Concepts and Examples
Liquid Capacity

Based on power point presentations by Pearson Education, Inc.
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Learning Objectives

1. Memorize units of liquid capacity in the U.S. Measuring System and use dimensional analysis to change units.
2. Memorize units of liquid capacity in the Metric Measuring System and use dimensional analysis to change units.
3. Memorize the relationship between volume and liquid capacity in the Metric Measuring System.
4. Change to and from the Metric Measuring System.

Liquid capacity is the amount of fluid that a three-dimensional object can hold. **You must memorize the following measures.**

Symbol	Unit	Meaning
1 fl oz	fluid ounce	
1 c	cup	8 fl oz
1 pt	pint	2 c = 16 fl oz
1 qt	quart	2 pt
1 gal	gallon	4 qt

Liquid Capacity in the U.S. Measuring System

Example 1:

Change 5.6 quarts to pints using dimensional analysis.

First, we'll write the original measure as the fraction $\dfrac{5.6\,qt}{1}$

We memorized that 1 quart contains 2 pints. We express this as a unit ratio in which the new unit of measure (pt) is in the numerator and the original unit of measure (qt) is in the denominator.

$$\frac{2\,pt}{1\,qt}$$

Now, we'll multiply the original measure in fraction form with the unit ratio.

Example 1 continued:

$$\frac{5.6\,qt}{1}\left(\frac{2\,pt}{1\,qt}\right) = \frac{5.6(2)\,pt}{1}$$

$$= 11.2\,pt$$

We find that 5.6 quarts equal 11.2 pints.

The milliliter and the liter are the most commonly used metric liquid capacity measures. **You must memorize them.**

Symbol	Unit	Meaning
1 mL	milliliter	
1 L	liter	1000 mL

Less commonly used metric units of liquid capacity:

1 centiliter (cL) = 10 milliliters (mL)

1 deciliter (dL) = 100 mL

1 dekaliter (dkL) = 10 liters (L)

1 hectoliter (hL) = 10 dekaliters (dkL)

1 kiloliter (kL) = 10 hectoliters (hL)

Liquid Capacity in the Metric Measuring System

Example 2:

Change 0.714 liters to milliliter using dimensional analysis.

First, we'll write the original measure as the fraction $\frac{0.714\,L}{1}$.

We memorized that 1 liter contains 1000 milliliter. We express this as a unit ratio in which the new unit of measure (mL) is in the numerator and the original unit of measure (L) is in the denominator.

$$\frac{1L}{1000\ mL}$$

Now, we'll multiply the original measure in fraction form with the unit ratio.

Liquid Capacity in the Metric Measuring System

Example 2 continued:

$$\frac{0.714\cancel{L}}{1}\left(\frac{1000\ mL}{1\cancel{L}}\right) = \frac{0.714(1000)\ mL}{1(1)}$$

$$= 714\ mL$$

We find that 0.714 liters equal 714 milliliters.

Volume refers to the amount of space occupied by a three-dimensional figure. In the Metric Measuring System, there is a relationship between liquid capacity and volume.

To illustrate this, let's use a unit cube which is a three-dimensional figure having a height of 1 cm, a width of 1 cm, and a length of 1 cm.

height h = 1 cm

width w = 1 cm

length l = 1 cm
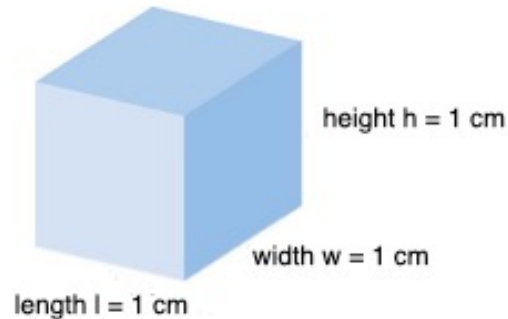
We calculate the volume of a cube by multiplying its measures of height, width, and length.

In our case, this will be 1 cm × 1 cm × 1 cm which equals 1 cubic centimeter usually symbolized by 1 cm³ or 1 cc.

The Relationship Between Liquid Capacity and Volume

We will now state the following relationships between liquid capacity and volume:

1 mL (milliliter) = 1 cm^3 = 1 cc

1 L (liter) = 1000 cm^3 = 1000 cc

You must memorize this because cc is especially important in medicine.

Example 3:

An aquarium has a volume of 34,000 cubic centimeters (cm³). How many liters of water does the aquarium hold? Use dimensional analysis.

First, we'll write the original measure as the fraction $\frac{34000cm^3}{1}$.

We memorized that 1 liter contains 1000 cubic centimeters. We express this as a unit ratio in which the new unit of measure (L) is in the numerator and the original unit of measure (cm³) is in the denominator.

$$\frac{1L}{1000cm^3}$$

Now, we'll multiply the original measure in fraction form with the unit ratio.

Example 3 continued:

$$34000cm^3 \cdot \left(\frac{1L}{1000cm^3} \right) = \frac{34000(1)L}{1000} = 34L$$

We find that 34000 cubic centimeters equals 34 liters.

You must memorize the following conversions.

1 fluid ounce (oz) ≈ 29.57 milliliter (mL) This is an approximation!
1 quart (qt) ≈ 0.95 liter (L) This is an approximation!
1 gallon (gal) ≈ 3.79 liter (L) This is an approximation!

Example 4:

Change 10000 cubic centimeters to fluid ounces using dimensional analysis.

Since we know that **1 cc = 1 mL**, we'll write the original measure as the fraction

$$\frac{10000 \ mL}{1}.$$

We memorized that 1 fluid ounce is <u>approximately</u> equal to 29.57 milliliter. We express this as a unit ratio in which the new unit of measure (oz) is in the numerator and the original unit of measure (mL) is in the denominator.

$$\frac{1 \ fl \ oz}{29.57 \ mL}$$

Now, we'll multiply the original measure in fraction form with the unit ratio.

Convert to and from the Metric Measuring System

Example 4 continued:

$$10000 \; mL \left(\frac{1 \; fl \; oz}{29.57 \; mL} \right) \approx 338.18 \; fl \; oz$$

We find that 10000 cubic centimeters equals <u>approximately</u> 337.84 fluid ounces.