Dosage and Calculation Module
Level 4
Summer and Fall, 2016
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### 1. OBJECTIVES

Upon the completion of the Dosage and Calculation Module Level IV for Spring 2015, the incoming level 4 student of the associate degree nursing program of South Texas College will be able to:

1. Identify the components and concentrations of IV solutions,
2. Calculate IV flow rates,
3. Calculate infusion time and volume,
4. Calculate subcutaneous dosages of heparin,
5. Calculate intravenous dosages of heparin,
6. Calculate weight-based bolus dosages of heparin,
7. Calculate heparin bolus/loading dose and infusion rate of heparin based on heparin protocol,
8. Calculate the hourly flow rate for IV infusions ordered in dosage per time,
9. Calculate IV flow rates for medications ordered based on body weight over a specified period of time,
10. Compute dosage and calculation questions with 100% proficiency
I. BASIC FACTS

A. ABBREVIATIONS:

Official Do Not Use List

<table>
<thead>
<tr>
<th>Do Not Use</th>
<th>Potential Problem</th>
<th>Use Instead</th>
</tr>
</thead>
<tbody>
<tr>
<td>U, u (unit)</td>
<td>Mistaken for “0” (zero), the number “4” (four) or “cc” Mistaken for IV (intravenous) or the number 10 (ten) Mistaken for each other</td>
<td>Write “unit”</td>
</tr>
<tr>
<td>IU (International Unit)</td>
<td>Period after the Q mistaken for “I” and the “O” mistaken for “I” Decimal point is missed</td>
<td>Write “International Unit”</td>
</tr>
<tr>
<td>Q.D., QD, q.d., qd (daily)</td>
<td>Can mean morphine sulfate or magnesium sulfate</td>
<td>Write “daily” Write “every other day”</td>
</tr>
<tr>
<td>Q.O.D., QOD, q.o.d, qod (every other day) Trailing zero (X.0 mg)* Lack of leading zero (.X mg) MS</td>
<td>Confused for one another</td>
<td>Write X mg</td>
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Source: The Joint Commission

<table>
<thead>
<tr>
<th>ABBREVIATION</th>
<th>MEANING</th>
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<tbody>
<tr>
<td>ac</td>
<td>Before meals</td>
</tr>
<tr>
<td>pc</td>
<td>After meals</td>
</tr>
<tr>
<td>Daily</td>
<td>Every day</td>
</tr>
<tr>
<td>bid</td>
<td>Twice a day</td>
</tr>
<tr>
<td>tid</td>
<td>Three times a day</td>
</tr>
<tr>
<td>qid</td>
<td>Four times a day</td>
</tr>
<tr>
<td>qh</td>
<td>Every hour</td>
</tr>
<tr>
<td>at bedtime</td>
<td>At hour of sleep</td>
</tr>
<tr>
<td>stat</td>
<td>Immediately</td>
</tr>
<tr>
<td>q2h</td>
<td>every 2 hours</td>
</tr>
<tr>
<td>q3h</td>
<td>every 3 hours</td>
</tr>
<tr>
<td>q4h</td>
<td>every 4 hours</td>
</tr>
<tr>
<td>prn</td>
<td>if needed</td>
</tr>
</tbody>
</table>
B. Units of Measures

c = cup
cm = centimeters
ft = foot
g = grams
gr = grains
in = inches
kg = kilograms
L = liters
lb = pound
m = meters
mcg = micrograms
mEq = milliequivalents
mg = milligrams
mL = milliliters
mm = millimeters
oz = ounce
pt = pint
Tbsp./T = tablespoons
tsp./t = teaspoons

C. Decimal Place Values/Rounding
Whole numbers & decimal fractions

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>.</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<tbody>
<tr>
<td>Thousandths</td>
<td>Hundredths</td>
<td>Tens</td>
<td>Ones</td>
<td>decimal</td>
<td>d</td>
<td>e</td>
<td>c</td>
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<tr>
<td>d</td>
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<td>t</td>
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<td>r</td>
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No commas on thousands.
Write zero before a decimal point when the value is less than a whole number.
Example = 0.5 mL (correct) 5 mL (wrong)
For tablets if the value is less than a whole number use fraction. Ex: ½ tab not 0.5 tab

Do not use a decimal point or zero after a whole number.
Example = 1.0 mL (wrong) 1 mL (correct)

Fractions = reduce to the smallest term.
Mixed number = combination of a whole number and a fraction.

D. Equivalents

1 g = 1000 mg
1 mg = 1000 mcg or 0.001 g
1 mcg = 0.000001 g
gr i = 60 mg (65 mg only for acetaminophen)
1 t = 5 mL
1 T = 3 tsp./t or 15 mL
1 oz. = 30 mL
1 c = 8 oz. or 240 mL
1 L = 1000 mL
1 pt = 500 mL or 16 fl oz
1 kg = 2.2 lbs.
1 kg = 1000 g
1 in = 2.54 cm or 25.4 mm

Grains – utilizes Roman numeral lower case
Ex: 1 grain is written as gr i
5 grains = gr v
Quantities less than one are expressed as fraction, except ½ - it is expressed as ss

To convert:

- kg to lb = multiply
  (k l m – just follow the alphabet)

- lb to kg = divide

Celsius to Fahrenheit:

\[(1.8 \times °C) + 32 = °F\]
(in the alphabet C comes before F, it’s going up so, we multiply & add to get the number up)

Fahrenheit to Celsius:

\[\frac{°F - 32}{1.8} = °C\]
(in the alphabet F comes after C, it’s backwards thus, we minus & divide to get the number down)

D. Time Equivalent

Conventional Time to Military Time or 24 hr clock time
Ex. 8:00 am = 0800
8:00 pm = 2000
12:00 am = 0000 or 2400
4:16 pm = 1616
II. Rounding Decimals

A. Round to Whole Number:

Example: Round to whole number:

- a. 3.7658
- b. 6.2413

If the first decimal number is ≥ 5, round off by adding 1 to the whole number and drop all the numbers after the decimal point. If the first decimal place is ≤ 4, leave the whole number and drop all the numbers after the decimal point.

- a. 3.7658 = 4
- b. 6.2413 = 6

B. Round to 1st decimal:

Example: Round to whole number:

- a. 3.7658
- b. 6.2413

If the 2nd decimal number is ≥ 5, round off by adding 1 to the 1st decimal number and drop all the number after the 1st decimal number. If the second decimal number is ≤ 4, leave the 1st decimal number as is and drop all the numbers thereafter.

- a. 3.7658 = 3.8
- b. 6.2413 = 6.2

C. Exercises:

Round to the first decimal place:

1. 4.7564 = ____________
2. 7.564 = ____________
3. 9.5679 = ____________
4. 12.2346 = ____________
5. 53.113 = ____________

Round to the second decimal place:

6. 1.0023 = ____________
7. 4.3465 = ____________
8. 5.263 = ____________
9. 10.945 = ____________
10. 15.234 = ____________

Round to whole number:

11. 26.032 = ____________
12. 2.034 = ____________
13. 21.89 = ____________
14. 9.97 = ____________
15. 0.978 = ____________

III. Methods of Dosage Calculations

A. Formula Method:

1. Identify the following on the problem: D, H, Q and A
2. Fill in the formula
3. Cancel the units
4. Calculate

\[
\frac{D}{H} \times Q = X
\]

D = desired dose
H = dose on hand
Q = dosage unit
A = unknown

B. Ratio-Proportion Method
1. Convert:
   Units you are converting to \((A)\)
   Number you need to convert \((B)\)
   \[
   \frac{A}{B} \text{ or } A:B
   \]

2. Unknown \((C)\)
   Number that you need to convert \((D)\)

3. Set up the proportion:
   \[
   \frac{A}{B} = \frac{C}{D} \quad \text{or} \quad A:B = C:D
   \]

4. Cancel Units

5. Cross-multiply to solve for the unknown

\[
\frac{\text{Dosage on Hand}}{\text{Amount on Hand}} \times \frac{\text{Desired Dosage}}{(X) \text{ Amount desired}}
\]

C. Dimensional Analysis

1. Determine the unit of measure for the:
   \text{amount to give ratio} \ (\text{left side of the equation})

2. \text{Supply dosage ratio} \ (\text{right side of the equation})
   (unit of numerator should match the unit numerator of
   \text{amount to give ratio})

3. Set-up \text{Conversion factor ratio} \ (\text{units of measure for the
   answer on top and the units you are converting from on
   the bottom})

4. Cancel units on the right side of the equation, leaving unit
   of amount to give.

\[
\frac{\text{Amount to Give}}{\text{Supply Dosage Ratio}} = \frac{\text{Conversion Factor Ratio}}{\text{Ordered Dosage Ratio}}
\]

D. IV Flow Rate

\[
\text{mL/h} = \frac{\text{Total mL}}{\text{Total h}}
\]

\[
\text{mL/h} = \frac{\text{Total mL}}{\text{Total min}} \times 60 \text{ min/h}
\]

\[
R(\text{gtt/min}) = \frac{V (\text{mL})}{T (\text{min})} \times C(\text{gtt/mL})
\]

Shortcut:

IV Flow Rate: \(\frac{\text{mL/h}}{\text{Drop factor constant}} = R(\text{gtt/min})\)

Drop Factor and Flow Rate Conversion Number

<table>
<thead>
<tr>
<th>Drop Factor (DF)</th>
<th>Flow Rate Conversion (FC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>(\frac{60}{10} = 6)</td>
</tr>
<tr>
<td>15</td>
<td>(\frac{60}{15} = 4)</td>
</tr>
<tr>
<td>20</td>
<td>(\frac{60}{20} = 3)</td>
</tr>
<tr>
<td>60</td>
<td>(\frac{60}{60} = 1)</td>
</tr>
</tbody>
</table>

FC Method Compute for:
- Drops you have to \text{Divide}
- Milliliters you have to \text{Multiply}

\text{Flow rate will be rounded to the nearest whole number.}
IV. **Calculating Flow Rates**

A. Flow rates in mL/h

A.1 Formula Method

Order: NS 2L continuous IV for 24 hours (Round to nearest whole number):

\[
\text{mL/h} = \frac{\text{Total mL}}{\text{Total h}}
\]

\[
2L \times 1000mL = 2000 mL
\]

\[
\text{mL/h} = \frac{2000 mL}{24 h}
\]

\[
\text{mL/h} = 83.33
\]

\[
\text{mL/h} = 83
\]

A.2 Ratio-Proportion Method

Order: Vancomycin 500 mg/100 mL x 75 min.

Compute for hourly rate (mL/h)

(Round to nearest whole number):

\[
\frac{A}{B} = \frac{C}{D}
\]

\[
\frac{100 mL}{75 min} = \frac{? \times mL}{60 min}
\]

\[
75x = (100 mL \times 60 min)
\]

\[
X = \frac{6000}{75}
\]

\[
X = 80 \text{ mL/h}
\]
B. Flow rates in gtt/min

Order: D\textsubscript{5}LR 125 mL/hr IV
Drop Factor: 10 gtt/mL
Find the flow rate in gtt/min
(Round to the nearest whole number)

B.1 Formula Method

\[
gtt/min = \frac{125 \frac{mL}{hr} \times 10 \frac{gtt}{mL}}{60 \ min/h}
\]
\[
gtt/min = \frac{125 \times 10}{60}
\]
\[
gtt/min = 20.833
\]
\[
= 21 \ gtt/min
\]

B.2 Dimensional Analysis

\[
\frac{gtt}{min} = \frac{10 \ gtt}{1 \ mL} \times \frac{125 \ mL}{1 \ h} \times \frac{1 \ h}{60 \ min} = 20.833 = 21 \ gtt/min
\]

C. Flow rates in mL/h

Order: D\textsubscript{5}LR to run at 18 gtt/min
Drop Factor: 20 gtt/mL
Find the flow rate in mL/h
(Round to the nearest whole number)

C.1 Flow Rate Conversion Method

\[
18 \ \frac{gtt}{min} = ? \ \frac{mL}{h}
\]

Drop Factor (DF) = 20 ; Flow Rate Conversion (FC) = $\frac{60}{20} = 3$

Milliliters ? = Multiply (See Flow Rate Conversion Table p. 5)
18 x 3 = 54 mL/h

C.2 Dimensional Analysis

\[
\frac{18 \ gtt}{min} \times \frac{1 \ mL}{20 \ gtt} \times \frac{60 \ min}{1 \ h} = 54 \ \frac{mL}{h}
\]
D. Flow rates in mL/h to gtt/min

Order: D₅W 900 mL IV to run for 8 hours
Drop Factor: 10 gtts/mL
Find the flow rate in gtt/min
(Round to the nearest whole number)

D.1 Flow Rate Conversion Method

\[
\frac{900 \text{ mL}}{8 \text{ h}} = ? \frac{\text{gtt}}{\text{min}}
\]

\[
\frac{900 \text{ mL}}{8 \text{ h}} = 112.5
\]

Drop Factor (DF) = 10 ; Flow Rate Conversion (FC) = \( \frac{60}{10} = 6 \)
Drops ? = Divide (See Flow Rate Conversion Table p. 5)

\[
\frac{112.5}{6} = 18.75 = 19 \text{ gtt/min}
\]

D.2 Dimensional Analysis

\[
\frac{\text{gtt}}{\text{min}} = \frac{900 \text{ mL}}{8 \text{ h}} \times \frac{10 \text{ gtt}}{1 \text{ mL}} \times \frac{1 \text{ h}}{60 \text{ min}} = 18.75 = 19 \frac{\text{gtt}}{\text{min}}
\]

E. Infusion Time

Order: D₅W 1 L IV to run 60 mL/h started at 0600
(Hours and minutes)
What time will the IV be completed? (military time)

E.1 Time to Infuse Formula

\[
T = \frac{V}{F}
\]

\[
T = \frac{1000 \text{ mL}}{60 \text{ mL/h}}
\]

\[
T = 16.66666 \text{ (0.66666 x 60min/h = 40 min)}
\]

\[
T = 16 \text{ h and 40 min}
\]

IV will be completed at 0600 + 1640 = 2240
E.2 Time to Infuse Dimensional Analysis

\[ T \text{h} = \frac{1000 \text{ mL}}{1} \times \frac{1 \text{ h}}{60 \text{ mL}} = \frac{1000}{60} = 16.\overline{66666} = 16 \text{ h and } 40 \text{ min} \]

\[(0.\overline{66666} \times 60 \text{ min/h} = 40 \text{ min})\]

IV will be completed at \(0600 + 1640 = 2240\)

F. Volume Infused

How much will be infused in 8h and 30 min \((30 \text{ min/60} = 0.5 \text{h})\) at 100 mL/h?

F.1 Volume infused Formula

\[ V = T \times F \]
\[ V = 8.5 \text{ h} \times 100 \text{ mL/h} \]
\[ V = 850 \text{ mL} \]

F.2 Volume infused Dimensional Analysis

\[ V \text{mL} = \frac{8.5 \text{ h}}{1} \times \frac{100 \text{ mL}}{1 \text{ h}} \]
\[ V \text{mL} = 8.5 \text{ h} \times 100 \text{ mL/h} \]
\[ V \text{mL} = 850 \text{ mL} \]

G. Exercises

G.1 Flow rates in mL/h (Round to the nearest whole number)

1. D5W 1 L IV to run for 10 h = ________ mL/h
2. LR 500 mL IV to infuse in 4 h = ________ mL/h
3. NaCl 0.33\% 600 mL IV in 3 h = ________ mL/h
4. D5NS 100 mL IV to run for 30 min = ________ mL/h
5. Antibiotic 50 mL IV to run for 30 min = ________ mL/h
6. NS IV to run at 18 gtt/min (Drop factor = 20 gtt/mL) = ________ mL/h
7. D5 0.45\% NaCl to infuse at 60 gtt/min IV (Drop factor = 60 gtt/mL) = ________ mL/h
8. D5LR to run at 21 gtt/min IV (Drop factor = 15 gtt/mL) = ________ mL/h
9. D5W infusing IV at a rate of 20 gtt/min (Drop factor = 15 gtt/mL) = ________ mL/h
10. Piperacillin sodium/tazobactam sodium 0.375 g in 50 mL NS IV to infuse in 30 min = ________ mL/h

G.2 Flow rates in gtt/min (Round to the nearest whole number)
1. D₃ LR to infuse at 100 mL/h IV using a 10 gtt/mL = ________ gtt/min
2. NS to run at 150 mL/h IV. (Drop factor = 15 gtt/mL) = ________ gtt/min
3. D₅ W 2 L IV to infuse for 12 h. (Drop factor = 10 gtt/mL) = ________ gtt/min
4. ampicillin 500 mg IV in 100 mL NS to run for 45 min (Drop factor= 20 gtt/mL)= ________ gtt/min
5. azithromycin 500 mg IV in NS 250 mL to infuse in 2 h (Drop factor = 20 gtt/mL) = ________ gtt/min
6. D₅ W 2L to infuse in 16 h (Drop factor = 10 gtt/mL) = ________ gtt/min
7. 50 mL IV to infuse in 15 min. (Drop factor = 15 gtt/mL) = ________ gtt/min
8. Give 12 mL in 22 min (Drop factor = 60 gtt/mL) = ________ gtt/min
9. Infuse 4000 mL in 20 h (Drop factor = 20 gtt/mL) = ________ gtt/min
10. levofloxacin 500 mg in 100 mL D₅ W IV to infuse in 1 h (Drop factor = 15 gtt/mL) = ________ gtt/min

G.3 Volume and Time Infused
1. NS 1L IV at 100 mL/H started at 7:00 AM. What time will the IV infusion be completed? _______ military time
2. LR 500 mL at 75mL/h started at 4:15 PM. What time will the IV be completed? _______ military time
3. NS 2L at 83 mL/h. Total time to infuse? _________ Hours (whole number)
4. D₅ LR 1000mL to infuse at 125 mL/h started at 2330
   a. Total time to infuse: ________ h
   b. What time will the IV infusion be completed: ________ Conventional time
5. NaCl 0.45% 500 mL at 50 mL/h started at 8:15 AM
   a. Total time to infuse: ________ h
   b. What time will the infusion be completed: ________ military time
6. vancomycin 1 g in 250 mL D₅ W at 100 mL/h started at 9:00 AM
   a. Total time to infuse ________ h/min
   b. What time will the infusion be completed: ________ conventional time
7. D₅ 0.33% NaCl 250 mL IV at 40 mL/h via using an infusion set drop factor of 60 gtt/mL. Infusion started at 9:45 AM.
   a. Total time to infuse: ________ h/min
   b. What time will the infusion be completed: ________ conventional time

V. Calculating Heparin Dosages

A. Subcutaneous Heparin
   Order: Heparin 4000 units subcutaneous q 12 h.
   On hand: 10000 units/mL
   A.1 Formula:
   \[
   \frac{D}{H} \times Q = X
   \]
   \[
   \frac{4000 \text{ units}}{10000 \text{ units}} \times 1 \text{ mL} = ?\text{mL}
   \]
   \[x = 0.4 \text{ mL}\]
A.2 Ratio-Proportion
\[
\frac{10000 \text{ units}}{1 \text{ ml}} = \frac{\sqrt{4000 \text{ units}}}{x \text{ ml}}
\]

\[4000 = 10000x\]
\[x = \frac{4000 \text{ units}}{10000 \text{ units}}\]
\[x = 0.4 \text{ mL}\]

A.3 Dimensional Analysis
\[4000 \text{ units} \times \frac{mL}{\text{ units}} = mL\]
\[4000 \text{ units} \times \frac{1 \text{ mL}}{10000 \text{ units}} = \frac{4 \text{ mL}}{10} = 0.4 \text{ mL}\]

B. Heparin Hourly Rate
Order: D5W 500 mL with heparin 25000 units IV at 850 units/h

B.1 Formula
\[\frac{D}{H} \times Q = X\]
\[x = \frac{850 \text{ units/h}}{25000 \text{ units}} \times 500 \text{ mL}\]
\[= \frac{850}{50} \text{ mL/h}\]
\[= 17 \text{ mL/h}\]

B.2 Proportion Method
\[\frac{25000 \text{ units}}{500 \text{ mL}} = \frac{850 \text{ units/h}}{x}\]
\[25000 \text{ units} \times x = 425000\]
\[X = \frac{425000}{25000}\]
\[X = 17 \text{ mL/h}\]

B.3 Dimensional Analysis
\[X = \frac{500 \text{ mL}}{25000 \text{ units}} = \frac{850 \text{ units}}{1 \text{ h}}\]
\[X = \frac{425000}{25000}\]
\[X = 17 \text{ mL/h}\]
C. Heparin Hourly Dose
Order: 10000 units of IV heparin in 500 mL of D₅W at 40 mL/h
What is the hourly dose?

C.1 Proportion Method
\[
\frac{10000 \text{ units}}{500 \text{ mL}} = \frac{x}{40 \text{ mL/h}}
\]

\[500 \times x = 400000\]

\[x = \frac{400000}{500}\]

\[x = 800 \text{ units/h}\]

C.2 Dimensional Analysis
\[x = \frac{10000 \text{ units}}{500 \text{ mL}} = \frac{40 \text{ mL}}{1 \text{ h}}\]

\[x = \frac{400000}{500}\]

\[x = 800 \text{ units/h}\]

D. Heparin Protocol Dose
Heparin Protocol for DVT, PE and High Intensity Indications  Goal: aPTT 70 – 100

**Heparin Protocol Table**

<table>
<thead>
<tr>
<th>APTT RESULT</th>
<th>IV BOLUS DOSE</th>
<th># MINUTES TO HOLD INFUSION</th>
<th>AMOUNT TO CHANGE CURRENT INFUSION RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 54 Notify AP</td>
<td>80 units/kg (max. 8,000 units)</td>
<td>Do not hold</td>
<td>Increase by 4 units/kg/h</td>
</tr>
<tr>
<td>54–59</td>
<td>40 units/kg (max. 4,000 units)</td>
<td>Do not hold</td>
<td>Increase by 2 units/kg/h</td>
</tr>
<tr>
<td>60–69</td>
<td>40 units/kg (max. 4,000 units)</td>
<td>Do not hold</td>
<td>Increase by 1 unit/kg/h</td>
</tr>
<tr>
<td>70–100 goal</td>
<td>No bolus dose</td>
<td>Do not hold</td>
<td>Do not change current infusion rate</td>
</tr>
<tr>
<td>101–115</td>
<td>No bolus dose</td>
<td>Do not hold</td>
<td>Decrease by 1 unit/kg/h</td>
</tr>
<tr>
<td>116–135</td>
<td>No bolus dose</td>
<td>30</td>
<td>Decrease by 2 units/kg/h</td>
</tr>
<tr>
<td>136–150</td>
<td>No bolus dose</td>
<td>60</td>
<td>Decrease by 3 units/kg/h and repeat aPTT 6 hours after infusion resumed</td>
</tr>
<tr>
<td>151–200 Notify AP</td>
<td>No bolus dose</td>
<td>90</td>
<td>Decrease by 4 units/kg/h and repeat aPTT 6 hours after infusion resumed</td>
</tr>
</tbody>
</table>

Source: Math & Dosage Calculations for Healthcare Professionals by: Booth
Patient’s weight: 110 lbs
Supply: heparin 1000 units/mL

1. Using the heparin protocol table above calculate for the loading dose.

\[
110 \text{ lbs} \div 2.2 \text{ lb/kg} = 50 \text{ kg}
\]

\[
\frac{80 \text{ units}}{\text{kg}} \times 50 \text{ kg} = 4000 \text{ units}
\]

2. Calculate the dose in mL:

D.1 Formula

\[
\frac{D}{H} \times Q = X
\]

\[
x = \frac{4000 \text{ units}}{1000 \text{ units}} \times 1 \text{ mL}
\]

\[
= \frac{4000}{1000}
\]

\[
= 4 \text{ mL}
\]

D.2 Proportion Method

\[
\frac{1000 \text{ units}}{\text{mL}} = \frac{4000 \text{ units}}{x \text{ mL}}
\]

\[
1000 \times = 4000
\]

\[
X = \frac{4000}{1000}
\]

\[
X = 4 \text{ mL}
\]

D.2 Dimensional Analysis

\[
X = \frac{1 \text{ mL}}{1000 \text{ units}} = \frac{4000 \text{ units}}{1}
\]

\[
X = \frac{4000}{1000}
\]

\[
X = 4 \text{ mL}
\]

3. Calculate the infusion rate for the heparin IV drip

Protocol: Start drip at 18 units/kg/h
Supply: heparin 25000 units in D5W 250 mL

\[
18 \text{ units/kg/h} \times 50 \text{ kg} = 900 \text{ units/h}
\]

E.1 Formula

\[
\frac{D}{H} \times Q = X
\]

\[
x = \frac{900 \text{ units}}{100 \text{ units}} \times 1 \text{ mL}
\]

\[
= \frac{900}{100}
\]

\[
= 9 \text{ mL/h}
\]
**E.2 Proportion Method**

\[
\frac{100 \text{ units}}{1 \text{ mL}} = \frac{\sqrt{900 \text{ units}}}{x \text{ mL}}
\]

\[100 \times x = 9000\]

\[X = \frac{9000}{100}\]

\[X = 9 \text{ mL/h}\]

**E.3 Dimensional Analysis**

\[X = \frac{1 \text{ mL}}{100 \text{ units}} \times \frac{900 \text{ units}}{1}\]

\[X = \frac{900}{100}\]

\[X = 9 \text{ mL/h}\]

**F. Exercises heparin dosages**

1. **Order:** heparin 3500 units subcutaneously q 12 h.  
   **Supply/stock:** 5000 units/mL  
   How many mL will you administer: _______ mL

2. **Order:** heparin 8000 units subcut every 8 h  
   **Supply/stock:** 10000 units/mL  
   How many mL will you administer: _______ mL

3. **Order:** Heparin 4500 units SQ every 8 h  
   **Supply/stock:** 20000 units/mL  
   How many mL will you administer: _______ mL

4. **Order:** Heparin 6000 units SQ every 12 h  
   **Supply/stock:** 20000 units/mL  
   How many mL will you administer: _______ mL

5. **Order:** Heparin 2000 units SQ every 8 h  
   **Supply/stock:** 5000 units/mL  
   How many mL will you administer: _______ mL

6. **Heparin 30000 units in D\textsubscript{5}W 750 mL**  
   **Order:** 25 mL/h  
   Calculate for units/hr: _______ units/h

7. **Heparin 25000 units in D\textsubscript{5}W 1L**  
   **Order:** 30 mL/h  
   Calculate for units/hr: _______ units/h

8. **Heparin 20000 units in D\textsubscript{5}W 500 mL**  
   **Order:** 20 mL/h  
   Calculate for units/hr: _______ units/h

9. **Heparin 25000 units in D\textsubscript{5}W 500 mL**  
   **Order:** 30 mL/h  
   Calculate for units/hr: _______ units/h
10. Heparin 25000 units in D₅W 1000 mL
   Order: 30 mL/h
   Calculate for units/hr: _____________ units/h
11. Order: Heparin 1000 units/h
   Supply/Stock: heparin 20000 units in D₅W 1000 mL
   Calculate for flow rate: ____________ mL/h
12. Order: Heparin 850 units/h
   Supply/Stock: heparin 40000 units in D₅W 1500 mL
   Calculate for flow rate: ____________ mL/h
13. Order: Heparin 1000 units/h
   Supply/Stock: heparin 25000 units in D₅W 500 mL
   Calculate for flow rate: ____________ mL/h
14. Order: Heparin 1100 units/h
   Supply/Stock: heparin 15000 units in D₅W 1000 mL
   Calculate for flow rate: ____________ mL/h
15. Order: Heparin 1500 units/h
   Supply/Stock: heparin 40000 units in D₅W 1000 mL
   Calculate for flow rate: ____________ mL/h

Refer to heparin protocol table for question 16-20 for patient weighing 176 lb.

16. Calculate for the loading dose:
   a. ___________ units
   b. ___________ mL
17. Calculate the initial infusion rate _____________ mL/h
18. Calculate bolus dose is the patient’s aPTT was 60
19. Calculate the rate change if the patient’s aPTT was 60
20. If the IV is infusing at 24 mL/h; calculate the rate change if the patient’s aPTT was 115

Refer to heparin protocol table for question 21-25 for patient weighing 264 lb.

21. Calculate for the loading dose:
   a. ___________ units
   b. ___________ mL
22. Calculate the initial infusion rate _____________ mL/h
23. Calculate bolus dose is the patient’s aPTT was 60
24. Calculate the rate change if the patient’s aPTT was 60
25. If the IV is infusing at 36 mL/h; calculate the rate change if the patient’s aPTT was 115

VI. Critical Care Calculations

A. Flow Rates for Dosage per Time Infusion

Order: lidocaine 2 mg/min IV
Supply/stock: 2 g in 500 mL
Calculate for the flow rate in mL/min and mL/h

A.1 Formula

\[
\frac{D}{H} \times Q = X
\]

\[
x = \frac{2 \text{ mg/min}}{2000 \text{ mg}} \times 500 \text{ mL}
\]

\[
= \frac{2}{4} \text{ mL/min} = 0.5 \text{ mL/min}
\]
Dosage and Calculation: Level 4 Self-Study Module

South Texas College Associate Degree Nursing Program

A.2 Proportion Method

\[
\frac{2000 \text{ mg}}{500 \text{ mL}} = \frac{\text{2 mg/min}}{x}
\]

2000 \times x = 1000

\[x = \frac{1000}{2000}\]

X = 0.5 mL/min

\[x = \frac{0.5 \text{ mL}}{\text{min}} \times \frac{60 \text{ min}}{\text{h}}\]

= 30 mL/h

A.3 Dimensional Analysis

\[x = \frac{500 \text{ mL}}{2000 \text{ mg}} \times \frac{2 \text{ mg}}{\text{min}} \times \frac{60 \text{ min}}{1 \text{ hr}}\]

\[x = \frac{60000}{2000}\]

X = 30 mL/h

Calculate for the flow rate in mg/h

A.4 Formula

\[\frac{D}{H} \times Q = X\]

\[x = \frac{2 \text{ mg}}{\text{min}} \times 60 \text{ min}\]

= 120 mg/h

A.5 Dimensional Analysis

\[x = \frac{2 \text{ mg}}{\text{min}} \times \frac{60 \text{ min}}{1 \text{ hr}}\]

\[x = \frac{120 \text{ mg}}{\text{hr}}\]
B. Flow Rates Based on Body Weight per Time

Order: Dopamine 5 mcg/kg/min
Supply/Stock: 400 mg in NS 250 mL
Patient’s weight: 242 lb.
Calculate the hourly rate of dopamine (round to the nearest 1st decimal)

B.1 Formula Method
Patient’s weight in kg
242 lb ÷ 2.2 lb/kg = 110 kg
Desired dose of dopamine:
5 mcg/kg/min x 110 kg = 550 mcg/min
550 mcg/min x 60 min/hr = 33000 mcg/h

\[
\frac{D}{H} \times Q = X
\]
\[
x = \frac{\frac{33000 \text{ mcg/h}}{400000 \text{ mcg}}}{250 \text{ mL}} \times 250 \text{ mL}
\]
\[
= 20.625 \text{ mL/h}
\]
\[
= 20.6 \text{ mL/h}
\]

B.2 Proportion Method

\[
\frac{1 \text{ kg}}{2.2 \text{ lb}} = \frac{x}{242 \text{ lb}}
\]
\[
2.2 x = 242
\]
\[
X = \frac{242}{2.2}
\]
\[
X = 110 \text{ kg}
\]

Patient’s weight in kg
242 lb ÷ 2.2 lb/kg = 110 kg
Desired dose of dopamine:
5 mcg/kg/min x 110 kg = 550 mcg/min
550 mcg/min x 60 min/hr = 33000 mcg/h

\[
\frac{\frac{400000 \text{ mcg}}{250 \text{ mL}}}{X} = \frac{\sqrt{33000 \text{ mcg/h}}}{X}
\]
\[
400000 x = 8250000
\]
\[
X = \frac{8250000}{400000}
\]
\[
X = 20.625 \text{ mL/h}
\]
\[
X = 20.6 \text{ mL/h}
\]
B.3 Dimensional Analysis

Patient’s weight in kg
242 lb ÷ 2.2 lb/kg = 110 kg

Desired dose of dopamine:
5 mcg/kg/min × 110 kg = 550 mcg/min

\[
X = \frac{1 \text{ mg}}{1000 \text{ mcg}} \times \frac{60 \text{ min}}{1 \text{ h}} \times \frac{250 \text{ mL}}{400 \text{ mg}} \times \frac{550 \text{ mcg}}{1 \text{ min}}
\]

\[
X = \frac{8250000}{400000}
\]

X = 20.625 mL/h
X = 20.6 mL/h

C. Exercises

1. Order: morphine sulfate 200 mg IV in NS 1 L to be infused at 20 mcg/kg/h.
   Patient’s weight: 134 kg
   a. How many mg/h will the patient receive: _________ mg/h
   b. How many mL/h of the solution will the patient receive: _______ mL/h

2. Order: norepinephrine bitartrate 2 mcg/min
   Supply/Stock: 8 mg/250 mL
   Calculate the flow rate: ___________ mL/h

3. Order: adenosine 140 mcg/kg/min IVP now.
   Patient’s weight: 110 lb.
   Stock/Supply: adenosine 6 mg/2 mL
   Calculate for the dosage rate: _________ mg/min

4. Order: dopamine hydrochloride 3 mcg/kg/min IV.
   Patient’s weight: 110 lb.
   Stock/Supply: dopamine hydrochloride 200 mg/250 mL
   How many mcg/min will the patient receive _________mcg/min
   How many mL/h will the patient receive: ___________ mL/h

5. Order: dopamine hydrochloride 5 mcg/kg/min IV.
   Patient’s weight: 91 kg.
   Stock/Supply: dopamine hydrochloride 400 mg/250 mL D5W
   How many mcg/min will the patient receive _________mcg/min
   How many mL/h will the patient receive: ___________ mL/h

6. Order: nipride 4 mcg/kg/min IV
   Patient’s weight: 82 kg.
   Stock/Supply: dopamine hydrochloride 50 mg/250 mL D5W
   How many mcg/min will the patient receive _________mcg/min
   How many mL/h will the patient receive: ___________ mL/h
7. Order: procainamide 2 mg/min
   Stock/Supply: procainamide 0.5 g/250 mL D_{5}W
   How many mL/min will the patient receive __________mL/min
   How many mL/h will the patient receive: __________ mL/h

8. Order: dobutamine hydrochloride at 15 mL/h IV
   Patient’s weight: 125 lb.
   Stock/Supply: dobutamine hydrochloride 500 mg/500 mL D_{5}W
   How many mcg/min will the patient receive __________mcg/min
   How many mg/min will the patient receive: ____________ mg/min

9. Order: dobutamine hydrochloride at 2.5 mcg/kg/min IV
   Patient’s weight: 50 kg
   Stock/Supply: dobutamine hydrochloride 250 mg/500 mL D_{5}W
   How many mcg/min will the patient receive __________mcg/min
   How many mg/min will the patient receive: ____________ mg/min
   How many mL/h will the patient receive: ____________ mL/h

10. Order: phenylephrine hydrochloride at 0.5 mcg/kg/min IV
   Patient’s weight: 110 lb
   Stock/Supply: phenylephrine 40 mg/250 mL NS
   How many mcg/min will the patient receive __________mcg/min
   How many mg/min will the patient receive: ____________ mg/min
   How many mL/h will the patient receive: ____________ mL/h

11. Order: nitroglycerine at 15 mcg/min IV
    Patient’s weight: 110 lb
    Stock/Supply: nitroglycerine 25 mg/500 mL D_{5} W
    Calculate flow rate: ____________ mL/h

12. Order: amiodarone at 0.5 mg/min IV
    Stock/Supply: amiodarone 450 mg/250 mL D_{5} W
    Calculate flow rate: ____________ mL/h

13. Order: nisiritide 2 mcg/kg/h
    Patient’s weight: 70 kg
    Stock/Supply: nisiritide 1.5 mg/250 mL D_{5} W
    Calculate flow rate: ____________ mL/h

14. Order: diltiazem hydrochloride IV at 10 mg/h
    Stock/Supply: diltiazem hydrochloride 125 mg/250 mL NS
    Calculate flow rate: ____________ mL/h

15. Order: aminophylline IV at 30 mg/h
    Stock/Supply: aminophylline 250 mg/500 mL D_{5} W
    Calculate flow rate: ____________ mL/h
References


http://www.jointcommission.org/facts_about_the_official_/.


