

# Physical and Chemical Properties



A **physical property** is a characteristic of a material that can be observed or measured without changing the composition of the material.

### Examples

- Viscosity
- Conductivity
- Malleability
- Hardness
- Melting and Boiling point
- Density

# Viscosity

- The resistance to flow. The thicker a liquid, the higher the viscosity (the slower a liquid moves).



What has higher viscosity, water or honey?

- Viscosity usually decreases when a liquid is heated.



What is more viscous, oil in a hot wok or oil in a cold wok?

# Conductivity

- The ability to allow heat to flow.
- Metals are good conductors; they have a high conductivity. (they also conduct electricity well)
- Wood is a poor conductor.



Which spoon would you use to stir boiling water and pasta?

# Malleability

- The ability of a solid to be hammered without shattering.
- Most metals are malleable. Solids that shatter when struck are called brittle.



What is more malleable, gold or glass?

# Hardness

- Hardness is the ability to scratch a material. Hard materials can scratch other softer materials.
- Many grinding wheels contain diamond particles because diamond is a very hard material.



In order to sharpen this hunting knife, how hard must the grinding stone be?

# Melting and Boiling Points

- **Melting point** - the temperature at which a substance turns from a solid to a liquid.
- **Boiling point** - the temperature at which a substance turns from a liquid to a gas.

# Density

- The ratio of mass of a substance to its volume ( $D = M/V$ )
- Density can be used to test the **purity** of a substance. (remember the King and his crown story)



The coin on the left is pure silver. The coin on the right is fake. How could you prove that?

# What can you do with the knowledge about a material's physical properties?

1. They help to identify a material by comparing the results to known materials.

(Ex.- finding red paint chips at a crime scene and comparing them to a data base of known car paint)

2. They help you to choose one type of material over another to perform a task.

(Ex.- you would not want to construct a shelter out of cellulose packing peanuts)

3. They can help to separate mixtures by:

### Filtration

The process that separates materials based on the size of the particles.

(Ex.- drip method to brewing coffee separates liquid from coffee grounds)

### Distillation

The process that separates substances in a solution based on their boiling points.

(Ex.- Boiling seawater to evaporate and collect the fresh water for drinking. Sea salts are left behind)

# How do you recognize physical changes?

- When some of the properties of the material change but the substances in the material remain the same.

## Examples

Melting butter  
Crumpling paper

Slicing a tomato  
Cutting hair

- Some physical changes can be undone, some cannot.



# Chemical Properties



# What is a chemical property?

- The ability to produce a change in the composition of matter.
- They can be observed only when one substance in a sample of matter is changed into another substance.

Ex.-whenever something is burned, that substance becomes something completely different. The ability to burn is a chemical property.

# Flammability

- The ability to burn in the presence of oxygen.



# Reactivity

- How easily a substance combines chemically with another substance.



Oxygen easily reacts with many other elements. What other element is oxygen reacting with in this photo?

# How Can You Recognize Chemical Changes?

- **A change in color** - Ex. The green patina on an old copper roof.
- **Production of a Gas** - Ex. Using baking powder and water in a cake mix.  $\text{CO}_2$  is produced which helps the cake rise.
- **Formation of a Precipitate** - (any solid that forms and separates from a liquid). Ex. Adding vinegar to milk causes the proteins to clump together.

(**The Law of Conservation of Mass** states that even though chemical changes occur, matter is neither created or destroyed in the process)



Fruis Lappia



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A



Fisk Saunders/foodpict.com/ Images, Inc.

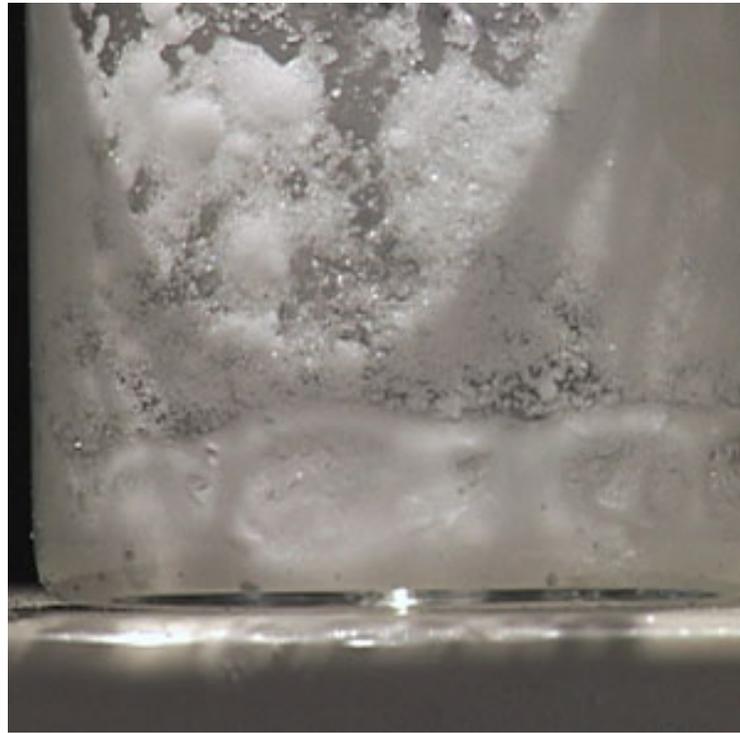
B

Is a change in color always an indicator of a chemical change?



Phil Degginger/Color Pro, Inc.

Is the formation of a gas always  
an indicator of a chemical  
change?



# Physical v. Chemical Changes

- Before you decide whether a chemical change has actually taken place, ask yourself this question: **Are different substances present after the change takes place?** If not, it is a physical change (the composition of the matter stays the same).