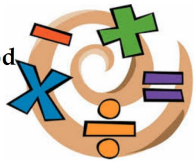
Unit Overview
Introductory Concepts

Unit Purpose:
Chemistry is a great amalgamation of history, English, math and science. We need to use all of these skills!

Unit Outline:
I. Scientific Notation
II. Basic Algebra Skills (for Chemistry)
III. English vs. Metric Units
IV. Conversions with Factor-Label Method
V. Using Reference Materials



Scientific Notation:
Expressing Large and Small Quantities

In Science, we use very large and small numbers like:
1. the speed of light = 300000000 m/s
2. the K_w in acid-base Chemistry = 0.00000000000001

- The problem with expressing numbers this way.

We use scientific notation as a solution to this problem!

Scientific Notation:
Expressing Large and Small Quantities

2×10^9

2.000000000
1 2 3 4 5 6 7 8 9

2,000,000,000

Large numbers get a positive exponent. Small numbers get a negative exponent.

Sample Problem
Scientific Notation

Express these values in scientific notation:

(a)45600000 **(b) 0.00000025678**

Additional Practice
(2 minutes)

For additional practice, let's convert the first two values we encountered into scientific notation. Write these numbers in the margin next to these numbers.

1. the speed of light = 300000000 m/s
2. the K_w in acid-base Chemistry = 0.00000000000001

Objective Check

Objective(s):

The student will be able to
(1) write values in standard and scientific notations,
(2) solve basic algebra expressions.

Metacognitive (Thinking) Questions:

A. What have you learned?
B. What can the teacher clarify for you?
C. How are we meeting our objective?
D. Other questions?

A. What's something you didn't know before you walked into class today?

Basic Algebra Skills

We need algebra to solve expressions and eventually evaluate them for some number.

We *never memorize* equations. You will always be given the equation you need. It is your job to determine which one you will need.

Sample Problem

Solve the following algebraic expression for the indicated variable:

a) $4x + 3 = 10$ for "x"

Sample Problem

Solve the following algebraic expression for the indicated variable:

b) $10x - 7 = 13x + 11 + 15$ for "x"

Sample Problem

Solve the following algebraic expression for the indicated variable:

c) $5(x + 4) = 21 + -3(x - 2)$ for "x"

Sample Problem

Solve the following algebraic expression for the indicated variable:

d) $2(p + 6) + 3(m - 14) = 22p - 3(m + 12) - 15$ for "m"

Evaluating Algebraic Expressions

Of course, we practice solving algebraic expressions so that we can eventually *evaluate* these expressions with an actual number. We will follow these steps every time we solve an algebraic expression in this class:

1. Identify the equation and variable to solve.
2. Write the expression in terms of the indicated variable.
3. Plug in values for known quantities.

In the past, you've been taught to switch steps 2 and 3. This is a problem in Chemistry. It leads to more error in calculations.

Sample Problem

Solve each equation for the variable "k" and then evaluate each expression using the values given:

$k = x - 7 + y(x - (y - 7))$ where $(y = 7, x = 7)$

Sample Problem

Solve each equation for the variable "k" and then evaluate each expression using the values given:

$(x - c) \div (k \cdot (3 - c)) = 2$ where $(x = 9, c = 5)$

Objective Check

Objective(s):

The student will be able to
(1) write values in standard and scientific notations,
(2) solve basic algebra expressions.

Metacognitive (Thinking) Questions:

A. What have you learned?
B. What can the teacher clarify for you?
C. How are we meeting our objective?
D. Other questions?

A. What's something you didn't know before you walked into class today?

Today's Practice

Discuss In-Class Practice Philosophy

Practice:
Scientific Notation & Basic Algebra Problem Set

Exit Ticket

1. Put the following number in scientific notation: 0.000002365
2. For the next two questions solve for "k" and then evaluate the expression:

a. $(z - 7) \div (9 - (4 - 3) \times 7) = k$
$(z = 10)$

b. $k(x - 6 + 2) \div (c \times c) = 2$
$(x = 8, c = 6)$

Unit 0 Lesson II
Units of Measurment & Conversions

Objective: The student will be able to compare and contrast the English and Metric Systems of Units.

Homework: Metric Conversions Practice

Warm-Up: (7 minutes)
1. Put this number in scientific notation: 0.00002587
2. Solve the following equation for "k" and evaluate according to the assigned variables:
k[(x – 6) + 2] = (c × c) × 2 where (x = 8, c = 6)

Warm - Up Answers

1. Put this number in scientific notation: 0.00002587

2.587×10^{-5}

2. Solve the following equation for "k" and evaluate according to the assigned variables:
k[(x – 6) + 2] = (c × c) × 2 where (x = 8, c = 6)

$$k = \frac{(c \times c) \times 2}{(x - 6) + 2} \qquad k = 18$$

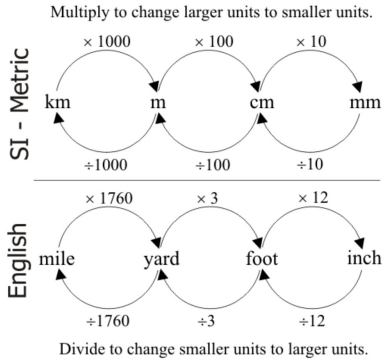
In-Class Practice
(15 minutes)

Finish the following problem set(s):

Scientific Notation & Basic Algebra Review

These problem sets will be collected at the end of the 15 minutes.

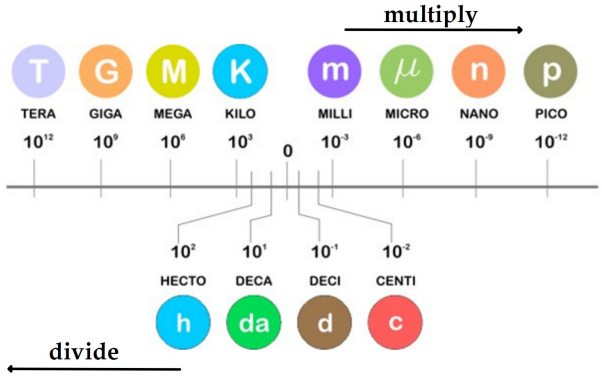
Units of Measurement
The Metric System



Measurements and their Units

Mass	kilogram (kg)
Time	second (s or sec)
Length	meter (m)
Quantity (Amount of substance)	mole (mol)
Luminous Intensity	candela (cd)
Electric current	ampere (A or amp)
Temperature	Kelvin (K)

The Metric Scale



change deca to "deka" and da to "dk"

Mnemonic Device
How to Remember the Metric System Prefixes

1. discuss which portions of the metric scale we will use
2. discuss multiplication / division

Metric Unit Practice

a) 1000 mg = _____ g

b) 1 L = _____ mL

c) 160 cm = _____ mm

d) 14 km = _____ m

e) 109 g = _____ dg

f) 250 hm = _____ cm

Objective Check

Objective(s):

The student will be able to use the factor-label method and dimensional analysis to interconvert between different units.

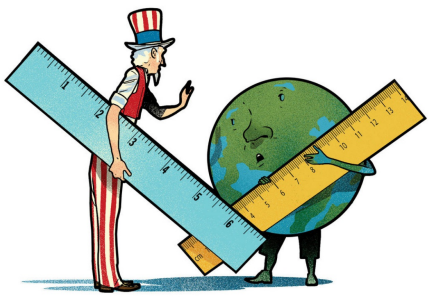
Metacognitive (Thinking) Questions:

A. What have you learned?
B. What can the teacher clarify for you?
C. How are we meeting our objective?
D. Other questions?

A. What's something you didn't know before you walked into class today?

Today's Practice

Metric Conversions Practice



Unit 0 Lesson III
Unit Conversions with Factor-Label Method

Objective: The student will be able to use the factor-label method and dimensional analysis to interconvert between different units.

Homework: Factor-Label Practice #s 1-7

Warm-Up: (7 minutes)

1. A chemist needs to add 450.0 ml of water to a reaction vessel. There are only devices which measure in liters. How many liters should be added?

2. How mant hectograms are in 4506.3 centigrams?

Warm - Up Answers

1. 0.450 Liters

2. 0.45063 hg

Unit Conversions
Factor Label

(given, know, need)

Sample Problem #1

The average weight of an African Forest Elephant is 6250 pounds (lbs). How many tons is this?

Sample Problem #2

A cooking pot contains 345 fluid ounces (fl. oz.) of water. How many cups of water is this?

Sample Problem #3

A high school swimmer competes in the 100-meter backstroke event. How many centimeters does this athlete swim?

Objective Check

Objective(s):

The student will be able to use the factor-label method and dimensional analysis to interconvert between different units.

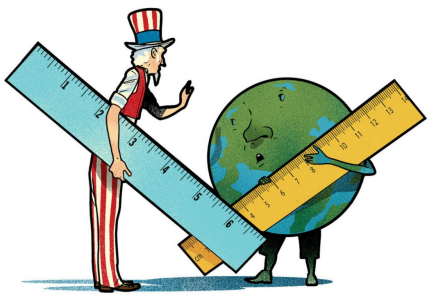
Metacognitive (Thinking) Questions:

A. What have you learned?
B. What can the teacher clarify for you?
C. How are we meeting our objective?
D. Other questions?

A. What's something you didn't know before you walked into class today?

Today's Practice

Factor-Label Practice #s 1-7



Unit 0 Lesson IV
Multi-Step Factor-Label Problems

Objective: The student will be able to use the factor-label method and dimensional analysis to interconvert between different units with more than one step.

Homework: Complete Factor-Label Practice

Warm-Up: (7 minutes)
1. The distance between the cities of Melbourne and Sydney, Australia is 878.2 km. What is this distance in miles (mi.)?
2. An average house cat weighs 8.5 pounds. What is this weight in grams?

Warm - Up Answers

1. = 545.80 mi

2. = 3855.6 g

Warm - Up Answers (with explanations)

1. $\frac{878.2 \text{ km}}{} \times \frac{1 \text{ mi}}{1.609 \text{ km}}$ = 545.80 mi

2. $\frac{8.5 \text{ lb.}}{} \times \frac{453.6 \text{ g}}{1 \text{ lb.}}$ = 3855.6 g

Sample Problem #4

The same swimmer now competes in a different event, the 350-meter front stroke. How many inches does this athlete swim? (Hint: multi-step problem)

Challenge Problem

Objective Check

Objective(s):

The student will be able to use the factor-label method and dimensional analysis to interconvert between different units with more than one step.

Metacognitive (Thinking) Questions:

A. What have you learned?
B. What can the teacher clarify for you?
C. How are we meeting our objective?
D. Other questions?

A. What's something you didn't know before you walked into class today?

Today's Practice

Complete Factor-Label Practice