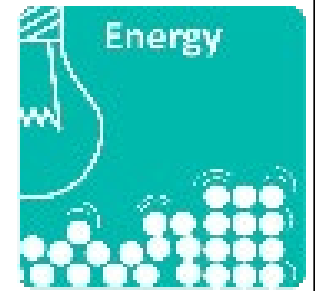


**Knowledge organiser**



**Y8 topic: THERMAL ENERGY**

**I have already learned:**

**In KS2:** observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius ( $^{\circ}\text{C}$ )

**Y7:** ENERGY INTRO, ENERGY AT HOME, WAVES INTRO

**This topic links to:**

**KS4:** P1b energy changes in systems

**It is important to study about thermal energy because...**

It helps us explain why materials feel hot and cold. It also helps us explain why some objects are able to cool down or heat up faster than other objects. In the real world, knowing how to insulate can help us save money on energy bills and reduce our domestic carbon footprint

**Possible careers involving thermal energy are...**

- Mechanical engineer
- Chemical engineer
- Material scientist
- Plumber
- Insulation fitter

**KNOWLEDGE ORGANISER**  
**BIG IDEA: PHYSICS - ENERGY**  
**TOPIC: Thermal Energy**

Key Word	Definition
<b>temperature</b>	A measure of the energy of individual particles. Measured in degrees Celsius, °C.
<b>thermal energy</b>	A measure of the total amount of energy in an object. Measured in joules, J.
<b>thermal conductor</b>	Material that allows heat to move quickly through it..
<b>thermal insulator</b>	Material that only allows heat to travel slowly through it.
<b>conduction</b>	Transfer of thermal energy through solids by the vibration of particles.
<b>convection</b>	Transfer of thermal energy through fluids (liquids and gases), when hot particles rise.
<b>infrared radiation</b>	Transfer of thermal energy as a wave. It does not require particles so can occur through a vacuum.

The **temperature** of an object is to do with how hot or cold it is, measured in degrees Celsius. Note that the unit of temperature is written as °C, (not °c or oC).

### Conductors

A substance that transfers energy easily from the hot part to the cold part is called a **conductor**. Metals are good conductors.

### Insulators

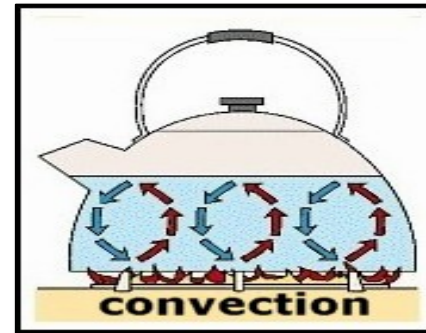
A substance that does not transfer energy easily from the hot part to the cold part is called an **insulator**. Air and plastics are insulators.

Double glazing involves having two panes of glass in the window instead of just one. There is air between the two panes of glass. This reduces energy transfer by conduction.  
 Energy loss through walls can be reduced using cavity wall insulation. Again trapped air is used to reduce conduction and convection. Loft insulation works in a similar way.



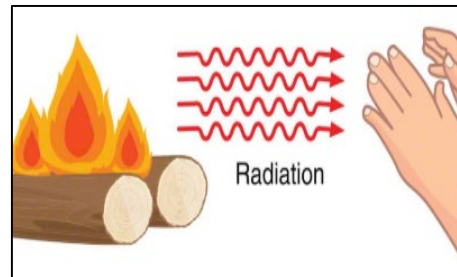
### Conduction

When a substance is heated, its particles gain internal energy and move more vigorously. The particles bump into nearby particles and make them vibrate more. This passes internal energy through the substance by **conduction**, from the hot end to the cold end.



### Convection

The particles in liquids and gases can move from place to place. Convection happens when particles with a lot of thermal energy in a liquid or gas move, and take the place of particles with less thermal energy. Thermal energy is transferred from hot places to cold places by convection



### Radiation

All objects transfer energy to their surroundings by **infrared radiation**. The hotter an object is, the more infrared radiation it gives off (emits).

Objects will increase in temperature if it takes in (absorbs) more infrared radiation than it emits. Objects will stay the same temperature if they emit and absorb infrared radiation at the same rate.

No particles are involved in radiation, unlike conduction. This means that energy transfer by radiation can work when objects are not touching, even in space:

Infrared cameras give images even in the dark, because they are detecting infrared light, not visible light

**Quantities** can be measured. Each quantity has a **unit** of measurement that everyone across the world has agreed to measure it in.

Quantity	unit
Temperature	°C
Thermal energy	J