

Chapter 1

Chemistry in Our Lives



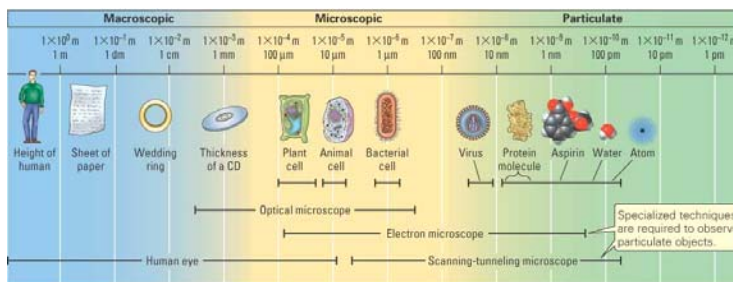
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Matter

- **Matter** is any substance that has mass and takes up space (occupies volume).
 - **Macroscopic** matter is matter that can be easily observed with the unaided human eye
 - **Microscopic** matter is matter too small to be seen with the unaided human eye.
 - **Particulate** matter is matter too small even to be seen with an optical microscope.






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States of Matter

- Matter exists in one of three states: **Gas**, **Liquid** or **Solid**
- The differences among these states can be explained in terms of the **Kinetic Molecular Theory**

	Gas	Liquid	Solid
Water as an example:	 Gaseous water (steam)	 Liquid water	 Solid water (ice)
Shape	Variable—same as a closed container	Variable—same as the bottom of the container	Constant—rigid, fixed
Volume	Variable—same as a closed container	Constant	Constant
Particle Movement	Completely independent (random); each particle may go anywhere in a closed container	Independent beneath the surface, limited to the volume of the liquid and the shape of the bottom of the container	Vibration in fixed position

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Can you think of another state of matter?

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Physical Properties & Changes

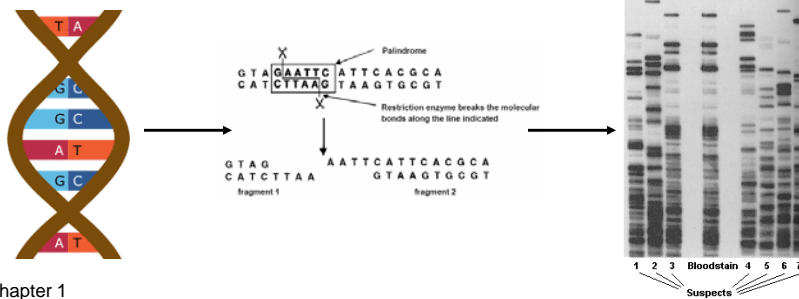
- A ***physical property*** is a characteristic of a pure substance that we can observe without changing its composition.
 - Physical properties include characteristics you can observe with one of your five senses: color, shape, state of matter, appearance, smell, taste
 - Physical properties also include characteristics you cannot observe with one of your five senses: melting and boiling points, viscosity density and conductivity
- A ***physical change*** is a change where the chemical composition of the substance remains unchanged.
 - These include changes in physical state or shape of a pure substance.
 - An example would be liquid freezing to a solid

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The Ultimate Physical Property: DNA

- **Forensic Science** focuses on the examination of physical evidence in an effort to identify some fact, object or individual.
- The physical characteristics of an individual are governed by their genetic information stored in their DNA (**D**eoxyribo**N**ucleic **A**cid).
- Because every person's DNA (aside from identical twins) is thought to be unique, DNA analysis can, in theory, provide positive identification of an individual.



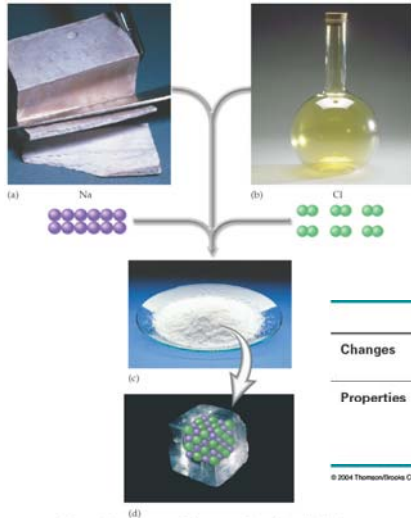
Chemical Properties & Changes

- A **chemical property** describes the chemical reactions of a pure substance.
 - Chemical properties cannot be observed and include reactions with other chemical entities.
- A **chemical change** indicates that a chemical reaction has occurred resulting in the formation of a new compound with a new set of physical and chemical properties.
 - The composition of the substances changes during a chemical change.
 - An example would be the ripening of a banana or burning wood

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Physical & Chemical Properties



- No two substances have the same physical or chemical properties
- The physical and chemical properties of a compound, such as table salt (NaCl), are never the same as the properties of the elements that make it up (Na and Cl).

	Chemical	Physical
Changes	Old substances destroyed New substances formed	New form of old substance No new substances formed
Properties	Properties defined by types of chemical changes possible	Description by senses—color, shape, odor, and others Measurable properties—density, boiling point, and others

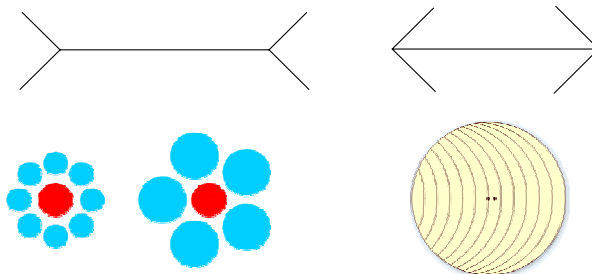
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Scientific Investigations

- Science is the methodical exploration of nature followed by a logical explanation of the observations.
- The Scientific method is based upon **measurable evidence** rather than belief



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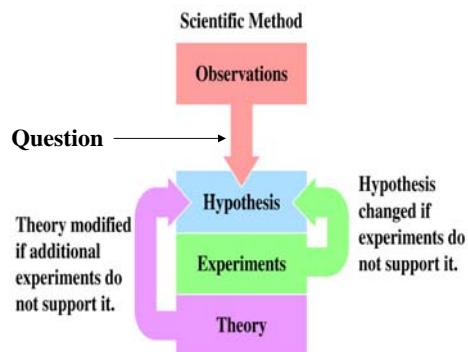
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Science and Technology

- When scientific information is applied to industrial and commercial industries, it is called *technology*

The Scientific Method

- The *scientific method* is a systematic process for the investigation of nature used by scientists.

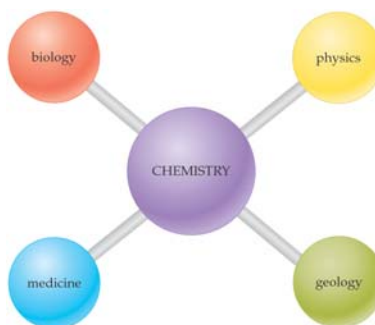


Let's look at this situation:

You arrive home late at night, walk up to your front door, unlock the door and reach in to turn on the light inside the front door. The light does not come on.

Chemistry: The Central Science

- **Chemistry** is the study of the composition, structure, properties and reactions of matter.
- Most other sciences demand an understanding of basic chemical principles, and Chemistry is often referred to as the Central Science



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Modern Chemistry

- **Chemistry** is a science that studies the composition of matter and its properties.
- Chemistry is divided into several branches:
 - **Organic chemistry** is the study of substances containing carbon
 - **Inorganic chemistry** is the study of all other substances that don't contain carbon
 - **Biochemistry** is the study of substances derived from plants and animals
 - **Analytical Chemistry** includes quantitative and qualitative analysis (how much and what makes up a substance)
 - **Physical Chemistry** proposes mathematical and theoretical explanations for chemical behavior

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Tips for Success in CHE 100

- Know how to use your calculator (ask for help if you are unsure!)
- Rewrite your lecture notes within 24 hours of the lectures.
 - At the very least, review your notes prior to the next lecture to identify areas that are unclear. If you cannot find the answers on your own in the text, ask questions!
- Work the assigned homework. If you have problems, seek assistance.
- **Form or join a study group**: The most successful students are those who help each other.
- Come to my office hours on a regular basis. That is why I have them.
- Review your quizzes and exams; don't repeat your mistakes.