

Chemistry Lecture #10: Properties of Matter

Matter: anything that has mass and takes up space.

Properties of matter: Examples include mass, volume, color, flammability, and resistance to rusting.

Properties of matter fall into two categories: physical and chemical.

Physical property: A property that can be observed without changing the sample's composition.

Examples of physical property include mass, volume, length, color, melting and boiling point, density and state of matter (solid, liquid, or gas).

Physical properties fall into two categories: extensive and intensive.

Extensive property: Property that depends on the amount of matter present.

For example, if I keep adding water to a bucket, the mass of water increases. Mass is an extensive physical property of matter. The more matter you have, the greater the mass.

Other examples of extensive properties include volume and length.

Intensive property: Property that does not depend on the amount of matter present.

For example, suppose I have a glass of water that's half-filled. I then add more water until the glass is completely filled. Does the color of the water change? No, the color remains the same. The color does not depend on the amount of water. Thus, color is an intensive property.

Other examples of intensive properties include hardness, boiling point, melting point, density, and malleability.

Malleability is the ability of a metal to be hammered into thin sheets. This is why we have things like aluminum and tin foil. Coins are made of metal, and their malleable properties allow them to be squished into flatter, souvenir trinkets in the gift shops of museums and other tourist attractions.

Notice that for all the types of physical properties mentioned, the substance stays the same. The substance does not have to change into a new substance to observe the mass, volume, boiling point, etc. This is in contrast to a chemical property.

Chemical Property: The ability or inability of a substance to combine with or change into another substance. Most of the time, the substance has to change into a new material to observe the chemical property.

Examples of chemical properties include flammability, ability to rust, and whether something will dissolve in acid. When all of these properties are observed, a new substance is formed.

Additional Physical Properties: States of Matter

Matter can exist in 3 physical states: solid, liquid and gas.

Solid: A form of matter that has a definite shape and volume. The particles that make up a solid are packed very close together.

Liquid: A form of matter that can flow from one location to another. When placed in a container, it takes the shape of the container. The volume is constant and does not change-you cannot compress a liquid and reduce its volume. Particles in a liquid are close together but are far enough apart to slide past each other.

Gas: Like a liquid, it is a form of matter that can flow from one location to another. It also takes the shape of the container it occupies, but unlike a liquid it expands and fills the entire volume of the container. Thus, the volume of a gas can change (it expands to the volume of the container it is in).

The particles that make up a gas are far apart and moving very fast.