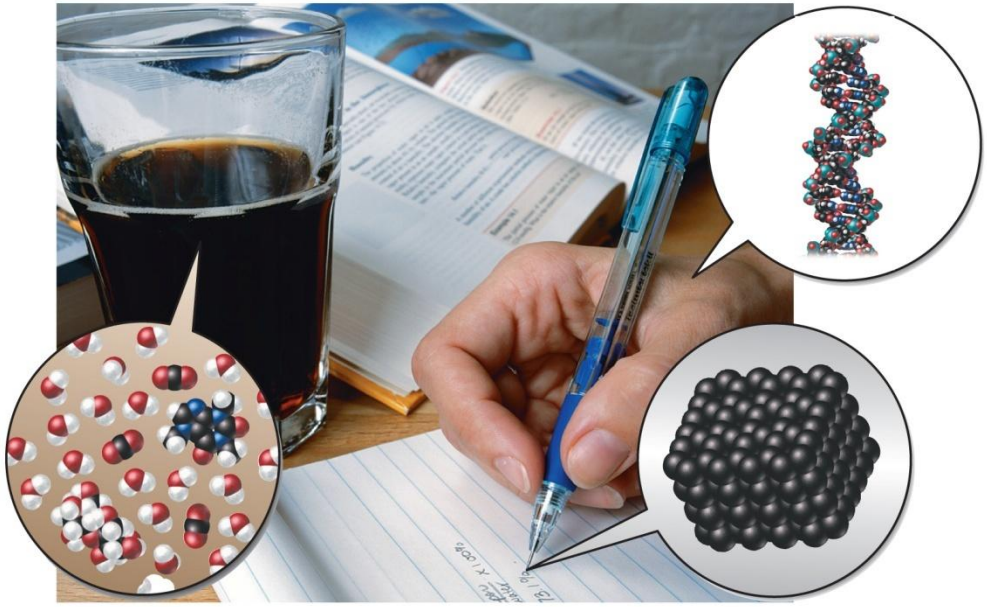
Chapter 1
The Chemical World



What Is Chemistry?

- What chemists try to do is discover the relationships between the particle structure of matter and the properties of matter we observe.

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

Philosophical Methods *versus* Scientific Method

Philosophers:

- Observe nature.
- Explain the behavior of nature.
- Communicate and debate ideas with other philosophers.
- Truth is revealed through logic and debate.

Scientists:

- Observe nature.
- Explain the behavior of nature.
- Communicate and debate ideas with other scientists.
- Truth is revealed through experimentation.

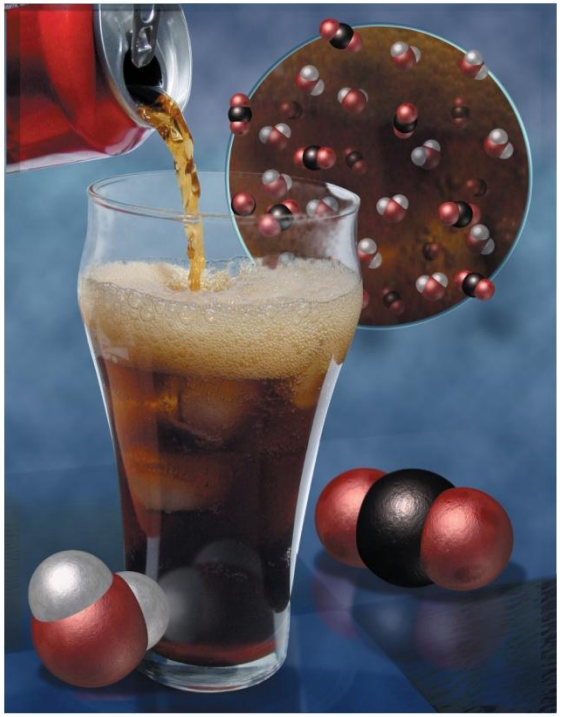
The Scientific Method

- A process for trying to understand nature by observing nature and the way it behaves, and by conducting experiments to test our ideas.

- Key characteristics of the scientific method include **Observation**, formulation of **Hypotheses**, **Experimentation**, and formulation of **Laws and Theories.**

Observation

- A way of acquiring information
  - ✓ Also known as **Data**.
- Some observations are simple descriptions about the characteristics or behavior of nature.
  - ✓ "The soda pop is a liquid with a brown color and a sweet taste. Bubbles are seen floating up through it."
- Some observations compare a characteristic to a standard numerical scale.
  - ✓ "A 240-mL serving of soda pop contains 27 g of sugar."



Hypothesis

- A tentative interpretation or explanation of your observations.
  - ✓"The sweet taste of soda pop is due to the presence of sugar."
- A good hypothesis is one that can be tested.
  - ✓Falsifiable.
  - ✓One test may invalidate your hypothesis.

Experiments

- Tests of hypotheses, laws, or theories.
- Can you think of a way to test whether the sweet taste of soda pop is due to the presence of sugar?
- Results either validate (confirm) or invalidate (deny) your ideas.
  - ✓Invalidate = Discard or Modify
    - ➢Many times experiments invalidate only parts of the hypothesis or theory, in which case the idea is modified.
  - ✓Validate ≠ Proof your idea will always hold

Laws

- Summary of observations.
  - ✓**Law of Conservation of Mass—** "In a chemical reaction matter is neither created nor destroyed."

- Allows you to predict future observations.
  - ✓So you can test the law with experiments.

- Unlike state laws, you cannot choose to violate a scientific law.

Thinking time!!!

What's the Difference Between a Hypothesis and a Law?

Theory

- General explanation for the characteristics and behavior of nature.

- Models of nature.
  - ✓Dalton's Atomic Theory

- Can be used to predict future observations.
  - ✓So they can be tested by experiments.