

Thermal Energy

Relationships

1. Particles have energy. The more energy they have, the faster they move. Temperature is a measure of the average speed of the particles in something. If the object is at a low temperature, some particles may be moving fast, but many more of them will be moving slowly.
2. All materials have thermal energy. Thermal energy is the sum of the energy of all of the particles. That means that large objects at a lower temperature (with slower moving particles) can have more energy than small objects with high temperatures (faster moving particles).
3. When objects with different temperatures are in the same environment, energy is transferred from objects at higher temperatures to objects at lower temperatures until everything is at the same temperature (thermal equilibrium).
4. Thermal energy can be transferred three ways: by conduction, convection, or radiation.
 - a. In conduction, particles bump into other particles and transfer energy like pool balls. The faster the particles, the more energy they can transfer. The closer the particles are to each other, the more collisions will happen.
 - b. In convection, energy transfers when matter moves from one place to another
 - Convection requires uneven heating.
 - When matter is heated, the particles move more quickly and bump each other more, pushing all the particles farther apart. For that reason, a material will have a higher density when it is cold and lower density when it is hot.
 - Denser material has more mass for each unit of volume, so it weighs more (gravity pulls more strongly on it). Therefore, in a fluid, denser materials sink.
 - As the colder stuff sinks, it pushes the warmer, less dense stuff up.
 - c. In radiation, thermal energy can move through empty space.
 - We know energy reaches us from the Sun.
 - We also know there are long stretches of space between the Earth and the Sun with very little matter in it.
 - So the energy is not being transferred by particles bumping, or by big masses of particles moving from one place to another because of density differences.
 - Therefore there must be another way that thermal energy can transfer. We'll call it electromagnetic waves. Light is a kind of electromagnetic wave.

Phenomena

<p>Hot rock & hot paper clip <i>A rock at 100 degrees heats a pot of water better than a red hot safety pin at 300 degrees.</i></p>	#2
<p>Knife in hot water <i>.The part of the knife not in the water also gets hot</i></p>	##1, #3, #4a
<p>Handle of metal pan heats up.</p>	#1, #3, #4a
<p>Convection pan <i>Food coloring rises over the heated area, sinks over colder areas</i></p>	#1, #4b
<p>Land and sea breezes <i>Requires that we know different materials heat at different rates</i></p>	#4b
<p>Atmosphere is hotter at the bottom and gets colder as you go up <i>Earth heats by radiation, heats air above by conduction, and the air moves by convection</i></p>	#1, #3, #4a, #4b, #4c
<p>Naked guy problem <i>Is it better to wear wet clothes in cold air or take them off?</i></p>	#1, #4a, #4c