Firrhill High School

Science

Summary Files P2: Energy & Reactions

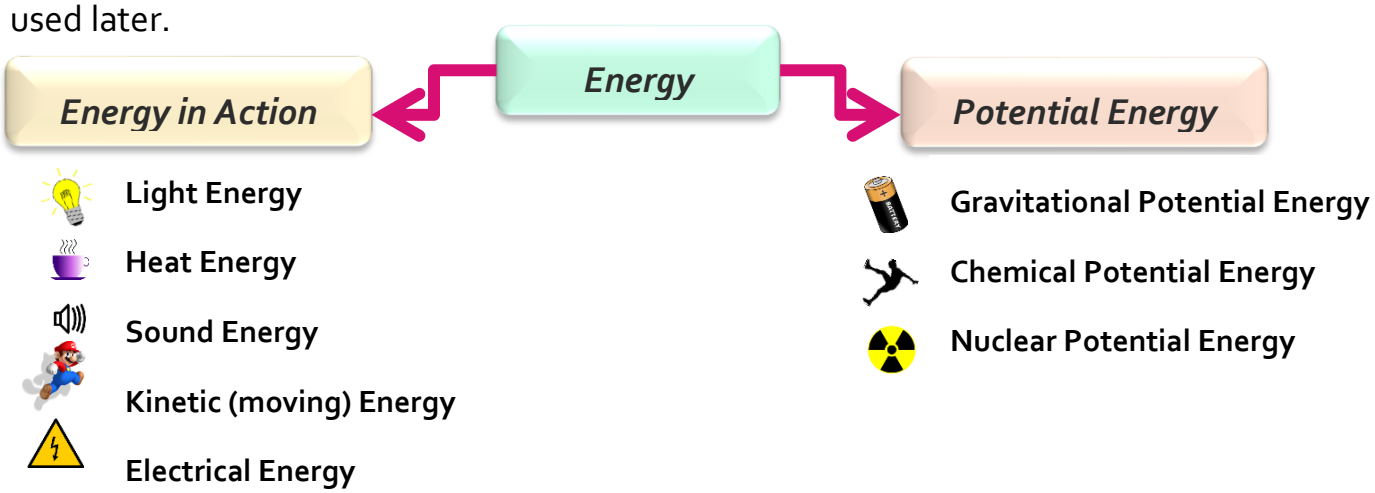
WHAT SHOULD I KNOW?

Success Criteria	Before reading	After reading	Before my test
I can name the five 'energies in action'.			
I can name the three potential energies.			
I can explain what the term 'potential energy' means.			
I can explain the conservation of energy.			
I can figure out the energy change in various situations.			
I can identify chemical and physical changes.			
I can identify reversible and irreversible changes.			
I can list the signs of a chemical reaction.			
I can explain how the particles are aligned in a solid, a liquid and in a gas.			
I can explain what happens to the particles when a substance changes state.			
I can explain what is meant by the term 'conduction'.			
I can explain why conduction only occurs in solids.			
I can state what convection is.			
I can explain why convection can't occur in solids.			
I can give examples of convection in everyday life.			
I can state what the term radiation means.			
I can give examples of conserving heat in the home.			

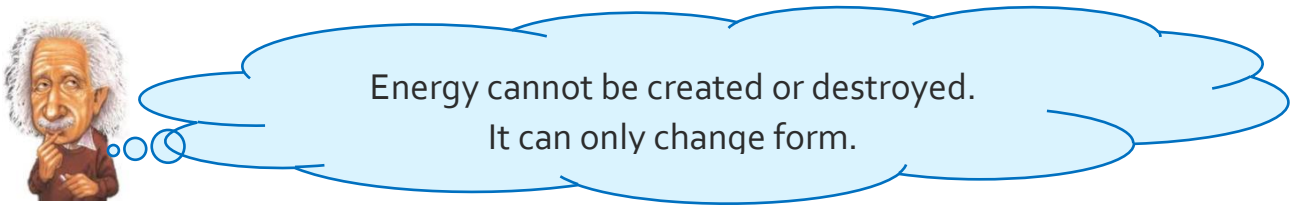
ENERGY

Types of Energy

There are lots of different types of energy. 'Energy in Action' is the term given to energy that is used all the time. 'Potential Energy' is stored energy that could be used later.

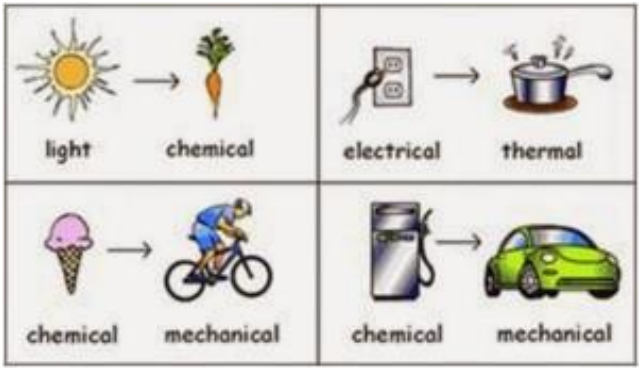


Energy Conservation



Energy can change from any form into any other form. Energy can't be made or unmade, but it can be lost as a not useful from of energy (like when brake pads heat up).

Plants convert light energy from the sun into chemical energy. This chemical energy is then used by all animals and converted into heat energy, sound energy etc.

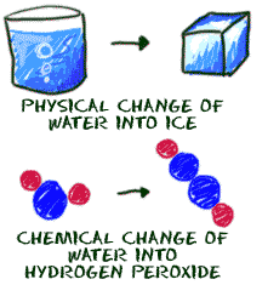


CHEMICAL & PHYSICAL CHANGES

Chemical changes occur during a chemical reaction

During a chemical reaction a chemical change happens. **This results in a new substance being formed** and is hard to reverse.

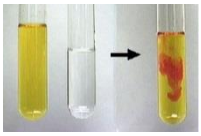
A physical change occurs when no chemical reaction occurs and is usually easy to reverse.



SIGNS OF A CHEMICAL REACTION

How can we tell a chemical reaction has taken place?

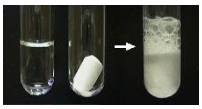
There is a change of colour

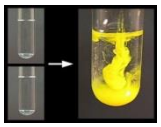


Energy is taken in or given out (heat, light or sound)

We know a chemical reaction has taken place when two or more substances are mixed together and:

Gas is given off (bubbles)





A solid is formed (precipitate)

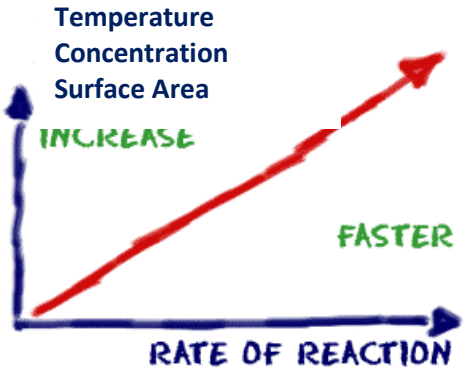
RATES OF REACTION

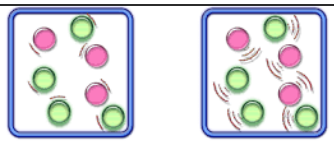
Chemical reactions can happen quicker

Chemical reactions can happen at different speeds.

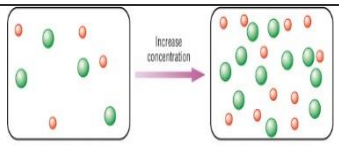
To increase the rate of reaction we can:

- Increase the temperature
- Increase the concentration
- Increase the surface area (this is done by making the particles smaller)
- Using a catalyst

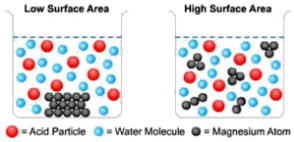




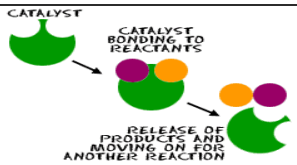
Increasing the temperature makes particles move around quicker and makes them more likely to hit into other particles, causing a reaction.



Increasing concentration means there are more particles that are then more likely to collide, causing a reaction



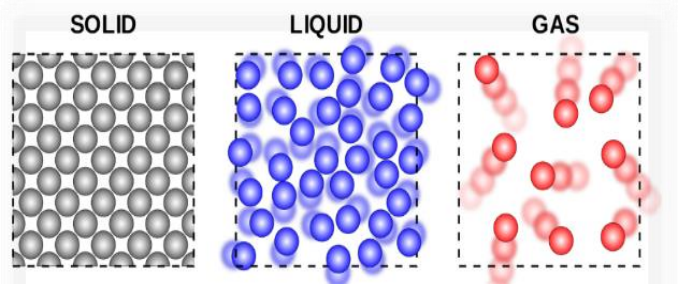
Making particles smaller means there is more surface area that can touch other particles and react.



A catalyst is a chemical that acts like a jigsaw, joining particles together without being changed itself.

PARTICLE THEORY

Particles in Matter



This how the particles are aligned in a solid, a liquid and a gas:

All particles vibrate. When a solid is heated the particles vibrate so much that they move out of their rigid pattern and the solid melts into a liquid.

When a liquid is heated the particles gain so much energy that the move around really fast and increase the spaces between them. The liquid has evaporated into a gas.

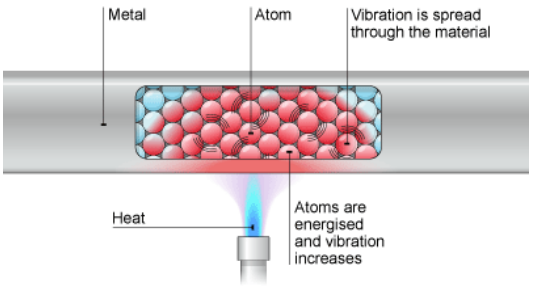
HEAT AND TEMPERATURE

Heat and Temperature are NOT the same thing!

Heat is a measure of how much energy an object has / is being transferred.
Temperature is how hot something is.

CONDUCTION

Conduction Occurs in Solids



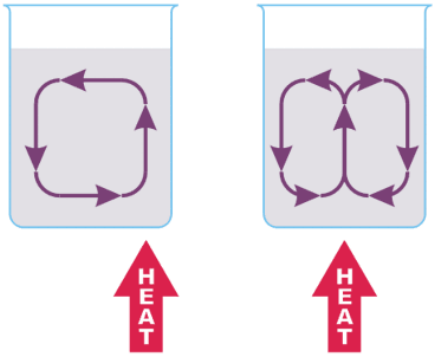
Conduction is when the particles vibrate and pass on the energy they have gained. This causes the temperature of the solid to rise. Particles with lots of heat energy will pass the energy on to particles with less heat energy.

CONVECTION

Convection Occurs in Gases and Liquids

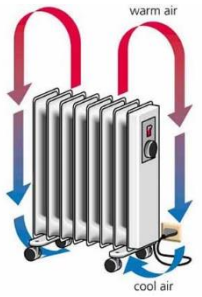
Liquids and gases are fluids. The particles in these fluids can move from place to place. Convection occurs when particles with a lot of heat energy in a liquid or gas move and take the place of particles with less heat energy. Heat energy is transferred from hot places to cooler places by convection.

We saw this in the experiment where potassium permanganate was placed in boiling water. The purple dye (potassium permanganate) was heated by the Bunsen burner, the dye moved and then gradually moved to cooler places, along the top of the beaker and then falling back down to the bottom of the beaker.



Going further >>>

Liquids and gases expand when they are heated. This is because the particles in liquids and gases move faster when they are heated than they do when they are cold. As a result, the particles take up more volume. This is because the gap between particles widens, while the particles themselves stay the same size.



The liquid or gas in hot areas is less dense than the liquid or gas in cold areas, so it rises into the cold areas. The denser cold liquid or gas falls into the warm areas. In this way, convection currents that transfer heat from place to place are set up.

Convection Applications

Hot Air Balloons

The pilot heats the air in a hot air balloon. Hot air rises, the balloon rises as the particles with more energy try to move to somewhere with less energy.

Going Further >>>

As the air gets hotter, it expands and its density drops. The balloon will float above the more dense cool air and it rise up into the sky.

Radiators

The heat from a radiator should be able to increase the temperature of a room evenly. Particles with more heat energy move to areas with less heat energy.

Going Further >>>

The heat source causes the fluid to expand and rise upwards. The hot fluid transfers heat energy to cooler parts of the fluid. A convection current of warm fluid is set up. The air around the radiator also moves by convection, hot less dense air rises and a convection current is created. A roomful of air can be heated by convection.

RADIATION

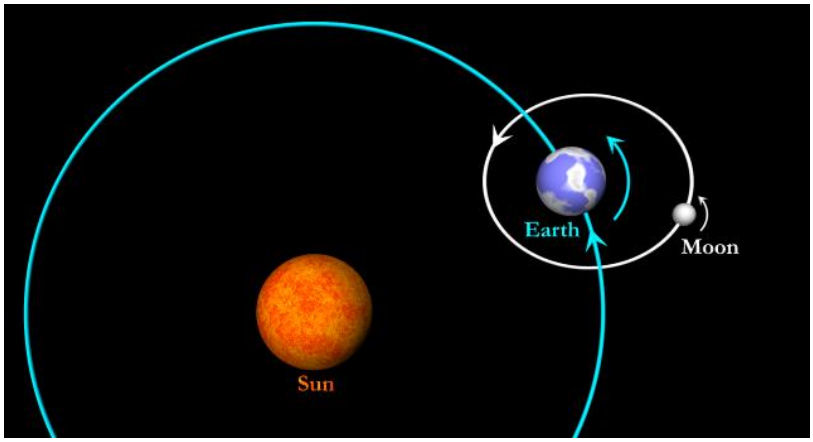
Radiation Occurs in a Vacuum

Space is a vacuum, this means there are no particles in deep space. If there are no particles to transfer heat energy – how can the heat from the sun (150 million km away) be felt on Earth?

The answer is radiation. Radiation is a wave that transfers energy. Infrared radiation transfers heat energy.

All objects give out and take in thermal radiation, which is also called **infrared radiation**. The hotter an object is, the more infrared radiation it emits.

Light from the sun reaching earth



Some surfaces are better than others at reflecting and absorbing infrared radiation.

colour	finish	ability to emit thermal radiation	ability to absorb thermal radiation
dark	dull or matt	good	good
light	shiny	poor	poor

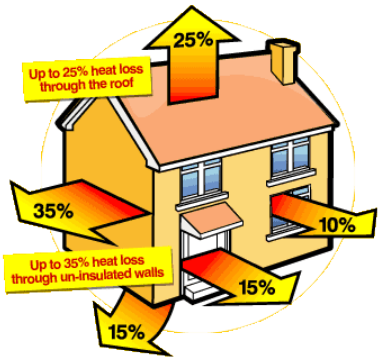
If two objects made from the same material have identical volumes, a thin, flat object will radiate heat energy faster than a fat object.

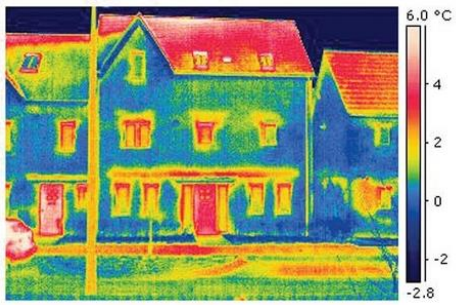
HEAT LOSS

Conserving Heat Loss in the Home

Convection is the movement of particles from areas of high heat energy to areas of lower heat energy. In a house this can mean that all the heat energy leaves your house – making a very expensive heating bill!

By taking infrared pictures of houses scientists can figure out where heat is being lost and design plans to stop it happening.





Heat is lost:

- through the roof
- through windows
- through gaps around the door
- through the walls
- through the floor

Heat energy is transferred from homes by **conduction** through the walls, floor, roof and windows. It is also transferred from homes by **convection**. For example, cold air can enter the house through gaps in doors and windows, and convection currents can transfer heat energy in the loft to the roof tiles. Heat energy also leaves the house by radiation through the walls, roof and windows.