Acid : a solution containing excess H\(^+\) ions over OH\(^-\) ions (pH <7).

Acidic oxides : non-metal oxides which dissolve in water such as SO\(_2\) or NO\(_2\).

Activity series or Reactivity series : a list of metals placed in order of their reactivity, with the most reactive at the top.

Addition polymer : a type of polymer in which the monomer contains a C=C bond. The C=C bond opens and the monomer units add on to each other to form the polymer, e.g. ethene forms poly(ethene).

Addition reaction : a reaction in which a chemical adds on to the C=C bond in a molecule, e.g. bromine water reacting with an alkene.

Alcohols : carbon compounds containing the \(-\text{OH}\) group (hydroxyl), e.g. ethanol

Alkali : a soluble base which when dissolved in water forms a solution containing excess OH\(^-\) ions over ions H\(^+\) (pH >7).

Alkali metals : the elements in Group 1 of the Periodic Table (Li, Na, K, Rb, Cs).

Alkanes : an homologous series of hydrocarbons with the general formula C\(_n\)H\(_{2n+2}\), e.g. ethane C\(_2\)H\(_6\).

Alkenes : an homologous series of hydrocarbons containing a C==C double bond with the general formula C\(_n\)H\(_{2n}\), e.g. ethene C\(_2\)H\(_4\).
Allotrope: an element that can exist in two or more different forms, e.g. diamond and graphite are both forms of carbon.

Alloys: a mixture of two or more metals (or carbon). The physical properties of individual metals are changed when made into an alloy.

Ammonia: \( \text{NH}_3 \), an alkaline gas made by heating an ammonium salt with an alkali, e.g. ammonium chloride and sodium hydroxide.

Atomic mass unit: a mass equal to the mass of \( 1/12 \)'th of a carbon-12 atom.

Anode: the positive electrode in electrolysis and where oxidation occurs.

Anodising: a process used to thicken the protective oxide layer on aluminium.

Atom: the smallest part of an element, which can exist alone.

Atomic number: the number of protons in the nucleus of an atom.

Atomic mass: the same as relative atomic mass.

Base: a substance, which reacts with an acid to produce a salt and water usually the oxide or hydroxide of a metal.

Benedict's solution: a solution which changes from blue to red/brown when warmed with a reducing sugar.

Bitumen: the last fraction produced by the fractional distillation of oil with the highest melting/boiling point used for road and roofing.

Blast furnace: the industrial process where iron ore is reduced with coke and limestone to produce iron.
Bond: a force by which atoms or ions are held together in a molecule or crystal.

Burette: a long glass graduated tube into which acid is usually used in titrations so that an exact measure of acid needed for neutralisation can be determined.

Carbohydrates: a group of carbon compounds with the general formula C_x(H_2O)_y which living organisms can use as an energy source by respiration.

Catalyst: a substance which will speed up (or slow down) a chemical reaction without itself being changed at the end of the reaction.

Catalytic cracking: when long chain hydrocarbons are broken down by using heat and a catalyst producing a mixture of alkanes and alkenes, e.g.

\[ \text{C}_8\text{H}_{18} \rightarrow \text{C}_6\text{H}_{14} + \text{C}_2\text{H}_4 \]
Octane   hexane   ethene

Cathode: the negative electrode in electrolysis and where reduction occurs.

Cathodic protection: a method of protecting iron from corrosion by making it the negative electrode of a cell. The iron becomes “coated” with electrons which stops it from losing its own, or from rusting.

Cell: a device, which produces electricity by chemical means or a device, which uses electricity to bring about chemical change.

Chemical equation: this shows the chemicals reacting and the new chemicals formed during a chemical reaction. There are several types of equations:

- balanced symbol equations
- half equations
- ionic equations
- state equations
- word equations

Chlorophyll: the green pigment in plants which catalyses photosynthesis.

Chromatography: a physical process used to separate very similar chemicals, often using paper chromatography.

Coal: a fossil fuel formed from the remains of plants over millions of years at high temperature and pressure.

Coke: the product remaining after coal has been roasted in the absence of air to remove impurities such as sulphur.

Colloid: a “solution” which contains particles which are small enough to pass through filter paper but large enough to scatter light (Tyndall Effect), e.g. a starch “solution”.

Combustion: the burning of a substance, usually in air or oxygen.

Compound: a substance in which two or more elements are bonded together.
Concentrated solution: contains a large amount of solute compared to the volume of solvent.

Concentration: a measure of how much of a substance is dissolved in a solution.  
\[
C = \frac{n}{V}
\]
where  
\(C\) = concentration in mol l\(^{-1}\)  
\(n\) = number of moles  
\(V\) = volume in liters

Condensation: when a gas changes into a liquid usually by cooling.

Condensation polymer: a type of polymer in which the monomer units are joined together by a condensation reaction.

Condensation reaction: a reaction in which two (or more) molecules are joined together by removing a molecule of water from between them. Major reaction in the formation of carbohydrates. The opposite is called hydrolysis.  
\[
2C_6H_{12}O_6 \rightarrow C_{12}H_{22}O_{11} + H_2O
\]
glucose  
sucrose  
water

Condenser: a piece of apparatus which cools a gas to change it into a liquid.

Conductivity: a measure of how well a substance conducts electricity.

Conductor: a substance, which allows electricity to flow through it.

Corrosion: the oxidation of metals when they are exposed to the atmosphere (air & oxygen). Corrosion of iron alone is called rusting.

Covalent bond: a bond formed when two non-metal atoms share a pair of electrons equally between them, e.g. Cl—Cl.

Cracking: the breaking up of long chain hydrocarbons into a mixture of shorter chain alkanes and alkenes, e.g.  
\[
C_8H_{18} \rightarrow C_6H_{14} + C_2H_4
\]
Octane  
hexane  
ethene

Crystal: a three dimensional array (or network) of atoms, ions or molecules which repeats itself over and over to give a large unit which has flat sides and constant angles, e.g. sodium chloride crystals are perfect cubes.

Crystal lattice: the regular three-dimensional arrangement of particles (often ions) in a crystalline structure.
Decomposition: the breaking down of a single compound into two or more products, e.g. \( \text{CaCO}_3(s) \rightarrow \text{CaO}(s) + \text{CO}_2(g) \)

Dehydrating agent: a substance that is able to remove water from other chemicals, e.g. concentrated sulphuric acid.

Dehydration: the removal of water from a substance.

Delocalised electrons: electrons that are not closely attached to particular atoms, and so can move easily between atoms in a structure, e.g. graphite and metals.

Diamond structure: carbon atoms covalently bonded in a tetrahedral structure giving great strength to the crystal. Non-electrical conductor, very hard and shiny.

Diatomic molecule: a molecule containing two atoms covalently bonded together, e.g. \( \text{H}_2 \), \( \text{HCl} \).

Diesel: a fraction obtained from crude oil distillation used in cars and trucks.

Diffusion: a physical process by which particles of one substance spread into the spaces between particles of another substance.

Dilute solutions: solution containing small amounts of solute compared to the volume of solvent.

Disaccharide: a type of carbohydrate formed by the joining together of two monosaccharide molecules, e.g. sucrose formed by glucose & fructose.

Displacement reaction: a reaction in which a metal is formed from the solution of its ions by adding a metal higher in the Electrochemical Series.

Dissolve: the process of making one substance go into solution in another.

Distillate: the liquid that is collected after distillation.

Distillation: a physical method of separating a mixture of different liquids by using their different boiling points.

Double bond: a bond in which four electrons are shared between two atoms, e.g. \( \text{C}==\text{C} \) in ethene.

Ductile: describes a solid (metal) that can be drawn out into a wire without breaking.

Electrochemical Series: an order of metals and hydrogen arranged in order of how well they lose electrons and form ions. See page 7 in data book.

Electrode: the conductor used to pass electricity into or out of solutions or melts.
**Electrode potential**: a measure of how easily a metal forms ions in solution.

**Electrolyte**: a solution or melt that conducts electricity and is decomposed by it.

**Electrolysis**: a process whereby a solution or melt is decomposed by the passage of electricity.

**Electron**: a small negative particle, which moves around the nucleus of an atom. It has a charge of -1 and a very small mass (1/1850 of 1 a.m.u).

**Electron arrangements**: shows the number of electrons present in the energy levels of an atom e.g. Na - 2,8,1.

**Electron clouds**: are regions within the energy levels of an atom in which electrons can be found. Each electron cloud can hold a maximum of two electrons.

**Electroplating**: an electrolysis process that deposits a layer of metal on a negative electrode made from another metal, e.g. nickel plating on cutlery.

**Element**: a substance that cannot be split up into simpler substances by chemical means. It contains only one type of atom, and all its atoms have the same atomic number (number of protons).

**Empirical formula**: gives the simplest ratio of the atoms (or ions) of the different elements present in the compound, e.g. ethane (C\textsubscript{2}H\textsubscript{6}) has an empirical formula of CH\textsubscript{3}, a formula that cannot exist for a real compound.

**Endothermic**: a reaction in which heat is taken in from the surroundings.

**End-point**: the same as the neutralisation point in titrations.

**Energy levels**: the “layers” of electrons around an atom.

**Enzymes**: are biological catalysts found in living things, e.g. amylase found in saliva.

**Equilibrium**: when the rate at which the reactants combine to form products is the same as the rate at which the products break down into reactants in a reversible reaction.

**Evaporation**: the turning of a liquid into a gas by supplying heat energy.

**Exothermic**: a reaction in which heat is given out.

**Fermentation**: a process by which carbohydrates are converted into ethanol and carbon dioxide by enzymes found in yeast.

**Ferroxyl indicator**: a solution used in corrosion experiments with iron. It turns blue when Fe is being oxidised to Fe\textsuperscript{2+} ions, and pink whenever reduction occurs due to OH\textsuperscript{-} ions.
Fertiliser: a substance that is added to the soil to replace nutrients that have been removed by plants. May be natural such as manure, or synthetic such as ammonium nitrate (NPK system).

Filtrate: the liquid that passes through filter paper and is collected.

Filtration: a process whereby a solid is separated from a liquid by filtering.

Formula: this shows the number of atoms or ions of the elements present in a substance. Five types: Empirical formula
- General formula
- Ionic formula
- Molecular formula
- Structural formula

Formula mass: the sum of the relative atomic masses of all the atoms shown by the formula of a substance.

Fossil fuel: a fuel found in the earth that has been formed from the remains of living things. The three main ones are coal, oil and gas.

Fraction: the distillate collected over a restricted temperature range.

Fractional distillation: a method of separating a mixture of liquids which all have different boiling points. The different fractions are collected separately as they condense.

<table>
<thead>
<tr>
<th>FRACTION</th>
<th>NO. OF C ATOMS</th>
<th>BOILING RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel gas</td>
<td>1 - 4</td>
<td>~160 - 20°C</td>
</tr>
<tr>
<td>Petrol</td>
<td>5 - 10</td>
<td>20 - 70°C</td>
</tr>
<tr>
<td>Naphtha</td>
<td>8 - 12</td>
<td>70 - 120°C</td>
</tr>
<tr>
<td>Paraffin</td>
<td>10 - 16</td>
<td>120 - 240°C</td>
</tr>
<tr>
<td>Diesel oil</td>
<td>15 - 70</td>
<td>240 - 350°C</td>
</tr>
<tr>
<td>Bitumen</td>
<td>70 +</td>
<td>350°C +</td>
</tr>
</tbody>
</table>

Diagram:
- Crude oil enters at 400°C.
- Distillation takes place in the fractionating column.
- Fuel gas is collected at ~160 - 20°C.
- Petrol is collected at 20 - 70°C.
- Naphtha is collected at 70 - 120°C.
- Paraffin is collected at 120 - 240°C.
- Diesel oil is collected at 240 - 350°C.
- Bitumen is collected at 350°C +.
Fructose: a monosaccharide of formula $C_6H_{12}O_6$. Isomeric with glucose.

Fuel: a substance that combines with oxygen (burns) to give out heat.

Galvanising: is the protection of iron by coating it with zinc.

Gas: a substance that has no fixed volume or shape.

General formula: a formula that applies to a large number of similar compounds such as the alkanes ($C_nH_{2n+2}$), alkenes ($C_nH_{2n}$), and carbohydrates.

Glucose: a monosaccharide of formula $C_6H_{12}O_6$. Isomeric with fructose.

Graphite: a form of carbon in which carbon atoms are arranged in hexagonal rings with each carbon atom making three bonds. These rings form flat sheets which are stacked upon each other. Graphite is the only conducting non-metal element. It is very soft and black-gray in colour. Used for pencils and electrical brushes in electric motors.

Group: a vertical column of elements in the Periodic Table.

Haber Process: the industrial manufacture of ammonia ($NH_3$) from hydrogen and nitrogen.

Haemoglobin: the red pigment in blood responsible for transporting oxygen round the body.

Half equation: an equation, which shows electrons, being lost or gained. It shows either the oxidation or the reduction half of a redox reaction, e.g. $Cu \rightarrow Cu^{2+} + 2e$ is an oxidation (loss of electrons).

Halogens: group VII (7) elements (F, Cl, Br, I).

Homologous series: a group of carbon compounds with similar chemical properties that can be represented by a general formula.

Hydrocarbon: a compound containing the elements carbon and hydrogen only.

Hydrolysis: a chemical reaction in which a substance is broken down into smaller molecules by reacting with water, e.g. starch can be hydrolysed to give glucose.

Immiscible: when two liquids do not mix together but form two layers, one on top of the other.

Indicator: a dye that changes colour within a certain pH range.

Inert: unreactive.

Inorganic: concerned with non-organic chemistry. See organic.
Insoluble: substance is said to be insoluble if it does not dissolve in a given solvent.

Ion: an atom (or group of atoms) which has lost or gained one or more electrons. It is electrically charged, e.g. Na⁺.

Ion bridge: a device used to join two half-cells. It completes the electrical circuit without mixing or reacting with the two solutions. It contains a solution of an electrolyte such as sodium chloride.

Ion-electron half-equation: same as half equation.

Ionic bond: a type of bond formed when electrons are transferred between atoms forming positive and negative ions which then attract each other, e.g. Na⁺Cl⁻. Usually formed between metals and non-metals. See crystal lattice for structure.

Ionic equation: an equation that shows the individual ions present in a chemical reaction, e.g. 

\[ \text{Na}^+ \text{OH}^- + \text{H}^+ \text{Cl}^- \rightarrow \text{Na}^+ \text{Cl}^- + \text{H}_2\text{O} \]

Isomers: are compounds with the same molecular formula but different structural formulae, e.g. both the following have a formula C₄H₁₀

[Diagram of two isomers]

Isotopes: atoms of an element that have the same atomic number but different mass numbers because they have different numbers of neutrons in the nucleus, e.g. chlorine has two common isotopes: 

\(^{35}\text{Cl}\) or chlorine-35

\(^{37}\text{Cl}\) or chlorine-37

Lattice: a three dimensional network of atoms or ions in a repeating pattern. See crystal lattice.

Leguminous plants: are plants which can convert nitrogen from the air directly into soluble nitrates by means of bacteria contained in nodules in their roots, e.g. peas, beans and clover.

Limestone: a rock consisting mainly of the chemical calcium carbonate, CaCO₃, usually formed from the shell remains of marine organisms.

Lime water: a solution of calcium hydroxide, Ca(OH)₂, which turns milky when carbon dioxide is bubbled through as insoluble calcium carbonate forms.

Linear molecules: a molecule in which the atoms all lie in straight line, e.g. carbon dioxide

\[ \text{O} = \text{C} = \text{O} \]
**Liquid**: a state in which molecules/atoms/ions move around freely, but are still very close together. Fixed volume, but no fixed shape.

**Macromolecule**: a very large molecule containing many atoms.

**Malleable**: describes a solid (metal) that can be beaten out into sheets without breaking.

**Maltose**: a disaccharide of formula $C_{12}H_{22}O_{11}$. Isomeric with sucrose.

**Mass number**: the total number of protons and neutrons in the nucleus of an atom.

**Mass spectrometer**: an instrument used for finding the relative atomic mass of elements. It measures the amounts of the different isotopes of an element.

**Melting**: a physical process whereby a solid changes into a liquid by the application of heat.

** Metallic bond**: a type of bond found in metals. It consists of the attraction between positive metal ions and the surrounding “sea” of delocalised electrons.

**Metals**: are shiny, malleable and ductile elements. All conduct electricity. They occur on the left side of the zigzag line on the Periodic Table.

**Miscible**: two liquids that can mix together completely.

**Mixture**: two or more substances mixed together, but not chemically joined.

**Mobility of ions**: a measure of how fast ions move during electrolysis.

**Molarity**: a measure of the concentration of a solution in moles per litre ($\text{mol l}^{-1}$)

**Mole**: the formula mass expressed in grams.

**Molecular formula**: this represents the number of atoms of the different elements present in one molecule of the substance, e.g. methane is CH$_4$.

**Molecule**: a particle which consists of two or more atoms covalently bonded together.

**Monatomic**: atoms that only occur as single units. Only the Noble gases are monatomic.

**Monomer**: a relatively simple molecule, which can be linked together many, times to form a large molecule by the process called polymerisation, e.g. ethene.

**Monosaccharide**: a type of carbohydrate consisting of one saccharide unit per molecule, e.g. glucose.

**Natural gas**: a fossil gas consisting mainly of methane.

**Natural polymers**: polymers, which occur in plants or animals such as proteins or rubber.
Negative electrode: the electrode, which gives away electrons and attracts positive ions during electrolysis.

Neutral: a solution in which the concentration of the $H^+$ ions equals the concentration of the $OH^-$ ions and the pH = 7.

Neutralisation: a reaction in which an acid cancels out a base to form a neutral solution or vice-versa.

Neutron: a particle with no overall charge, which occurs in the nucleus of atoms. Each neutron has zero charge and a mass of 1 a.m.u.

Nitrogen cycle: the routes by which nitrogen is re-cycled by animals, plants and humans involving the chemical links between nitrogen gas, ammonia and nitrates.

Noble gases: are the elements in group VIII (8) or 0 of the Periodic Table (He, Ne, Ar, Kr, Xe, Rn)

Non-metals: are elements, which occur on the right hand side of the periodic table. They are all (with the exception of graphite) non-conductors of electricity. They are not usually shiny, malleable or ductile.

Nucleus: the tiny positive center of an atom where most of its mass is concentrated. It consists of neutrons and protons.

Oil: a liquid fossil fuel formed millions of years ago from the remains of tiny sea creatures. Consists mainly of hydrocarbons. Petrol and other fractions are extracted from it by fractional distillation.

Ore: a naturally occurring substance from which an element can be extracted, e.g. metal oxides or carbonates to give metals.

Organic: compounds containing carbon except carbon dioxide or carbonates.

Ostwald Process: the industrial manufacture of nitric acid ($HNO_3$) from ammonia.

Oxidation: a chemical change in which electrons are lost. Also defined as when the % of oxygen increases in a substance.

Oxidising agent: a substance that takes electrons from (oxidises) other substances. The oxidising agent itself is reduced.

Paraffin: a liquid fuel extracted from crude oil by fractional distillation. Used for lighting and cooking.

Period: a horizontal row in the Periodic Table, e.g.
  - Period 1: H to He
  - Period 2: Li to Ne
  - Period 3: Na to Ar
  - Period 4: K to Kr
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodic Table</td>
<td>a way of presenting the elements by atomic number so as to show their similarities and differences.</td>
</tr>
<tr>
<td>Petroleum</td>
<td>see oil.</td>
</tr>
<tr>
<td>Petrochemical</td>
<td>a chemical that has been made from petroleum, e.g. plastics.</td>
</tr>
<tr>
<td>pH</td>
<td>a scale that says how acid or alkaline a solution is. It is a measure of the hydrogen ion concentration.</td>
</tr>
<tr>
<td></td>
<td>pH &gt; 7 is alkaline</td>
</tr>
<tr>
<td></td>
<td>pH = 7 is neutral</td>
</tr>
<tr>
<td></td>
<td>pH &lt; 7 is acidic</td>
</tr>
<tr>
<td>Photosynthesis</td>
<td>a process whereby green plants convert carbon dioxide and water into carbohydrates and oxygen using sunlight as the energy source.</td>
</tr>
<tr>
<td>Physical change</td>
<td>a change to a substance not involving a chemical change, e.g. melting and boiling.</td>
</tr>
<tr>
<td>Pipette</td>
<td>a glass tube into which an exact predetermined volume of a solution can be taken, e.g. 25 cm³</td>
</tr>
<tr>
<td>Planar molecule</td>
<td>a flat molecule, e.g. water.</td>
</tr>
<tr>
<td>Plastic</td>
<td>a common term used to describe polymers that can be moulded by heat or pressure.</td>
</tr>
<tr>
<td>Polymer</td>
<td>a large molecule formed by joining together a large number of smaller molecules called monomers.</td>
</tr>
<tr>
<td>Polymerisation</td>
<td>the process whereby a polymer is formed. There are two main types :</td>
</tr>
<tr>
<td></td>
<td>i) addition polymerisation</td>
</tr>
<tr>
<td></td>
<td>ii) condensation polymerisation</td>
</tr>
<tr>
<td>Polymorphs</td>
<td>are different crystalline forms of the same substance, element or compound, e.g. diamond and graphite are both carbon.</td>
</tr>
<tr>
<td>Polysaccharide</td>
<td>a type of carbohydrate formed by joining together a large number of monosaccharide molecules, e.g. starch.</td>
</tr>
<tr>
<td>Positive electrode</td>
<td>the electrode, which accepts electrons and attracts negative ions during electrolysis.</td>
</tr>
<tr>
<td>Precipitate</td>
<td>an insoluble solid formed when certain solutions are mixed.</td>
</tr>
<tr>
<td>Products</td>
<td>the new chemicals formed by a chemical reaction.</td>
</tr>
</tbody>
</table>
Proton: a positive particle that occurs in the nucleus of atoms. Each proton has a charge of +1 and a mass of 1 a.m.u.

Rate of reaction: a measure of how quickly a reaction is proceeding.

Reactants: the chemicals that react with each other during a chemical reaction.

Redox reaction: a chemical reaction in which one chemical is reduced and the other oxidised. They must both occur simultaneously, e.g. the reaction of magnesium in chlorine:

\[
\begin{align*}
\text{Mg} & \rightarrow \text{Mg}^{2+} + 2e^- \\
\text{Cl}_2 & + 2e^- \rightarrow 2\text{Cl}^-
\end{align*}
\]

Reducing agent: a substance that gives electrons to (reducing) other substances. The reducing agent itself is oxidised.

Reducing sugar: a type of carbohydrate that gives a positive test with Benedict’s solution, e.g. glucose & maltose.

Reduction: a chemical change in which electrons are gained.

Refining: this involves the removal of impurities from a substance or the removal of components from a mixture, e.g. fractional distillation of oil.

Relative atomic mass: the average mass of 1 atom of an element, based on a scale where a atom of carbon-12 has 12 units of mass.

Residue: the solid chemical left after a reaction or the solid substance that is trapped on filter paper after filtration.

Respiration: a process whereby carbohydrates are broken down to release energy in plants and animals, e.g. glucose

\[
\begin{align*}
\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 & \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{energy}
\end{align*}
\]

Reversible Reaction: a chemical reaction in which the products are unstable and change back into the reactants leading to an equilibrium being set up.

Rust: the reddish-brown product of corrosion of iron, which has been exposed to air and water. It is hydrated iron(III) oxide, Fe$_2$O$_3$.xH$_2$O.

Sacrificial protection: a method of protecting metal by attaching it to a more reactive metal.

Salts: are chemicals formed when the hydrogen (H$^+$) ion of an acid is replaced by another positive ion such as the Na$^+$ or the Mg$^{2+}$ ions.

Saturated compound: a carbon compound in which all the carbon to carbon bonds are single bonds.

Saturated solution: a solution in which no more solute will dissolve at a given temperature.
Solid : has fixed volume and fixed shape.

Soluble : a substance is said to be soluble if it dissolves in a solvent to form a solution.

Solute : the solid that dissolves in a solvent to form a solution.

Solution : a solvent with something dissolved in it.

Spectator ions : are ions that appear unchanged on both sides of an ionic equation, and do not take part in a chemical reaction, e.g. Na\(^+\) ions in a neutralisation reaction.

Standard flask : a special flask, which has a mark, indicating a precise volume. Used for making standard solutions.

Standard solution : a solution of known concentration.

Starch : a polysaccharide found in plants, and an energy source in many living organisms. Consists of many glucose molecules joined together with a formula \((C_6H_{10}O_5)_n\) where \(n\) is a very large number (1000’s).

State : the physical state in which matter occurs, e.g. solid, liquid or gas.

State equation : an equation that shows the states of the reactants and the products in a chemical reaction:
\[(s) \rightarrow \text{solid} \quad (l) \rightarrow \text{liquid} \quad (g) \rightarrow \text{gas} \quad (aq) \rightarrow \text{aqueous (in solution)}\]

Structural formula : a formula that shows the arrangement of the atoms in the molecule.

Subatomic particles: the small units that make up the atom: protons, electrons and neutrons.

Sucrose : a disaccharide of formula \(C_{12}H_{22}O_{11}\). Isomeric with maltose.

Symbols : a shorthand way of writing the names of the elements, e.g. Al = aluminium.

Synthetic polymers: are polymers that do not occur naturally, i.e. man-made such as poly(ethene) and poly(propene).

Temperature : the measure of the kinetic energy of a substance.

Tetrahedral shape : atoms in a molecule or ion arranged with bond angles of 109.5°

Thermal cracking : when long chain hydrocarbons are broken down by heat alone.

Thermoplastic : a term used to describe polymers that soften when heated, e.g. nylon and poly(ethene).
Thermosetting: a term used to describe polymers that do not soften when heated. If heated strongly they decompose, e.g. bakelite and formica.

Titration: slowly adding an acid to an alkali (or vice-versa) until a neutral solution is obtained. Technique used to determine the concentrations of solutions.

Titre: the value of a titration in millilitres.

Transition metal: the metals found in the central part of the Periodic Table.

Triatomic molecule: a molecule with three atoms in it, e.g. carbon dioxide and water.

Tyndall Effect: the scattering of light by particles in a colloid.

Units: these are quantities or measurements, which are used as standards to measure other things. Common ones used in chemistry are:
- mass in grams (g) or kilograms (kg)
- volume in litres (l) or millilitres (ml)

Universal Indicator: a solution that is used for finding the pH of a solution. It changes different colours for different pH values:
- pH 1 = red
- pH 7 = green
- pH 12 = purple
- pH 4 = orange
- pH 10 = blue

Unsaturated: a compound that contains a carbon to carbon double bond (C==C) such as the alkenes.

Valency: a number that shows the combining power of atoms or ions.

Valency Rule: the valency of an element is the same as the group number up to group 4 and after group 4 it is 8 minus the group number, e.g.

<table>
<thead>
<tr>
<th>Group number</th>
<th>Valency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
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</tr>
</tbody>
</table>

Word equation: an equation that shows the chemicals involved in a reaction as words rather than as symbols.

Yeast: a single celled organism that produces enzymes able to break down certain carbohydrates into ethanol and carbon dioxide by fermentation.