

Some Reminders:

- Completely answer all parts of the Main Quest on the Discussion Board, using Standard English, in clear and easy to follow sentences.
- Respond to two or more classmates, also in Standard English with easy to follow sentences, and further the Discussion. One of the best types of reply is one that helps your classmate with the Main Quest . Another answers "What good is this in the real world?"
- You can do "similar problems" in the MML until you get them correct until the due date.
- The Math & Writing Centers are there to help you with all of your work! They won't do it for you, but it sure helps!
- Additional materials and the pdf, with links to more, can be found at http://www.ramshillfarm.com/Math/Math150/Unit_5.html
- Questions: email: TEyster@kaplan.edu, AIM: TamaraEyster or your instructor

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5.1

Basic Terms and Conversions within the Metric System

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Basic Terms

Metric Term	Abbrev	Common Use	Comparison to Customary
meter	m	length	a little more than a yard
kilogram	kg	mass	about 2.2 pounds
liter	L	volume	a little more than a quart

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Metric Prefixes

Page 176, even more on 178 and at <http://www.nist.gov/index.html>

Prefix	Symbol	Meaning
kilo	k	1000 x base unit
hecto	h	100 x base unit
deka	da	10 x base unit
		base unit
deci	d	1/10 (0.1) of base unit
centi	c	1/100 (0.01) of base unit
milli	m	1/1000 (0.001) of base unit

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Changing Units within the Metric System

- a) Convert 54.6 m to km.
- b) Convert 15 L to mL.
- c) Convert 0.89 kg to cg.

kilo hecto deka (unit) deci centi milli

k h da (unit) d c m

k h da (unit) d c m

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5.4

Dimensional Analysis and Conversions to and from the Metric System

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Dimensional Analysis

- **Dimensional analysis** is a procedure used to convert from one unit of measurement to a different unit of measurement.
- A **unit fraction** is any fraction in which the numerator and denominator contain different units and the value of the fraction is 1.

Examples of unit fractions:

$$\frac{16 \text{ oz}}{1 \text{ lb}} \quad \frac{1 \text{ hr}}{60 \text{ min}} \quad \frac{12 \text{ in.}}{1 \text{ ft}}$$

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U.S. Customary Units

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U.S. Customary Units	
1 foot = 12 inches	1 quart = 2 pints
1 yard = 3 feet	1 gallon = 4 quarts
1 mile = 5280 feet	1 minute = 60 seconds
1 pound = 16 ounces	1 hour = 60 minutes
1 ton = 2000 pounds	1 day = 24 hours
1 pint = 2 cups	1 year = 365 days
1 cup (liquid) = 8 fluid ounces	

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Using Dimensional Analysis

A recipe calls for 8 cups of blueberries. How many pints is this?

Solution:

$$8 \text{ cups} \cdot \frac{1 \text{ pint}}{2 \text{ cups}}$$

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Using Dimensional Analysis

Convert 75 miles per hour to inches per minute.

Solution:

$$\frac{75 \text{ miles}}{\text{hour}} \times \frac{5280 \text{ ft}}{1 \text{ mi}} \times \frac{12 \text{ in}}{1 \text{ ft}} \times \frac{1 \text{ hr}}{60 \text{ min}}$$

$$\frac{75 \cdot 5280 \cdot 12 \text{ in}}{1 \cdot 1 \cdot 1 \cdot 60 \text{ min}}$$

$$\frac{79,200 \text{ in}}{\text{min}}$$

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Conversions between the US and Metric Systems can be found on page 207, use these for the MML!

Other good places for *practical* use:

- <http://www.wsdot.wa.gov/reference/metrics/factors.htm>
- <http://www.nist.gov/index.html>
- Measurements & Conversions: A Complete Guide, Running Press Gem
- Papertech Marketing Group, Inc. Chemical Periodic Table Card, has conversions on back

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Example: Weight (Mass) Conversion for Medication

A newborn baby weighs 8 pounds 4 ounces. If 20 mg of a medication is given for each kilogram of the babies weight, what dosage should be given?

Solution:

$$8 \text{ lbs} + \frac{16 \text{ oz}}{1 \text{ lbs}} + 4 \text{ oz}$$

$$8 + \frac{16 \text{ oz}}{1} + 4 \text{ oz}$$

$$128 \text{ oz} + 4 \text{ oz}$$

$$132 \text{ oz}$$

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Conversion for Medication

If 20 mg of a medication is given for each kilogram of the babies weight, what dosage should be given?

Solution:

$$132 \text{ oz} \times \frac{28 \text{ g}}{1 \text{ oz}} \times \frac{1 \text{ kg}}{1000 \text{ g}} \times \frac{20 \text{ mg}}{1 \text{ kg}}$$

$$132 \times \frac{28}{1} \times \frac{1}{1000} \times \frac{20 \text{ mg}}{1}$$

$$\frac{132 \times 28 \times 20 \text{ mg}}{1000}$$

The dosage of the medication is 73.92 mg.

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Example: Application

A case of fruit juice contains twenty-four 0.75 liter bottles. How many 250 milliliter glasses can you fill using one case of juice?

$$\frac{24 \text{ bottles}}{1} \times \frac{.75 \text{ liters}}{1 \text{ bottle}} \times \frac{1000 \text{ ml}}{1 \text{ liter}} \times \frac{1 \text{ glass}}{250 \text{ ml}}$$

72 glasses can be filled.

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5.2 Length, Area, and Volume

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Length

- The **meter** is used to measure things that we normally measure in yards and feet.
- Centimeters and millimeters are used to measure what we normally measure in inches.
 - A centimeter is a little less than a half of an inch.
 - A millimeter is about the thickness of a dime.

Example: The length of a pair of scissors would be measured in centimeters.

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Area

Areas are always expressed in square units.

Example:

The **length** of a rectangular park is **82.5 m**, and its **width** is **25.4 m**. Find the area of the park.

Solution: Area = **length** * **width**

$$A = 82.5 \text{ m} * 25.4 \text{ m}$$

$$A = (82.5 * 25.4)(\text{m} * \text{m})$$

$$A = 2095.5 \text{ m}^2$$

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Volume

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- When a figure has three dimensions; length, width and height, the **volume** can be found.
- The volume of an item can be considered the space occupied by the item.
- Volume can be expressed in terms of liters or cubic meters.

Volume in Cubic Units	=	Volume in Liters
1 cm ³	=	1 mL
1 dm ³	=	1 L
1 m ³	=	1 kL

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Volume

When the volume of a liquid is measured, the abbreviation cc is often used instead of cm^3 to represent cubic centimeters.

An asthma patient must mix 0.25 cc of a bronchodilator with 2 cc of saline to use in an aerosol machine.

- a) How many milliliters of the bronchodilator will be administered?
- b) What is the total volume of drug and saline solution in milliliters?

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Volume continued

Solution:

- a) Since 1 cc is equal in volume to 1 milliliter, there will be 0.25 milliliters of the bronchodilator.
- b) The total volume is $0.25 + 2 \Rightarrow 2.25$ cc, which is equal to 2.25 mL.

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5.3

Mass and Temperature

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Mass

- Although weight and mass are not the same, on Earth they are proportional to each other.
 - **Mass** is a measure of the amount of matter in an object.
 - **Weight** is the measure of gravitational pull on an object.

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Metric System

- The **kilogram** is the basic unit of mass in the metric system.
 - A **man** has the mass of about 75 kg.
- The **gram** is relatively small and used in place of the ounce.
 - A **nickel** has the mass of about 5 g.
 - An **M&M** and a **raisin** are each about 1g.
- The **milligram** is used in the medical and scientific fields.
- The **metric tonne (t)** is used to express mass of heavy items. One metric tonne = 1000 kg.

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Example: Choosing an Appropriate Unit

Determine which metric unit you would use to express the mass of the following.

- | | |
|-------------|--------------------|
| a) A spider | c) A bicycle |
| b) A nickel | d) A box of cereal |

Solution:

- | | |
|---------------|--------------|
| a) Milligrams | c) Kilograms |
| b) Grams | d) Grams |

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
Page 197 & 198

Volume and Mass of Water

Volume in Cubic Units	=	Volume in Liters	=	Mass of Water
1 cm ³	=	1 mL	=	1 g
1 dm ³	=	1 L	=	1 kg
1 m ³	=	1 kL	=	1 t (1000 kg)

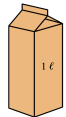
Water

Cubic measure




1 dm³

Liquid measure



1 L

Mass of water



1 kg

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Example: Capacity

A fish tank is **1 m** long, **60 cm** high and **260 mm** wide.

- Determine the number of **liters** that the tank holds.
- What is the mass of the water in **kilograms**.

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Capacity, continued: **1 m** long, **60 cm** high and **260 mm** wide

Solution: First find the volume

Volume = Length * Width * Height

V = **1 m** * **260 mm** * **60 cm**

V = **1 m** * **.260 m** * **.6 m**

V = .156 m³

- Convert to **liters**:

$$\frac{.156 \text{ m}^3}{1} \cdot \frac{1 \text{ kl}}{1 \text{ m}^3} \cdot \frac{1000 \text{ l}}{1 \text{ kl}} = 156 \text{ liters}$$
- Convert to **kilograms**:

$$\frac{156 \text{ liters}}{1} \cdot \frac{1 \text{ kg}}{1 \text{ l}} = 156 \text{ kg}$$

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Temperature

- The term degrees Celsius (°C) is used to measure temperature.

Temperature		
°C	°F	Description
0 °C	32°F	Water freezes
22°C	71.6°F	Comfortable room
37°C	98.6°F	Body temperature
100°C	212°F	Water boils

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Example: Conversions

The air temperature on a warm summer day is **about 85°F**. What is the equivalent temperature on the Celsius thermometer?

Solution:

$$C = \frac{5}{9} (F - 32)$$

$$C = \frac{5}{9} (85 - 32)$$

$$C = \frac{5}{9} (53)$$

$$C = 29.4$$

The equivalent temperature is about 29.4°C.

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Example: Conversions

The temperature of a cold glass of milk is **about 5°C**. What is the equivalent temperature on the Fahrenheit thermometer?

Solution:

$$F = \frac{9}{5} C + 32$$

$$F = \frac{9}{5} (5) + 32$$

$$F = 9 + 32$$

$$F = 41$$

The equivalent temperature is about 41°F.

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