Chemistry I Cycle I Lesson 3

Identify, use, and convert SI units of mass and volume.

Warmup (5 minutes):

The Universe is made of matter & energy. Matter has mass and volume, while energy has neither. Classify as matter or energy: sound, water, light, air, a lamp, heat, a loudspeaker, the Sun

Chemistry I Cycle I Lesson 3

Identify, use, and convert SI units of mass and volume.

Vocab

Pages 10-14 (in sidebars)

"Matter", "Volume", "Mass", "Weight", "Quantity", "Units", "Conversion Factor"

Perspective on Units

Classwork

Unit conversion – p. 14 #1-3 (all parts)

HONORS: Write out Conversion Factors

CHEM: "King Henry Died By Drinking Chocolate Milk"

Objectives

- **Distinguish** between different characteristics of matter, including mass, volume, and weight.
- **Identify** and use SI units in measurements and calculations.
- **Set up** conversion factors, and use them in calculations.

End Of Slide

Matter Has Mass and Volume

- **Matter** is anything that has mass and volume.
- **Volume** is the space an object occupies.
- **Mass** is the quantity of matter in an object.
  - Devices used for measuring mass in a laboratory are called *balances.*
- **Weight** is the force produced by gravity acting on a mass.

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Comparing Mass and Weight

End Of Slide

Units of Measurement

- When working with numbers, be careful to distinguish between a quantity and its unit.
  - **Quantity** describes something that has magnitude, size, or amount.
  - **Unit** is a quantity adopted as a standard of measurement.

End Of Slide

Units of Measurement, *continued*

Scientist Express Measurements in SI Units

- Scientists worldwide use a set of units called the *Système Internationale d'Unités* or *SI*.

Quantity	Symbol	Unit	Abbreviation
Length	l	meter	m
Mass	m	kilogram	kg
Time	t	second	s
Thermodynamic temperature	T	kelvin	K
Amount of substance	n	mole	mol
Electric current	I	ampere	A
Luminous intensity	I_v	candela	cd

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Chapter menu
Resources

Units of Measurement, *continued*

Scientist Express Measurements in SI Units, *continued*

- Base units can be too large or too small for some measurements, so the base units may be modified by attaching prefixes.

Prefix	Abbreviation	Exponential multiplier	Meaning	Example using length
Kilo-	k	10^3	1000	1 kilometer (km) = 1000 m
Hecto-	h	10^2	100	1 hectometer (hm) = 100 m
Deka-	da	10^1	10	1 dekameter (dam) = 10 m
		10^0	1	1 meter (m)
Deci-	d	10^{-1}	1/10	1 decimeter (dm) = 0.1 m
Centi-	c	10^{-2}	1/100	1 centimeter (cm) = 0.01 m
Milli-	m	10^{-3}	1/1000	1 millimeter (mm) = 0.001 m

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SI (*Système Internationale d'Unités*)

Common SI Units		
Length 	**meter (m)** kilometer (km) decimeter (dm) centimeter (cm) millimeter (mm) micrometer (μm) nanometer (nm)	 1 km = 1,000 m 1 dm = 0.1 m 1 cm = 0.01 m 1 mm = 0.001 m 1 μm = 0.000 001 m 1 nm = 0.000 000 001 m
Volume 	**cubic meter (m^3)** cubic centimeter (cm^3) liter (L) milliliter (mL)	 1 cm^3 = 0.000 001 m^3 1 L = 1 dm^3 = 0.001 m^3 1 mL = 0.001 L = 1 cm^3
Mass 	**kilogram (kg)** gram (g) milligram (mg)	 1 g = 0.001 kg 1 mg = 0.000 001 kg
Temperature 	**Kelvin (K)** Celcius (°C)	 0°C = 273 K 100°C = 373 K

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Perspective on SI Units (Participation Points)

How big is a meter? __(example – about a yard)

How big is a centimeter?

How heavy is 1 kg?

How heavy is 100g?

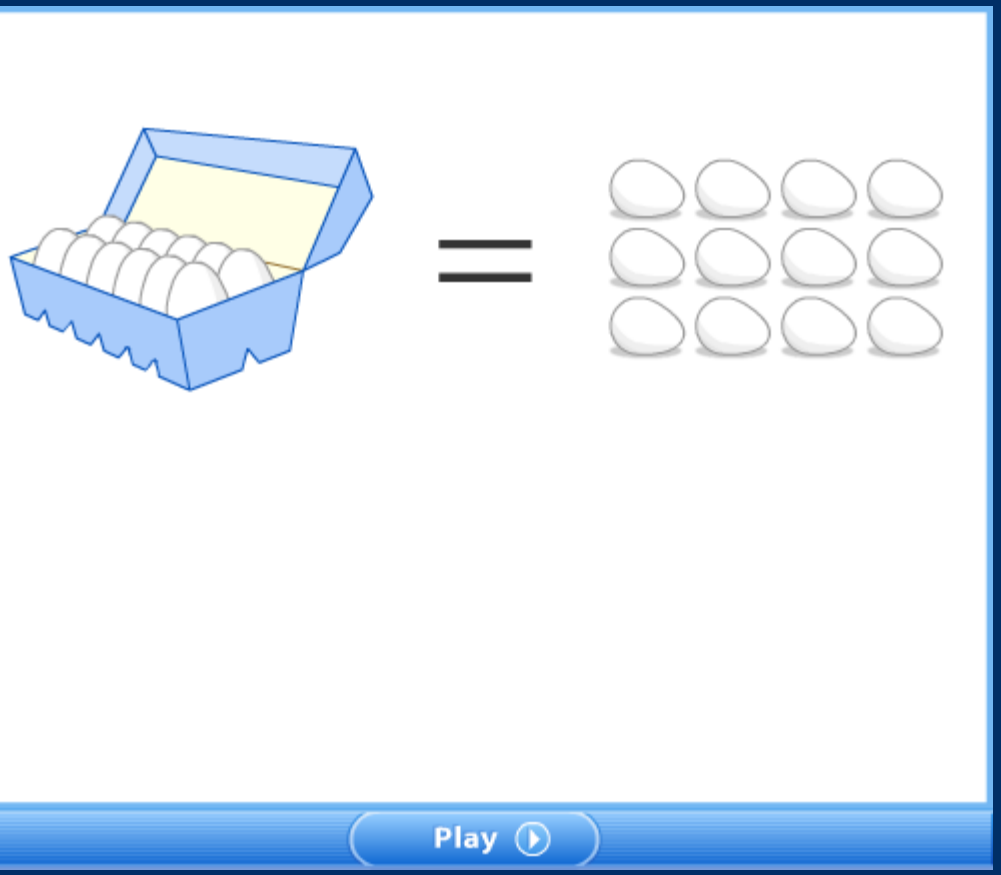
How heavy is 5g?

How much is 5 mL?

How much is 250 mL?

Use balances, meter stick, cylinders, and beakers to help!

Conversion Factor



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Unit of Measurement, *continued*

Converting One Unit to Another

- A **conversion factor** is a simple ratio that relates two units that express a measurement of the same quantity.
  - example: You can construct conversion factors between kilograms and grams as follows:

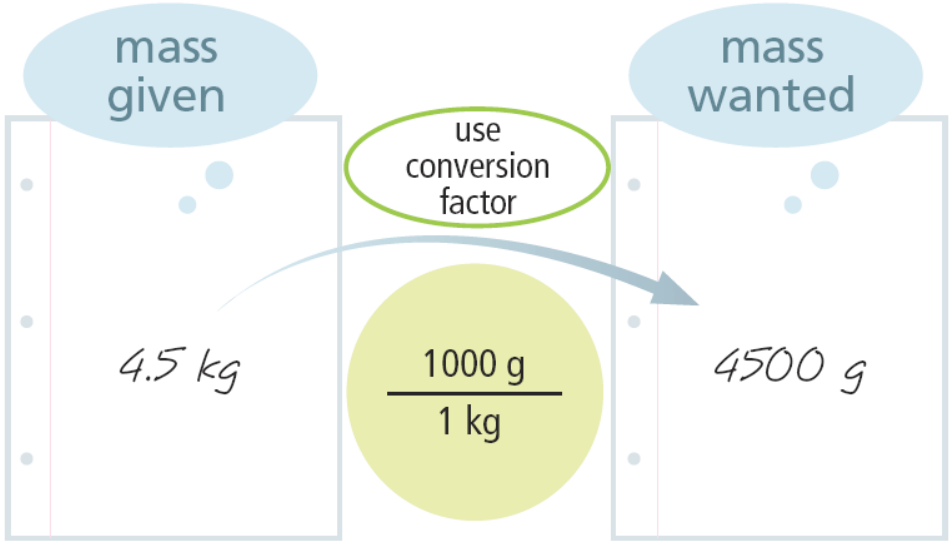
1 kg = 1000 g can be written as $\frac{1\text{ kg}}{1000\text{ g}}$ or $\frac{1000\text{ g}}{1\text{ kg}}$

0.001 kg = 1 g can be written as $\frac{0.001\text{ kg}}{1\text{ g}}$ or $\frac{1\text{ g}}{0.001\text{ kg}}$

End Of Slide

Using Conversion Factors

1. Identify the quantity and unit given and the unit that you want to convert to.
2. Using the equality that relates the two units, set up the conversion factor that cancels the given unit and leaves the unit that you want to convert to.
3. Multiply the given quantity by the conversion factor. Cancel units to verify that the units left are the ones you want for your answer.



Converting Units

Sample Problem A

Convert 0.851 L to milliliters.

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Sample Problem A Solution

- The equality that links the two units is 1000 mL = 1 L. (The prefix *milli-* represents 1/1000 of a base unit.)

- The conversion factor needed must cancel liters and leave milliliters. Thus, liters must be on the bottom of the fraction and milliliters must be on the top.

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

$$?\ \text{mL} = 0.851\ \text{L} \times \frac{1000\ \text{mL}}{1\ \text{L}} = 851\ \text{mL}$$

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