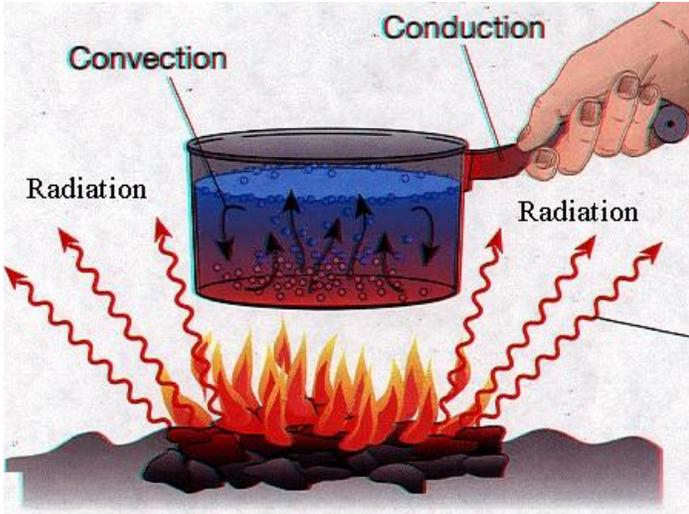


HEAT TRANSFER STUDY GUIDE



CONDUCTION

Even in solid matter, like hot pots and cold feet, the atoms and molecules are always doing a dance, jiggling up and down and all around. We can't see them jiggle, but we can feel their energy. How? As heat! Adding heat energy to matter makes its atoms and molecules jiggle even faster. As they speed up, they bump against their neighbors, and get them jiggling faster too.

Put a cool pan on a hot stove, and soon the pan is hot. If the handle is metal, it will get hot too, as the faster-moving molecules in the metal pass their energy along. That's conduction: Matter "conducting" energy throughout itself, through molecules bumping into each other.

Bacon is fried on a stove burner by the stove burner transferring heat directly to the pan, and the pan directly transferring heat to the bacon. People should wear gloves when heating up their metal conducts heat and could burn your hand. A metal spoon that stays in a heated bowl of soup becomes very hot because the heat from the soup is conducted through the spoon. An example of conduction is touching a hot handle and getting burned. Plastic will conduct the least amount of heat.

CONVECTION

Like conduction, convection happens in matter too, but only in liquids and gases like water and air. The atoms and molecules in liquids and gases are farther apart than in solids. Because they have more room between them, they are freer to move around. As they heat up and jiggle faster, they move much farther, carrying the heat energy with them. The atoms and molecules themselves move in currents. For example, a candle flame (which is made of gases so hot they glow) heats the air right around it. The warmed air rises, making a current. Cooler air moves in to replace the warmed air, gets warmed up too, and rises into the current.

Hot air balloons stay in the air because the heat is convecting or rising and circulating causing the balloon to stay up in the air. Earth's climate is impacted by convection because it helps move thermal energy around the earth.

RADIATION

Radiation moves energy without any help from matter. We say the Sun's energy radiates through space to reach Earth. That means it travels in waves and doesn't need atoms and molecules to move along.

Although we can't see it, the heat we feel on our skin when we stand in the Sun or put our hands over a hot stove is caused by infrared radiation, another type of electromagnetic radiation. An example of radiation is getting hot from lying in the sun. Getting warm by sitting near a campfire is another example of radiation. Heat is transferred in radiation through air. Heat energy from the Sun reaches Earth through radiation. People put metallic cover on their windshields because it reflects the sun's rays away from the windshield.