# Chapter 12 – Lesson 1 – Matter: Properties and Changes

##  What is matter?

Matter is anything that has mass and takes up space.

**States of Matter**

One property of matter is describing the states of matter. They are solids, liquids, and gases.

You can determine a materials state by asking two questions:

* Does it have a definite shape?
* Does it have a definite volume? (***volume*** = amount of space an object takes up)

**Solids, Liquids, and Gases**

***Solid*** is a state of matter with a definite shape and volume.

***Liquid*** is a state of matter with a definite volume and no definite shape.

***Gas*** is a state of matter without a definite shape or volume.

**Moving Particles**

All matter is made of tiny particles that are constantly moving. The particles move differently in each state of matter.

***Solid*** – particles are packed closely together and cannot move, they vibrate in place.

***Liquids*** – particles are free to move or slide past one another, but still close together.

***Gas*** – particles move freely and are further apart.

**Attraction between Particles**

Particles of matter that are close together exert an attractive force (or pull) on each other. ***The strength of the attraction depends on the distance between particles.***

A solid’s particles are close together so they have a strong attraction between them. A liquids particles are further apart so the attraction is weaker which allows them to flow.

A gas’s particles are spread apart, so that they are not held together by attractive forces.

**What are physical properties?**

**Mass and Weight**

* ***Mass*** is the amount of matter in an object.
* ***Weight*** measure the amount of gravitational pull on an object.

*Weight depends on the location of an object, mass does not.*

*Ex: A golf ball on the moon would weigh less (less gravitational force acting on it) but the mass would not change (still made up of the same amount of particles).*

**Volume**

Another physical property is volume. ***Volume*** measures the amount of space an object takes up.

Volume can be found for liquids using a graduated cylinder – measure using the unit milliliter (mL)

 Volume of irregular shaped object can be found using the displacement method.

**Density**

Density is a physical property of matter that does not depend on the size of the sample.

***Density*** measure how much mass in in a given volume.

Density is useful for identifying unknown substances because it is constant for a given substance.

Ex: If you find a shiny, metallic gold covered rock in the woods you may think it is gold! You calculate the density and find it has a density of 5 g/cm3. The rock cannot be gold because gold will always have a density of 19.3 g/cm3.

A sample of pure gold, not matter how big or small, will always have a density of 19.3 g/cm3.

**Solubility**

***Solubility*** is a physical property of matter that measures the ability of a material to dissolve in another.

**Melting and Boiling Points**

These are also physical properties of matter.

***Melting point*** – temperature at which a solid changes to a liquid.

***Boiling point*** – temperature at which a liquid changes to a gas.

Different materials have different boiling and melting points. The temperatures do not depend on the amount of the material.

Ex: Water will boil at 100 C, whether you have a pot full of water or a giant bucket full of water.

**Additional Physical Properties**

Other physical properties include magnetisms, malleability, and electrical conductivity.

**What are Chemical Properties?**

***Chemical property*** is the ability or inability of a substance to combine with or change into one or more substances.

You observe a chemical property as it reacts with or changes into a new substance.

Ex: A chemical property of copper is that it reacts with oxygen in the air to produce rust.

Another chemical property is flammability.

**Flammability**

***Flammability*** is the ability of a type of matter to burn easily.

Ex – wood is flammable, rocks and sand are not flammable. Oxygen and hydrogen gases are very flammable.

**Ability to Rust**

The ability to rust is a chemical property. Rust form when iron (Fe) reacts with water (H2O) and oxygen (O2) in the air to produce rust.

**Identifying Matter Using Physical Properties**

Physical properties are helpful for describing matter but are also helpful in identifying unknown matter.



Notice the table above - we can use the information to help us identify the unknown substance.

 We cannot use the physical property color (they are all white). You also cannot use mass because mass changes with the amount of a substance we have.

Melting Point and density however; are properties that do not depend on the size or the amount. Notice the melting point (801 C) and Density 2.17 g/cm3) of table salt match those of the unknown substance – we can assume the substance is table salt.

It is important when using physical properties to identify an unknown substance that they do not change for a sample size.

**Sorting Materials using Properties**

Both physical and chemical properties are useful for sorting materials.

Color and shape are one way you could sort materials

Ex: Beads are sorted by color and shape – physical properties.

Food is often sorted by its ability to rot – chemical property.

We put crackers and canned good in a cupboard. Milk and Yogurt a put into a refrigerator because of their chemical property to rot (decompose).

**Separating Mixtures Using Physical Properties**

Physical properties such as state of matter, boiling point, and magnetism are helpful in separating mixtures.

Ex: If you boil a mixture of salt and water, the liquid water changes to a gas when it reaches it boiling point and the salt is left behind.

You can separate iron fillings (which have the physical property of magnetism) from sand using a magnet.

