

How Science Works

Why is it important that scientist publish their results?

Results can be checked

Further evidence can be collected

How do scientists publish their work?

Scientific conference

Scientific journals

Why is it a good idea for scientists to work as a team?

They can have different ideas

They can check each other's results

Explain why scientific theories keep changing

More evidence is being found

Better technology/equipment is available

C1 - Particles

What is an isotope?

Atom with the same atomic number and different mass number

How did Geiger and Marsden contribute to ideas about the structure of the atom?

Fired alpha particles at gold

Some alpha particles rebounded

Led to the idea that atoms have a nucleus

How did JJ Thompson contribute to atomic theory?

He discovered the electron

How did Bohr contribute to atomic theory?

He suggested that electrons occupy energy levels

C2 – Elements, compounds and mixtures

Describe metallic bonding

Attraction between positive metal cations

And delocalised electrons

Why do metals conduct electricity?

They have delocalised electrons

Why do ionic compounds conduct electricity when molten or in solution but not as a solid?

In a solid ions cannot move

When dissolved or molten the ions can move

Why do ionic compounds have high melting points?

Strong attraction between oppositely charged ions

Why do metals have high melting points?

Strong attraction between positive ions and delocalised electrons

Why can non-cross linked polymers be stretched easily?

Weak intermolecular forces

Polymer molecules can slide over each other

Why do cross-linked polymers have high melting points?

Strong crosslinks between the polymer molecules

Why is diamond used in cutting tools?

It is hard and it has a high melting point

Why is graphite slippery?

Weak bonds between the layers

Layers can slide over each other

Why is diamond used in jewellery?

Lustrous and transparent

Why do giant covalent compounds have high melting points?

Strong covalent bonds

Need lots of energy to break the bonds

What is an allotrope?

Different structures of the same element

Why does graphite conduct electricity?

It has delocalised electrons

Why is graphite used in pencils?

Layers can slide over each other

Black so can be seen on the paper

Why does graphite / diamond have a high melting point?

Many covalent bonds

Lots of energy needed to break the bonds

Why do simple covalent compounds have low melting and boiling points?

Weak forces between molecules

C3 – Chemical Reactions

What is a spectator ion?

An ion that is in the solution both at the start and the end of the reaction

Explain what happens during neutralisation

Hydrogen ions react with hydroxide ions to make water

What makes a reaction be exothermic?

Bond making gives out energy

Bond breaking takes in energy

Bonds in the products are stronger than those in the reactants

So more energy is given out than taken in

What makes a reaction be endothermic?

Bond making gives out energy

Bond breaking takes in energy

Bonds in the products are weaker than those in the reactants

So more energy is given out than taken in

What is reduction?

Gain of electrons

What is oxidation?

Loss of electrons

What is the difference between a strong and a weak acid?

Strong acids completely dissociate

Weak acids only partially dissociate

Why do weak acids react more slowly than strong acids?

Weak acids dissociate less so there is a lower concentration of H⁺ ions

This gives a lower frequency of collisions

What is a redox reaction?

A reaction that involves both oxidation and reduction

C4 – Predicting and identifying reactions and products

Why do all group 1 elements react in the same way?

They all have one electron in the outer shell

Why do all group 7 elements react in the same way?

They all have 7 electrons in the outer shell

Why do group 2 elements have higher melting points than group 1 elements?

Group 2 elements have a higher charge

There is greater attraction between the oppositely charged ions

C5 – Monitoring and controlling chemical reactions

What is meant by equilibrium when we are discussing reversible reactions?

The rate of the forwards and backwards reaction are equal

The concentrations of reactants + products remain constant

Why is universal indicator not used in titrations?

Universal indicator gives a gradual colour change

A single indicator needs to be used so there is a sudden colour change

Why does increasing the temperature increase the rate of reaction?

Particles move faster

More frequent collisions between reactant particles

More successful collisions between reactant particles

What is a limiting reactant?

The reactant that is all used up

Why does increasing the concentration/pressure of a reactant increase the rate of reaction?

More particles in the same volume

More frequent collisions

Why is a high percentage yield important for a reaction?

Reduces cost

Doesn't waste starting materials

Why is a high atom economy desirable?

Reduces the production of unwanted products

Makes the process more sustainable

Maximises profit

How are soluble salts made?

Titration - Alkali added to acid until it is just neutralised

Water evaporated

Why is a compromise temperature sometimes used for reversible reactions which are exothermic in the forward direction?

A low temperature would give a high yield

However, a low temperature would give a slow rate of reaction.

Why does a powder react faster than a lump of solid?

Powder has a greater surface area

Greater frequency of collisions between reactant particles

What effect does a catalyst have on reversible reactions?

It increases the rate of the forward and backwards reactions

It doesn't affect the position of equilibrium

C6 – Global Challenges

What are the disadvantages of using fuel cells?

Contain poisonous catalysts

Pollution is caused by the burning of fossil fuels when making the raw materials for the fuel cell

Why is a batch process used to make drugs but a continuous process used to make fertilisers?

Drugs are needed in small amounts

Fertilisers are used in large amounts

Why is it important that air pollution is controlled?

Prevent harm to living organisms

Protect buildings

Explain one advantage and one problem of recycling copper.

Saves resources because the ore does not have to be extracted

But, copper has to be sorted from other metals

Why is reinforced steel a better construction material than normal concrete?

Steel is strong under tension, concrete is strong under compression

Steel is more flexible

What are the advantages of using aluminium rather than steel in car construction?

Aluminium is less dense

Aluminium does not corrode

What is a hydrocarbon?

A compound that contains only hydrogen and carbon

What is meant by a saturated compound?

All carbon-carbon bonds are single bonds

What is meant by an unsaturated hydrocarbon?

Contains carbon-carbon double bonds

Describe a chemical test for unsaturated fats

Add bromine water

Goes from orange to colourless

Why can hydrocarbons be separated by fractional distillation?

Larger hydrocarbon molecules have stronger intermolecular forces

This means they have higher boiling points

What political problems are associated with oil production?

UK is dependent on oil from other countries

Future supplies are not secure because wars happens

What does non-renewable mean?

It is made slower than it is used up

What is the test for an unsaturated hydrocarbon?

Bromine water

Changes from orange to colourless

How do fertilisers increase crop yield?

Replaces essential elements

Nitrogen used to make plant protein

Phosphorous used to make ATP

What are the benefits and disadvantages of fertilisers?

World population is rising so we need to produce more food

Water supplies become polluted

Why is it important that fertilisers are soluble in water?

So they can be absorbed by the plant

Why is water filtered before it is used for drinking?

To remove insoluble substances

Why is water chlorinated before it is used for drinking?

To kill microbes

What is a disadvantage of using distillation to purify water?

Large amounts of energy are needed

How can rusting be prevented?

Painting, alloying, galvanising or sacrificial protection

How does galvanising work?

Zinc acts a barrier for the water and oxygen

Zinc is a sacrificial metal as it loses electrons more readily