Changes in State

Three other physical properties of matter are melting point, boiling point, and freezing point. The **melting point** of a substance is the temperature at which the substance melts. The **boiling point** is the temperature at which the substance boils, and the **freezing point** is the temperature at which the substance freezes. Most matter can change state, from solid to liquid to gas and back again, if there is a change in heat. This change in state is a physical change.

A Popsicle has the same matter whether it is frozen or melted, but a frozen Popsicle (a solid) has particles that vibrate in place. A melted Popsicle (a liquid) has particles that move with more energy and thus use more heat. If a frozen Popsicle is placed in a pan and heated, it will turn to liquid that will, with enough heat, turn to gas. It will look as though the Popsicle has disappeared.

Evaporation occurs when a liquid turns to gas at a temperature below the boiling point. (Notice that "evaporation" has the word "vapor" in it.) Evaporation involves an increase in heat, but not to a boiling point. If a wet bathing suit is left in the sun to dry, the liquid water evaporates without boiling. The liquid water absorbs the heat, which causes the water molecules to move faster as well as farther away from one another until the particles escape from the liquid.

Condensation is the reverse process. **Condensation** occurs when energy is removed and gas turns to liquid or liquid turns to solid. With less energy (heat), the particles slow down and move closer together. If warm weather cools, then rain (liquid) can turn into snow or sleet (solids) through the condensation it experiences in the atmosphere. Steam from a hot bath can condense on your skin to become droplets of water.

Sublimation occurs when a solid changes into a gas without first turning into a liquid. The liquid state is skipped. Sublimation can happen in a freezer when water, in the form of gas, sublimes from ice cubes or uncovered food. The gaseous water condenses on the walls of the freezer to form frost.

Exercise

1. What happens when a liquid freezes? _____

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2. What happens to a liquid exposed to heat below the boiling point? _____

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3. How can a gas become a liquid? _____
4. How can a liquid become a solid? _____
5. What is sublimation? _____

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6. How are condensation and evaporation alike? How are they different? _____

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