

Chapter One

Intro to Chemistry

*CHEMISTRY - WHERE IT IS
PERFECTLY NORMAL TO BOND WITH
STRANGERS!*



**WHO ARE
YOU?**

**WHO
CARES?!?!**

Day One:

Today, your child should complete their reading and practice problems for the week.

Below are the supplies for this week's lab:

Ruler and/or measuring tape
Measuring cups and spoons
Electric kitchen scale*
Calculator
U.S. nickel coin

** There is no need to break the bank for this item! Digital pocket scales will work fine. Most are around \$15 at the time of this writing and can be found in most large retail stores and online. There will be many uses for this device throughout the book!*

Next Generation Science Standards covered this week:

Mathematics and Scientific Practice Standards MP.2 - Reason abstractly and quantitatively; MP.4 - Model with mathematics; SEP.5 - Using mathematics and computational thinking; SEP.1 - Asking questions and defining problems; and, SEP.6 - Constructing explanations and designing solutions.

Definitions

Base Units	The standard units used to measure basic quantities like length (meter), mass (gram), and volume (liter), without any prefixes attached.
Chemistry	The study of what things are made of, how they change, and how they react with other substances.
Coefficient (scientific notation)	A number between 1 and 9.999 that is multiplied by a power of ten to represent a very large or small number.
Exponent	A number that describes how many times to multiply or divide by 10 in scientific notation.
Physics	The study of energy and motion.
Scientific Notation	A shorthand way of writing very large or very small numbers using powers of 10.

Sample questions to ask your child

How are chemistry and physics connected when it comes to understanding how the world works?

Chemistry explains what things are made of, while physics explains how those things move and interact with energy. Together, they give a complete understanding of why the world behaves the way it does.

Why is the metric system important in science?

The metric system makes it easy to convert between units because it's based on powers of ten. Scientists around the world use it to ensure consistent and clear communication.

What is the purpose of scientific notation in science?

Scientific notation allows very large or very small numbers to be written in a shorter form using powers of 10. This helps scientists work with extreme values more easily and clearly.

How does math, especially algebra, help in solving problems in physical science?

Math helps scientists calculate, measure, and predict what will happen in an experiment or natural event. Algebra allows them to solve for unknowns using formulas like $F = ma$.

Why is it helpful that scientific variables always represent the same thing?

In science, variables like "F" for force and "a" for acceleration always mean the same thing, no matter where they're used. This consistency makes solving equations and understanding problems much easier for students and scientists.

Day Two:

Your child should check their work on the practice worksheets today with the answer key on the next page.

In addition, your child should read the lab activity and start collecting all of the necessary materials!

Answer Key for Practice Problems

Definitions

- 1) Scientific Notation
- 2) Physics
- 3) Base Units
- 4) Exponent
- 5) Chemistry
- 6) Coefficient

Convert the following metric values.

- | | |
|----------------------|--------------------|
| 1) 5,000 meters | 9) 8.5 kilograms |
| 2) 1.2 liters | 10) 45 milliliters |
| 3) 25 centimeters | 11) 1,200 grams |
| 4) 0.075 kilograms | 12) 5 millimeters |
| 5) 3 grams | 13) 0.82 liters |
| 6) 4,700 milliliters | 14) 60 centimeters |
| 7) 900 meters | 15) 2 grams |
| 8) 0.63 meters | |

Write the following numbers in scientific notation or convert the scientific notation into its normal form:

- | | | |
|--------------------------|--------------------------|--------------------------|
| 16) 5.0×10^6 | 21) 3,200,000 | 26) 670,000 |
| 17) 3.6×10^{-4} | 22) 0.045 | 27) 0.00999 |
| 18) 2,400 | 23) 5.1×10^{-3} | 28) 8.2×10^{-2} |
| 19) 0.00091 | 24) 1.25×10^3 | 29) 575 |
| 20) 1.0×10^{-6} | 25) 7.5×10^{-7} | 30) 8.6×10^{-9} |

Rearrange the following equations:

$$31) \text{Time (t)} = \frac{\text{distance (d)}}{\text{velocity (v)}}$$

$$32) \text{Velocity (v)} = \text{acceleration (a)} \times \text{time (t)}$$

$$33) \text{Mass (m)} = \text{density (d)} \times \text{volume (v)}$$

$$34) \text{Current (I)} = \frac{\text{voltage (V)}}{\text{resistance (R)}}$$

Day Three: Lab Activity

Your child should have already read through this lab and has been reviewing all of this week's vocabulary words.

Measuring the Invisible: A Metric and Density Challenge

Nickels & Nonsense: A Coin-venient Metric Mission

Students will practice their use of the metric system and use mathematics to identify an unobservable physical quality of an object.

Materials:

- Ruler and/or measuring tape
- Measuring cups and spoons
- Electric kitchen scale*
- Calculator
- U.S. nickel coin

** There is no need to break the bank for this item! Digital pocket scales will work fine. Most are around \$15 at the time of this writing and can be found in most large retail stores and online. There will be many uses for this device throughout the book!*

Procedure:

Part 1 - Metric Scavenger Hunt

1) Search your home for objects that match the following target measurements as closely as possible:

- | | |
|-------------------------|--------------------------|
| • Tiny Mass (5g) | • Large Volume (1,500mL) |
| • Medium Mass (250g) | • Short Length (12cm) |
| • Large Mass (2,000g) | • Medium Length (85cm) |
| • Small Volume (50mL) | • Large Length (200cm) |
| • Medium Volume (300mL) | |

2) For mass you will be using the electric scale (write down every number after the decimal!) For volume, the measuring cups and spoons will be used. And, for length, the ruler or measuring tape would be the best tool.

3) Record the following in your worksheet:

- The object's name
- Its actual measured value in metric units (it is unlikely you will find something that is exactly the target value!)
- The same measured value converted into scientific notation

Part 2 – Volume of a Nickel Using Density

- 4) Turn on your electronic scale and set it to grams.
- 5) Weigh the U.S. nickel on the scale and record the mass.
- 6) Use the known density of a nickel: 8.9g/cm^3 .
- 7) Rearrange the equation for density, to solve for volume:

$$\text{Density (D)} = \frac{\text{mass (m)}}{\text{volume (v)}}$$

- 8) Plug in your measured mass into your new equation and solve using cross multiplication.
- 9) Express your volume answer in both decimal form and scientific notation.

Explanation:

Understanding measurement in science begins with mastering the metric system. Unlike the U.S. customary system, metric units are based on powers of ten, making calculations and conversions more straightforward and logical. Expressing values in scientific notation is a task that scientists often utilize every day as they work with very large or very small numbers.

Another skill that is used by scientists is the ability to calculate measurements that are not directly observable. The calculation of volume in the second part of the activity is one example of how this can be accomplished. Not all characteristics of an object can be experimentally determined. Sometimes, simple math is needed to determine these hidden variables. By integrating metric units, scientific notation, and problem-solving, the activity shows how chemistry and physics work together to answer real-world questions—even with something as simple as a coin.

Through careful measurements and calculations, it should be discovered that the mass of the nickel is close to 5g and its volume will be calculated to be $\sim 0.7\text{g/cm}^3$ by using the following equation:

$$\text{Volume (v)} = \frac{\text{mass (m)}}{\text{density (D)}}$$

Do not worry about the units at this time! We will have plenty of time to practice this in future chapters and labs!

Student Worksheet

Part 1 - Metric Scavenger Hunt

Target	Object Found	Measured value (metric)	Scientific Notation
Tiny Mass (5g)			
Medium Mass (250g)			
Large Mass (2,000g)			
Small Volume (50mL)			
Medium Volume (300mL)			
Large Volume (1,500mL)			
Short Length (12cm)			
Medium Length (85cm)			
Large Length (200cm)			

Part 2 - Volume of a Nickel Using Density (Complete your calculations below)