

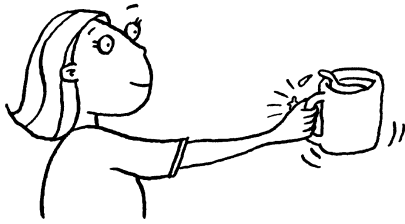
Heating and cooling

Heat and temperature

When we know the **temperature** of something we know how hot it is, *not* how much **heat energy** is in it.

Temperature is measured in **degrees Celsius (°C)**.

Heat (**thermal**) energy is measured in **joules (J)**



The tea is hot (80°C) but there is not much of it, so it does not contain much heat energy and does not burn her hand.



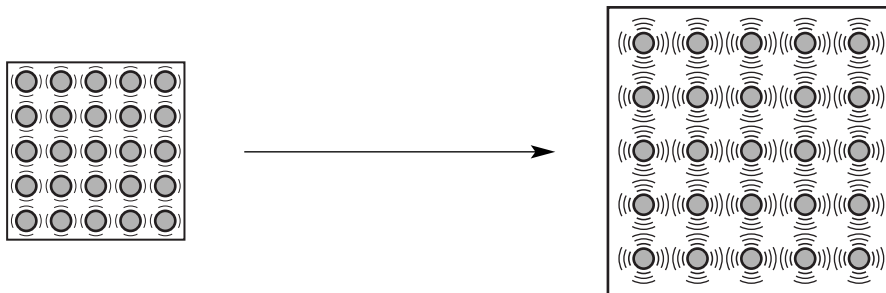
The tea is hot (80°C), and there is a lot of it, so it contains a lot of heat energy. It burns her hand.

The amount of heat or **thermal energy** in something depends upon

- how hot it is (its temperature)
- the material it is made from
- its mass.

Travelling heat

The **kinetic theory** or **particle model of matter** helps to explain how some forms of heat energy travel. The theory suggests that everything is made of moving or vibrating particles. When these particles are heated they move faster.

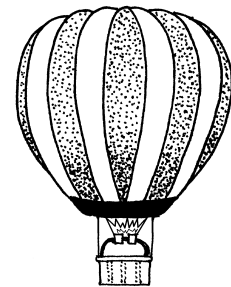


When the particles vibrate faster the material expands.

When the air particles in the balloon are heated, they move apart and the air expands and becomes less dense. This causes the hot air to rise, and the balloon rises too.

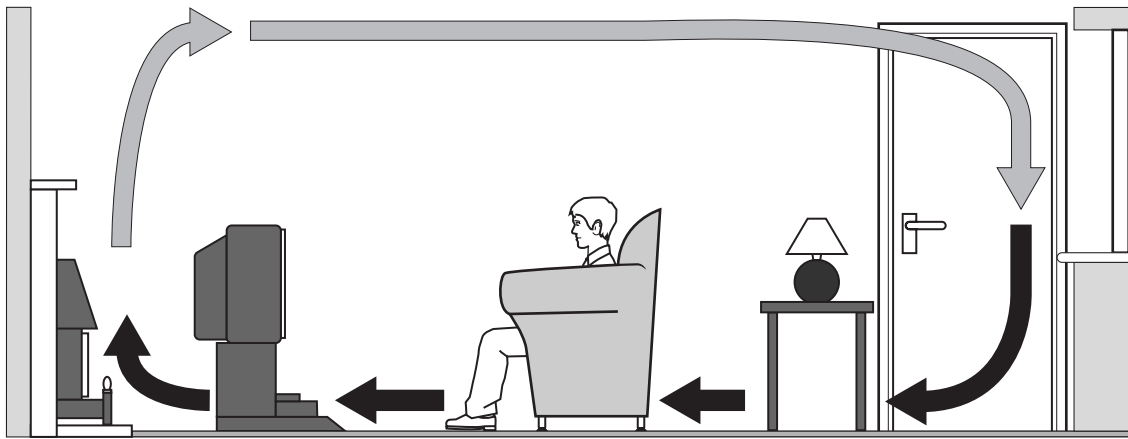
Thermal energy can travel in three different ways.

Conduction takes place in solids and can also happen in liquids (although not very well). The particles in a solid are held together tightly. When they gain energy they vibrate faster and the vibrations are passed on. Particles are not as close in a liquid, so conduction is not very good. Metals are the best conductors. Most other solids are poor conductors.



Something which does not conduct heat very well is an **insulator**. Liquids, gases, and solids which contain a lot of trapped air are insulators.

Convection takes place in liquids and gases.



When the air near the fire is heated, the particles spread further apart and the air becomes less dense and rises. As it rises it meets cooler air and passes the energy on. Having passed on the energy, it cools and becomes denser. The denser air sinks, setting up a cycle or **convection current**.

Heat can be transferred through empty space by **infrared radiation**. Radiation does not require the movement of particles. Any hot or warm object gives off or **emits** radiation. When something takes in heat energy from radiation, it is said to **absorb** it.

Infrared radiation travels as waves. It can be reflected and it can also be focused.



Changes of state

Substances can change state when they are heated or cooled. The melting point and the freezing point of a substance are the same temperature. The temperature of a substance does not change while it is melting, even if it is still being heated.

