

PHYSICS
FORM 5
KINETIC THEORY OF HEAT

The Caloric Theory

It was first thought that heat was a weightless fluid called caloric. A hot object contained a large quantity of caloric while a cold object contained very little of no caloric. Heat was transferred from one place to another via the movement of caloric.

The Kinetic Theory

In 1798 Benjamin Thompson also known as Count Rumford proposed the kinetic theory of heat. His experiment was called the Cannon Boring Experiment. In drilling the hole within the cannon, Count Rumford made the following observations:

1. The procedure produced a lot of heat energy.
2. The longer the drilling occurred the greater the amount of heat produced.
3. When the cannon boring was done in water, enough heat was produced to convert water into steam.
4. The tiny drops of metal produced in the drilling procedure were hot enough to burn through skin.

From the observations he concluded the following:

1. Heat was generated from motion.
2. Since heat could be generated then it is not possible for heat to be a material substance (since matter cannot be created).

Recall: The law of conservation of energy states that energy cannot be created or destroyed but instead be converted from one form to another.

Energy conversions are never 100% efficient. There is always some loss of energy during energy conversions. This loss in energy is usually in the form of heat.

Recall: Energy is measured in Joules.

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Evaporation & Boiling

Boiling is the process of converting a liquid to a gaseous form using heat (the vapour pressure must be equal to atmospheric pressure for boiling to occur.)

Note: The vapour pressure is the pressure of the gaseous form of the substance in the presence of the liquid form.

Evaporation is a process by which a substance goes from liquid to gaseous form without the use of excess heat.

Evaporation and Cooling

Molecules in a liquid have varied kinetic energy. Some particles contain large amount of kinetic energy. While others contain lower amounts. The average kinetic energy is directly related to the temperature of the liquid. The particles with the highest kinetic energy move rapidly and are able to break the bonds of the liquid state. These particles go into vapour form. Since the particles with the highest kinetic energy leaves the liquid, the average kinetic energy drops. This results in a decrease of temperature in the liquid.

Factors Affecting Evaporation

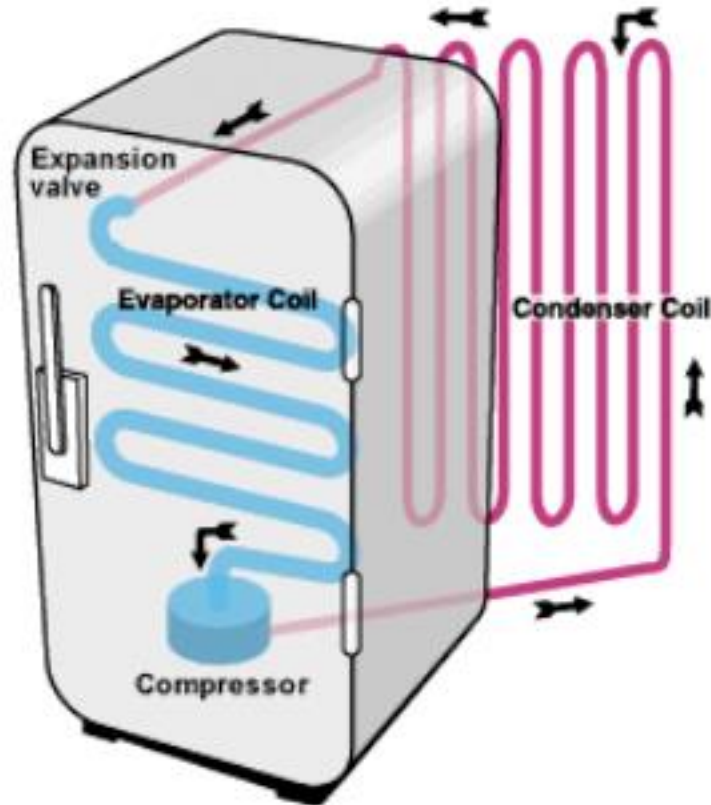
1. Surface area – Increase in surface area decreases the rate of evaporation.
2. Temperature – higher temperature increases evaporation since water molecules are more likely to break the bonds.
3. Wind – the vapour that is formed after evaporation removed increases the rate of evaporation.

Differences Between Evaporation and Boiling

1. In evaporation, the liquid is freely converted into vapour. In boiling the liquid is turned into vapour by heat.
2. Evaporation does not involve heat. Boiling involves heat.
3. Evaporation causes cooling. Boiling does not cause cooling.

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The Refridgerator



1. The compressor constricts the refrigerant vapor, raising its pressure, and pushes it into the coils on the outside of the refrigerator.
2. When the hot gas in the coils meets the cooler air temperature of the kitchen, it becomes a liquid.
3. Now in liquid form at high pressure, the refrigerant cools down as it flows into the coils inside the freezer and the fridge.
4. The refrigerant absorbs the heat inside the fridge, cooling down the air.
5. Last, the refrigerant evaporates to a gas, then flows back to the compressor, where the cycle starts all over.

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Perspiration

Sweating is one of the body's mechanism of temperature control. When the water from the sweat evaporates, the skin is cooled and this results in the cooling of the entire body.

R. Mondol (Do Not Copy)