

## Heat Transfer

### Heat Energy

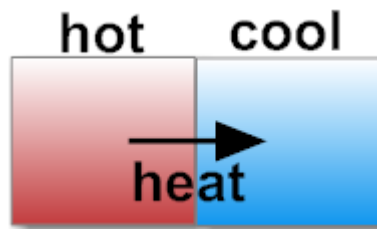
*Heat is a form of energy.*

*Heat energy always flows from warmer objects to cooler objects.*

**Heat transfer** is the process of heat moving from one thing to another. Heat will continue moving from a hotter object to a cooler object until both the objects are the same temperature. Heat transfer can happen with direct contact or without direct contact.

### Heat Transfer by Direct Contact

When two objects are touching one another, they are in *direct contact*, and heat can flow straight from one to the other.

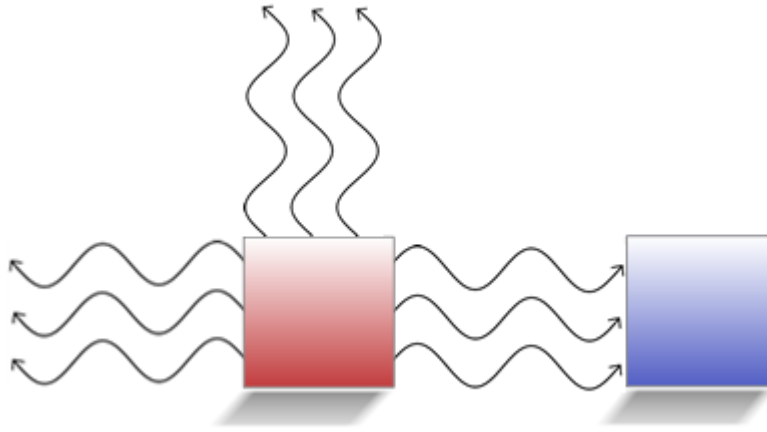


Examples of direct contact include:

- When you place your hand on a cold surface, heat moves from your hand to the surface.
- When you pour hot coffee into a cool mug, heat moves from the coffee into the mug.
- When you stick a fork into a hot pot pie, heat moves from the pot pie into the fork.

### Heat Transfer Without Direct Contact

Heat can move from one object to another even when they are not touching. Air or water can carry heat from one object to another. Even if there is nothing between two objects, heat can still move between them. This is the way that energy from the Sun can reach the Earth.



The wavy lines show heat moving away from the hot red box. Some of it goes indirectly to the cool blue box through the empty space between them.

Examples of heat transfer without direct contact include:

- Heat from a fire warms a whole room.
- Putting your hand near something that is very cold such as a large amount of ice will make your hand feel cooler.
- Heat from a stove can be indirectly transferred into the air by steam that rises from water being heated on the stove.

Heat usually moves more quickly from one thing to another when they are in direct contact than when they are not.

## Conductors & Insulators

*A **conductor** is a material that allows energy to flow through it easily. An **insulator** is a material that does not allow energy to flow through it easily.*

### Conductors

If a conductor is in contact with a form of energy (such as heat), it will likely allow that energy to flow through it. Most metals are very good conductors. For example, imagine a metal spoon is allowed to sit in a cup of hot tea.



When the spoon is touched, it will likely feel hot because heat energy from the tea moves through the spoon to the person's hand.

If the spoon were plastic, which is an insulating material, the spoon would not feel hot because the heat energy would not move through the plastic very well.

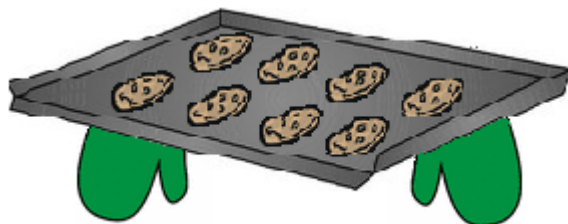
## Insulators

An insulator is a material that does not allow energy to flow through it easily. Insulators are sometimes called *nonconductors*.

An insulator stops the flow of energy from moving through the material. Common insulators include:

- plastics, such as Styrofoam
- wood
- cloth
- rubber

Many objects that are meant for holding hot things are made of insulating material so that people can hold the objects without getting burned. For example, Ted is baking cookies on a cookie sheet made of aluminum metal.



Once the cookies are done baking, Ted needs to remove the hot cookie sheet from the oven using an insulator so that he does not burn himself. Ted would most likely use oven

mitts made from cloth or silicone plastic to pick up the cookie sheet and carry it to the counter.

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