CHEMISTRY 11

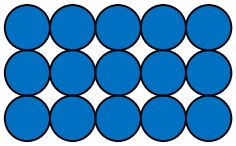
UNIT #3 - ELEMENTS, COMPOUNDS & MIXTURES

SECTION #1: THE CLASSIFICATION OF MATTER (continued)

The Phases Of Matter

Solids

Solids are rigid. They do not easily change their shape or volume. Even if you heat them up, there is little expansion. One can explain these properties by looking at how the molecules arrange themselves within a solid.



Here the molecules are close together. They are touching each other. A solid has a constant volume, because these molecules stay in touch. They **cannot** spread apart, so they cannot occupy a larger space.

The molecules are frozen into position. Inside a solid there is almost no molecular movement. The molecules are in rigid positions. If the molecules cannot move, then a solid cannot change its shape.

However if enough force is used, you can cause **some** solids to change shape. In fact there are two terms that are used to describe this. They are commonly applied to metals.

Malleability - The ability to bend a solid, or pound it into thinner sheets. Copper is a very malleable metal, so it is easy for metal workers to pound it into new shapes.

Ductility - The ability to draw (stretch) a solid into thin wires. Copper is a very ductile metal. That is one reason why it is commonly used to make electrical wires.

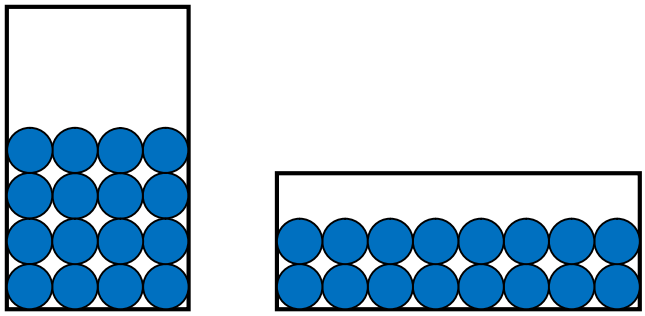
Liquids

Liquids are ***fluid.*** In other words they can readily change shape. Change the container and the liquid will change its shape, in order to fit the container.

However liquids are like solids in one respect - they have constant volumes. Adding heat will cause very little expansion.

A sample of water that occupies 100 mL in a cylinder, will still occupy 100 mL if you pour it into a beaker. The change in shape does not change the volume.

Again the properties of the phase can be explained by looking at its molecules.



Tall thin container Short wide container

The shape of the container can change, but the liquid will still occupy the same volume. The molecules can freely flow. This allows a liquid to fit the shape of any container.

In a liquid, the molecules are close together. They stay in touch. As a result they do not spread out. This keeps the liquid's volume constant.

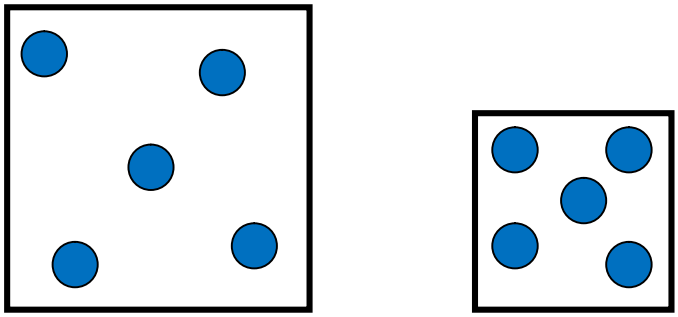
Unlike solids, the liquid's molecules do have some ability to move. They can flow past each other. This allows the liquid to fit different containers. The molecules will move around until the liquid fills the shape of the container.

Not all liquids are the same. Some flow more readily than others. It is easy to pour water out of a bottle. However pouring syrup is a much slower process.

Viscosity - The resistance of a fluid to flow. Water has a low viscosity, while the viscosity of syrup is high. It would be a lot harder to swim across a lake of syrup, than a lake of water.

Gases

Gases do not have constant volumes or constant shapes. A gas will simply take the shape and volume of its container.



Large container Small container

The gas molecules spread out in order to fill the available space. Thus the larger the container, the larger the gas volume.

Gas molecules tend to spread themselves out evenly. Usually there is lots of space between any two molecules.

Gas molecules are free to move in any direction. They often move at high speed.

Most of the time gas molecules do not touch each other. Usually there is a lot of space between neighbouring molecules.

Since there is lots of empty space between the molecules, it is easy to **compress** a gas. A gas can be squeezed into a much smaller container.

Molecules in liquids and solids are already close together. Therefore very little compression can be done on these phases.

It would be impossible to take 900 mL of liquid water and squeeze it into an 800 mL bottle.