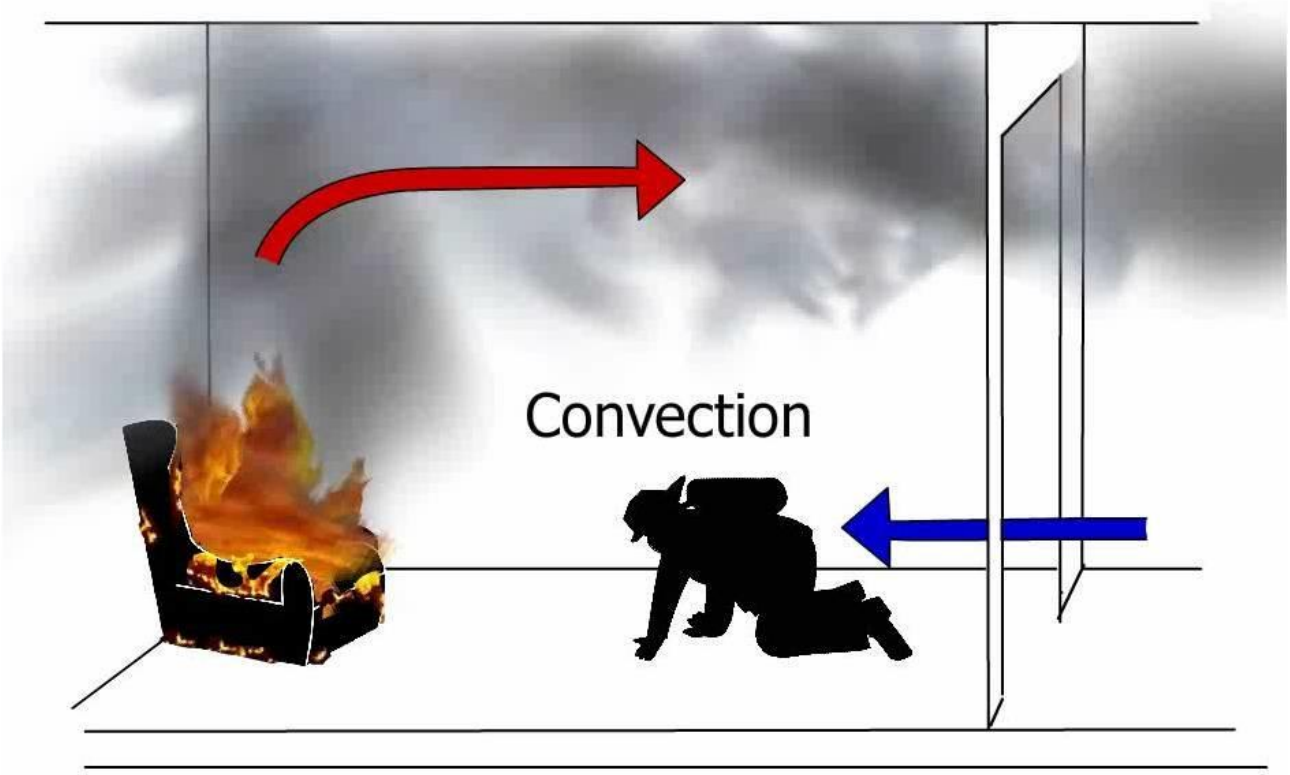
How Does Fire Spread? Convection

The first way that fire can spread is through **convection**. This is perhaps one of the most challenging and dangerous ways that a fire spreads. During the process of convection, ***heat causes air molecules to spread out, become less dense, and rise.*** The ceiling traps the heat and causes the fire to spread rapidly. As the ***hot molecules rise, cooler dense air takes its place and is drawn in and fuels the fire.*** If the process of cooler air that feeds the fire is interrupted, the fire cannot spread.

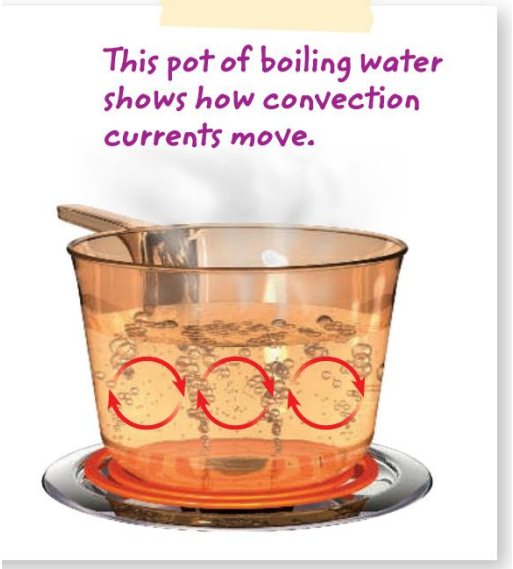
Convection has been identified as one of the main ways that fire is spread in workplaces and homes. Materials of a combustible nature can easily catch fire and cause an even faster and more damaging spread of fire, which can be difficult to contain and lead to major damage and injury.



What is convection?

Energy in the form of heat can also be transferred through the movement of gases or liquids. **Convection** (kuhn•VEK•shuhn) is the transfer of energy as heat by the movement of a liquid or gas. In most substances, as temperature increases, the density of the liquid or gas decreases. Convection occurs when a cooler, denser mass of a gas or liquid replaces a warmer, less dense mass of a gas or liquid by pushing it upward.

When you boil water in a pot, the water moves in roughly circular patterns because of convection. The water at the bottom of the pot gets hot because there is a source of heat at the bottom. As the water heats, it becomes less dense. The warmer water rises through the denser, cooler water above it. At the surface, the warm water begins to cool. The particles move closer together, making the water denser. The cooler water then sinks back to the bottom, is heated again, and the cycle repeats. This cycle causes a circular motion of liquids or gases. The motion is due to density differences that result from temperature differences. The motion is called a *convection current*.

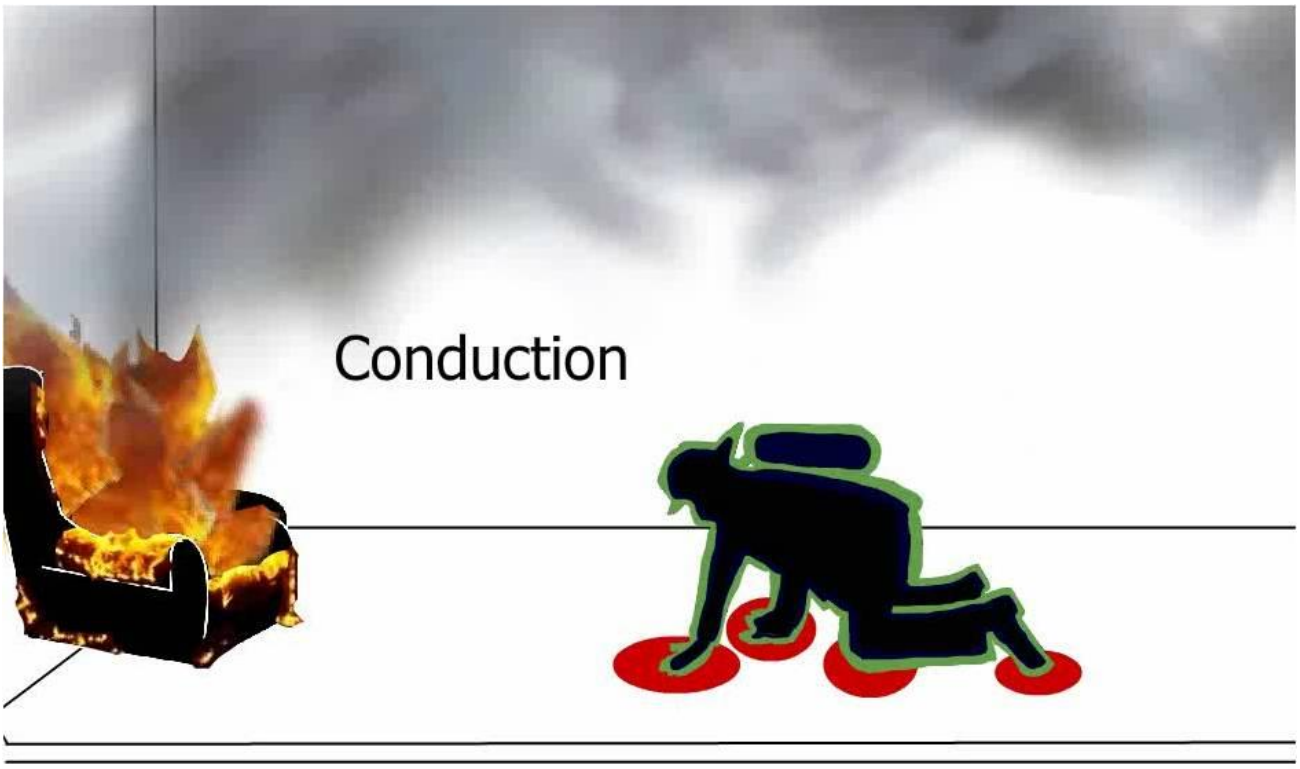


This pot of boiling water shows how convection currents move.

How Does Fire Spread? Conduction

Conduction is another way in which fire can be easily spread. Conduction spreads fire when fire comes into **direct contact with materials (solid states of matter)**. The severity of conduction fires depends on the type of materials found in your home. The damage done by a conduction fire depends on the type of material burning. (Example: synthetic materials burn faster than natural materials.)

Heat and fire can spread through free-standing items in your space (such as bookshelves, desks and chairs), through the walls, and halls of the building. Your carpets, steel structural beams, and wooden construction elements can conduct fire easily, and cause a structural collapse in some extreme cases.



What is conduction?

There are three main ways to transfer energy as heat: conduction, convection, and radiation. **Conduction** is the transfer of energy as heat from one substance to another through direct contact. It occurs any time that objects at different temperatures come into contact with each other. The average kinetic energy of particles in the warmer object is greater than the average kinetic energy of the particles in the cooler object. As the particles collide, some of the kinetic energy of the particles in the warmer object is transferred to the cooler object. As long as the objects are in contact, conduction continues until the temperatures of the objects are equal.

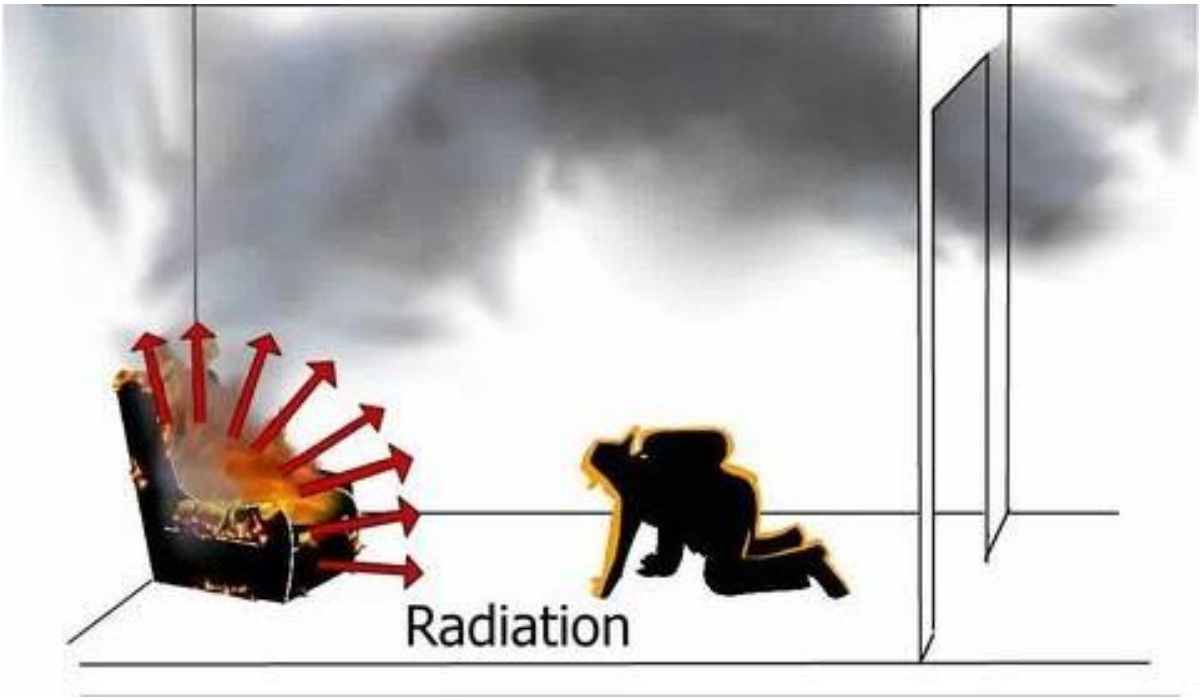
Conduction can also occur within a single object. In this case, energy in the form of heat is transferred from the warmer part of the object to the cooler part of the object. Imagine you put a metal spoon into a cup of hot cocoa. Energy will be conducted from the warm end of the spoon to the cool end until the temperature of the entire spoon is the same.

How Does Fire Spread? Radiation

The final way in which a fire is commonly spread is through **<u>radiation</u>**.

The spread of fire through radiation is the ***process in which heat is transferred due to electromagnetic waves (waves that do not require matter to transfer energy).*** This causes heat to spread in multiple directions (Example – you can feel heat from a campfire in all directions.)

Radiation is how fire can seemingly spread to other buildings, entering through windows, lighting materials on fire, and causing a distressingly fast spread that can prove destructive to multiple buildings if left unchecked.



What is radiation?

Radiation is another way in which heat can be transferred. **Radiation** is the transfer of energy by electromagnetic waves. Some examples of electromagnetic waves include visible light, microwaves, and infrared light. The sun is the most significant source of radiation that you experience on a daily basis. However, all objects—even you—emit radiation and release energy.

When radiation is emitted from one object and then absorbed by another, the result is often a transfer of heat. Like conduction and convection, radiation can transfer heat from warmer to cooler objects. However, radiation differs from conduction and convection in a very significant way. Radiation can travel through empty space, as it does when it moves from the sun to Earth.