

The Properties of Matter

PHYSICAL PROPERTIES VS. CHEMICAL PROPERTIES

Physical Property:

- A property of a substance that can be observed or measured **without changing** the chemical identity of the substance.

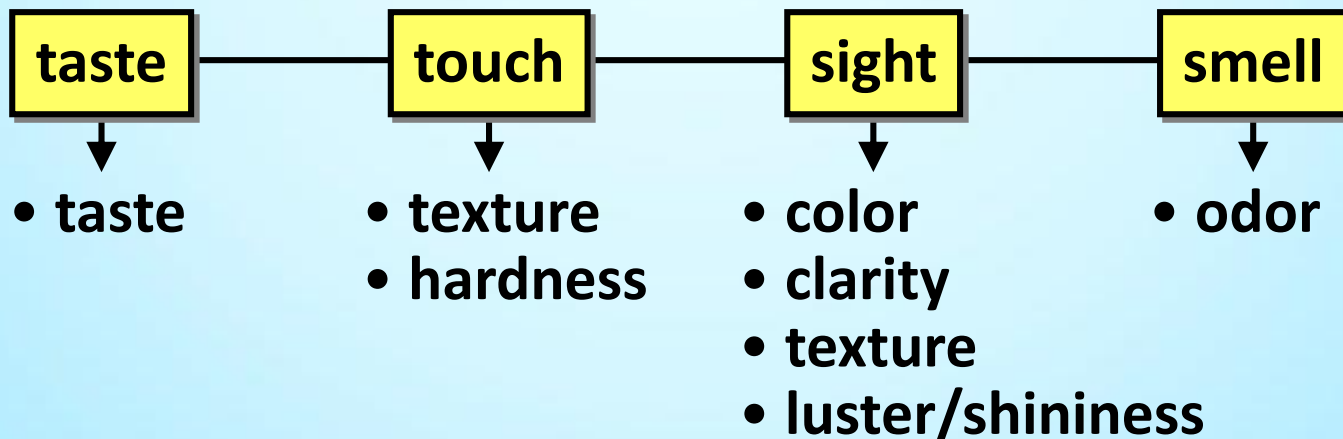
e.g. color, state of matter

Chemical Property:

- A property of a substance that describes **how it reacts** to other substances and **changes its chemical identity** as a result.

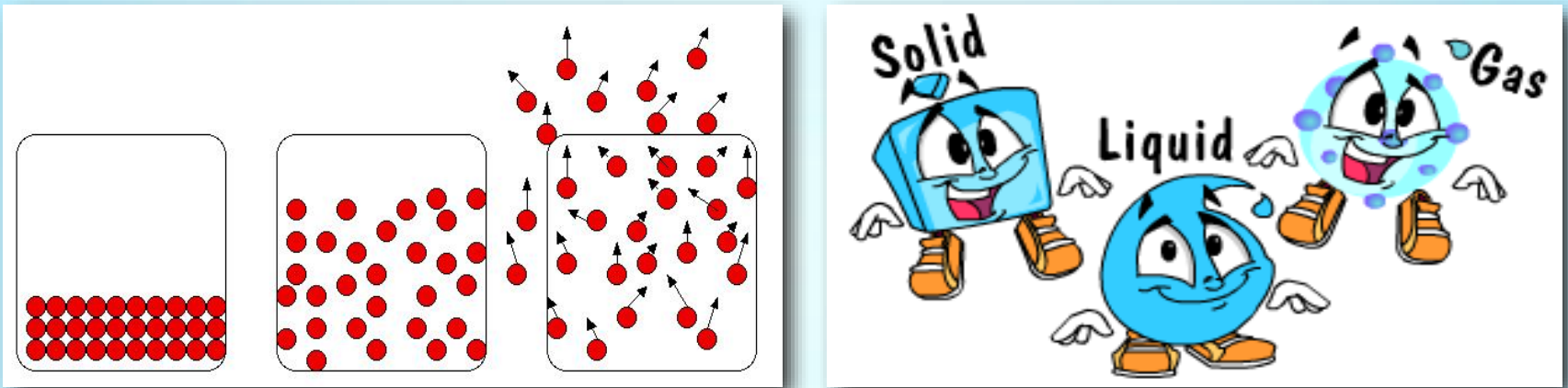
e.g. combustibility

Which properties can you detect with only your senses?



PHYSICAL PROPERTIES

State of Matter: The property of a substance that determines whether or not it is a liquid , solid or gas.



There are three states of matter. Water in a lake is found in the liquid state, water in your ice cube tray is found in the solid state, and water in steam is found in the gas state.

PHYSICAL PROPERTIES

Taste: The property of a substance that describes how it affects the taste receptors otherwise known as taste buds.



Sugar tastes sweet and lemons taste sour. Nothing in a chemistry lab should ever be tasted. Even if one of the ingredients is a common food item, once it is used for a lab, it is considered potentially contaminated.

PHYSICAL PROPERTIES

Odor: The property of a substance that describes how it affects the olfactory (smell) receptors .



Old dirty gym socks smell bad and roses smell good . Never smell anything in a chemistry lab unless instructed to do so. If smelling a substance, the hand-waving method should be used to sniff it.

PHYSICAL PROPERTIES

Color: The property of a substance that describes how it affects the light sensing receptors in your eyes / retina when that substance reflects different wavelengths of light.



A fire truck is red but the sky on a sunny day is blue. The leaves on the trees in the summer are green, but the color of the sun is yellow. The color of an orange is orange !

PHYSICAL PROPERTIES

Luster: The property of a substance that describes how shiny or lustrous it is.



A piece of paper is dull because it does not reflect much light, but the chrome on a car is lustrous / shiny because it reflects a lot of light. Another dull thing is an eraser and another shiny thing is a spoon.

PHYSICAL PROPERTIES

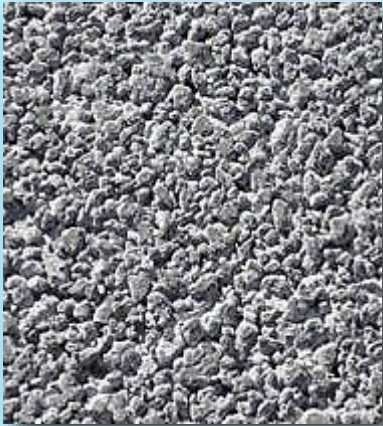
Clarity: The property of a substance that describes how much **light** can pass through it.



A piece of glass is **transparent** , meaning that it lets all the light pass through it, maple syrup is **translucent** because it lets some light through it, and mud is **opaque** because it lets no light pass through it.

PHYSICAL PROPERTIES

Texture: The property of a substance that describes how the surface of a substance feels.



The surface of a bowl feels smooth but the surface of the cement sidewalk feels rough. The fur of a cat feels soft/fluffy. The surface of an eraser feels rough/tacky.

PHYSICAL PROPERTIES

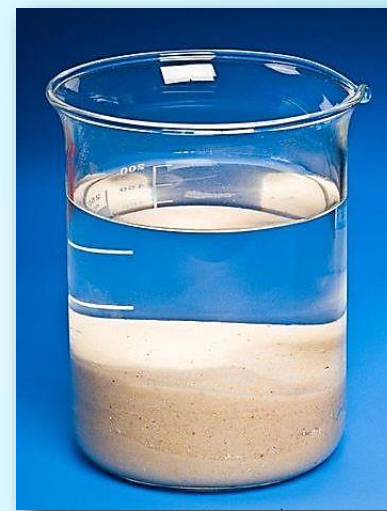
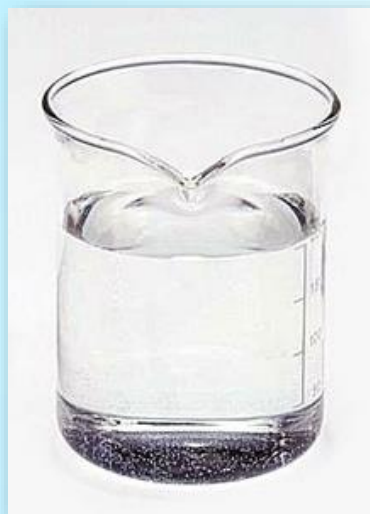
Hardness: The property of a substance that describes how difficult it is to scratch its surface.



On Mohs hardness scale of minerals, a diamond is the hardest known substance on Earth with a hardness level of 10. An emerald is also hard but it has a hardness level of 7.5.

PHYSICAL PROPERTIES

Solubility: The property of a substance that describes how easily it **dissolves** when mixed with another substance.



Water and vinegar mix together completely and therefore, vinegar is **soluble** in water. Salt is also **soluble** in water because it will dissolve completely in water. Neither oil nor sand will dissolve in water, and that is why they are considered **insoluble** in water.

PHYSICAL PROPERTIES

Viscosity: The property of a substance that describes how easily it can pour or how thick it is.



Water is less viscous than oil, and that is why it pours out of its container more easily than oil does. Ketchup is more viscous than oil, and that is why it's harder for it to pour out of its container.

PHYSICAL PROPERTIES

Malleability:

The property of a substance that describes its ability be bent or hammered into a thin sheet without breaking.



Aluminum is very malleable and that is why we use it to make foil to wrap our food. Other substances, like glass, are not malleable because it would break instead of change shape. Wood is not malleable, while copper is malleable.

PHYSICAL PROPERTIES

Ductility: The property of a substance that describes its ability to be drawn into a **thin wire** without **breaking** .

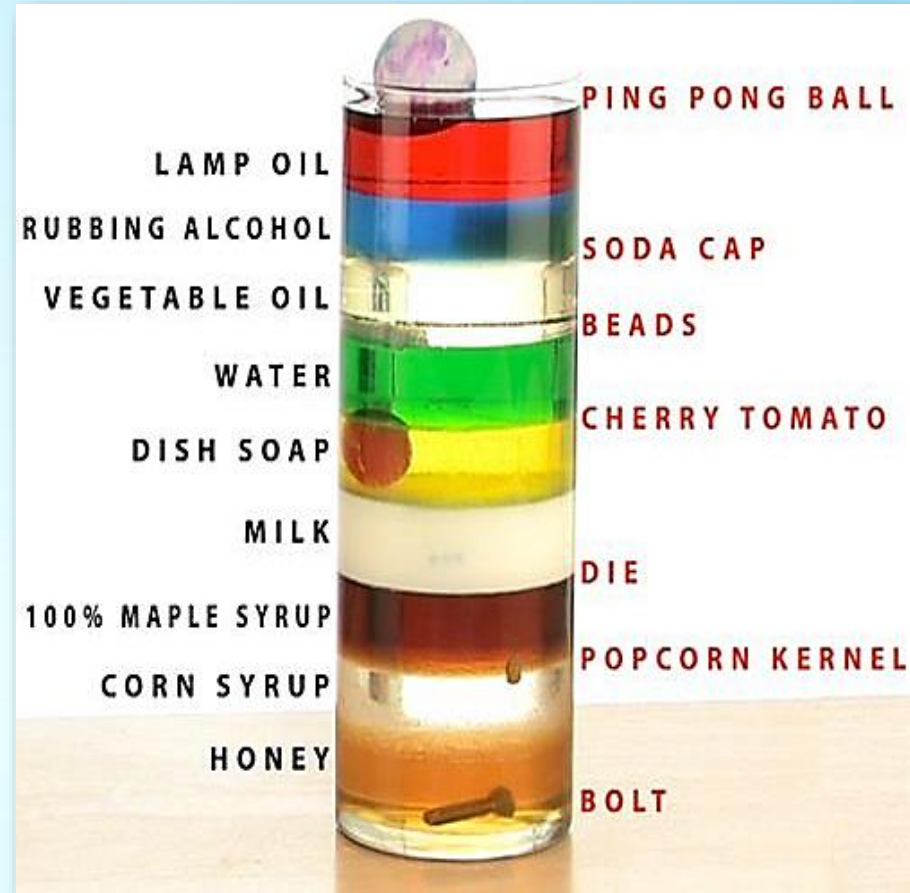


Many metals like **copper** and **gold** can easily be drawn into a thin wire. Substances like water and cement are not **ductile** .

PHYSICAL PROPERTIES

Density:

The property of a substance that describes how much **mass** of a substance is contained in a given **volume** of space of that substance.

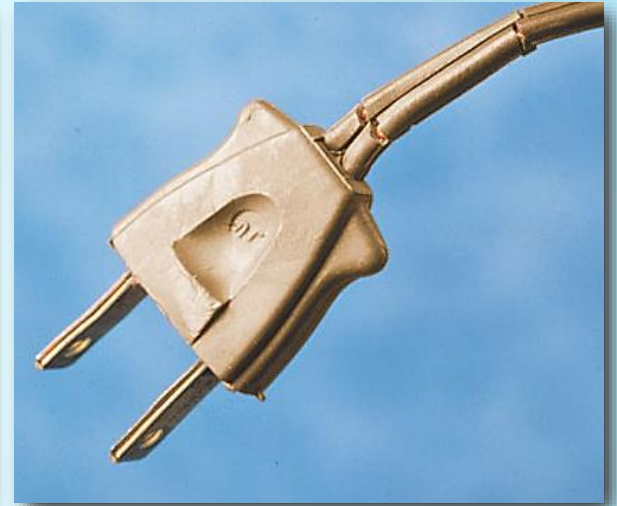
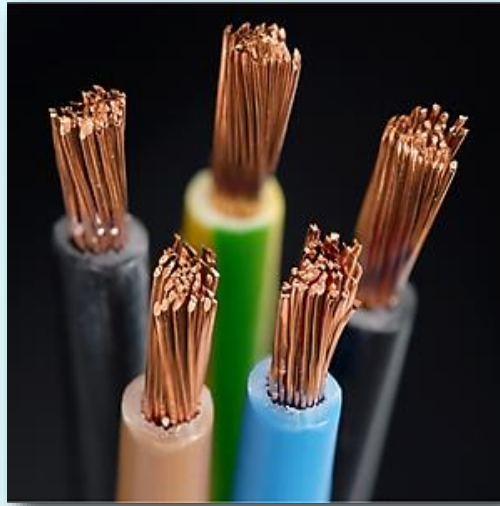
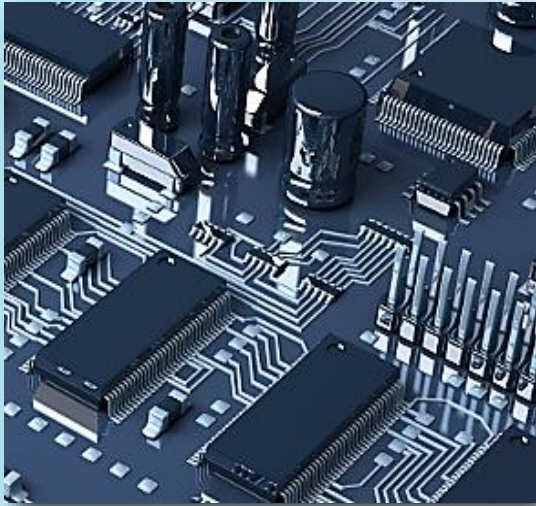


Rubber is **less** dense than water and that is why it will float on water. A penny is **more** dense than water and that is why it will sink to the bottom of the water. Water in its **solid** state is less dense than water in its **liquid** state. That is why ice floats on water.

PHYSICAL PROPERTIES

Electrical Conductivity:

The property of a substance that is a measure of its ability to conduct an electrical current.



Copper is a good electrical conductor, and that is why it is used as the main material for the wiring found in most homes and electronics. Plastic is not a good conductor of electricity and that is why it is used to insulate electrical wires.

PHYSICAL PROPERTIES

Melting Point:

The property of a substance that is the temperature at which it transforms from the solid state into the liquid state.



Boiling Point:

The property of a substance that is the temperature at which it transforms from the liquid state into the gas state.

The melting point of water is 0 °C and the boiling point of water is 100 °C. The melting point of gold is 1063 °C and the boiling point of gold is 2856 °C.



PHYSICAL PROPERTIES

Crystal Form: The property of a substance that describes the geometrical shapes that it takes when it forms crystals in its solid state.



If you look with a high powered microscope, you can observe that sugar crystals are oblong and slanted at the sides, but the crystal form of salt is shaped more like a cube.

PHYSICAL PROPERTIES

Magnetism: The property of a substance that describes if it is attracted to a magnetic field.



Some substances like steel are attracted to a magnet and therefore are considered magnetic. Substances like glass are not attracted to magnets and are called non-magnetic.

SOME CHEMICAL PROPERTIES OF MATTER

RECALL: A CHEMICAL PROPERTY of a substance describes how it reacts to other substances and how it changes its chemical identity as a result.

CHEMICAL PROPERTIES

Combustibility:

The property of a substance that describes whether or not it will catch on fire in the presence of oxygen and heat.



Glass is not combustible. Dry wood is more combustible than wet wood. Fossil fuels like coal, natural gas, and gasoline are all combustible.

CHEMICAL PROPERTIES

Reactivity with Water:

The property of a substance that describes whether or not it is reactive with water.

sodium



water

Some substances like sodium are very reactive with water, and so they have to be stored in a water-free environment. Even the water vapor in the air can cause a reaction, so these substances must be stored under mineral oil.