

## Physical and Chemical Properties of Matter

**Physical Property** - a characteristic or description of a substance used to identify it

they can be observed without change to the physical make-up of the matter (it remains the **same substance**)

**Chemical Property** - describes behaviours when the substance interacts with other substances and becomes a **new substance**.

## Physical Properties of Matter

1. Colour - light reflected to our eyes.  
e.g. green, blue, white, black, etc...

2. Texture - what does it feel like?  
e.g. smooth, rigid, rough, sharp, soft

3. Odour - what does it smell like?  
stinky, smelly, flowery

4. Lustre - how shiny is it?  
shiny, dull

5. Clarity - how easily can we see through it  
clear, transparent, translucent, opaque, cloudy

6. Taste - This is NOT a good choice in most chemistry labs!  
salty, sweet, sour, bitter



Note: The above physical properties we can obtain directly with our senses.

(smell, sight, touch, taste, hearing)

7. State - solid, liquid, gas

← very high temp.  
- plasma, Bose-Einstein condensate

← very low temp.



	Definite Shape (Yes or No)	Definite Volume (Yes or No)
Solid	yes	yes
Liquid	no	yes
Gas	no	no

Note: There are two other states of matter - plasma and Bose-Einstein Condensate (BEC) - that we don't see in the lab (or much at all on Earth).

**Plasma** is not common on earth, but may be the most common state in the universe. It involves highly charged particles at very high temperatures (like inside stars)

**BECs** occur at extremely LOW temperatures (near absolute zero), where the atoms don't move much and almost no energy is being transferred between atoms.

## 8. Hardness -



1 TALC		6 FELDSPAR	
2 GYPSUM		7 QUARTZ	
3 CALCITE		8 TOPAZ	
4 FLUORITE		9 CORUNDUM	
5 APATITE		10 DIAMOND	

9. Malleability - how easily a substance deforms under shear force (pushing)  
malleable vs. brittle



10. Ductility - ability to stretch under strain (pulling force)



11. Melting and Boiling Points - the temperatures at which a substance changes states (melts, boils)



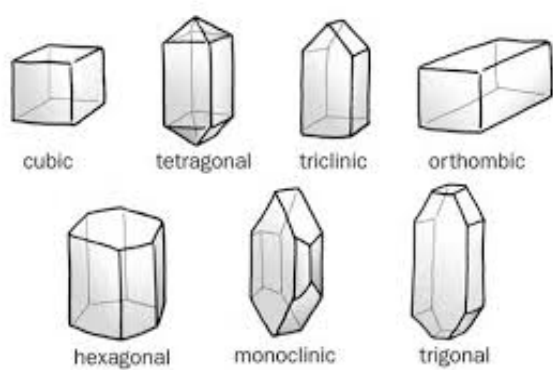
Water Boiling Point

$100^{\circ}\text{C}$  (at sea level)

Water Melting Point

$0^{\circ}\text{C}$  (at sea level)

## 12. Crystal Form



Microcline (Triclinic)



Rock Salt (Cubic)



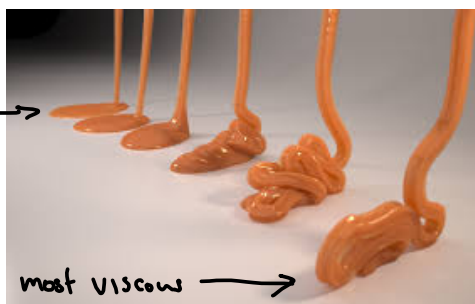


13. Solubility - the ability of a substance to dissolve in another substance  
(solute) (solvent)

2 common solvents: water  
alcohol

14. Viscosity - how thick or runny  
something is  
"viscous"

least  
viscous →



most viscous →

## 15. Density -

$$D = \frac{M}{V}$$

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

increasing  
density  
↓

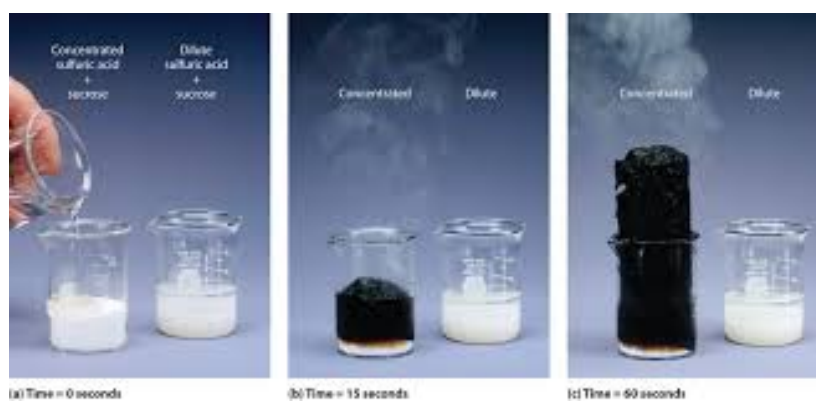



## Chemical Properties

1. Combustibility/Flammability - the reaction of a substance with oxygen and heat.



## 2. Reaction with Acid -



 [https://youtu.be/pgTRZjd\\_HSg](https://youtu.be/pgTRZjd_HSg)

Note: There are many other Physical and Chemical properties of matter - these are just the common physical properties and a couple of chemical properties.

## Exercise: Physical vs. Chemical Properties

1. What property is described by each of the following statements?

- a) Copper metal can be bent into different shapes. - malleability
- b) A steel blade can scratch glass. - hardness
- c) Alcohol boils at 60°C. - boiling point
- d) Under a magnifying glass, sugar appears to be made of tiny cubes. - crystal form
- e) A nickel coin is shiny. lustre