Southwest Wisconsin Technical College

Dimensional Analysis in Nursing

Module 1.1

MAKING GENERAL MEASUREMENT CONVERSIONS (ENTRY LEVEL)

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Noteworthy

- Start your computational setup with the original measurement.
- Have a list of measurement equivalencies nearby when you are solving problems.
- Don't shortcut any of the dimensional analysis process. These are your safeguards to help avoid miscalculations when working with drugs.

Pete Esser
Knox Learning Center Mathematics Instructor
Contact: pesser@swtc.edu

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Introduction

Dimensional analysis is a problem-solving technique that can not only help you solve measurement conversion problems, but also a wide range of drug calculation problems ranging from basic to advanced.

General Measurement Conversions

In this module you will get your first chance to practice using the dimensional analysis technique. You will use the five elements of dimensional analysis covered in Module 1.0.

The calculations will be written following the plan established by Element 5, Module 1.0.

Original Measurement x Equivalency = New Measurement

The problems presented here are general measurement conversion problems. These will get you off to a good start learning dimensional analysis!

Measurement Equivalencies

Listed below is a small collection of measurement equivalencies that can be used to solve the problems presented in this module. You can find even more on page 1 of the *Appendix*.

Length	Weight and mass	Volume
1 foot = 12 inches	1 pound = 16 ounces	1 fluid ounce = 30 milliliters
3 feet = 1 yard		1 gallon = 3.79 liters (L)
	2.2 pounds = 1 kilogram (kg)	1 teaspoon = 5 milliliters (mL)
1 inch = 2.54 centimeters (cm)	1 ounce = 28 grams (g)	1 tablespoon = 15 milliliters (mL)
1 yard = 0.914 meters (m)	1 grain = 65 milligrams (mg)* *Some instructors/schools use 1 grain = 60 mg	

Example 1.1.1

A patient weighs 18.6 pounds. Convert this to *kilograms*.
Round your answer to the *nearest tenth*.

Step 1 – Write the original measurement as a fraction with a denominator of 1

Continue Step 1 by writing a multiply symbol (×) and another fraction bar with the *same units of measure* in the denominator.

$$\frac{18.6\ pounds}{1} \times \frac{\quad}{pounds}$$

Writing **pounds** in the denominator guarantees that **pounds** will get cancelled-out.

Step 2 – Since the goal is to end up with kilograms, we will try to find a measurement equivalency that relates pounds and kilograms. From the table on page 8, we note that
2.2 pounds = 1 kilogram.

Where does each part of the equivalency go? Since *pounds* has already been written in the denominator, it is easy to decide that "2.2 pounds" goes in the denominator while "1 kilogram" belongs in the numerator. *Crossing-out the eliminated units of measure verifies the correct placement of the information.*

$$\frac{18.6\ \cancel{pounds}}{1} \times \frac{1\ kilogram}{2.2\ \cancel{pounds}}$$

Indicate the removal of ***pounds*** by drawing a line through each.

Step 3 – We can now compute the answer because we have eliminated *pounds* and have introduced *kilograms*.

Solve by multiplying the numerators together, then multiplying the denominators.

Finish by dividing numerator by denominator. Round your answer to the nearest tenth.

Answer!

$$\frac{18.6\ \cancel{pounds}}{1} \times \frac{1\ kilogram}{2.2\ \cancel{pounds}} = \frac{18.6\ kilograms}{2.2} = \mathbf{8.454545\ldots\ pounds = 8.5\ pounds}$$

Example 1.1.2

855 milliliters (mL) of fluid loss is equivalent to how many fluid ounces?
Round your answer to the *nearest tenth*.

Step 1 – Write the original measurement as a fraction with a denominator of 1

Continue Step 1 by writing a multiply symbol (×) and another fraction bar with the *same units of measure* in the denominator.

$$\frac{855\ mL}{1} \times \frac{}{mL}$$

Writing **mL** in the denominator guarantees that **mL** will get cancelled-out.

Step 2 – Since the goal is to end up with *fluid ounces*, we will try to find a measurement equivalency that relates *milliliters* and *fluid ounces*. From the table on page 8, we note that
1 fluid ounce = 30 milliliters (mL).

Where does each part of the equivalency go? Since *mL* has already been written in the denominator, it is easy to decide that "30 mL" goes in the denominator while "1 fluid ounce" belongs in the numerator. *Crossing-out the eliminated units of measure verifies the correct placement of the information.*

$$\frac{855\ \cancel{mL}}{1} \times \frac{1\ fluid\ ounce}{30\ \cancel{mL}}$$

Showing cancellation is good form. Make this a habit!

Step 3 – We can now compute the answer because we have eliminated *milliliters (mL)* and have introduced *fluid ounces*.

Solve by multiplying the numerators together, then multiplying the denominators.

Finish by dividing numerator by denominator. Round your answer to the nearest tenth.

$$\frac{855\ \cancel{mL}}{1} \times \frac{1\ fluid\ ounce}{30\ \cancel{mL}} = \frac{855\ fluid\ ounces}{30} = \mathbf{28.5\ fluid\ ounces}$$

Answer!

Example 1.1.3

7.5 ounces is equal to how many pounds? Round your answer to the *nearest tenth*.

Step 1 – Write the original measurement as a fraction with a denominator of 1

Continue Step 1 by writing a multiply symbol (×) and another fraction bar with the *same units of measure* in the denominator.

$$\frac{7.5\ ounces}{1} \times \frac{}{ounces}$$

Writing **ounces** in the denominator guarantees that **ounces** will get cancelled-out.

Step 2 – Since the goal is to end up with *pounds*, we will try to find a measurement equivalency that relates *pounds* and *ounces*. From the table on page 8, we note that **16 ounces = 1 pound**.

Where does each part of the equivalency go? Since *ounces* has already been written in the denominator, there is no guesswork in deciding that "16 ounces" goes in the denominator. "1 pound" belongs in the numerator. *Crossing-out the eliminated units of measure verifies the correct placement of the information.*

$$\frac{7.5\ \cancel{ounces}}{1} \times \frac{1\ pound}{16\ \cancel{ounces}}$$

Step 3 – We can now compute the answer because we have eliminated *ounces* and have introduced *pounds*.

Solve by multiplying the numerators together, then multiplying the denominators.

Finish by dividing numerator by denominator. Round your answer to the *nearest tenth*.

$$\frac{7.5\ \cancel{ounces}}{1} \times \frac{1\ pound}{16\ \cancel{ounces}} = \frac{7.5\ fluid\ ounces}{16} = \mathbf{0.46875\ pounds} = \mathbf{0.5\ pounds}$$

Answer!

Example 1.1.4

5 grains of medicine is the same as _____ milligrams? Round your answer to the *nearest tenth*.

Step 1 – Write the original measurement as a fraction with a denominator of 1

Continue Step 1 by writing a multiply symbol (×) and another fraction bar with the *same units of measure* in the denominator.

$$\frac{5\ grains}{1} \times \frac{\quad}{grains}$$

Writing **grains** in the denominator guarantees that **grains** will get cancelled-out.

Step 2 – Since the goal is to end up with *milligrams*, we will try to find a measurement equivalency that relates *grains* and *milligrams*. From the table on page 8, we note that **1 grain = 65 milligrams**.

Where does each part of the equivalency go? Since *grains* has already been written in the denominator, it is apparent that "1 grain" goes in the denominator while "65 milligrams" belongs in the numerator. *Crossing-out the eliminated units of measure verifies the correct placement of the information.*

$$\frac{5\ \cancel{grains}}{1} \times \frac{65\ mg}{1\ \cancel{grain}}$$

Step 3 – We can now compute the answer because we have eliminated *grains* and have introduced *milligrams* (*mg*).

Solve by multiplying the numerators together, then multiplying the denominators.

Finish by dividing numerator by denominator. Round your answer to the *nearest tenth*.

$$\frac{5\ \cancel{grains}}{1} \times \frac{65\ mg}{1\ \cancel{grain}} = \frac{325\ mg}{1} = \mathbf{325\ mg}$$

Answer!

Practice Problems

Directions – For each problem, use dimensional analysis to convert each measurement to the required measurement. Round each answer to the ***nearest tenth***.

Length	Weight and mass	Volume
1 foot = 12 inches	1 pound = 16 ounces	1 fluid ounce = 30 milliliters
3 feet = 1 yard		1 gallon = 3.79 liters (L)
	2.2 pounds = 1 kilogram (kg)	1 teaspoon = 5 milliliters (mL)
1 inch = 2.54 centimeters (cm)	1 ounce = 28 grams (g)	1 tablespoon = 15 milliliters (mL)
1 yard = 0.914 meters (m)	1 grain = 65 milligrams (mg)	

1.) Convert 8.4 kg (kilograms) to pounds.

2.) Convert 4.7 pounds to ounces.

3.) Convert 75 g (grams) to ounces.

4.) Convert 34 feet to yards.

5.) Convert 15 cm (centimeters) to inches

6.) Convert 400 mg (milligrams) to grains.

7.) Convert 20 mL (milliliters) to teaspoons.

8.) Convert 202 pounds to kilograms (kg).

9.) Convert 5.5 feet to inches.

10.) Convert 50 meters (m) to yards.

11.) Convert 1.5 tablespoons to milliliters (mL).

12. Convert 6.25 ounces to grams (g).

13.) Convert 0.75 grains to milligrams (mg).

14.) Convert 45 ounces to pounds.

15.) Convert 750 milliliters (mL) to fluid ounces.

Solutions to Practice Problems

1.) Convert 84 kg (kilograms) to pounds.

$$\frac{8.4\ \cancel{kg}}{1} \times \frac{2.2\ pounds}{1\ \cancel{kg}} = \frac{18.48\ pounds}{1} = \mathbf{18.5\ pounds}$$

2.) Convert 4.7 pounds to ounces.

$$\frac{4.7\ \cancel{pounds}}{1} \times \frac{16\ ounces}{1\ \cancel{pound}} = \frac{75.2\ ounces}{1} = \mathbf{75.2\ ounces}$$

3.) Convert 75 g (grams) to ounces.

$$\frac{75\ \cancel{g}}{1} \times \frac{1\ ounce}{28\ \cancel{g}} = \frac{75\ ounces}{28} = \mathbf{2.7\ ounces}$$

4.) Convert 34 feet to yards.

$$\frac{34\ \cancel{feet}}{1} \times \frac{1\ yard}{3\ \cancel{foot}} = \frac{34\ yards}{3} = \mathbf{11.3\ yards}$$

5.) Convert 15 cm (centimeters) to inches.

$$\frac{15\ \cancel{cm}}{1} \times \frac{1\ inch}{2.54\ \cancel{cm}} = \frac{15\ inches}{2.54} = \mathbf{5.9\ inches}$$

6.) Convert 400 mg (milligrams) to grains.

$$\frac{400\ \cancel{mg}}{1} \times \frac{1\ grain}{65\ \cancel{mg}} = \frac{400\ grains}{65} = \mathbf{6.2\ grains}$$

7.) Convert 20 mL (milliliters) to teaspoons.

$$\frac{20\ \cancel{mL}}{1} \times \frac{1\ teaspoon}{5\ \cancel{mL}} = \frac{20\ teaspoon}{5} = \mathbf{4\ teaspoons}$$

8.) Convert 202 pounds to kilograms (kg).

$$\frac{202\ \cancel{pounds}}{1} \times \frac{1\ kg}{2.2\ \cancel{pounds}} = \frac{202\ kg}{2.2} = \mathbf{91.8\ kg}$$

9.) Convert 5.5 feet to inches.

$$\frac{5.5\ \cancel{ft}}{1} \times \frac{12\ inches}{1\ \cancel{ft}} = \frac{66\ inches}{1} = \mathbf{66\ inches}$$

10.) Convert 50 meters (m) to yards.

$$\frac{50\ \cancel{m}}{1} \times \frac{1\ yard}{0.914\ \cancel{m}} = \frac{50\ yards}{0.914} = \mathbf{54.7\ yards}$$

11.) Convert 1.5 T (tablespoons) to milliliters (mL).

$$\frac{1.5\ \cancel{T}}{1} \times \frac{15\ mL}{1\ \cancel{T}} = \frac{22.5\ mL}{1} = \mathbf{22.5\ mL}$$

12. Convert 6.25 ounces to grams (g).

$$\frac{6.25\ \cancel{ounces}}{1} \times \frac{28\ g}{1\ \cancel{ounce}} = \frac{175\ g}{1} = \mathbf{175\ g}$$

13.) Convert 0.75 grains to milligrams (mg).

$$\frac{0.75\ \cancel{grains}}{1} \times \frac{65\ mg}{1\ \cancel{grain}} = \frac{48.75\ mg}{1} = \mathbf{48.8\ mg}$$

14.) Convert 45 ounces to pounds.

$$\frac{45\ \cancel{ounces}}{1} \times \frac{1\ pound}{16\ \cancel{ounces}} = \frac{45\ ounces}{16} = \mathbf{2.8\ pounds}$$

15.) Convert 750 milliliters (mL) to fluid ounces.

$$\frac{750\ \cancel{mL}}{1} \times \frac{1\ fluid\ ounce}{30\ \cancel{mL}} = \frac{750\ fluid\ ounces}{30} = \mathbf{25\ fluid\ ounces}$$