

# Heat Transfer Knowledge organiser

**Temperature** describes how hot or cold an object is.  
It is measured in degrees Celsius ( $^{\circ}\text{C}$ )

Temperature is measured using a thermometer.

## Typical temperatures

Freezing/melting point of water  $0^{\circ}\text{C}$

Boiling/condensing point of water  $100^{\circ}\text{C}$

Room temperature  $20^{\circ}\text{C}$

Absolute zero  $-273^{\circ}\text{C}$

Body temperature  $37^{\circ}\text{C}$

**Thermal energy** is an energy store. Hot objects have a large store of thermal energy.

**Heating is an energy transfer.** This is how thermal energy moves from one object to another.  
Energy is measured in joules (J).

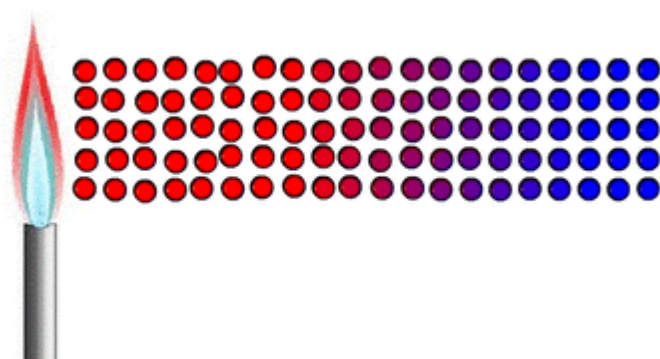
The amount of thermal energy stored in something depends on:

1. Its *temperature*
2. Its *mass*

If there is a difference in temperature between two objects, **energy transfers by heating from the hotter object to the cooler one.** The greater difference in temperature, the faster the energy is transferred.

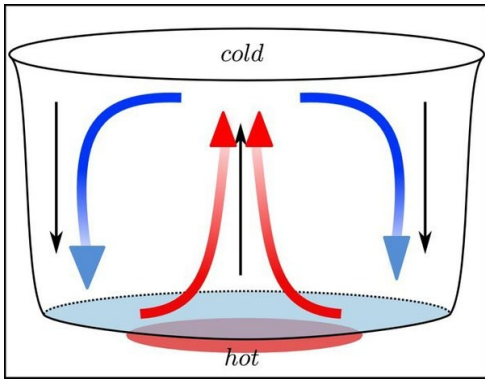
When the objects reach the same temperature as the surrounding environment, the energy transfer will stop. When the objects are at the same temperature, they are in **thermal equilibrium.**

Conduction is how heat is transferred in solids.



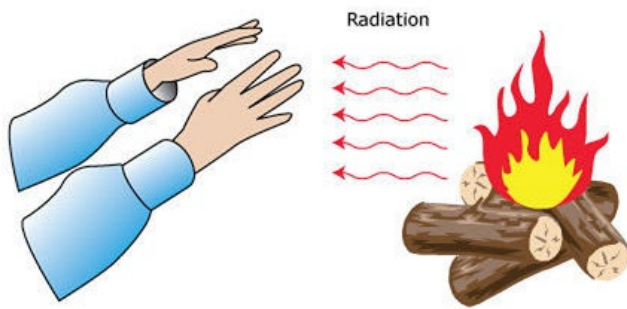
- The particles in a solid are close together and arranged in a regular pattern. They vibrate on the spot.
- Heating the solid at one end transfers energy to the particles there and they vibrate more.
- They bump into nearby particles, transferring energy to them and making them vibrate more.
- These then bump into particles further along.
- In this way heat energy is quickly transferred to the other end of the solid.

**Convection** is how heat is transferred in liquids and gases.



- The water near the flame gets hot and expands because the particles in the hot water move faster and get further apart.
- The water becomes less dense and so rises.
- Cooler, denser water moves in to take its place.
- This water gets heated, and so on.

**Radiation** is how heat is transferred by waves (without the need for particles).



All objects emit (give out) and absorb (take in) thermal energy as waves called infrared radiation. The hotter an object is, the more infrared radiation it emits.

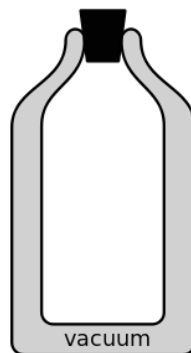
White objects are bad absorbers and bad emitters of infrared radiation (they are good at reflecting radiation)

Black objects are good absorbers and good emitters of infrared radiation.

IR radiation does not need particle to transfer energy, so it can travel through a vacuum

### **Insulation**

Insulation is used to reduce heat transferring to (or from) the surroundings.



## SCHOLARS ONLY

### Latent heat

Latent heat is the amount of energy required to change the state of 1kg of a substance at a constant temperature.

