Chapter 7

Measurement and Conversion

Objective 1:

Section 7.1 Using Customary Measurement

Learn US Customary Measurements:

Length

12 inches (in) = 1 foot (ft) → note: (foot) or plural (feet)   (ft) can be singular

3 feet (ft) = 1 yard

5280 feet (ft) = 1 mile (mi)

Capacity

8 Fluid Ounces (fl oz) = 1 cup (c)

2 Cups (c) = 1 pint (1pt)

2 pints (pt) = 1 Quart (qt)

4 Quarts (qt) = 1 gallon (gal)

Time

60 Seconds (sec) = 1 minute (min)

60 minutes (min) = 1 Hour (hr)

24 Hours (hr) = 1 day   orbital Period $24\frac{1}{4}$ Day

7 Days = 1 Week (wk)

Weight

16 Ounces (oz) = 1 pound (lb)

2000 pounds (lb) = 1 Ton

Objective 2: Use Multiplication or Division To Convert Between Units

Example 1: Convert the Following

a) 7 Feet to inches → $\left(\dfrac{7\,\text{ft}}{1}\right)\left(\dfrac{12\,\text{inches}}{1\,\text{Foot}}\right) = 84\,\text{inches}$ or 84 in

given Quantity

NOTE: This conversion is also called a UNIT FRACTION — it represents a UNIT OF 1. This conversion Factor is arranged to convert Feet to inches.

Dimensional Analysis: Numeric Quantities

$$\left(\frac{84 \text{ in}}{1}\right)\left(\frac{1 \text{ foot}}{12 \text{ in}}\right) \rightarrow 7 \text{ ft} \rightarrow$$

Given Quantity   This conversion Factor will convert inches to Feet

Dimensional Analysis with TWO Conversion FACTORS

How many Inches in one mile?

Convert 2 miles to Inches:

$$\left(\frac{2 \text{ mi}}{1}\right)\left(\frac{5280 \text{ ft}}{1 \text{ mi}}\right)\left(\frac{12 \text{ in}}{1 \text{ ft}}\right) = 126,720 \text{ inches}$$

Given Quantity   * This conversion Factor Converts Feet To inches From miles To Feet.

Objective 3: USE UNIT Analysis To Convert Between UNITS

Example 2: Convert the Following

a) Convert 1 miles to inches

$$\left(\frac{0.1 \text{ mi}}{1}\right)\left(\frac{5280 \text{ ft}}{1 \text{ mi}}\right)\left(\frac{12 \text{ in}}{1 \text{ ft}}\right) = 6,336 \text{ inches}$$

given Quantity   converts miles To Feet   Converts Feet To inches.

Part B : How many Gallons to oz?

$$\left(\frac{1\ gallon}{1}\right)\left(\frac{4\ qt}{1\ gal}\right)\left(\frac{2\ pints}{1\ qt}\right)\left(\frac{2\ cups}{1\ pint}\right)\left(\frac{8\ fl\ oz}{1\ cup}\right) = 128\ fl\ oz$$

given Quantity   converts   converts   converts
          gallons To   Quarts   pints
                  to   to
           Quarts   Pints   Cups

Objective 4: Solve Applied Problems Using Conversion.

Example 3:

A Ladybug Flaps its wings 85 times per second. How many times Does it Flap its wings in 5 minutes?

$$\left(\frac{5\ minutes}{1}\right)\left(\frac{60\ Seconds}{1\ min}\right)\left(\frac{85\ flaps}{1\ second}\right) = 25,550\ Flaps$$

given Quantity   minutes/ Flaps per second
(To Seconds)

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Irina will make buttermilk Pancakes for her Daughter's Pajama Party. She has to make six batches, and each batch uses $2\frac{1}{2}$ c buttermilk. How many pints of buttermilk Should she buy?

$$\left(\frac{6\ batches}{1}\right)\left(\frac{2\frac{1}{2}\ cups}{1\ batch}\right)\left(\frac{1\ pint}{2\ cups}\right) = 7\frac{1}{2}\ pints \Rightarrow Trina\ must\ buy\ 8\ pints.$$

given
Quantity

7.2 The Metric System: Units of Length

The metric system is also called The International System of Metric units of length units (SI)

"System 'international"

Metric units of length	
1 kilometer (km) = 1000 m	
1 hectometer (hm) = 100 m	
1 dekameter (dam) = 10 m	"Deka" means × 10
1 meter (m) = 1 m	

1 decimeter (dm) = $\dfrac{1}{10}$ m or 0.1 m

1 centimeter (cm) = $\dfrac{1}{100}$ m or 0.01 m

1 millimeter (mm) = $\dfrac{1}{1000}$ m or 0.001 m

Examples

4 dekameters = 40 meters   "milli" = $\dfrac{1}{1,000}$

20 decimeters = $\dfrac{20 \text{ meters}}{10}$ "centi" = $\dfrac{1}{100}$

     "deci" = $\dfrac{1}{10}$

1000 mm = 1 meter   "deka" = × 10

100 centimeter = 1 meter   "hecto" = × 100

10 decimeters = 1 meter   "kilo" = × 1,000

Example 1: Fill in the blank with the appropriate metric unit:

km, m, cm, mm

a) A pen is 14 <u>cm</u> long.

b) David drives 8 <u>km</u> to work.

c. The lens on a phone camera is 3 <u>mm</u> wide.

D) The length of a soccer field is 72 __M__ .

Objective 2: Use unit fractions to convert between units

Example 2: Convert the following: 2 kilometers to meters

a) $\left(\dfrac{2\ km}{1}\right)\left(\dfrac{1,000\ km}{1\ km}\right) = 2,000\ m$

b) 162 mm to M:

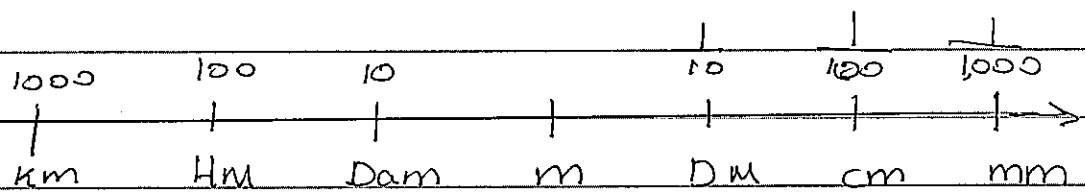$\left(\dfrac{162\ mm}{1}\right)\left(\dfrac{1\ m}{1,000\ mm}\right) = \dfrac{162\ m}{1,000} = 0.162\ m$

c) 1.5 m to cm:

$\left(\dfrac{1.5\ m}{1}\right)\left(\dfrac{100\ cm}{1\ m}\right) = 150\ cm$

Objective 3: Convert between units using the metric conversion chart

	1000	100	10		$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
	km	Hm	Dam	m	DM	cm	mm
Powers of 10	Kilo	Hecto	Decca		deci	centi	milli

One unit to the left means 10   One unit to the right means 10

Example 3: Convert the following using the conversion chart

a) 1 km to M = move 3 times to the right.
multiply 10 x 10 x 10 = 1,000
"Move the decimal to the right 3 times"
1,000. m

b Convert: 2.378 m to decimeters:
= 23.78 Dm

c) 13 dekameters to cm → 13,000 cm

7.3 the Metric System: capacity and Weight (Mass)
          ↓   ↓
    Refers to Volume   not the same
                           as weight.

objective 1: learn the Basic units of Capacity

Metric units of Capacity
1 kiloliter (kL) = 1000 L
1 hectoliter (hL) = 100 L
1 dekaliter (daL) = 10 L
    1 Liter (L) = 1 L
1 deciliter (dL) = $\frac{1}{10}$ L or 0.1 L
1 centiliter (cL) = $\frac{1}{100}$ L or 0.01 L
1 milliliter (mL) = $\frac{1}{1000}$ L or 0.001 L

Objective 2: Convert Between Metric (Units of) Capacity

1000 L	100 L	10 L	1 L	$\frac{1}{10}$ or 0.1 L	$\frac{1}{100}$ or 0.01 L	$\frac{1}{1000}$ or 0.001 L
kL	hL	daL	L	dL	cL	mL
(kilo)	hecto	deka		deci	cemi	milli

Example 2: Convert the following using the conversion chart/ and by Dimensional analysis.

a) 1,200 mL to dL → using the chart we need to move the Decimal two places to the left

1,2 00. = 12 dL

using unit fractions

$$\left(\frac{1,200\ mL}{1}\right)\left(\frac{1\ L}{1,000\ mL}\right)\left(\frac{10\ dL}{1\ L}\right) = 12\ dL$$

Part b: convert 2,500 mL to hectoliters (hL) using the chart, we move 5 places to the left.

002500.0 → 0.02500 ⇒ We disregard the last two zeroes, so the answer is 0.025 hL

using unit fractions:

$$\left(\frac{2500\ mL}{1}\right)\left(\frac{1\ L}{1,000\ mL}\right)\left(\frac{1\ hL}{100\ L}\right) = 0.025\ hL$$

Objective 3: Learn basic units of mass

1 Small paperclip = About one gram

1 nickel = 5 gram

an iphone 4.s = 140 g

Metric units of mass

1 kilogram (kg) = 1000 g

1 hectogram (hg) = 100 g

1 deckagram (dag) = 10 g

1 gram = 1g

1 decigram (dg) = $\frac{1}{10}$ g or 0.1g

1 centigram (cg) = $\frac{1}{100}$ g or 0.01g

1 milligram (mg) = $\frac{1}{1000}$ g or 0.001g

examples:
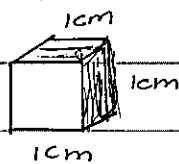
→ If you filled this box with water, the mass of the water in this cube would be 1 gram

so 1 cm³ of water = 1 gram of water

The Average man weighs 84 kg

Objective 4: Convert between Metric units of weight (Mass)

1000 g	100g	10 g	1g	$\frac{1}{10}$ or 0.1g	$\frac{1}{100}$ or 0.01g	$\frac{1}{1000}$ or 0.001g
kg	hg	dag	g	dg	cg	mg
(kilo)	(hecto)	deka		deci	centi	milli

Refer to chart.

a) 0.04 kg to cg

0.04000 = 4,000 cg

b) 0.02 dg to hectogram (hg)

0.000 0.02 ⇒ 0.00002 hg

c) 0.02 dag to hg =
0.002 hg

7.4 Solve Applied Problems Involving Metric Units

Objective 1: Perform operations with Metric Units

Example 1: Add or Subtract as indicated

1) 10 cm + 50 cm → convert to Like terms

10 cm to mm   or   mm to cm = 10 cm + 50 mm

100 mm + 50 mm = 150 mm   10 cm + 5 cm =

the answers are Equivalent   15 cm

2) 3.25 kg - 455 g

3250. kg → 3,250 g - 455 g = 2,795 g

Example 2:

90 kg of rice is divided into 120 bags. How many grams
does each bag weigh?

$$\left(\frac{90\,Kg}{1}\right)\left(\frac{1000\,Kg}{1\,Kg}\right) = \frac{9,000\,grams}{120\,bags} = 750\,grams\ \text{Per every bag.}$$

Example 3

A length of cloth is 1 meter 4 cm Long. How much cloth is left if you cut off 30 cm?

104 cm total.

(1 m + 4 cm) or   104 cm (Length of cloth)

100 cm + 4 cm = 104   − 32 cm (amount you cut off)

                          72 cm of cloth left.

7.5 metric — U.S. Customary conversions and Temperature.

Relationships Between U.S. customary units and Metric units

Length   capacity

1 inch = 2.54 centimeters   1 cup ≈ 236.59 milliliters

1 foot ≈ 0.30 meter   1 quart ≈ 0.95 Liter

1 yard ≈ 0.91 meter   1 gallon ≈ 3.79 Liters

1 mile ≈ 1.61 Kilometers

weight (mass)   Converting between Fahrenheit and

1 ounce ≈ 28.35 grams   Celsius units

1 pound ≈ 0.45 Kg   Change from °F to °C   From °C to F

                                $C = \dfrac{5(F-32)}{9}$ $F = \dfrac{9c}{5} + 32$

Examples °C → °F   25° Celsius To Fahrenheit

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

$$F = \frac{9}{5}(25) + 32$$

$$45 + 32 = 77 \text{ Degrees Fahrenheit}$$

From °F → °C

32° F → °C   212° F → °C

$$C = \frac{5(F - 32)}{9}$$ $$C = \frac{5(212 - 32)}{9} =$$

$$C = \frac{5(32 - 32)}{9} = 0$$ $$C = \frac{5(180)}{9}$$

$$C = 100° C$$

Example 1 Convert the Following

a) 1mi to km

$$\left(\frac{1mi}{1}\right)\left(\frac{5280ft}{1mi}\right)\left(\frac{12in}{1ft}\right)\left(\frac{2.54cm}{1in}\right)\left(\frac{1m}{100cm}\right)\left(\frac{1km}{1,000m}\right) =$$

$$= 1.609 km$$

Part B : Convert 420 yd to cm

$$\left(\frac{420yd}{1}\right)\left(\frac{3ft}{1yd}\right)\left(\frac{12in}{1ft}\right)\left(\frac{2.54cm}{1in}\right) = 38,404.8 cm$$

c) Convert 32,450 Kg to lbs:

$$\left(\frac{32,458\ kg}{1}\right)\left(\frac{2.20\ lb}{1\ kg}\right) = 71,407.600\ Lbs$$

Part D = 10L → gallon

$$\left(\frac{10\ L}{1}\right)\left(\frac{1\ gal}{3.79\ L}\right) = 2.639\ gallons$$

E) 10L to cups (1L to cups)

$$\left(\frac{1\ L}{1}\right)\left(\frac{1.06\ qt}{1\ L}\right)\left(\frac{2\ Pt}{1\ qt}\right)\left(\frac{2\ cups}{1\ pt}\right) = 4.240\ cups$$

F) Convert 65 mph to km/Hr

$$\left(\frac{65\ mi}{1\ hr}\right)\left(\frac{5,280\ ft}{1\ mi}\right)\left(\frac{12\ in}{1\ ft}\right)\left(\frac{2.54\ cm}{1\ in}\right)\left(\frac{1\ m}{100\ cm}\right)\left(\frac{1\ km}{1000\ m}\right) =$$

$$\frac{104.607\ Km}{Hr}$$

E) Convert $\frac{483\ ft}{Sec}$ to $\frac{mi}{hr}$

$$\left(\frac{483\,ft}{1\,sec}\right)\left(\frac{1\,mi}{5280\,ft}\right)\left(\frac{60\,sec}{1\,min}\right)\left(\frac{60\,min}{1\,hr}\right) = \frac{329.314\,mi}{hr}$$

h) $\dfrac{1000\,cm}{sec}$ to $\dfrac{miles}{hr}$

$$\left(\frac{1000\,cm}{1\,sec}\right)\left(\frac{1\,in}{2.54\,cm}\right)\left(\frac{1\,ft}{12\,in}\right)\left(\frac{1\,mi}{5280\,ft}\right)\left(\frac{60\,sec}{1\,min}\right)\left(\frac{60\,min}{1\,hr}\right) =$$

cm → in → ft → mi → sec → min → hrs

$\dfrac{22.369\,miles}{hr}$

I) $\dfrac{100\,m}{10\,sec}$ to $\dfrac{mi}{hr}$

$$\left(\frac{100\,m}{10\,sec}\right)\left(\frac{100\,cm}{1\,m}\right)\left(\frac{1\,in}{2.54\,cm}\right)\left(\frac{1\,ft}{12\,in}\right)\left(\frac{1\,mi}{5280\,ft}\right)\left(\frac{60\,sec}{1\,min}\right)\left(\frac{60\,min}{1\,hr}\right) =$$

22.369 mph