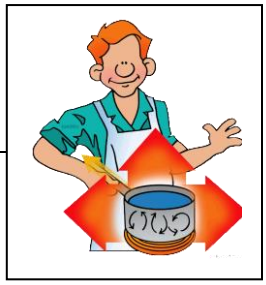


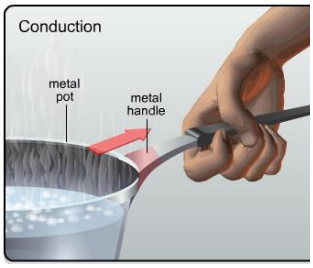
Week 32 – SCIENCE NOTE PAGE
Thermal Energy & Temperature

Thermal Energy

- **Thermal Energy** - is the **total** kinetic and potential energy of the particles in a substance
  - Thermal Energy depends partly on the **size** of an object.
    - The larger the object the more thermal energy in the object.
  - Thermal Energy also depends on the temperature of an object.
    - A cold block of iron will have **less** kinetic energy than a warm block.
  - Thermal Energy is a form of energy. Remember, energy is the ability to do work.
    - The more thermal energy in a substance, the more **work** it can accomplish.
- **Heat -** the **transfer** of thermal energy from one place to another
  - Heat flows from hotter objects to colder objects

Conduction

- **Conduction** is the transfer of thermal energy between objects that are **touching**.
  - **Example:** The two iron blocks touching transfer energy by conduction.
  - Another **example** is where a metal pan meets its metal handle: the handle is not heated directly; heat **flows** from the hot pan to the handle.

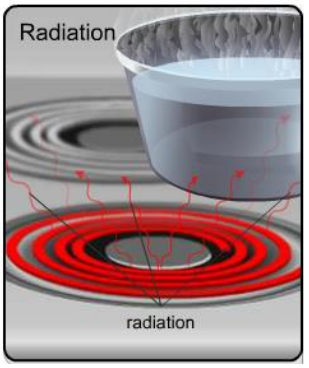


Convection

- **Convection** is the transfer of energy by the **movement** of a fluid, such as air or water.
  - The transfer of energy by convection **does not** require direct contact between objects.
  - **Example:** Uneven distribution of heat in a pan causes pressure differences that allow convection currents to be set up in the pan.
    - **Warmer water rises and cooler water sinks.**
    - These convection **currents** rapidly spread the liquid throughout the pan, transferring thermal energy from one place to another.
      - Winds and ocean currents are also convection currents

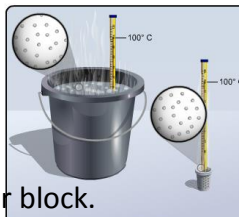
Radiation

- **Radiation** is the transfer of thermal energy by electromagnetic **waves**; is transferred between objects or across empty space.
  - Warmer objects emit **more** radiation than cooler ones.
  - **Example:** the heated coil on the stovetop: the particles in this coil are moving and emit radiation.
    - That radiation travels away from the coil to the bottom of the pan and the surrounding air.
      - The sun and camp fires transfer heat by radiation.



Temperature

- **Temperature** for any substance will **increase** when the *average* kinetic energy of a substance increases.
    - If you have two iron blocks of different sizes, but the same temperature: Do they have the same amount of thermal energy?
        - **No.** The larger block has more mass and more atoms than the smaller block.
            - Therefore, the larger block has more thermal energy than the smaller block.



Temperature and Expansion

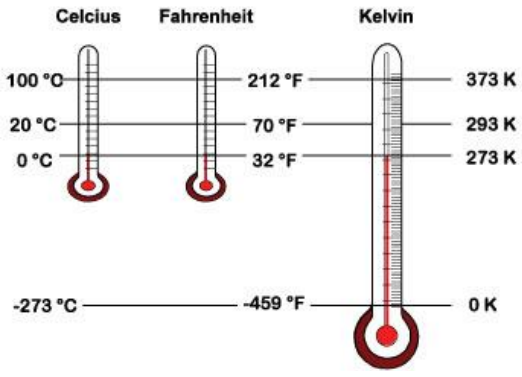
- Remember, the temperature of a substance increases, the **kinetic energy** of its particles also **increases**.
    - When kinetic energy increases, the particles move faster and farther apart.
        - And, as a result of the particles spreading out, the substance **expands in size**.
        - **Example:** Have you ever tried to open a jar with a tight lid?
            - You can loosen the jar top by running hot water over the lid.
            - Why does this work?
                - **When hot water heats the lid, the higher temperature of the lid causes it to expand slightly, making the lid easier to come off.**

Temperature and Contraction

- What do you think happens with a decrease in temperature?
    - When the temperature of an object decreases, the **kinetic energy** of its particles **decreases**.
    - A **lower temperature** will cause most objects to **contract.**
        - **Example:** Most car tires need more air in the winter than in the summer. Why?
            - When the temperature of the inside air decreases, the air contracts, making the tire slightly flat.

Fahrenheit and Celsius Scales

- Temperature is measured with different scales. Two common scales are **Fahrenheit** and **Celsius**.
    - Most countries use the **Celsius scale** to measure temperature.
        - With this scale:
            - the freezing point of water is set at **0°**
            - the boiling point is set at **100°**
            - room temperature in Celsius is about **24°**
    - In the United States, the **Fahrenheit scale** is used for temperature.
        - With this scale:
            - the freezing point of water is set at **32°**
            - the boiling point is set at **212°**
            - room temperature in Fahrenheit is about **75°**



Kelvin Scale

- One unit on the Kelvin scale, called a **kelvin** (K), is the SI unit of temperature.
- The Kelvin system is based on the temperature at which the motion of particles is at its lowest possible level. At this temperature, the **kinetic** energy of the particles is as small as it can be.
- The lowest temperature that a molecule could possibly be is called **absolute zero**.
    - The **value** of **absolute zero** is **0 K or –273°C**.