

The Chemical World

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Chapter Overview

In this chapter, an understanding of the history of chemical investigation is presented. It is hoped that this will help the student understand the history of experimentation and scientific inquiry such that he or she feels a real-world association with the material to be covered later in the course. A few examples that the student may be familiar with are presented.

Lecture Outline

1.1 Soda Pop Fizz

- A. “Pop”: Higher pressure on the inside than on the outside
- B. “Sweet”: sugar water
- C. “Fizz”: CO₂ coming out of solution
 - 1. Carbon dioxide: 2 oxygen atoms and 1 carbon atom
 - 2. Water: 2 hydrogen atoms and 1 oxygen atom

1.2 Chemicals Compose Ordinary Things

Learning Objective: Recognize that chemicals make up virtually everything we come into contact with in our world.

- A. Everything made of chemicals
- B. Molecules interact all around you all the time
- C. Understanding how the universe works means understanding how molecules interact

1.3 All Things Are Made of Atoms and Molecules

Learning Objective: Recognize that all things are made of atoms and molecules.

- A. Chemistry: the science that seeks to understand what matter does by studying what atoms and molecules do

1.4 The Scientific Method: How Chemists Think

Learning Objective: Identify and understand the key characteristics of the scientific method: observation, the formulation of hypotheses, the testing of hypotheses by experiment, and the formulation of laws and theories.

- A. Observation – hypothesis – law – theory – experiment
- B. Scientific law (e.g., law of conservation of mass)
- C. Dalton’s atomic theory

1.5 A Beginning Chemist: How to Succeed

- A. Curiosity
- B. Calculation
- C. Commitment

Chemical Principle Teaching Ideas

Matter and Molecules

Go around the room and point out how everything around the students, including the room and their notebooks, are made of matter. Emphasizing the real-world association with what is covered in lecture is always a good idea.

The Scientific Method

Using the scientific method to cover a simple concept such as putting together a children's puzzle or baking a cake will help them understand the method, which is most important here.

Success as a Beginning Chemist

If the students are to do well in this course, they must be willing to expand their horizons outside the classroom and try to use everyday interactions with their world to help understand the concepts to be covered.

Suggested Demonstrations

Open a can of soda in the students' presence and talk about the myriad of reactions and interactions taking place. The more often students associate chemical principles with real life events, the better.

Burning of Magnesium, *Chemical Demonstrations* 1:38, Shakhshiri, B.Z. University of Wisconsin Press, 1983.

Use the scientific method to analyze an everyday occurrence in students' lives. Suggestions are a jigsaw puzzle, the burning of a combustible material, or some aspect of body chemistry.

Guided Inquiry Ideas

Below are a few example questions that students answer in the guided inquiry activities provided in the Guided Activity Workbook.

In a grammatically correct sentence, describe the relationship between laws and theories.

The way the terms are used in science, are laws more certain than theories? Explain.

In a grammatically correct sentence, describe the difference between atoms and molecules.

How many hydrogen atoms are there in one molecule of water? What do all the atoms have in common?

What famous law might be explained with the kinetic theory of gases?