

Temperature vs. Thermal Energy

temperature —average kinetic energy (energy of motion) or **average speed** of all the particles in a material

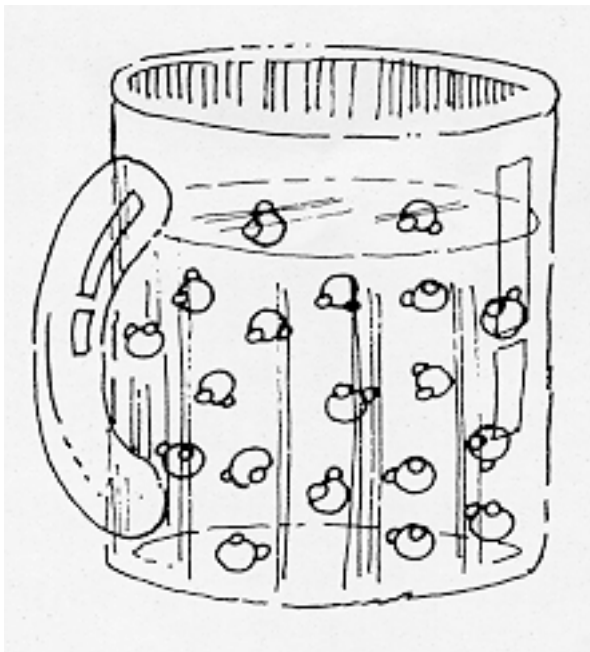
- a. higher temp. = particles move faster and farther apart
- b. lower temp. = particles move slower and closer together

thermal energy—total kinetic energy of all the particles in a material

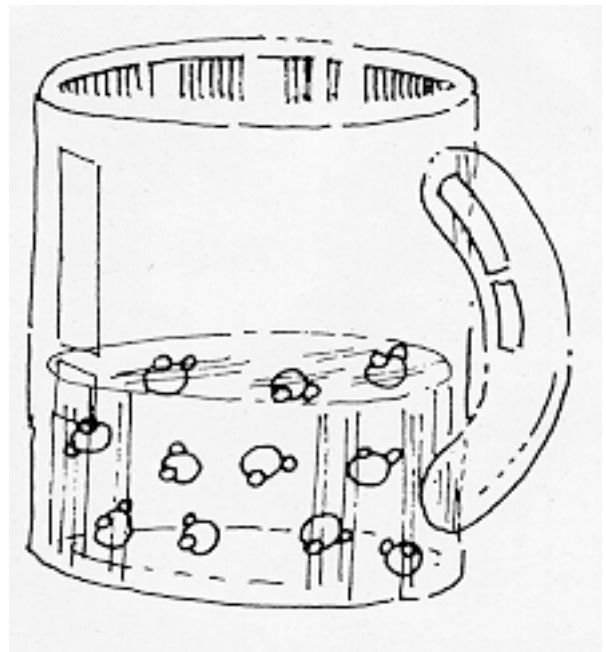
heat—energy transferred between two objects of **different temperature**

more molecules = more thermal energy

95°C



100°C



← heat transfer

more thermal energy

less thermal energy

Example: Lake Mendota is close to freezing (1°C) while a cup of boiling water is 100°C . Yet, if placed next to the lake in below freezing temperatures, the cup of boiling water freezes first because it has less thermal energy than Lake Mendota.

Types of Heat Transfer

conduction—transfer of energy from molecule to molecule within a substance → touching a hot burner

convection—transfer of energy by the mass movement of a liquid or gas → feeling warmer, less dense air pushed up above the hot burner

radiation—transfer of energy by waves → feeling the warmth off to the side of the hot burner

Heat transfer within the atmosphere

- a) Sun **radiates** Earth, heating the surface
- b) Air in contact with Earth's surface is heated by **conduction**
- c) Warmer, less dense air, pushed up by cooler, more dense air, transferring thermal energy by **convection**