

Heat



By the end of this chapter you will be able to:

- Describe heat energy, its' units and explain how it converts to other forms
- Explain how heat affects expansion and contraction of materials
- Explain conduction, convection and radiation
- Identify good and bad conductors of heat (insulators V conductors)
- Differentiate between heat energy and temperature



What is Heat?

- **Form of energy** because it can move things
 - E.g: Makes a hot air balloon rise.
 - Steam engines
- Measured in **JOULES (J)**



Heat can be converted to other forms of energy

- Sunlight (heat) is used by plants for Photosynthesis (to make food), it is converted to chemical energy.
- Oil and gas are burned in power stations to produce heat energy, this is used to turn turbines which produce electricity (electrical energy)



How is heat produced?

- The movement of particles/molecules produces heat
- Particles move about more and take up more room if heated – this is why things expand if heated
- It is also why substances change form when heated

solids → liquids → gases



Heat Transfer

- Heat always moves from a warmer place to a cooler place.
- Hot objects in a cooler room will cool to room temperature.e.g: tea, coffee
- Cold objects in a warmer room will heat up to room temperature.e.g: butter, ice



Forms of Heat Transfer

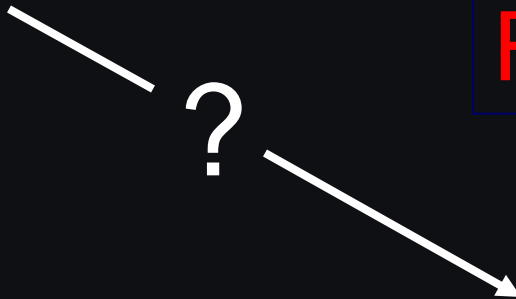
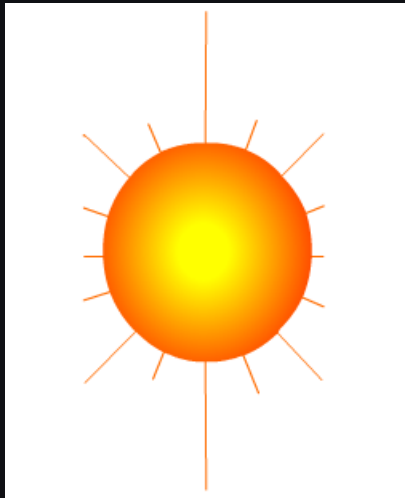
- 3 types;
- Conduction
- Convection
- Radiation



Radiation

How does heat energy get from the Sun to the Earth?

There are no particles between the Sun and the Earth so it MUST travel by radiation

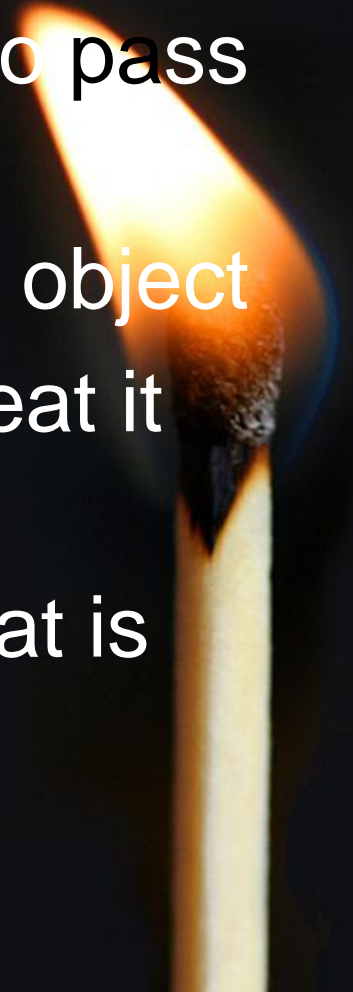


RADIATION



Radiation

- The transfer of heat in rays, from a hot object, without needing a medium to pass through
- It travels in all directions from a hot object
- The hotter an object is, the more heat it will radiate out
- Does the surface affect the way heat is radiated?



Conduction

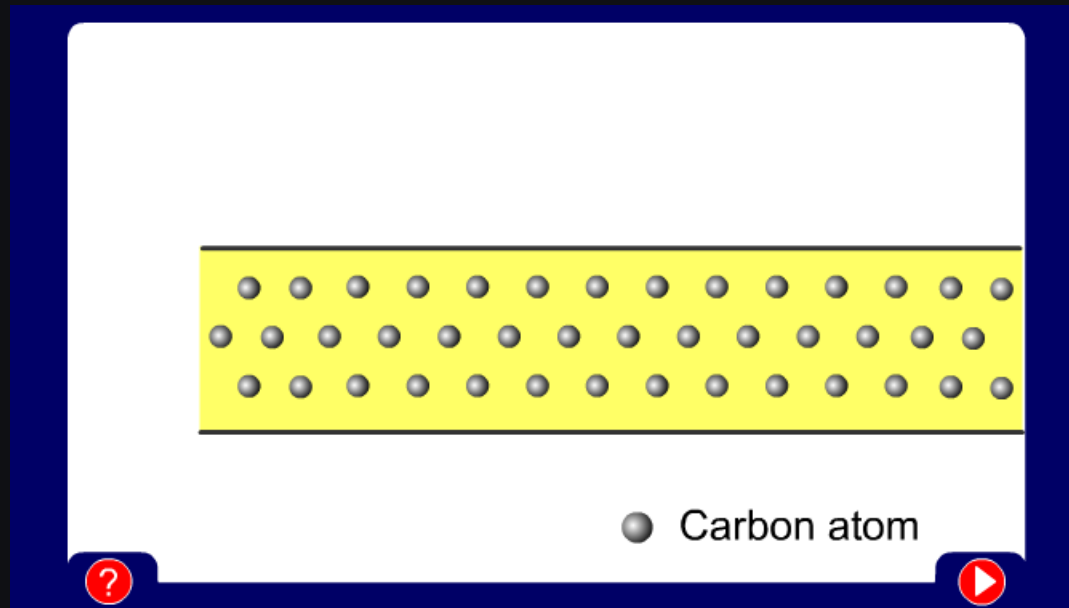
- Transfer of heat is through a SOLID by being passed from one particle to the next
- Particles at the warm end move faster and this then causes the next particles to move faster and so on. e.g: poker in fire
spoon in tea
- In this way heat in an object travels from:

the HOT end  the cold end



Conduction

- When you heat a metal strip at one end, the heat travels to the other end.



- As you heat the metal, the particles vibrate, these vibrations make the adjacent particles vibrate, and so on and so on, the vibrations are passed along the metal and so is the heat. We call this? Conduction

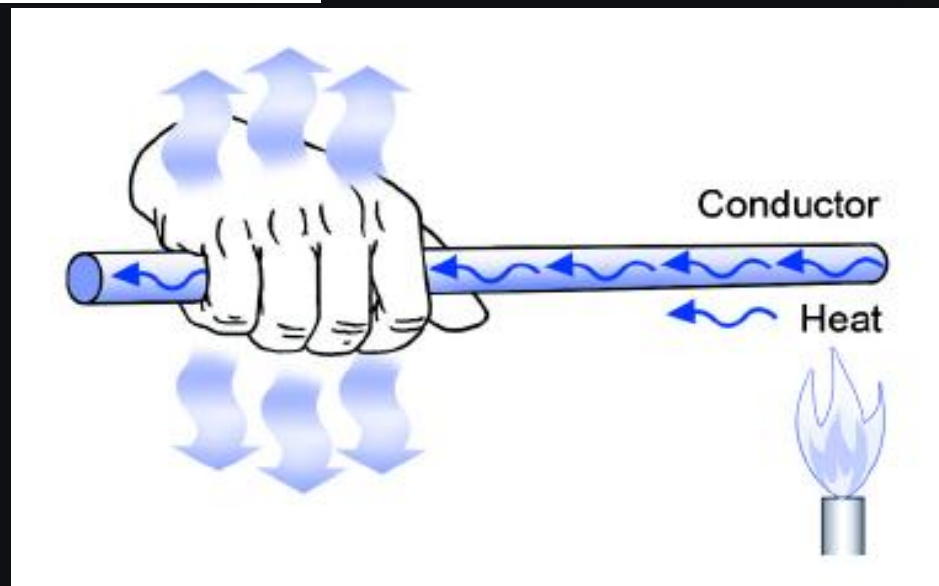
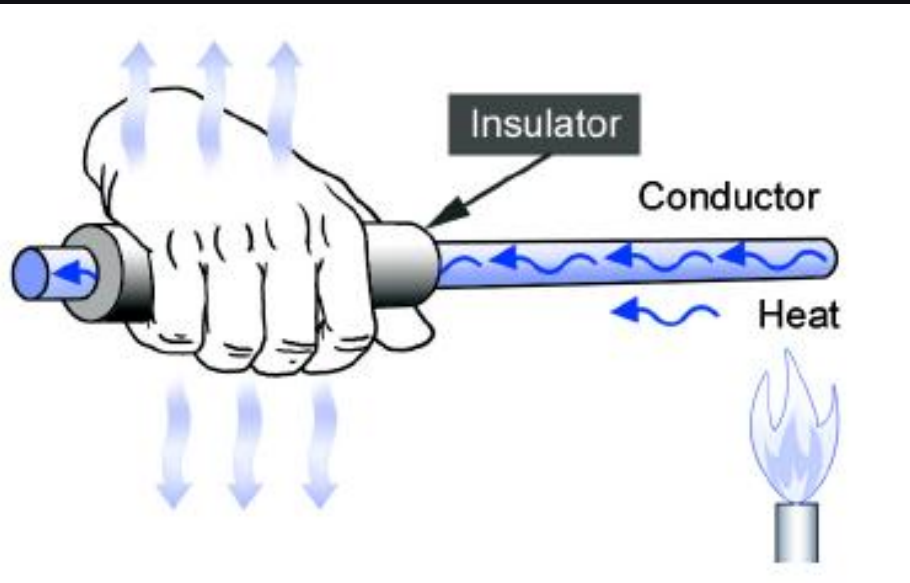


Conductors/Insulators

- If a substance easily allows heat to move through it, we can say it is a good conductor of heat. e.g: most metals
- If a substance does not allow heat to pass through it easily we can say it is an Insulator. E.g: wood, plastic, glass
- Why do many sauce pans have plastic handles?



Conduction V Insulation



Conductor or Insulator?

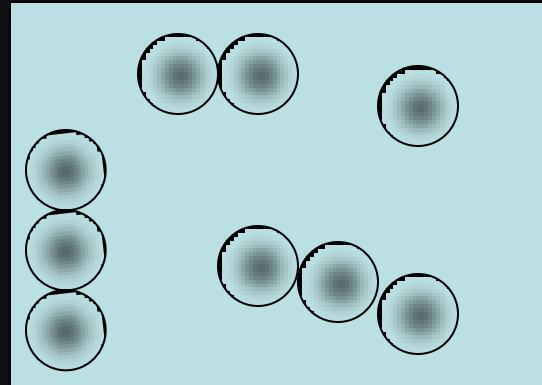
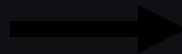
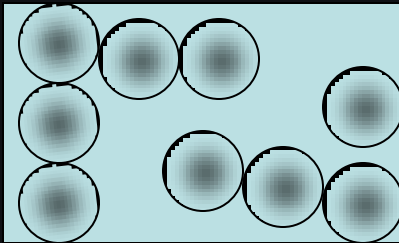
- Wood?
- Aluminium?
- Plastic?
- Glass?
- Iron?
- Polystyrene?
- Copper?
- Cardboard?



Convection

What happens to the particles in a liquid or a gas when you heat them?

The particles spread out and become less dense.



A liquid or gas.



Convection

- It is the way in which particles in a GAS or LIQUID move **upwards**, carrying heat with them



- Think about when you boil water, the bubbles move upwards
- Or think of a gas heater in the room, the heat rises around the room



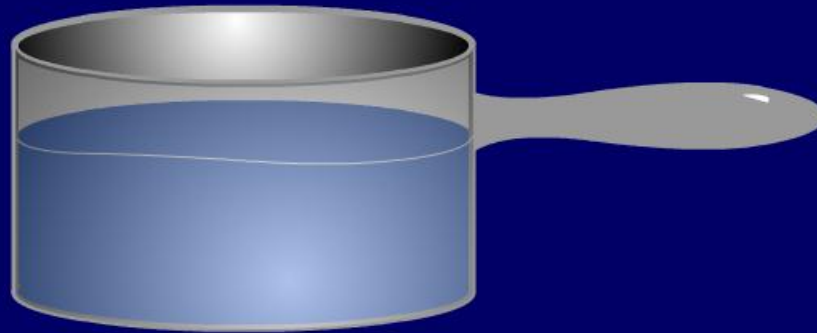
Convection

Cools at the
surface

Convection
current

Cooler
water sinks

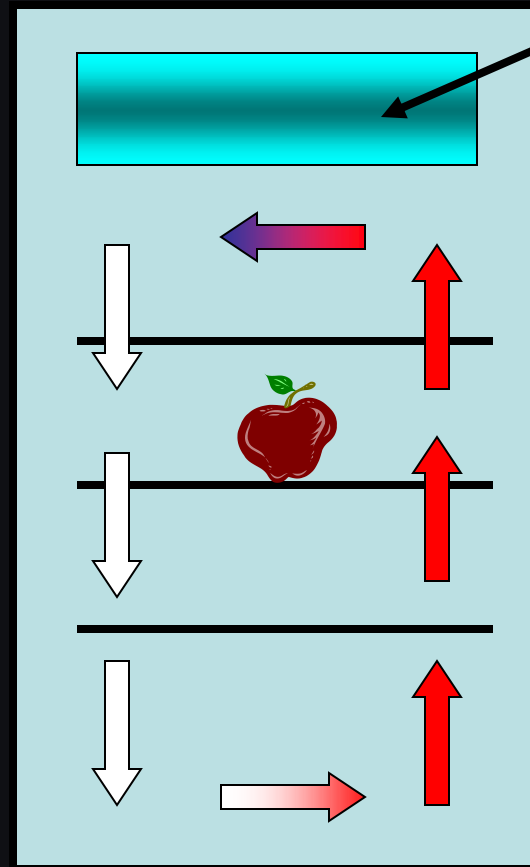
Hot water
rises



Convection

Where is the cooling compartment put in a fridge?

It is put at the top, because cool air sinks, so it cools the food on the way down.



Cooling compartment

It is warmer the bottom, so this warmer air rises and a convection current is set up.

