

Exploring Matter

Safety First

A good science lab is a safe one.

All of the procedures, equipment and chemicals you use have been designed to help you understand the science principles you are investigating.

Go over the safety notes provided and be prepared to take the safety test in class (do the practice test to help prepare you for the experiments and inquiry activities you will complete in the Science Lab).



Classifying Matter

The **Particle Model of Matter** is an important part of what you will be learning in this unit.

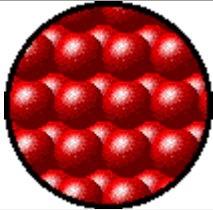

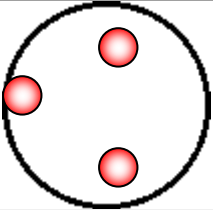
Recall that:

- All matter is made up of tiny particles.
- All the particles in a substance are the same; different substances are made of different particles.
- There are attractive forces among particles-these attractions may be strong or weak.
- The particles are always moving; the more energy the particles gain, the faster they move.
- There are spaces among the particles.

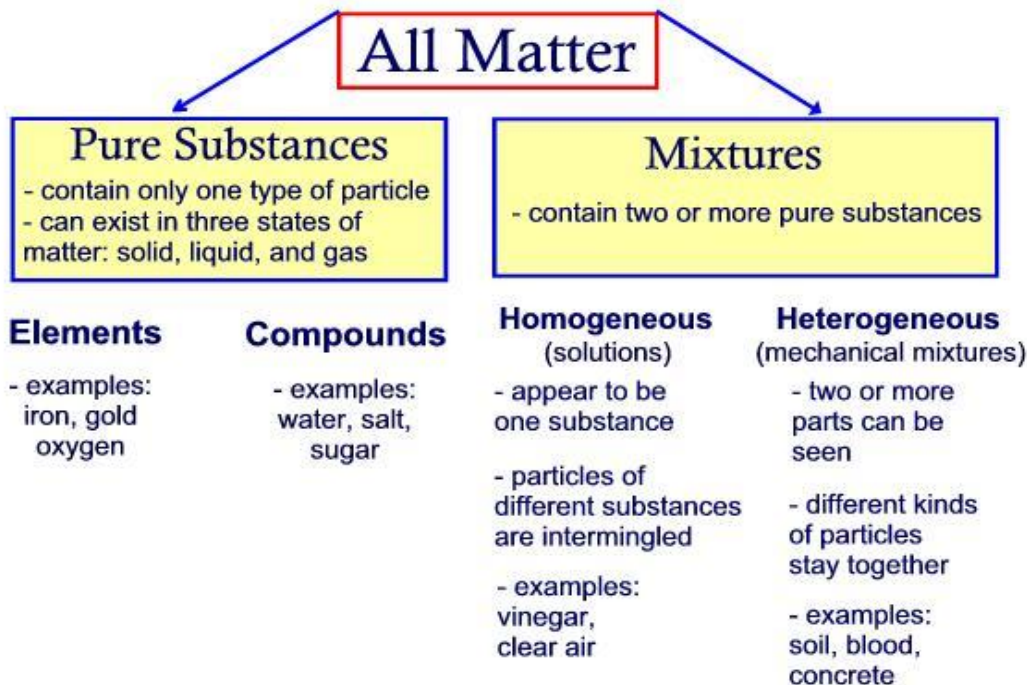
The **Particle Model of Matter** is a scientific model which helps to visualize a process we cannot see directly. The first two points help us to understand that particles make up matter. The other three points help to explain density and how matter behaves when temperature changes.

Matter exists in three states: **solid, liquid, or gas.**

The Particle Model of Matter is useful in explaining the differences among solids, liquids, and gases. Illustrations such as these help to clarify the particle theory.

		
<p>Solids have a definite shape and volume because the particles of a solid can move only a little. They vibrate back and forth, but strong forces hold them in fixed positions.</p>	<p>Liquids take the shape of its container because the particles can move around more freely than they can in solids. A liquid's particles are held together by strong attractions to each other, so a liquid, like a solid, occupies a definite volume.</p>	<p>Gases always fill whatever container they are in. The attractions among the particles of a gas are so weak that individual particles are quite far apart, with spaces among them. Since gas particles are moving constantly and randomly in all directions, they spread throughout their container, no matter what its shape and volume.</p>

Classification of Matter



A pure substance is made up of only one kind of matter and has its own unique set of physical properties.

Types of Pure Substances

- **element**
 - cannot be broken down into any simpler substance
- **compound**
 - is a combination of two or more elements in fixed proportions

A mixture is a combination of 2 or more pure substances

Types of Mixtures

- **mechanical (heterogeneous)**
 - each substance in the mixture is visible
- **solution (homogeneous)**
 - each substance is not clearly visible
 (A substance dissolved in water is called an **aqueous solution**)
- **suspension**
 - is a cloudy mixture in which tiny particles are held (suspended) with another substance, and can be filtered out
- **colloid (emulsions)**
 - is also a cloudy mixture, but the particles are so small that they cannot be filtered out easily (emulsions are types of colloids in which liquids are dispersed in liquids)

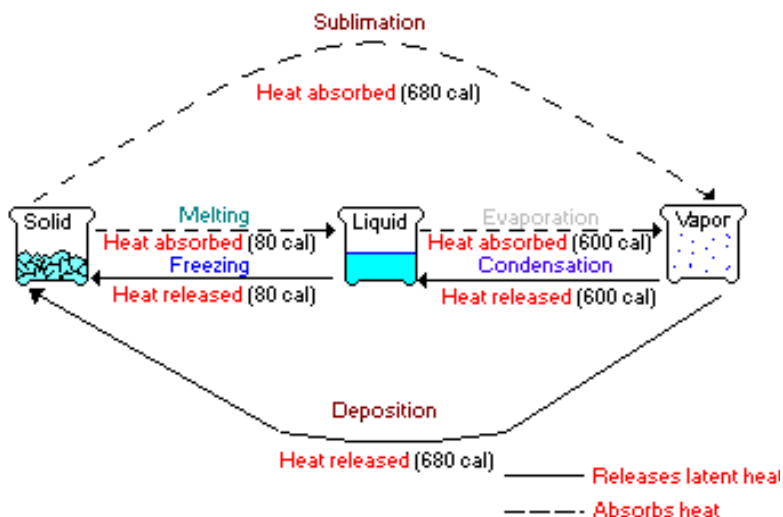
Whether a mixture is a solution, colloid or suspension depends on the size of the particles, solubility and mixing ability (miscibility)

Changes In Matter

Matter can change from one form to another, or create new materials.

Every kind of matter has its own distinguishing characteristic properties that can be used to identify the kind of matter it is. **Properties** are characteristics that can be used to describe how a substance behaves substance. These properties can be physical or chemical. Changes that matter can undergo fall into two classification categories: physical change and chemical change.

A **physical change** occurs when a material changes form but not composition. A change of state is an example of a physical change where energy is used or released.



No new substances are formed. The change is not permanent. Dissolving is also a physical change.

A **chemical change** occurs when two or more substances react and create one or more new substances. It is often permanent, although not always. Combustion is an example.

Can You Ever Be Sure About Changes?

It is often difficult to decide if a change is physical or chemical, so certain clues will help you decide if a chemical change has occurred.

- Change in colour
- Change in odour
- Formation of a gas (bubbles) in a liquid
- Formation of a solid (precipitate) in a liquid
- Release or absorption of energy (heat)
- Materials you started with are used up
- A new material is formed
- The change is difficult to reverse

The only evidence that will guarantee a chemical change has occurred is that a new substance has been formed.

Properties: Chemical or Physical?

Any property that can be observed without forming a new substance is a physical property. These can include: color, texture, luster, smell, state, melting point, boiling point, hardness, malleability, ductility, crystal shape, viscosity, solubility, density and conductivity (electrical and heat).

Any property that describes how a substance reacts with another substance when forming a new substance is a chemical property. Chemical properties include: reaction with acids, ability to burn (combustibility), reaction with water, behaviour in air and reaction to heat, toxicity, stability.