

8P1 Knowledge Organiser – Heating and Cooling

Key words:

Thermal conductor	A material that will let heat flow through it
Thermal insulator	A material that will not let met flow through it.
Conduction	Heat is conducted due to particles vibrating and hitting each other. The movement of heat (or electricity) through a substance.
Convection	The transfer of heat through a liquid or gas (fluid) Convection occurs when particles with a lot of heat energy in a liquid or gas move and take the place of particles with less heat energy
Radiation	Heat can be transferred by infrared radiation, this is an electromagnetic wave and doesn't use particles.
Temperature	temperature is a measure of how hot something is.
Heat	heat is a measure of the thermal energy contained in an object.
Thermal energy	Energy that is due to particles moving and results in an object having a temperature. It is transferred as heat

Conduction: Conduction can only happen in **solids** as the particle must be touching to pass on energy to it's neighbours.

molecules in solid objects don't "move" - they vibrate or "jiggle"



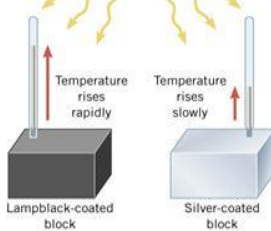
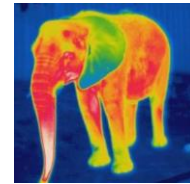
Heat moves from the hotter part of the object to the colder part

heat conducts from warm to cold

Particles in the metal are packed closely together. As they are heated the particles gain kinetic energy and vibrate more. The particles that are vibrating collide with other particles and start to make them vibrate. This passes the kinetic energy from the heated particles to the cooler particles causing them to heat up too.

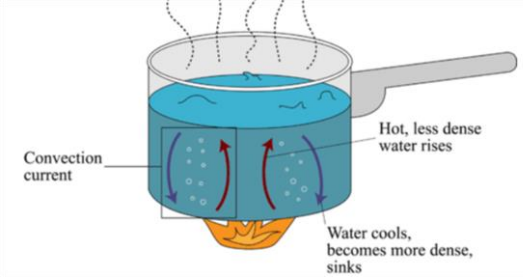
Radiation: Radiation doesn't need particles for the energy to Travel though as it is a type of electromagnetic radiation called infrared radiation.

Infrared radiation involves waves instead of particles. As such it can travel through a vacuum e.g. space. The hotter an object is, the more infrared radiation it emits.



You can experience radiation for yourself, on a warm day dull dark objects feel warmer as they **absorb** the thermal energy from the sun whereas shiny or white objects **reflect** the thermal energy and so feel cooler.

Convection: This occurs naturally in fluids (**liquid or gas**) as the particles are free to move and pass the thermal energy to other particles they collide with.



Particles with lots of heat energy in a liquid or gas move and take the place of particles with a lot of energy. Heat energy is transferred from hot places to cooler places by convection.

Slower moving particles move closer together taking up less space.

Warmer particles transfer their energy to their surroundings and begin to move more slowly.

Warmer water is therefore lighter than denser cold water and rises

Cooler water becomes denser and sinks to the bottom of

Cooler particles take the space of the warmer ones that have risen.

Hot water rises

Cool water sinks

This makes them move faster and take up more space. They are now less dense.

Thermal energy from the heat source is transferred to the liquid particles

Convection current in water

Energy saving in the home:

- LOFT INSULATION**
Heat rises and it may be leaking into your loft. Insulating your loft, or topping up your existing insulation, will keep heat inside your living spaces for longer.
- CREATE YOUR OWN ENERGY**
Technologies like wind turbines and solar panels can capture energy and turn it into electricity or heat for your home.
- WINDOWS**
Homes leak heat through their windows. By replacing your windows with double or triple glazed windows, or installing secondary glazing to your existing windows, you'll keep your home warmer and reduce outside noise.
- EXTERNAL AND INTERNAL SOLID WALL INSULATION**
Older homes usually have solid walls. Installing insulation on the inside or outside of the wall can dramatically reduce the heat that escapes your home.
- CAVITY WALL INSULATION**
Some homes have walls with a hollow space in the middle. Putting insulation in this space is quick and makes no mess because the work can be done from outside your home.
- BOILERS**
Older boilers tend to lose a lot of heat so they use a lot of energy. High efficiency condensing boilers and air or ground source heat pumps recover a lot of heat so they use less energy.
- DRAUGHT PROOFING**
Gaps around doors, windows, loft hatches, fittings and pipework are common sources of draughts. Sealing up the gaps will stop heat escaping your home.

Do you let the heat in or the cold out?

This will continue till the inside and outside temp. is equal.

Hot air has more energy than the colder air outside so the net movement of the energy flows out of the warm room and to the surroundings.

	Conduction	Convection	Radiation
Particles	Y	Y	N
Solids	Y	N	Y
Liquids	N	Y	Y
Gases	N	Y	Y
Particles move far part	N	Y	n/a
Particles vibrate on the spot	Y	N	n/a
Particles rise and fall to transfer energy	N	Y	n/a
Particles hit each other to transfer energy	Y	N	n/a