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Subject: Basic Science

Topic: Changes in State of Matter

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What are changes of states?

A change of state of is a physical change in a matter. They are reversible changes and do not involve any changes in the chemical makeup of the matter. Common changes of the state include melting, freezing, sublimation, deposition, condensation, and vaporization.

Evaporation

Condensation

In a gas, molecules move about at great speed. Their attraction to one another is very weak

Gas

sublimationn

Freezing

Solid

Melting

In a liquid, molecules are attracted to one another. They are densely packed but can still move about.

Liquid

In a solid, the particles are attracted even more strongly. They vibrate about their fixed positions

Why do phase change occur?

When temperature or pressure change of a system occurs, phase change occurs. When the temperature or pressure increases, the interaction between the molecules increases. Similarly, when the temperature decreases, it is easier for molecules and atoms to settle into a more rigid structure.

Changes between liquids and solids

How would you make ice cubes from a tray? First you would fill the tray with water from a tap, then you would place the tray in the freezer compartment of a refrigerator. The freezer is very cold. What happens next?

**Freezing**

Heat transfer occurs between the warmer tray and the colder air in the freezer. The warm water loses heat to the cold air in the freezer. This heat transfer occurs until no energy is available for the particles collide past each other. This forces them to remain in fixed position locked in place by the force of attraction between them. This way liquid water is changed into solid ice.

**Melting**

If you took out the ice cubes from the freezer and place them in a warm room, the ice would absorb energy from the warmer air around them. This absorbed energy would facilitate them to overcome the force of attraction holding them together enabling them to slip out of the fixed position that they as ice. The process in which a solid change to liquid is called melting.

Changes between liquid and gases

If you fill a pot with cold water and heat it on a hot stove, the water heats up. Heat energy travels from the stove top to the pot, and the water absorbs the energy from the pot.

**Vaporization**

If the water is hot enough, it starts to boil. Bubbles of water vapor are formed in the boiling water. This happens as particles of liquid water gain enough energy to completely overcome the force of attraction between them and change to the gaseous state. The bubbles rise through the water and escape from the pot as steam. The process in which a liquid boils and changes to gas is called vaporization. The temperature at which a liquid boils is its boiling point.

Changes between solids and gases

Solids that change to gas pass through the liquid state first. However, sometimes solids change directly to gases and skip the liquid state. The reverse can also occur, sometimes gases change directly to solids.

**Sublimation**

The process in which solids directly change to gases is known as sublimation. This occurs when solids absorb enough energy to completely overcome the forces of attraction between them. Dry ice is an example of solids that undergo sublimation.

**Evaporation**

Particles in a liquid are attracted by neighboring particles equally in all directions. Particles at the surface of the liquid body, however are attracted only inwards and sideways by the neighboring particles.

Evaporation of a liquid occurs at all temperatures, but the rate of evaporation increases with increase in temperature. This is because the average kinetic energy of a liquid is greater at a higher temperature.

**Vapor Pressure**

When a liquid evaporates in a closed container the escaped particles will gradually accumulate in the space above the liquid. At the same time some vapor molecules hit the liquid surface and re-enter the liquid i.e. condense.

Condensation increases as the vapor pressure rises i.e. as more liquid particles evaporate. Thus, two opposing force are occurring in this system.