.</td>
</tr>
<tr>
<td>1200</td>
<td>12:00 p.m. (Noon)</td>
</tr>
<tr>
<td>1230</td>
<td>12:30 p.m.</td>
</tr>
<tr>
<td>1545</td>
<td>3:45 p.m.</td>
</tr>
<tr>
<td>2359</td>
<td>11:59 p.m.</td>
</tr>
</tbody>
</table>

Convert the following time expressed in the conventional 12-hour clock into the 24-hour clock.

1. 4:39 a.m. = ____________________
2. 11:11 a.m. = ____________________
3. 9:45 p.m. = ____________________
4. 12:00 a.m. = ____________________

Convert the following time expressed in the 24-hour clock into the conventional 12-hour clock.

5. 0515 = ____________________
6. 1050 = ____________________
7. 1725 = ____________________
8. 2130 = ____________________

Answers: 1) 0439  2) 1111  3) 2145  4) 0000  5) 5:15 am  6) 10:50 am  7) 5:25 pm  8) 9:30 pm
Metric System Notes

Terminology and Abbreviations

SI    international system of measurement, (the official metric system)
g     gram, about the mass, (weight), of a paper clip (sometimes abbreviated G or Gm or gm)
mg    milligram, about the mass, (weight), of a grain of sand
kg    kilograms, "weighs" about 2 pounds
L     liter, a liter is a little bit more than a quart (used to measure IV fluids) (also abbreviated l)
ml    milliliter, about the size of a sugar cube, (there is about 5 ml in a teaspoon) (also ml)
cubic centimeter (also abbreviated cm³) (cc should not be used - use mL instead)

1 cc = 1 mL

mEq    milliequivalent, a measurement for electrolytes like potassium
        (often equal to a millimole of electrolyte ions)

Conversion expressing a measurement in another unit

Prefixes changes the size of a unit

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Symbol</th>
<th>Meaning</th>
<th>Multiplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>kilo</td>
<td>k</td>
<td>thousand</td>
<td>1 000</td>
</tr>
<tr>
<td>deci</td>
<td>d</td>
<td>tenth</td>
<td>0.1</td>
</tr>
<tr>
<td>centi</td>
<td>c</td>
<td>hundredth</td>
<td>0.01</td>
</tr>
<tr>
<td>milli</td>
<td>m</td>
<td>thousandth</td>
<td>0.001</td>
</tr>
<tr>
<td>micro</td>
<td>μ</td>
<td>millionth</td>
<td>0.000 001</td>
</tr>
</tbody>
</table>

The Learning Lab has a variety of metric demonstration materials, workbooks, computer programs, etc. on the metric system and instructors that are available to help you.
Metric Conversion Methods

Convert 3000 mg into g

**Proportions Method**

\[
\frac{1 \text{ g}}{1000 \text{ mg}} = \frac{X \text{ g}}{3000 \text{ mg}}
\]

Note: similar units on top and on the bottom

Cross multiply and divide:

\[
1 \times 3000 = 3000
\]

\[
3000 \div 1000 = 3 \text{ g}
\]

**Dimensional Analysis Method** (Factor-Label Method)

\[
3000 \text{ mg} \times \frac{1 \text{ g}}{1000 \text{ mg}} = \frac{3000 \text{ g}}{1000} = 3 \text{ g}
\]

Note: similar units are diagonal and cancel out

**Conversion Line Method** (Only works with metric conversions)

Step 1: Draw the conversion line. (or have it in mind)

Note: This method can also be used for meters, liters, etc.

\[
\begin{array}{cccc}
\text{kg} & \text{g} & \text{cg} & \text{mg} \\
| & | & | & |
\end{array}
\]

3 2 1

The following mnemonic can be used to remember the order of the units:

kan u cee me

kilo unit centi milli

Step 2: Count the number of places the decimal point has to move to the left or the right.

*To convert 3000 mg to g, the decimal point has to move 3 places to the left.*

Step 3: Move the decimal point on your number and change the unit.

\[
3000 \text{ mg} = 3.000 \text{ g} = 3 \text{ g}
\]
Metric Conversions - A

Perform the following metric conversions.

1. 280 cm = _________________ m
2. 48 kg = _________________ g
3. 328 mm = _________________ cm
4. 56.4 m = _________________ cm
5. 382 g = _________________ kg
6. 76.4 g = _________________ mg
7. 0.28 g = _________________ mg
8. 328 mg = _________________ g
9. 4.2 L = _________________ mL
10. 964 mL = _________________ L
11. 7.6 m = _________________ cm
12. 19.6 m = _________________ mm
13. 384 g = _________________ kg
14. 0.64 L = _________________ mL
15. 48 cc = _________________ mL
16. 7.5 kg = _________________ g
17. 9.42 mL = _________________ L
18. 41.8 cm = _________________ m
19. 748 cc = _________________ cm³
20. 0.048 kg = _________________ mg
21. 600 mg of Normodyne is available on your nursing unit. 0.4 g of Normodyne has been prescribed. 0.4 g of Normodyne is equivalent to how many mg?

22. The physician has prescribed 0.2 g of Thorazine. On hand you have Thorazine labeled 100 mg. 0.2 g of Thorazine is equivalent to how many mg?

23. You have on hand 300 mg of Ticar. The physician has prescribe 0.5 g of Ticar. 0.5 g of Ticar is equivalent to how many mg?

24. 2 g of Ancef has been prescribed. You have Ancef on hand, but labeled 450 mg. 2 g of Ancef is equivalent to how many mg?

25. 0.2 g of Lopressor has been prescribed. You have Lopressor on hand labeled 150 mg. 0.2 g of Lopressor is equivalent to how many mg?

26. The physician has prescribed 1 g of Streptomycin. On hand you have Streptomycin labeled 200 mg. 1 g of Streptomycin is equivalent to how many mg?

**Answers:** 1) 2.8 m 2) 48 000 g 3) 32.8 cm 4) 5 640 cm 5) 0.382 kg 6) 76,400 mg 7) 280 mg 8) 0.328 g 9) 4200 mL 10) 0.964 L 11) 760 cm 12) 19 600 mm 13) 0.384 kg 14) 640 mL 15) 48 mL 16) 7 500 g 17) 0.00942 L 18) 0.418 m 19) 748 cm³ 20) 48 000 mg 21) 400 mg 22) 200 mg 23) 500 mg 24) 2 000 mg 25) 200 mg 26) 1 000 mg
Terminology and Abbreviations for Dosages

**General**
Do not use the Latin (written in italics.)

Rx  treatment, “recipere” or “recipe” literally “take thou”
dosage the amount of medicine to be given to the patient at a particular time
(Not the volume. For example, the dosage might be 300 mg of Lasix.
Not the 1.5 mL that is injected to obtain 300 mg.)

ampule A small closed bottle of liquid medication for injection
vial A small bottle of liquid with a diaphragm holding medication for injection
no number
c with “cum”
s without “sine”
et and “et”

**Method of Administration**
scored tablets tablets that can be broken in half or quarters
oral solution medicine provided in liquid form to be swallowed
suspension a mixture where small solid particles are suspended in a thick liquid
Gastrostomy tube a tube that goes directly into the stomach
NG nasogastric tube, a tube inserted through the nose and ending in the stomach
per by, through
os mouth
NPO nothing by mouth
SL sublingual tablets (a pill placed under the tongue)
IM intramuscular injections (an injection in a muscle)
IV intravenous injections (an injection in a vein)
ID intradermal injections (an injection in the dermis layer of the skin)
Sub-Q subcutaneous injections (an injection below the dermis layer of the skin)

**Frequency of Dose**
t.d. three times a day ("tri" = 3) “ter in die”
q.d. four times a day ("quad" = 4) “quater in die”
qu. every hour “quaque hora”
q2h, q 3h every two hours, every 3 hours, etc.
q.a.m. every morning “quaque ante meridiem”
ac before meals “ante cibum”
pc after meals “post cibum”
stat immediately “statim”
ad lib freely, as desired “ad libitum”
p.r.n. as necessary “pro re nata” literally “as need is born”
Prohibited Abbreviations  (Spell out unless otherwise indicated. Do not use the Latin)

- **cc** cubic centimeters use “mL” or “ml” (milliliters)
- **U** unit
- **IU** international unit
- **q.d.** every day “quaque die”
- **q.o.d.** every other day
- **MS or MSO₄** morphine sulfate
- **MgSO₄** magnesium sulfate
- **lack of leading zeros** use “0.2” rather than “.2”
- **trailing zeros** use “2” rather than “2.0”

Abbreviations that are NOT Recommended

(Spell out unless otherwise indicated. Do not use the Latin. Check with your agency’s policies and procedures.)

- **μg** microgram use “mcg” (μ is the Greek letter “mu”)
- **po** by mouth, oral, orally, “per os”
- **IM** intramuscular injection, (a shot into muscle)
- **SC or SQ** subcutaneous injection, (a shot into tissue, below the skin) use “Sub-Q”, “subQ”, or “subcutaneously”
- **b.i.d.** twice a day, two times a day (“bi”= 2) “bis in die”
- **T.I.W.** three times a week
- **h.s. or q.H.S.** hour of sleep “hora somni” use “at bedtime instead”
- **h.s.** half-strength
- **A.S., A.D., A.U.** left ear, right ear, both ears “auns sinistra”, “auns dextra”, “aunis”
- **O.S., O.D., O.U.** left eye, right eye, both eyes “ocuius sinister”, “acuius dexter”, “ocuius uterque”
- **D/C** discharge or discontinue
- **ss** sliding scale
- **DPT** Demerol-Phenergan-Thorazine
- **&** and
- **/** per
- **<** less than
- **>** more than
Acceptable Answers for Pharmacology Math

Failure to use the exact criteria as indicated below is sufficient for marking an answer incorrect.

Format
Place a zero before the decimal point (i.e. 0.15 or 0.023 - NOT .15 or .023)
Avoid trailing zeros (i.e. 2.3 - NOT 2.30)

Rounding
The rules given here will be sufficient to work the problems presented in this book. Round to the nearest dose that is measurable, this will be based on the equipment you are using.

If the digit to be rounded is less than 5, round down
i.e. 1.243 mL becomes 1.2 mL (rounded to the nearest tenth)

If the digit to be rounded is 5 or more than 5, round up
i.e. 34.65 kg becomes 34.7 kg (rounded to the nearest hundredth)
0.475 mL becomes 0.48 mL (rounded to the nearest hundredth, trailing zero is left off)
0.298 mL becomes .3 mL (rounded to the nearest hundredth)

1. Injections (mL)
If less than 1 mL, round to the nearest hundredth (0.01 mL) (a 1 mL syringe is used)
If more than 1 mL, round to the nearest tenth (0.1 mL) (a 3 mL syringe is used)
(Larger syringes may be marked in 0.2 mL increments, but won’t be used in this book.)

2. Tablets
Express as a whole number or one of the following fractions: ¼, ½, or ¾..

Calculations for examples and problems in this book will result in one of the above, whether it states that they are scored or not.

3. IV Drip Rates
Use whole numbers only

4. Body Mass (kg)
Round to the nearest tenth of a kilogram.

5. Mass of Medication (mg and mcg)
Round to 3 digits.
ex. 3 453.4736 mcg is rounded to 3450 mcg
2.46561536 mg is rounded to 2.47 mg

The Learning Lab has demonstration materials that help explain the significance of some of these rules.
Acceptable Answers - A

Write the numbers in the acceptable form for the Pharmacology Math Test

1. .483 = ____________
2. .393 = ____________
3. 8.300 = ____________
4. 93.0 = ____________
5. .2400 = ____________
6. .0340 = ____________
7. 3.2534 mL = ____________
8. 13.3452 mL = ____________
9. 0.35243 mL = ____________
10. .04525 mL = ____________
11. 45.3942 mL = ____________
12. 0.353256 mL = ____________
13. 9.53945 mL = ____________
14. 8.45023 mL = ____________
15. 2.250 tabs = ____________
16. 2.00 tabs = ____________
17. 2.5 tabs = ____________
18. 1.5 tabs = ____________
19. 3.75 tabs = ____________
20. 0.50 tabs = ____________
21. 39.2343 drops = ____________
22. 28.56203 drops = ____________
23. 19.389423 drops = ____________
24. 25.5488 drops = ____________
25. 36.5894 kg = ____________
26. 125.629 kg = ____________
27. 28.4573 kg = ____________
28. 152.3499 kg = ____________
29. 3.45523 mg = ____________
30. 829.548 mg = ____________
31. .03475382 g = ____________
32. 2890.532 mg = ____________

Answers:
1.) 0.483  2.) 0.393  3.) 8.3  4.) 93  5.) 0.24
6.) 0.034  7.) 3.3 mL  8.) 13.3 mL  9.) 0.35 mL  10.) 0.05 mL  11.) 45.4 mL
12.) 0.35 mL  13.) 9.5 mL  14.) 8.5 mL  15.) 2 ¼ tabs  16.) 2 tabs  17.) 2 ½ tabs
18.) 1 ½ tabs  19.) 3 ¾ tabs  20.) ½ tab  21.) 39 drops  22.) 29 drops  23.) 19 drops
24.) 26 drops  25.) 36.5 kg  26.) 125.6 kg  27.) 28.5 kg  28.) 152.3 kg  29.) 3.46 mg
30.) 830 mg  31.) 0.0348 g  32.) 2 890 mg
Calculating Dosages in Metric Units

Procedure

Solve all of these problems by setting up a proportionality. Make sure that you are consistent in setting up the proportionality. For our purposes we will always set up the problems in the following format.

\[
\frac{\text{On Hand Amount of Medicine}}{\text{Size of Dosage}} = \frac{\text{Ordered Amount of Medicine}}{\text{Size of Dosage}}
\]

ex.

Lanoxin 0.5 mg has been ordered. Scored 0.2 mg tablets are available. How many tablets do you give the patient?

\[
\frac{0.2 \text{ mg}}{1 \text{ tab}} = \frac{0.5 \text{ mg}}{X \text{ tab}}
\]

Solve by cross multiplying and dividing as usual.

\[
0.5 \times 1 = 0.5
\]

\[
0.5 \div 0.2 = 2.5 \quad \text{Dosage} = 2 \frac{1}{2} \text{ tabs}
\]

Always label your answer with the correct unit (ex. 1.6 mL, NOT simply 1.6)

Check your work by comparing the amount prescribed to the available medication dosage, deciding if you should give more than one tablet, or less than one tablet.

In the real world, an attempt is made to prescribe 3 tablets or less. If the calculation is more than 3 tablets, check you work or check to see if the medication comes in a higher amount per tablet. There is no guarantee on the tests that the answers will be 3 tablets or less.
SHOW ALL OF YOUR WORK

Adult Tablet Calculations

1. Lanoxin 0.25 mg has been ordered. Scored 0.125 mg tablets are available. How many tablets do you give the patient?

2. Amoxapine 50 mg is ordered. Scored tablets are labeled 200 mg. How many tablets do you give the patient?

Oral Solutions Calculations

3. Aventyl 12 mg oral solution is ordered b.i.d. Solution strength is 15.0 mg in 5 mL. How much oral solution do you give the patient?

4. Nortriptyline HCl is available as a 20 mg in 5 mL oral solution. Prepare a 25 mg dosage. How much oral solution do you give the patient?

Oral Solution Conversions

5. Chloral hydrate syrup contains 2 g per mL. Prepare a 4000 mg dosage. How much oral solution do you give the patient?
6. Furosemide oral solution has a strength of 10 mg in 1 mL. Prepare a 40 mg dosage. How much oral solution do you give the patient?

7. Lasix IM is available as a 15 mg per mL solution. Prepare a 30 mg injection. How many mL do you give the patient?

8. Prepare a 1.25 mg dosage of Tofranil for IM injection from a 2.5 mg per 5 mL solution. How many mL do you give the patient?

9. A dosage of Aristocort Forte 1.5 mg is ordered IM. It is available in a 0.75 mg per mL suspension. How many mL do you give the patient?

10. Torecan is available as a 80 mg per 5 mL IM solution. An order has been written for 30 mg t.i.d. IM. How many mL do you give the patient?

Answers: 1.) 2 tabs  2.) 1/4 tab  3.) 4 mL  4.) 6.3 mL  5.) 2 mL  6.) 4 mL  7.) 2 mL  8.) 2.5 mL  9.) 2 mL  10.) 1.9 mL
Additional Metric Dosage Problems

1. Isoniazid is available in 30 mg unscored tablets. 0.06 g has been prescribed po. You should administer how many unscored tablets?

2. The physician has prescribed 25 mg of Dilaudid HP for administration IM. The Dilaudid HP is available in an ampule containing 20 mg in 1 cc. In preparing the drug for administration, what volume should you withdraw from the ampule?

3. 0.3 g of Elixophyllin has been prescribed po. 150 mg of Elixophyllin is available in capsules. How many capsules should be administered?

4. The physician has prescribed 50 mg of coumadin po. The coumadin is available in scored tablets labeled 100 mg. How many scored tablets should you administer?

5. 1.2 mg Lanoxin has been prescribed po. 0.6 mg of Lanoxin is available in scored tablets. How many scored tablets should be administered?

6. You have available an ampule of Nitrostat labeled 500 mg in 1 cc. 0.8 g of Nitrostat has been prescribed by the physician IV. What volume of drug will you prepare?
7. The physician has prescribed 0.3 g of Clinoril po. The Clinoril is available in scored tablets labeled 600 mg. How many scored tablets should you administer?

8. 10 mg of Ativan has been prescribed po. 5 mg of Ativan is available in unscored tablets. How many unscored tablets should be administered?

9. Vistaril is available in a vial labeled 40 mg in 1 mL. 0.1 g of Vistaril has been prescribed IM. How many mL should you withdraw from the vial in preparing to administer the drug?

10. You have available an ampule of Nitrostat labeled 250 mg in 1 cc. 0.4 g of Nitrostat has been prescribed by the physician IV. What volume of drug will you prepare?

11. The physician has prescribed 0.075 g of Clinoril po. The Clinoril is available in scored tablets labeled 150 mg. How many scored tablets should you administer?

12. 20 mg of Vistaril has been prescribed IM. How many mL should be prepared using a vial labeled 15 mg in 1 mL?
13. Lanoxicaps are available in 0.4 mg tablets. 0.3 mg has been prescribed po. You should administer how many tablets?

14. Lasix is available in a vial labeled 300 mg per 2 mL. 0.2 g has been prescribed by the physician po. You should prepare how many mL of the drug for administration?

15. 18 mg of liquid Dilantin has been prescribed po by the physician. What volume of Dilantin should you administer if the Dilantin is available in a strength labeled 40 mg in 3 cc?

16. 5 mg of Folic Acid has been prescribed po. 2 mg of Folic Acid is available in scored tablets. How many scored tablets should be administered?

17. 2 g of Ampicillin has been prescribed. You have Ampicillin on hand but labeled 400 mg. 2 g of Ampicillin is equivalent to how many mg?

18. You have available an ampule of Ergotrate labeled 0.4 mg in 1 mL. 0.3 mg of Ergotrate has been prescribed by the physician IM. What volume of drug will you prepare?
19. The physician has prescribed 50 mg of Cardene po. The Cardene is available in capsules labeled 25 mg. How many capsules should you administer?

20. Dicloxacillin is available on your nursing unit in a vial labeled 40 mg in 1 cc. 0.1 g of dicloxacillin has been prescribed. What volume should you withdraw from the vial in preparing to administer the drug?

21. The physician has prescribed 2 mg of Valium for administration IM. The Valium is available in a vial containing 5 mg in 1 mL. In preparing the drug for administration, what volume should you withdraw from the vial?

22. The physician has prescribed 0.1 g of Nembutal for administration IM. The Nembutal is available in an ampule containing 200 mg in 4 cc. In preparing the drug for administration, what volume should you withdraw from the ampule?

23. 0.6 g of Chloromycetin has been prescribed IV. What volume should be prepared using a vial labeled 200 mg in 1 cc?

24. The physician has prescribed 0.4 g of Suprax. On hand you have Suprax labeled 200 mg. 0.4 g of Suprax is equivalent to how many mg?
25. The physician has prescribed 2 mg of Dilaudid for administration IM. The Dilaudid is available in a vial containing 4 mg in 1 cc. In preparing the drug for administration, what volume should you withdraw from the vial?

26. The physician has prescribed 0.2 g of Nitrostat for administration IV. The Nitrostat is available in an ampule containing 500 mg in 1 mL. In preparing the drug for administration, how many mL should you withdraw from the ampule?

27. 200 mg scored tablets of Diabinese are available. How many scored tablets should be administered po if 0.5 g of Diabinese is prescribed?

28. Ergotrate is available in an ampule labeled 0.1 mg in 1 cc. 0.2 mg of Ergotrate has been prescribed IM. What volume should you withdraw from the ampule in preparing to administer the drug?
29. You have a vial of Garamycin labeled 30 mg in 1 mL. 50 mg of Garamycin has been prescribed by the physician IV. What volume of drug will you prepare?

30. 200 mg tablets of Lithium Carbonate are available. How many tablets should be administered po if 0.5 g of Lithium Carbonate is prescribed?

31. You have on hand 20 mg of Vistaril. The physician has prescribed 0.2 g of Vistaril. 0.2 g of Vistaril is equivalent to how many mg?

32. You have available a vial of Ancef labeled 220 mg in 1 mL. 300 mg of Ancef has been prescribed by the physician IV. What volume of the drug will you prepare?

**Answers:**
1.) 2 tabs  
2.) 1.3 mL  
3.) 3 caps  
4.) ½ tab  
5.) 2 tabs  
6.) 1.6 mL  
7.) ½ tab  
8.) 2 tabs  
9.) 2.5 mL  
10.) 1.6 mL  
11.) ½ tab  
12.) 1.3 mL  
13.) 3/4 tab  
14.) 1.3 mL  
15.) 1.4 mL  
16.) 2 ½ tabs  
17.) 2 000 mg  
18.) 0.75 mL  
19.) 2 caps  
20.) 2.5 mL  
21.) 0.4 mL  
22.) 2 mL  
23.) 3 mL  
24.) 400 mg  
25.) 0.5 mL  
26.) 0.4 mL  
27.) 2 ½ tabs  
28.) 2 mL  
29.) 1.7 mL  
30.) 2 1/2 tab  
31.) 200 mg  
32.) 1.4 mL
Apothecary System Notes

O true apothecary!
Thy drugs are quick,
Thus with a kiss I die.

Shakespeare, *Romeo and Juliet*

Apothecary
a term that refers to prescription medicine, especially a system of measures that is not commonly used (often using Roman numerals: ii, iv, x, etc.)

Household System
most common system used in the United States (teaspoons, tablespoons, pounds, etc.)

Equivalents
relationships between apothecary units and metric units, these are commonly used approximations, not exact conversions

Minim (mL)
a measure of volume equivalent to a drop (sometimes found on syringes)

$$\text{16 minims} \approx 1 \text{ mL}$$ (actually 16.23119 minims = 1 mL)

Teaspoon (tsp)
a measure of volume, there are 3 teaspoons in one tablespoon

$$1 \text{ tsp} \approx 5 \text{ mL}$$ (actually 1 tsp = 4.92878 mL )

Tablespoon (Tbsp or T)
a measure of volume, there are 2 tablespoons to the ounce

$$1 \text{ Tbsp} \approx 15 \text{ mL}$$ (actually 1 Tbsp = 14.78634 mL )

Ounce (oz)
a measure of volume, there are 8 ounces to the cup

$$1 \text{ oz} \approx 30 \text{ mL}$$ (actually 1 oz = 29.572701 mL )

also a measure of weight, there are 16 ounces to a pound

Grain (gr)
a measure of weight, the weight of an average grain of wheat  

note: the label is usually placed before the number, ex. gr 3/4

$$\text{gr 1/100} \approx 0.6 \text{ mg}$$  $$\text{gr 1/200} \approx 0.3 \text{ mg}$$  $$\text{gr 1/300} \approx 0.2 \text{ mg}$$  

$$\text{gr 1} \approx 60 \text{ mg}$$  $$\text{gr 1 ½} \approx 100 \text{ mg}$$  $$\text{gr 15} \approx 1000 \text{ mg} \approx 1 \text{ g}$$

(of actually gr 1 = 64.79891 mg)
Calculating Dosages in Apothecary Units

**Procedure**

Solve all of these problems by setting up a proportionality, just like the metric dosage problems. You may have to convert all units of measure into a single system, usually from apothecary into metric. For consistency sake - we will always use \( \text{gr } 1 = 60 \text{ mg} \) and convert gr into mg when both are used.

ex.

Prolid 45 mg has been ordered. Unscored gr 1/4 tablets are available. How many tablets do you give the patient?

\[
\frac{\text{gr } \frac{1}{4}}{1 \text{ tab}} = \frac{45 \text{ mg}}{X \text{ tab}}
\]

First convert the grains into milligrams using a proportionality.

\[
\frac{\text{gr } 1}{60 \text{ mg}} = \frac{\text{gr } \frac{1}{4}}{X \text{ mg}}
\]

Solve by cross multiplying and dividing as usual.

\[60 \times \frac{1}{4} = 60 / 4 = 15\]

\[15 \div 1 = 15\]

\( \text{gr } \frac{1}{4} = 15 \text{ mg} \)

Change the original proportionality.

\[
\frac{15 \text{ mg}}{\text{gr } \frac{1}{4}} = \frac{45 \text{ mg}}{X \text{ tab}}
\]

Solve as usual.

\[45 \times 1 = 45\]

\[45 \div 15 = 3\]

Answer = 3 tabs
# Table of Equivalents

(This table will be provided on all pharmacology math tests.)

<table>
<thead>
<tr>
<th>Metric</th>
<th>Household</th>
<th>Apothecary</th>
</tr>
</thead>
</table>

## Length

| 2.54 cm | = | 1 inch |

## Liquid Volume

| 1 drop (gtt) | = | 1 minim (\(\text{mL}\)) |
| 1 mL | = | 15 - 16 drops |
| ¾ tsp | = | 1 dram (\(\text{d}\) or \(\text{dr}\)) = 60 minims |
| 5 mL | = | 1 teaspoon (tsp) |
| 15 mL | = | 1 tablespoon (Tbsp) = 3 tsp |
| 30 mL | = | 1 ounce (oz) = 2 Tbsp |
| 240 mL | = | 1 cup |
| 500 mL | = | 1 pint (pt) |
| 1000 mL | = | 1 quart (qt) = 2 pt |
| 1 gallon (gal) = 4 qt | = | 128 ounces |

## Weight

| 0.6 mg | = | gr 1/100 |
| 60 mg | = | gr 1 |
| 100 mg | = | gr ½ |
| 1 g | = | gr 15 |
| 1 kg | = | 2.2 lb |

## Temperature

\[ ^\circ C = \left( ^\circ F - 32 \right) \div 1.8 \quad ^\circ F = 1.8 \times ^\circ C + 32 \]
Apothecary Fractions

Knowing some "tricks" concerning fractions can be very useful when working with fractions in the apothecary system. These "tricks" will save you time and make your calculations more accurate. As with any short-cut, you still must know the long-way.

Since one of the equivalents used to convert grains into grams involves the number "60", using your knowledge of time will be helpful.

We know that...

\[
\begin{align*}
1 \text{ hour} &= 60 \text{ minutes} & \text{gr} \ 1 &= 60 \text{ mg} \\
\frac{1}{2} \text{ hr} &= 30 \text{ minutes} & \text{gr} \ \frac{1}{2} &= 30 \text{ mg} \\
\frac{1}{4} \text{ hr} &= 15 \text{ minutes} & \text{gr} \ \frac{1}{4} &= 15 \text{ mg} \\
\frac{3}{4} \text{ hr} &= 45 \text{ minutes} & \text{gr} \ \frac{3}{4} &= 45 \text{ mg} \\
\frac{1}{3} \text{ hr} &= 20 \text{ minutes} & \text{gr} \ \frac{1}{3} &= 20 \text{ mg} \\
\frac{2}{3} \text{ hr} &= 40 \text{ minutes} & \text{gr} \ \frac{2}{3} &= 40 \text{ mg} \\
\frac{1}{6} \text{ hr} &= 10 \text{ minutes} & \text{gr} \ \frac{1}{6} &= 10 \text{ mg} \\
\frac{1}{10} \text{ hr} &= 6 \text{ minutes} & \text{gr} \ \frac{1}{10} &= 6 \text{ mg} \\
\end{align*}
\]

Using a little knowledge of fractions lets us expand the number of fractions that we can "remember". We could take one-hundredth of the equivalent (1 hr = 60 minutes gr 1 = 60 mg), and come up with another equivalent. To change the fraction, we multiply the denominator by one hundred and to change the decimal we move the decimal point over two places.

\[
\begin{align*}
\frac{1}{100} \text{ hr} &= 0.6 \text{ minutes} & \text{gr} \ \frac{1}{100} &= 0.6 \text{ mg} \\
\end{align*}
\]

Continuing this procedure, we can get "new" equivalents by taking one-hundredth of the equivalents we have found above to come up with new equivalents.

\[
\begin{align*}
\frac{1}{100} \text{ of } \frac{1}{2} \text{ hr} (30 \text{ minutes}) &= 0.6 \text{ minutes} \\
\frac{1}{200} \text{ hr} &= 0.3 \text{ minutes} & \text{gr} \ \frac{1}{200} &= 0.3 \text{ mg} \\
\frac{1}{300} \text{ hr} &= 0.2 \text{ minutes} & \text{gr} \ \frac{1}{300} &= 0.2 \text{ mg, etc.}
\end{align*}
\]
Apothecary Fractions Practice

Convert the following apothecary measurements into metric measurements. You may want to use the "clock tricks" that have been presented. Do not rely on the "clock trick", it is not always the easiest.

1. gr ½ = ___________mg
2. gr 1/3 = ___________mg
3. gr 1/4 = ___________mg
4. gr 1/6 = ___________mg
5. gr 1/10 = ___________mg
6. gr 1/15 = ___________mg
7. gr 3/4 = ___________mg
8. gr 2/3 = ___________mg
9. gr 1/30 = ___________mg
10. gr 1/20 = ___________mg

11. gr 1/200 = ___________mg
12. gr 1/400 = ___________mg
13. gr 1/300 = ___________mg
14. gr 1/100 = ___________mg
15. gr 1/150 = ___________mg
16. gr 5/6 = ___________mg
17. gr 3/10 = ___________mg
18. gr 1/8 = ___________mg
19. gr 1/9 = ___________mg
20. gr 1/250 = ___________mg

Answers:
1.) 30  2.) 20  3.) 15  4.) 10  5.) 6  6.) 4  7.) 45
8.) 40  9.) 2  10.) 3  11.) 0.3  12.) 0.15  13.) 0.2  14.) 0.6
15.) 0.4  16.) 50  17.) 18  18.) 7.5  19.) 6.7  20.) 0.24
Apothecary System - A

Pharmacology Math Practice Problems

SHOW ALL OF YOUR WORK

**Adult Tablet Calculations:**

1. Prepare a gr 1/6 dosage of codeine from tablets labeled 5 mg. How many tablets do you give the patient?

2. Thyroid tablets have a strength of gr 1/150. Prepare 0.4 mg. How many tablets do you give the patient?

3. Proloid is available in unscored tablets marked gr 1/4. How many unscored tablets should be administered po if 30 mg of Proloid is prescribed?

**Adult Oral Solutions Calculations:**

4. Septra suspension 30 mL has been ordered. What is the equivalent in tablespoons?

5. How many mL is equivalent to a 2 oz dosage of Peri-Colace?

6. The physician prescribed gr 5 of Ferrous Sulfate po. The Ferrous Sulfate is available in liquid form labeled 200 mg in 5 cc. What volume should you administer of the Ferrous Sulfate.
Adult IM/SC Apothecary Calculations:

7. Pentapon is available in a gr 1/6 per mL solution. Prepare gr 1/4. How many mL do you give the patient?

8. Prepare a gr 1/4 dosage of Nembutal IM from a solution of gr 2/3 per mL. How many mL do you give the patient?

9. Prepare a gr 1/150 dosage of Hydromorphone from a solution labeled gr 1/200 per mL solution. How many mL do you give the patient?

10. Prepare gr morphine gr 1/4 from a solution whose strength is gr ½ per mL. How many mL do you give the patient?

11. Hydromorphone ½ grain has been ordered. Available is a 15 mg per mL solution. How many mL do you give the patient?

12. Prepare Morphine gr ½ from a 60 mg per 2 mL solution. How many mL do you give the patient?

Answers: 1.) 2 tabs  2.) 1 tab  3.) 2 tabs  4.) 2 Tbsp  5.) 60 mL  6.) 7.5 mL  7.) 1.5 mL  8.) 0.38 mL  9.) 1.3 mL  10.) 0.5 mL  11.) 2 mL  12.) 1 mL
Roman Numerals

Roman numerals are often used with the apothecary system. The numerals have also been modified by the pharmacists (apothecary) through the years. (The numbers that we are most familiar with - 1, 2, 3 - are called Arabic numerals.) Roman numerals above 12 are rarely seen or used by nurses.

<table>
<thead>
<tr>
<th>Arabic Numerals</th>
<th>Roman Numerals</th>
<th>Apothecary Numerals</th>
</tr>
</thead>
<tbody>
<tr>
<td>½</td>
<td>I</td>
<td>ss or ss “semis”</td>
</tr>
<tr>
<td>1</td>
<td>I</td>
<td>i</td>
</tr>
<tr>
<td>2</td>
<td>II</td>
<td>ii</td>
</tr>
<tr>
<td>3</td>
<td>III</td>
<td>iii</td>
</tr>
<tr>
<td>4</td>
<td>IV</td>
<td>iv</td>
</tr>
<tr>
<td>5</td>
<td>V</td>
<td>v</td>
</tr>
<tr>
<td>6</td>
<td>VI</td>
<td>vi</td>
</tr>
<tr>
<td>7</td>
<td>VII</td>
<td>vii</td>
</tr>
<tr>
<td>8</td>
<td>VIII</td>
<td>viii</td>
</tr>
<tr>
<td>9</td>
<td>IX</td>
<td>ix</td>
</tr>
<tr>
<td>10</td>
<td>X</td>
<td>x</td>
</tr>
<tr>
<td>11</td>
<td>XI</td>
<td>xi</td>
</tr>
<tr>
<td>12</td>
<td>XII</td>
<td>xii</td>
</tr>
</tbody>
</table>

Notes:

1.) Smaller numerals to the right of larger numerals are added to the larger numeral. (ex. VIII = 5 + 3 = 8)

2.) Smaller numerals to the left are subtracted from the larger numeral. (ex. IV = 5 - 1 = 4, IX = 10 - 1 = 9, XL = 40).

3.) Only one smaller numeral should be used to the left. (ex. IIV is NOT used for 3)

4.) If there are 2 ways of writing a numeral, the shorter way should be used. Never repeat the same numeral more than three times. (ex. IV is used vs. IIII)
Roman Numeral - A

Convert the following numbers into Roman numerals.

1. 2 = _______________ \\
2. 6 = _______________ \\
3. 9 = _______________ \\
4. 13 = _______________

Convert the following numbers into Apothecary numerals.

5. 4 = _______________ \\
6. 2 ½ = _______________

Convert the following Roman/Apothecary numerals into Arabic numerals.

7. III = _______________ \\
8. IV = _______________ \\
9. XV = _______________ \\
10. viii = _______________ \\
11. iss = _______________ \\
12. xiv = _______________

13. Hydromorphone ss gr has been ordered. How many grains were ordered?

14. The physician prescribed gr v of Ferrous Sulfate po. How many mg were ordered?

15. The order for a patient is for 3 ½ grains of morphine. Express this order with apothecary numerals.

Answers: 1) II 2) VI 3) IX 4) XIII 5) iv 6) iiss 7) 3 8) 4 \\
9) 15 10) 8 11) 1 ½ 12) 14 13) ½ 14) 300 mg 15) gr iiss
Unit Dosages Notes

A variety of drugs are administered in quantities called International Units and United States Pharmaceutical Units (U.S.P. Units), or just Units. These drugs include insulin, heparin and antibiotics, such as penicillin. These drugs come directly from living organism and can not measured in milligrams or grains since 2 mg of one batch of insulin might not have the same potency 2 mg of another batch, although 10,000 Units of one batch would have the same potency as 10,000 Units of any other batch.

The abbreviation of Units is U or u, but should not be written since it has been mistaken for a “0” or a “4”. For example, “10U” could be mistaken for “100”. The abbreviation for International Units is IU, but again should not be written since it has been mistaken for “IV” or “10”.

Insulin

This drug is used to treat diabetes mellitus. Insulin is a hormone produced by the pancreas which regulates the blood sugar level, (glucose level), of the body. Individuals with a high blood sugar level need insulin to lower their blood sugar level. Insulins can be obtained from bacteria which use human genes to produce human insulin and is identified as semi-synthetic, “recombinant DNA origin”. Animals are also used to obtain insulin and are labeled as pork or beef.

Types of Insulin

Insulin can be classified according to their action time. The four types are: rapid acting (LISPRO or humalog), short acting (Regular insulin), intermediate acting (NPH), and long acting (Lantus or glargine). Humulin and Iletin I are examples of brand names for insulin. Types of insulin may be mixed to meet the individual needs of the patient.

Insulin Syringes

U-100 syringes are designed to be used with insulin. Insulin syringes come in two sizes: Lo-Dose Syringes, (50 Units), and the 100 units Syringe.

Heparin

Heparin prevents clot formation and blood coagulation.
Unit Dosages - A
Pharmacology Math Practice Problems

SHOW ALL OF YOUR WORK

**Insulin**

Indicate the total volume of the combined dosage, and the smallest capacity syringe you can use to prepare it (50 units and 100 U capacity syringes are available).

<table>
<thead>
<tr>
<th>Total Volume</th>
<th>Syringe Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 30 Units NPH and 40 Units Regular</td>
<td>__________</td>
</tr>
<tr>
<td>2. 42 Units NPH</td>
<td>__________</td>
</tr>
<tr>
<td>3. 23 Units NPH and 22 Units Regular</td>
<td>__________</td>
</tr>
</tbody>
</table>

**Heparin and Antibiotics**

4. Dr. Perry Kardeum ordered 20,000 Units of heparin. You have a vial labeled 15,000 Units per mL. How many mL do you give the patient?

5. The order is for 5,000 Units of heparin. The solution available is 3,000 Units per mL. How many mL do you administer?

6. The heparin available is 18,000 Units per mL. Dr. A. Nuss orders a 16,000 Unit injection. How many mL do you use?

7. Dr. Ben Nyne orders 150,000 Units of penicillin. A vial of penicillin of 300,000 Units per mL is available. How many mL will you give?

8. 400,000 units of Mycostatin has been prescribed po. The Mycostatin is available in liquid form labeled 200,000 units in 1 cc. What volume of Mycostatin should you administer?

Answers: 1.) 70 Units 100 Units 2.) 42 Units 50 Units 3.) 45 Units 50 U 4.) 1.3 mL 5.) 1.7 mL 6.) 0.89 mL 7.) 0.5 mL 8.) 2 mL
Weight Based Dosages Notes

Terminology and Abbreviations

Weight-Based Dosages
Dosages based on their weight, usually expressed in kg. Often used for children and therefore can be referred to as “Pediatric Dosages”.

kilogram (kg)
A metric unit of mass, (weight).

pound (lb)
An English unit of weight, (mass).

\[1 \text{ kg} \approx 2.2 \text{ lb}\]

(Hint - To remember this conversion, most people would like to express their weight in kilograms since it is roughly half of their weight in pounds - ex. 160 lbs \(\approx 80 \text{ kg}\))

Procedure for Calculating Weight-Based Dosages

Directions for use usually indicate how much medication should be given per kilogram of body weight, (ex. 200 mg per kg per day).

Step 1: Convert the patient's weight into kg using the above equivalent.

Step 2: Use Proportionalities to determine how much medication is to be given per day.

Example
You need to verify that a prescribed dose of Claforan IV for a child weighing 26 lbs is safe. The drug literature recommends a maximum of 200 mg per kg per day. What is the maximum dose for this child per day?

\[
\begin{align*}
\text{Step 1} & \quad \frac{2.2 \text{ lb}}{1 \text{ kg}} = \frac{26 \text{ lbs}}{x \text{ kg}} \quad 26 \div 2.2 = 11.8181818181 \\
\text{Step 2} & \quad \frac{200 \text{ mg}}{1 \text{ kg}} = \frac{x \text{ mg}}{11.8} \quad 11.8181818181 \times 200 = 2363.6363 \\
& \quad 2360 \text{ mg per day}
\end{align*}
\]
Weight Based Dosages - A

SHOW ALL OF YOUR WORK

1. A physician has prescribed Demerol IM for a child weighing 66 lbs. The drug literature recommends a maximum of 5 mg per kg per dose. What is the maximum dose of Demerol for this child?

2. You need to verify that a prescribed dose of Claforan IV for a child weighing 35 lbs is safe. The drug literature recommends a maximum of 80 mg/kg/day. What is the maximum dose of Claforan for this child per day?

3. You need to verify that a prescribed dose of Ancef IV for a child weighing 34 lbs is safe. The drug literature recommends a maximum of 40 mg/kg/day. What is the maximum dose for this child per day?

4. A physician has prescribed Lasix for a child weighing 26 lbs. The drug literature recommends a maximum of 9 mg per kg per dose. What is the maximum dose of Lasix for this child?

5. A physician has prescribed Ceclor po for a child weighing 48 lbs. The drug literature recommends a maximum of 40 mg per kg per dose. What is the maximum dose for this child?
6. A physician has prescribed Theophylline po for a child weighing 35 lbs. The drug literature recommends a maximum of 0.8 mg/kg/hr. What is the maximum dose of Theophylline for this child per hour?

7. You need to verify that a prescribed dose of Gentamicin IM for a child weighing 52 lbs is safe. The drug literature recommends a maximum of 2 mg per kg per dose. What is the maximum dose for this child?

8. A physician has prescribed Phenobarbital po for a child weighing 32 lbs. The drug literature recommends a maximum of 4 mg per kg per dose. What is the maximum dose of Phenobarbital for this child?

9. Tom Silitis is to receive 6 mg of medication per kg of body weight. He weighs 88 pounds. Medication is available in 200 mg per mL. How many mL will you give?

10. Anne T. Byotic is to receive 40 mg of medication per kg of body weight. She weighs 44 pounds. Medication is available in 500 mg per mL. How many mL will you give?

Answers: 1.) 150 mg  2.) 1270 mg  3.) 618 mg  4.) 106 mg  5.) 873 mg  6.) 12.7 mg  7.) 47.3 mg  8.) 58.2 mg  9.) 1.2 mL  10.) 1.6 mL
Reconstitution Notes

Terminology and Abbreviations

**Reconstitution**  Changing a powdered drug into a liquid form by adding a liquid.  
(Some drugs can only be stored 1 - 14 days in their liquid form)

**Vial**  Small bottle with the powdered drug

**Diluent**  The liquid solvent that is added to the powdered drug

Some medications offer a choice of strengths on reconstitution. You would choose the strength that would best suit your needs for a particular usage. For example:

<table>
<thead>
<tr>
<th>Penicillin G</th>
<th>Amt Diluent</th>
<th>Units per mL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>75 mL</td>
<td>250,000</td>
</tr>
<tr>
<td></td>
<td>33 mL</td>
<td>500,000</td>
</tr>
<tr>
<td></td>
<td>11.5 mL</td>
<td>1,000,000</td>
</tr>
</tbody>
</table>

Procedure for Calculating Reconstitutions

The problem will include the reconstitution directions and the strength of the final solution. The directions can be ignored when calculating the dosage. The strength will be indicated by the phrase "to yield 20 mg in 1 mL".

**Example**

2 g of powdered Ticar is available. Directions for reconstitution state: Add 4 mL of diluent to yield 100 mg in 1 mL. To administer a prescribed dosage of 300 mg for IV administration, how many mL of drug should you withdraw from the vial after reconstituting the drug as directed?

*Ignore the reconstitution directions: “2 g in 4 mL of diluent”, concentrate instead on “yield 100 mg in 1 mL” and “prescribed dosage of 300 mg.”*

\[
\frac{100 \text{ mg}}{1 \text{ mL}} = \frac{300 \text{ mg}}{X \text{ mL}}
\]

\[
300 ÷ 100 = 3 \text{ mL}
\]
SHOW ALL OF YOUR WORK

1. You have on hand a vial of Nafcillin labeled 1 g. The physician has ordered 0.4 g of Nafcillin IM. You reconstitute the drug as directed, adding 3.4 mL of diluent to yield a strength of 500 mg in 2 mL. In preparing to administer the drug, how many mL should you withdraw from the vial?

2. You have on hand a vial of Ampicillin labeled 200 mg. The physician has ordered 0.1 g of the Ampicillin IV. You reconstitute the drug as directed, adding 0.8 mL of diluent to yield a strength of 250 mg in 1 mL. In preparing to administer the drug, how many mL should you withdraw from the vial?

3. You have on hand a vial of Ampicillin labeled 200 mg. The physician has ordered 0.2 g of the Ampicillin IV. You reconstitute the drug as directed, adding 0.9 cc of diluent to yield a strength of 200 mg in 1 cc. In preparing to administer the drug, What volume should you withdraw from the vial?

4. 0.5 g of powdered Ticar is available. Directions for reconstitution state: Add 2 cc of diluent to yield 200 mg in 1 cc. To administer a prescribed dosage of 600 mg for IV administration, What volume of drug should you withdraw from the vial after reconstituting the drug as directed?

Answers: 1.) 1.6 mL  2.) 0.4 mL  3.) 1mL  4.) 3 mL
Milliequivalent Notes

Milliequivalents is a unit of measure for electrolytes, such as potassium chloride (KCL). Note - chlorine is abbreviated as "CL" in the health professions, but "Cl" in chemistry. An equivalent is the number of moles of electrons that are gained or lost by ions. Potassium chloride is given either orally (po), or intravenously (IV). An overdose of KCL can be fatal. Remember KCL can Kill CLients.

Oral Dosage

ex. Administer 40 mEq KCL q8hr. Available is 20 mEq KCL per 10 mL. How much KCL solution should be administered?

\[
\frac{20 \text{ mEq}}{10 \text{ mL}} = \frac{40 \text{ mEq}}{x \text{ mL}} = 20 \text{ mL}
\]

IV Dosage

Potassium chloride must always be diluted when it is administered intravenously. High concentrations of potassium chloride (20 mEq per 10mL or greater) causes a painful reaction and death. Because of this, potassium chloride is often premixed in the IV bag, but not always.

Procedure:
Step 1: Calculate the total amount of medication that is needed in the IV bag.
Step 2: Calculate how many mL of concentrated medication has to be added.

Example:
The doctor orders 1500 mL D5W with KCL 8 mEq per 100 mL to infuse over 24 hours. You have KCL of 20 mEq per 10 mL. How many mL of KCL do you add?

\[
\begin{align*}
\text{Step 1} & \quad \frac{8 \text{ mEq}}{100 \text{ mL}} = \frac{X \text{ mEq}}{1 \ 500 \text{ mL}} \\
& \quad 8 \times 1 \ 500 = 12 \ 000 \quad 12 \ 000 \div 100 = 120 \text{ mEq} \\
\text{Step 2} & \quad \frac{20 \text{ mEq}}{10 \text{ mL}} = \frac{120 \text{ mEq}}{x \text{ mL}} \\
& \quad 120 \times 10 = 1 \ 200 \quad 1 \ 200 \div 20 = 60 \quad 60 \text{ mL}
\end{align*}
\]
1. The doctor orders 30mEq of KCL q4h. You have 20 mEq per 50mL KCL solution available.
   How many mL should you administer?

2. You have on hand 60 mEq per 100 cc KCL. 20 mEq q.h. has been prescribed. What volume do you administer?

3. You have on hand 40 mEq/100 mL KCL. 60 mEq q.h. has been prescribed. How many mL do you administer?

4. The doctor orders 30mEq of KCL q4h. You have 20 mEq per 50mL KCL solution available.
   How many mL should you administer?
5. The doctor orders 600 mL D5W with KCL 6 mEq per 100 mL to infuse over 12 hours. You have KCL of 20 mEq/10 mL. How many mL of KCL do you add?

6. The doctor orders 400 mL D5W with KCL 8 mEq per 100 mL to infuse over 12 hours. You have KCL of 10 mEq per 10 mL. How many mL of KCL do you add?

7. The doctor orders 1200 mL D5W with KCL 6 mEq per 100 mL to infuse over 24 hours. You have KCL of 15 mEq per 10 mL. How many mL of KCL do you add?

8. The doctor orders 400 mL D5W with KCL 8 mEq/100 mL to infuse over 8 hours. You have KCL of 20 mEq/10 mL. How many mL of KCL do you add?

Answers: 1) 75 mL 2) 33.3 mL 3) 150 mL 4) 75 mL 5) 18 mL 6) 32 mL 7) 48 mL 8) 16 mL
Temperature
Conversions

We are most familiar with taking temperature in the Fahrenheit scale, but sometimes it is necessary to use the Celsius scale. It is important to memorize the following important temperatures:

<table>
<thead>
<tr>
<th>Fahrenheit</th>
<th>Celsius</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiling Point of Water</td>
<td>212°F</td>
</tr>
<tr>
<td>Normal Body Temperature</td>
<td>98.6°F</td>
</tr>
<tr>
<td>Room Temperature</td>
<td>72°F</td>
</tr>
<tr>
<td>Freezing Point of Water</td>
<td>32°F</td>
</tr>
</tbody>
</table>

At times it will be necessary to convert from one system to another. To do this, the following formulas will be used. (Express your answers to the nearest tenth of a degree.)

\[
°C = (°F - 32) ÷ 1.8 \quad \text{and} \quad °F = 1.8 °C + 32
\]

Note - There are other ways of writing these formulas: 

\[
°C = \frac{5}{9} (°F - 32) \quad \text{and} \quad °F = \frac{9}{5} °C + 32
\]

ex. Convert 102 °F into °C.

\[
°C = (102 - 32) ÷ 1.8 = 70 ÷ 1.8 = 38.9 °C
\]

ex. Convert 25 °C into °F

\[
°F = 1.8 (25) + 32 = 45 + 32 = 77 °C
\]
Temperature
Conversions - A

Convert the following temperatures into the specified units.

1. 40°C = ___________ °F
2. 24°C = ___________ °F
3. 100°F = ___________ °C
4. 86°F = ___________ °C
5. 105°F = ___________ °C
6. 27°C = ___________ °F
7. 65°F = ___________ °C
8. 35°C = ___________ °F

9. A patient has had a temperature of 103°F for the past 4 hours. What is the patient’s temperature in Celsius?

10. A man was found outside exposed to the elements for the past 18 hours. The temperature outside is 32°C. What is this temperature in Fahrenheit?

11. From memory, what is room temperature in Celsius? ____________
12. From memory, what is body temperature in Celsius? ____________

Answers: 1) 104°F  2) 75.2°F  3) 37.8°C  4) 30°C  5) 40.6  6) 80.6°F
          7) 18.3°C  8) 95°F  9) 39.4°C  10) 89.6°F  11) 22°C  12) 37°C
Hints for Application Problems

In the application tests the problems are presented much like what you would see on the job. The “General Applications” test will cover topics presented to this point, while the “Advanced Applications” test will include problems involving IV dosages, which will be covered in the next section.

The challenge in working with these application problems is determining which equation or method should be used. (This was easier in previous sections since the whole section concentrated on one type of problem, but now any and/or all of these problems are presented on one test.) The following will help you decide which equation or procedure should be used.

<table>
<thead>
<tr>
<th>Things to Look For</th>
<th>Type of Equation or Method to be Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reconstitution</td>
<td>Use the given &quot;strength yields...&quot;, (ignore some numbers)</td>
</tr>
<tr>
<td>Weighs X pounds</td>
<td>Convert weight to kilograms  ( \div 2.2 ) then multiply by dosage per kg</td>
</tr>
<tr>
<td>All other problems</td>
<td>Solve using proportions  (may have to convert to metrics first)</td>
</tr>
</tbody>
</table>

\[
\begin{array}{c|c}
\text{Mass Available} & \text{Mass Prescribed} \\
\text{Volume Available} & \text{Volume Prescribed} \\
\end{array}
\]

For later tests...

- Drops - cc or mL only  IV Problem - One Step
- Drops - g, mg, or mcg  IV Problem - Two Step (find volume first then solve as usual)
Problems
William Reuben, Jr., an 80 year-old male is admitted to the Emergency Department on 10/20/98, with chest pain. The symptoms began 3 hours ago with a minor pain in his left arm. His skin has a yellow cast. Billy weighs 200 pounds. He is admitted to the floor you are working on for tests and treatment. His orders are as follows:

Bed Rest
Oxygen at 5 L
800 mL D5W with KCL 4 mEq/100 mL to infuse over 24 hours
Heparin 30,000 Units I.V. stat
Lasix 40 mg I.V. stat
NPH Insulin 24 Units with Regular Insulin 60 Units q.a.m.
Tricor 0.2 g
Nembutal gr 1/3 p.o. for sleep
Flagyl 5 mg per kg q4hr IV piggyback
Morphine gr ½ I.M. q4hr p.r.n.
Low salt, low fat diet
Urinalysis, routine blood work
Demerol 50 mg
Robinul 40 mL
Tylenol 300 mg

1. What volume of Demerol will you need to administer for the prescribed dose?

2. Shade in the amount of Tylenol on the med cup to the right that you will be administering to Billy.

3. Billy does not like the taste of the liquid and requests to receive Tylenol per oral tablets. How many tablets will you administer to the patient?

4. How many containers of Robinul will you need to administer the correct dose?

5. Billy returned from a trip to Cameroon where he was treated for malaria and according to his records had a temperature of 40°C for 6 days. What was his temperature in Fahrenheit?
6. How many mL of Heparin will you prepare to administer the prescribed dose?

7. How many capsules of Nembutal will you give?

8. What is the total volume of the insulins ordered and the smallest capacity syringe you can use to prepare it? (50 Unit and 100 Unit capacity syringes are available.)

   Total Volume

   Syringe Size

9. Billy is experiencing severe chest pain. You decide to give him morphine according to the doctor's orders. Shade in the total amount of the medication you will be administering on the correct syringe(s) below.

10. How many mg’s of Flagyl will you administer to Billy?

11. How many mL of KCL will you add to the 800 mL bag?

12. Runs-B-Gone is ordered for his diarrhea. He may receive 1 tablet of Runs-B-Gone after each loose stool. What is the maximum number of tablets Billy Reuben can receive in 24 hours?

13. How many mL of Tricor should you withdraw from the vial after reconstituting the drug in order to administer the prescribed dose?

   Answers: 1) 1.3 mL  2) 18.8 mL  3) 3 tabs  4) 4 containers  5) 104°F  6) 1.5 mL  7) 2 caps  8) 84 Units, 100 Units  9) 1 mL top syringe 10) 454.5 mg  11) 16 mL  12) 6 tabs  13) 2 mL
<table>
<thead>
<tr>
<th>Medicine Cabinet General Applications - A</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demerol®</strong> Injection</td>
</tr>
<tr>
<td>40 mg per mL</td>
</tr>
<tr>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td>8-mL Multidose Vial</td>
</tr>
<tr>
<td><strong>Flagyl®</strong> Injection</td>
</tr>
<tr>
<td>25 mg per mL</td>
</tr>
<tr>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td>6-mL Multidose Vial</td>
</tr>
<tr>
<td><strong>Heparin®</strong> Injection</td>
</tr>
<tr>
<td>20,000 Units per mL</td>
</tr>
<tr>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td>10-mL Multidose Vial</td>
</tr>
<tr>
<td><strong>Maalox®</strong> Antacid</td>
</tr>
<tr>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td>15 mL - single dose</td>
</tr>
<tr>
<td><strong>Morphine Sulfate</strong></td>
</tr>
<tr>
<td>30 mg per mL</td>
</tr>
<tr>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td>6-mL Multidose Vial</td>
</tr>
<tr>
<td><strong>Nembutal®</strong></td>
</tr>
<tr>
<td>10 mg tablets</td>
</tr>
<tr>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td>100 tablets</td>
</tr>
<tr>
<td><strong>Nitroglycerine</strong></td>
</tr>
<tr>
<td>0.3 mg per tablets</td>
</tr>
<tr>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td>50 tablets</td>
</tr>
<tr>
<td><strong>Potassium Chloride (KCL)</strong></td>
</tr>
<tr>
<td>20 mEq/10 mL</td>
</tr>
<tr>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td>60-mL Multidose Vial</td>
</tr>
<tr>
<td><strong>Tylenol®</strong></td>
</tr>
<tr>
<td>Acetaminophen</td>
</tr>
<tr>
<td>100 mg tablets</td>
</tr>
<tr>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td>250 tablets</td>
</tr>
<tr>
<td><strong>Tylenol®</strong></td>
</tr>
<tr>
<td>Acetaminophen</td>
</tr>
<tr>
<td>Liquid Suspension</td>
</tr>
<tr>
<td>80 mg/5 mL</td>
</tr>
<tr>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td>100 mL Multidose</td>
</tr>
<tr>
<td><strong>Robinul®</strong></td>
</tr>
<tr>
<td>10 mL</td>
</tr>
<tr>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td><strong>Runs-B-Gone®</strong></td>
</tr>
<tr>
<td>2 mg tablets</td>
</tr>
<tr>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td>100 tablets</td>
</tr>
<tr>
<td>Do not exceed 12 mg per day</td>
</tr>
<tr>
<td><strong>Tricor®</strong></td>
</tr>
<tr>
<td>Powdered for Injection</td>
</tr>
<tr>
<td>Add 4 mL of diluent to yield 100 mg/mL.</td>
</tr>
<tr>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td>2 g</td>
</tr>
<tr>
<td><strong>Versed®</strong></td>
</tr>
<tr>
<td>10 mg tablets</td>
</tr>
<tr>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td>100 tablets</td>
</tr>
</tbody>
</table>
IV Flow Rates

Terminology and Abbreviations

D5 1/2NS
D5W, D5NS  IV fluids (These "numbers" do not affect the calculation)
Ringer's Solution

flow rate  amount of liquid per period of time ordered by the physician
          usually in mL per hr or cc/hr  (remember: 1 cc = 1 mL)
Common rates are 1000 mL per 8 hrs (or 125 mL per 1 hr)
          or 2600 - 3000 mL per day or an average of 2800 mL per day.
Flow rates of 5000 mL per day are used in connection with surgical patients
to over hydrate.
This is the rate programmed into the IV pump.

IV Piggyback  a secondary IV bag which contains a particular IV medication in a small
(IVPB)     volume of diluent, and is infused intermittently for shorter periods of time than
          the primary IV. Also called “Intermittent Infusions.”

mcg  microgram (the abbreviation μg is not recommended)

1,000 mcg = 1 mg

the "Conversion Line" now looks like this

| kg | g | mg | mcg |
Methods of Controlling Flow Rates and/or Drip Rates

**Manual Infusion Devices**

The drip rate is regulated by the nurse using a roller regulating clamp on the IV line. The nurse counts the number of drops entering the drip chamber in one minute. Often the number of drops in 15 seconds are counted and the result is multiplied by 4 to obtain the drip rate in drops per minute.

![Roller Clamp]

**Electronic Infusion Devices** (Infusion Pumps or Electronic IV Regulators or Controllers)

An electronic pump that automatically controls the flow rate. These devices may handle 1 to 4 different IV bags at once. IMED is a common brand name.

The RN will program the pump to control the flow rate and volume to be infused (VTBI) into the pump. Flow rate is calculated and is entered into pumps control panel in “mL/hr”. The volume is entered as “mL”.

**ex.**

The doctor orders 480 mL to be infused in 4 hours. How many mL per hr should the electronic infusion pump be set at?

\[
\frac{480 \text{ mL}}{4 \text{ hr}} = 120 \text{ mL per hr}
\]

**ex.**

Dr. Luke Keemia has ordered Heparin at 20 mL/hr. Available is Heparin 300 mg in 100 cc D5W. What are the mcg/min and the mg/hr?

\[
\frac{300 \text{ mg}}{100 \text{ cc}} = \frac{X \text{ mg}}{20 \text{ mL}} \quad 60 \text{ mg} = 60\,000 \text{ mcg}
\]

\[
\frac{60 \text{ mg}}{1 \text{ hr}} = \frac{60\,000 \text{ mcg}}{60 \text{ min}} = \frac{1\,000 \text{ mcg}}{1 \text{ min}} \quad 60 \text{ mg per hr} = 1\,000 \text{ mcg per min}
\]
IV Flow Rates - A
Practice Pharmacology Math Problems

SHOW ALL OF YOUR WORK

1. Dr. Al Zeimer ordered 1200 mL of IV fluid to infuse in 8 hours. How many mL will infuse in 1 hour?

2. Dr. G. I. Searees ordered 1 g Cefazolin in 50 mL of D₂W solution, infused over 30 minutes. At what rate will you program the infusion pump?

3. Dr. Angie Gramm ordered an IV infusion to run at 125 mL per hour. How many hours will a 1000 mL IV bag last?

4. Cy Kosomatik is to receive insulin at 2 U/hr with a solution of 5 U/100 mL in normal saline. What should the rate of infusion be?

5. Dr. Al Lergey has ordered Heparin at 15 mL/hr. Available is Lasix 400 mg in 100 cc D₂W. What are the mg/hr and the mcg/min?

6. Dr. Anna Falactic has ordered Ticar 8 mcg/Kg/min. Available is Ticar 200 mg in 500 cc D₂W. The client weighs 180 pounds. What is the dosage per min?

Answers:
1.) 150 mL per hr  
2.) 100 mL per hr  
3.) 8 hrs  
4.) 40 mL per hr  
5.) 60 mg per hr, 1000 mcg per min  
6.) 1.6 mL per min
IV Drip Rates

Terminology and Abbreviations

**gtt or gt**
abbreviation for "drop" (from the Latin word *gutta*, similar to our word rain "gutter" which collects rain drops)

**drip rate**
how often drips move in the IV tubing
Expressed as drops per min using whole numbers
Usually between 10 and 30 drops per min, otherwise hard to count
Drip rates less than 10 are used to maintain an IV
("TKO" - "to keep open" or “KVO” - “keep vein open”)
Drip rates over 30 are used only in emergency situations

This is the rate counted if no IV pump is used.

**drop factor**
the size of the drops for the IV tubing being used
Expressed in drops/mL using whole numbers.
Printed on the tubing box.
There are two types of tubing

The size of the drop depends on the diameter of the tube.

1.) Macrodrop Tubing (also called "Maxidrop Tubing")
   10, 15 or 20 drops/mL (10 drops/mL is very common)

2.) Microdrop Tubing (also called "Minidrop Tubing")
   60 drops/mL (sometimes expressed as 60 microdrips/mL)
Using 60 microdrop tubing is very convenient since
1 drop/min = 1 mL/hr (60 drops/60 min). Therefore
12 drops/min = 12 mL/hr, 27 drops/min = 27 mL/hr, etc.

10 drops/mL  60 drops/mL
Drip Chamber  Drip Chamber
Procedures for Calculating IV Drip Rates

Method 1: Calculating the Rate, then Multiplying by the Drop Factor

Calculating the rate in mL/hr is an important intermediate step. This value is used to mark the IV bag and sometimes is ordered in these units.

1. Calculate the flow rate in mL/hr.
2. Divide by 60 (to get mL's per minute) and multiply by the Drop Factor (in gtt/mL).

This can be expressed as a formula:

\[
\frac{\text{Flow Rate (mL/hr)}}{60 \text{ min/hr}} \times \text{Drop Factor (gtt/mL)} = \text{Drip Rate (gtt per min)}
\]

OR

\[
\text{Flow Rate (mL/min)} \times \text{Drop Factor (gtt/mL)} = \text{Drip Rate (gtt per min)}
\]

example:

D5 1/2NS has been prescribed IV to infuse at a rate of 1000 mL per 8 hours. Your IV administration set delivers 15 gtt/mL. You should infuse the IV at how many gtt/min?

\[
\frac{1000 \text{ mL}}{8 \text{ hrs}} = 125 \text{ mL per hr} \quad \text{(Then you can mark your IV bag accordingly)}
\]

\[
\frac{125 \text{ mL/hr}}{31 \text{ gtt per min}} \times \frac{15 \text{ gtt}}{60 \text{ min/hr}} = \frac{125 \text{ mL/hr}}{4 \text{ mL}} \times \frac{15 \text{ gtt}}{6 \text{ min/hr}} = 125 \div 4 \text{ gtt/min} = 31 \text{ gtt per min}
\]

Method 2: Using the Factor-Label Method

This method is sometimes used since all of the calculations can be performed in one step. This is useful for more difficult problems and is easier to remember for some students. This method does not give the mL/hr as an intermediate step.

example:

D5 1/2NS has been prescribed IV to infuse at a rate of 200 mL per 5 hours. Your IV administration set delivers 15 gtt/mL. You should infuse the IV at how many drops/min?

\[
? \text{ gtt} = \frac{200 \text{ mL}}{8 \text{ hr}} \times \frac{15 \text{ gtt}}{1 \text{ hr}} = 10 \text{ gtt}
\]
Medication is often delivered intravenously. Often the physician will order the rate that the medication should be delivered (in mg/min or mcg/min or mU/min) and the concentration of the medication (X g of medication in Y mL of IV fluid). The amount of fluid to be infused in a certain amount of time will not be given directly, but will have to be calculated.

These problems involve two steps:

1. Calculate the volume of fluid (cc or mL) that needs to be given and express the answer in mL per min. (use proportionalities or the factor label method)
2. Calculate the drip rate (drops/min) by multiplying by the drop factor (drops/mL)

example:
The physician has ordered 200 mg of Nitrostat in 1,000 mL of D5W for IV infusion at a rate of 40 mcg/min. At how many microdrops/min should you infuse the IV using a solution administration set that delivers 60 microdrops/mL?

**Step 1: Calculate the Volume**

*Using proportionalities*

\[
\begin{array}{ccc}
\text{On Hand} & \text{Ordered} \\
\text{(Available)} & \text{(Prescribed)} \\
200 \text{ mg} & 40 \text{ mcg} \\
1,000 \text{ mL} & X \text{ mL}
\end{array}
\]

Convert mg into mcg, (using mcg avoids decimals), and cancel zeros

\[
\begin{array}{ccc}
\frac{200,000 \text{ mcg}}{1,000 \text{ mL}} & = & \frac{40 \text{ mcg}}{X \text{ mL}}
\end{array}
\]

Cross multiply and divide.

\[
40 \div 200 = X \text{ mL}
\]

\[
\text{vol} = 0.2 \text{ mL}
\]

\[
\text{flow rate} = \frac{0.2 \text{ mL}}{1 \text{ min}} = 0.2 \text{ mL per min}
\]

**Step 2: Calculate the Drip Rate**

\[
0.2 \text{ mL/min} \times 60 \text{ drops/mL} = 12 \text{ drops per min}
\]

Notice the mL cancel out to leave the unit “drops per min”
IV Drip Rates - A
Practice Pharmacology Math Problems

SHOW ALL OF YOUR WORK

IV Volume Problems

1. Dr. Kathy Terr ordered an IV to run at 50 cc per hour. The tubing has a drop factor of 20 drops/mL. How many drops per min should the IV run at?

2. Dr. Thor Assik ordered 120 mL of ampicillin to be infused in 60 minutes. The drop factor is 10. How many gtts per min will the IV run at?

3. You have available on your nursing unit an IV administration set that delivers 10 drops/mL. The physician has prescribed 100 mL of Ringer's Solution IV q 1 hr. At how many drops per min should you infuse the IV?

4. NS has been prescribed IV to infuse at a rate of 100 cc per 1 hr. Your IV administration set delivers 15 drops/cc. You should infuse the IV at how many drops per min?

5. NS has been prescribed IV to infuse at a rate of 800 mL per 4 hr. Your IV administration set delivers 10 drops/mL. You should infuse the IV at how many drops per min?

6. 500 cc of Ringer's Solution has been prescribed for IV infusion per 8 hrs. You are using an IV administration set that delivers 10 drops/cc. You will infuse the IV at how many drops per minute?
7. 2000 mL of Ringer's Solution has been prescribed for IV infusion per 24 hrs. You are using an IV administration set that delivers 10 drops/mL. You will infuse the IV at how many drops per minute?

8. 600 cc of Ringer's Solution has been prescribed for IV infusion per 12 hr. You are using an IV administration set that delivers 20 drops/cc. You will infuse the IV at how many drops per minute?

**IV Medication Problems**

9. The physician has prescribed 1000 mL of D5W with 10 Units of Oxytocin to be infused at a rate of 5 mU/min. Using an IV administration set that delivers 60 microdrops/mL, at how many microdrops per min will you infuse the IV?

10. 20 mg of Nitrostat in 500 cc of D5W has been ordered for IV infusion at a rate of 20 mcg/min. At how many microdrops per min should you infuse the IV using a solution administration set that delivers 60 microdrops/cc?

11. A patient requires an IV infusion of 9 g of Normodyne in 600 mL of D5W. An infusion rate of 4 mg/min has been prescribed. Your IV tubing delivers 60 microdrops/mL. You will infuse the IV at how many microdrops per min?
Mixed Practice

12. 0.5 Units of Oxytocin in 1000 cc of D5W has been ordered for IV infusion at a rate of 0.2 mU/min. At how many microdrops per min should you infuse the IV using a solution administration set that delivers 60 microdrops/cc?

13. The physician has prescribed 500 mL of D5W with 6 mg of Terbutaline Sulfate to be infused at a rate of 5 mcg/min. Using an IV administration set that delivers 60 microdrops/mL, at how many microdrops per min will you infuse the IV?

14. D5 1/2NS has been prescribed IV to infuse at a rate of 1000 cc per 12 hrs. Your IV administration set delivers 10 drops/mL. You should infuse the IV at how many drops per min?

15. 0.3 g of Aramine in 200 cc of D5W has been ordered for IV infusion at a rate of 0.5 mg/min. At how many microdrops per min should you infuse the IV using a solution administration set that delivers 60 microdrops/cc?

16. D5 1/2NS has been prescribed IV to infuse at a rate of 800 mL per 12 hrs. Your IV administration set delivers 15 drops/mL. You should infuse the IV at how many drops per min?

Answers:

1.) 17 drops per min 2.) 20 drops per min 3.) 17 drops per min 4.) 25 drops per min
5.) 33 drops per min 6.) 10 drops per min 7.) 14 drops per min 8.) 17 drops per min
9.) 30 drops per min 10.) 30 drops per min 11.) 16 drops per min 12.) 24 drops per min
13.) 25 drops per min 14.) 14 drops per min 15.) 20 drops per min 16.) 17 drops per min
Advanced Applications - A

Practice Pharmacology Math Problems
Use the “Medicine Cabinet - Advanced Applications - A” provided.

SHOW ALL OF YOUR WORK

Situation:
Mr. Larry Gytus, age 47, is admitted with chest pain. His doctor orders the following:
- Oxygen at 4.5 L
- 1500 mL D5W with KCL 6 mEq/100 mL to infuse over 24 hours
- Heparin 8,000 Units I.V. stat
- Lasix 30 mg I.V. stat
- NPH Insulin 38 Units with Regular 15 Units q AM
- Nitroglycerin gr 1/300 at the bedside
- Nembutal gr 3/4 p.o. for sleep
- Morphine gr 1/4 I.M. q8hr p.r.n.
- Demerol 40 mg
- Robinul 0.1 mg on call for OR
- Versed 5 mg

1. Calculate the number of drops per minute for the 1500 mL bag of D5W. The drop factor is 10.

2. How many mL of KCL will you add to the 1500 mL bag?

3. How many mL of heparin will you give?

4. How many nitroglycerin tablets will you give?

5. How much would you give of each, and what would the total volume of this pre-op injection.
   a. Demerol ____________
   b. Robinul ______________
   c. Versed ______________
   d. Total Volume__________
6. How many capsules of Nembutal will you give?

7. Mr. Gytus is experiencing severe chest pain. You decide to give him morphine according to the doctor's orders. How much will you give?

8. Indicate the total volume of the Insulins ordered and the smallest capacity syringe you can use to prepare it. (50 Unit and 100 Unit capacity syringes are available.)

   Total Volume ____________________________
   Syringe Size ____________________________

9. Ms. Anna Thesia is to receive 175,000 Units of penicillin. How many mL will you give?

10. Mr. Lou Monia is to receive 3 mcg of Flagyl per kg of body weight. He weighs 170 pounds. How many mL will you give?

11. Dr. Carrie Tossis orders ascorbic acid 0.225 g. How many tablets will you administer?

12. How many mL of Penicillin would be injected to give 100,000 U?

13. Postoperatively Mr. Perry Neeum has Compazine 8 mg IM ordered. How many mL will you administer?

Answers: 1.) 10 drops per min  2.) 45 mL   3.) 0.8 mL   4.) 2 tabs
          5 a.) 0.8 mL   b.) 0.5 mL   c.) 1.3 mL   d.) 2.6 mL   6.) 1 cap
          7.) 1.5 mL   8.) 53 Unit, 100 Unit   9.) 2.5 mL   10.) 1.8 mL
          11.) 3/4 tab  12.) 1.4 mL   13.) 1.6 mL
<table>
<thead>
<tr>
<th>Medicine Cabinet</th>
<th>Advanced Applications - A</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ascorbic Acid</strong></td>
<td>300 mg/tablet</td>
</tr>
<tr>
<td></td>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td></td>
<td>100 tablets</td>
</tr>
<tr>
<td><strong>Compazine</strong></td>
<td>5mg/mL</td>
</tr>
<tr>
<td></td>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td></td>
<td>30 mL</td>
</tr>
<tr>
<td><strong>Demerol®</strong></td>
<td>Injection</td>
</tr>
<tr>
<td></td>
<td>50 mg per mL</td>
</tr>
<tr>
<td></td>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td></td>
<td>8-mL Multidose Vial</td>
</tr>
<tr>
<td><strong>Flagyl®</strong></td>
<td>130 mcg per mL</td>
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<tr>
<td></td>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td></td>
<td>20 mL</td>
</tr>
<tr>
<td><strong>Heparin®</strong></td>
<td>Injection</td>
</tr>
<tr>
<td></td>
<td>10,000 U per mL</td>
</tr>
<tr>
<td></td>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td></td>
<td>10-mL Multidose Vial</td>
</tr>
<tr>
<td><strong>NPH Insulin</strong></td>
<td>U-100</td>
</tr>
<tr>
<td></td>
<td>ISOPHANE</td>
</tr>
<tr>
<td></td>
<td>INSULIN SUSPENSION USP</td>
</tr>
<tr>
<td></td>
<td>100 units per mL</td>
</tr>
<tr>
<td></td>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td><strong>Nitroglycerine</strong></td>
<td>0.1 mg per tablets</td>
</tr>
<tr>
<td></td>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td></td>
<td>50 tablets</td>
</tr>
<tr>
<td><strong>Penicillin</strong></td>
<td>350,000 U/5mL</td>
</tr>
<tr>
<td></td>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td><strong>Regular Insulin</strong></td>
<td>U-100</td>
</tr>
<tr>
<td></td>
<td>Human Insulin</td>
</tr>
<tr>
<td></td>
<td>(recombinant DNA origin)</td>
</tr>
<tr>
<td></td>
<td>extended zinc suspension</td>
</tr>
<tr>
<td></td>
<td>100 units per mL</td>
</tr>
<tr>
<td></td>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td><strong>Morphine Sulfate</strong></td>
<td>10 mg/mL</td>
</tr>
<tr>
<td></td>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td><strong>Potassium Chloride</strong></td>
<td>(KCL)</td>
</tr>
<tr>
<td></td>
<td>20 mEq/10 mL</td>
</tr>
<tr>
<td></td>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td></td>
<td>60-mL Multidose Vial</td>
</tr>
<tr>
<td><strong>Nembutal®</strong></td>
<td>45 mg capsules</td>
</tr>
<tr>
<td></td>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td><strong>Robinul®</strong></td>
<td>0.2 mg per mL</td>
</tr>
<tr>
<td></td>
<td>10 mL</td>
</tr>
<tr>
<td></td>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td><strong>Versed®</strong></td>
<td>4 mg per mL</td>
</tr>
<tr>
<td></td>
<td>Dairy Farmaceuticals</td>
</tr>
<tr>
<td></td>
<td>100 mL</td>
</tr>
</tbody>
</table>
Sliding Scale Dosages

The topic of “Sliding Scale Dosages” is placed in this book for reference. There are no questions on any tests given by BTC or NCLEX that refer to this material.

Sometimes the effectiveness of a medication needs to be monitored by blood tests and the dose modified based on the results. Often a dose is prescribed and then extra medication is added based on a sliding scale. The dose is given at a prescribed time, while the sliding scale dose allows for additional doses based on the blood tests. This occurs with insulin and heparin.

Insulin Sliding Scale

Additional rapid or short acting insulin is sometimes required when blood sugar levels are too high. Suggested insulin sliding scales may from doctor to doctor. The insulin sliding scales provided below are just two examples.

### Sliding Scale A

<table>
<thead>
<tr>
<th>Glucose (mg/dL)</th>
<th>Insulin (Units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 200</td>
<td>0</td>
</tr>
<tr>
<td>201 - 250</td>
<td>5</td>
</tr>
<tr>
<td>251 - 300</td>
<td>8</td>
</tr>
<tr>
<td>301 - 350</td>
<td>10</td>
</tr>
<tr>
<td>351 - 400</td>
<td>12</td>
</tr>
<tr>
<td>more than 400</td>
<td>Call Physician</td>
</tr>
</tbody>
</table>

### Sliding Scale B

<table>
<thead>
<tr>
<th>Glucose (mg/dL)</th>
<th>Insulin (Units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 179</td>
<td>0</td>
</tr>
<tr>
<td>180 - 249</td>
<td>5</td>
</tr>
<tr>
<td>250 - 379</td>
<td>10</td>
</tr>
<tr>
<td>380 - 450</td>
<td>15</td>
</tr>
<tr>
<td>more than 400</td>
<td>Call Physician</td>
</tr>
</tbody>
</table>

ex. 1

Anna Falaksis has a blood sugar level of 230 mg/dL. How many units of insulin should be administered using sliding scale A?

Since Anna’s glucose level falls in the range of 201 - 250 mg/dL, she should be given 5 Units.
**Heparin Sliding Scale**

IV heparin has to be monitored closely to keep the PTT (partial thromboplastin time) within a therapeutic range. A bolus (one-time dose of considerable size) is often given initially, and may also be given if PTT or aPTT is below a certain level. A continuous infusion drip (IV) of heparin is given based on body weight. The IV rate may be increased, decreased, or even held for a period of time depending on the results of the PTT or the aPTT. The PTT or the aPTT is generally checked every 4 - 6 hours and the IV heparin drip rate adjusted using the sliding scale.

The amount of medication is administered is based on the following three procedures: bolus, infusion, and sliding scale.

**Heparin IV Bolus** “IV Push” or “Initial Bolus of Heparin”

an amount of medication given in one large dose

**Heparin Infusion Drip** “IV Drip” or “Maintenance Infusion”

the amount of medication given continuously

**Sliding Scale**

the adjustment to keep PTT in the therapeutic range

The following two examples of sliding scales can be used.

<table>
<thead>
<tr>
<th>PTT (sec)</th>
<th>Bolus</th>
<th>Hold</th>
<th>Adjust Heparin Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 50</td>
<td>70 u/kg</td>
<td>0</td>
<td>Increase 200 Units per hr</td>
</tr>
<tr>
<td>50 - 59</td>
<td>0</td>
<td>0</td>
<td>Increase 100 Units per hr</td>
</tr>
<tr>
<td>60 - 80</td>
<td>0</td>
<td>0</td>
<td>No change</td>
</tr>
<tr>
<td>81 - 99</td>
<td>0</td>
<td>0</td>
<td>Decrease 100 Units per hr</td>
</tr>
<tr>
<td>more than 100</td>
<td>0</td>
<td>60 min</td>
<td>Decrease 200 Units per hr</td>
</tr>
</tbody>
</table>

ex. 1

Mrs. M. Bolizum had a pulmonary embolism. Her heparin IV is set at 1200 U/hr. If after 4 hours, her PTT is now 56 seconds, how should her medication be changed? Use a therapeutic range of 60 - 80 seconds.

*Since her PTT falls in the range of 50 - 59, her IV should be increased 100 Units per hr.*

\[
1200 + 100 = 1300 \text{ units per hr}
\]
At VA hospitals, the therapeutic range is 47 - 79, therefore the following sliding scale is used.

<table>
<thead>
<tr>
<th>PTT (sec)</th>
<th>Bolus</th>
<th>Hold</th>
<th>Adjust Heparin Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 39</td>
<td>70 u/kg</td>
<td>0</td>
<td>Increase 200 Units per hr</td>
</tr>
<tr>
<td>40 - 46</td>
<td>0</td>
<td>0</td>
<td>Increase 100 Units per hr</td>
</tr>
<tr>
<td>47 - 79</td>
<td>0</td>
<td>0</td>
<td>No change</td>
</tr>
<tr>
<td>80 - 99</td>
<td>0</td>
<td>0</td>
<td>Decrease 100 Units per hr</td>
</tr>
<tr>
<td>more than 100</td>
<td>0</td>
<td>60 min</td>
<td>Decrease 200 Units per hr</td>
</tr>
</tbody>
</table>

ex. 2

Tim Purture is at the VA hospital where the therapeutic range for PTT is 47 - 79 seconds. His heparin IV is set at 1000 U/hr. If his PTT is 38 seconds, calculate how many units Tim should receive per hour. He weighs 220 pounds.

Since his PTT is less than 39, his IV should be increased 200 Units per hr. In addition he should receive an IV bolus of 70 Units per kg.

\[
\frac{1 \text{ kg}}{2.2 \text{ lbs}} = \frac{x \text{ kg}}{220 \text{ lbs}} = \frac{100 \text{ kg}}{100 \text{ kg}} = \frac{70 \text{ Units}}{70 \text{ Units}} = \frac{xu}{7000 \text{ Units}}
\]

Inject 7000 Units, then set the IV to \(1000 + 200 = 1200\) Units per hr.

ex. 3

Ty Royd is at a hospital where the therapeutic range for PTT is 60 - 80 seconds. The doctor ordered heparin at 1200 U/hr. If the IV solution contains 10,000 units in the 1000 mL bag. The administration set delivers 20 gtt/mL.

a.) Calculate the drip rate.

\[
\frac{1200 \text{ Units}}{1 \text{ hr}} \times \frac{1000 \text{ mL}}{10,000 \text{ Units}} \times \frac{20 \text{ gtt}}{1 \text{ mL}} \times \frac{1 \text{ hr}}{60 \text{ min}} = 40 \text{ gtt per min}
\]

b.) If his PTT is 105, calculate the new drip rate.

\[
\frac{1000 \text{ Units}}{1 \text{ hr}} \times \frac{1000 \text{ mL}}{10,000 \text{ Units}} \times \frac{20 \text{ gtt}}{1 \text{ mL}} \times \frac{1 \text{ hr}}{60 \text{ min}} = 33 \text{ gtt per min}
\]

Hold the IV for 60 minutes, then set the drip rate to 33 gtt per min.
1.) Ann T. Assid has a blood sugar level of 305 mg/dL. How many units of insulin should be administered using sliding scale A?

2.) Sally Varry has a blood sugar level of 220 mg/dL. How many units of insulin should be administered using sliding scale A?

3.) Mrs. Carrie Tossis had a pulmonary embolism. Her heparin IV is set at 1600 U/hr. If after 4 hours, her PTT is now 65 seconds, how should her medication be changed? Use a therapeutic range of 60 - 80 seconds. She weighs 160 pounds.

4.) Mrs. Kathy Terr had a pulmonary embolism. Her heparin IV is set at 1400 U/hr. If after 4 hours, her PTT is now 94 seconds, how should her medication be changed? Use a therapeutic range of 60 - 80 seconds. She weighs 140 pounds.

5.) Art Terrial is at the VA hospital where the therapeutic range for PTT is 47 - 79 seconds. His heparin IV is set at 1500 U/hr. If his PTT is 105 seconds, calculate how many units Tim should receive per hour. He weighs 180 pounds.
6.) Mr. X. Ursige is at the VA hospital where the therapeutic range for PTT is 47 - 79 seconds. His heparin IV is set at 1000 U/hr. If his PTT is 80 seconds, calculate how many units Tim should receive per hour. He weighs 140 pounds.

7.) Larry Gytus is at a hospital where the therapeutic range for PTT is 60 - 80 seconds. The doctor ordered heparin at 1000 U/hr. If the IV solution contains 15,000 units in the 1000 mL bag. The administration set delivers 15 gtt/mL. (Larry weighs 110 pounds.)

a.) Calculate the drip rate.

b.) If his PTT is 35, calculate the new drip rate.

8.) Mack Ular is at a hospital where the therapeutic range for PTT is 60 - 80 seconds. The doctor ordered heparin at 1000 U/hr. If the IV solution contains 20,000 units in the 1200 mL bag. The administration set delivers 20 gtt/mL.

a.) Calculate the drip rate.

b.) If his PTT is 102, calculate the new drip rate.

Answers: 1.) 10 units  2.) 5 units  3.) No change  4.) Decrease 100 Units per hr to 1300 Units per hr  5.) Hold the IV for 60 min, decrease 200 Units per hr to 1300 Units per hr  6.) Decrease 100 Units per hr to 900 Units per hr  7. a.) 17 gtt per min b.) Increase to 20 gtt per min and inject bolus of 3500 units  8. a.) 20 gtt per min b.) Hold IV for 60 min and decrease to 16 gtt per min