What is a chemical bond?

A chemical bond is a lasting attraction between atoms that enables the formation of chemical compounds.

What are ions?

If an atom becomes charged by gaining or loosing electron(s) it is called ions.

Loosing electron(s) makes an atom positively charged and is called cation(s). Name of the cations are same as name of their atoms.

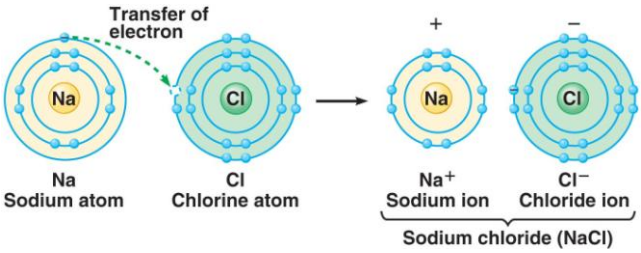
Gaining electron(s) makes an atom negatively charged and is called anion(s). Name of anions are slightly changed than the name of their atoms. Generally and –ide is added after the name.

Oxygen → Oxide

Chlorine →Chloride

What is ionic bond?

Ionic bonding is a type of chemical bond that involves the electrostatic attraction between oppositely charged ions, and is the primary interaction occurring in ionic compounds. The ions are atoms that have gained one or more electrons and atoms that have lost one or more electrons. An example of ionic bond is the bond between sodium and chlorine in sodium chloride. The bonding is shown below.



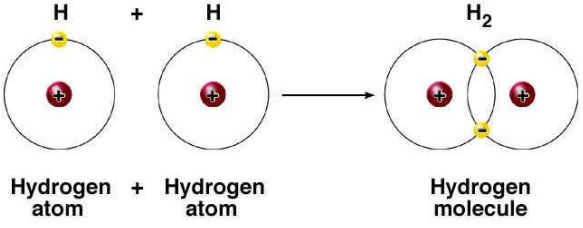
What is valency or valence?

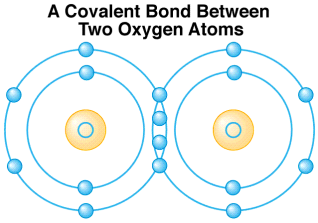
The valence or valency of an element is a measure of its combining power with other atoms when it forms chemical compounds or molecules. Some typical valency for common group are shown below.

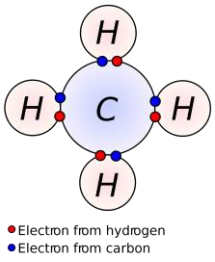
Group	Valence 1	Valence 2	Valence 3	Valence 4	Valence 5	Valence 6	Valence 7	Typical valencies
1 (I)	NaCl							1
2 (II)		$MgCl_2$						2
13 (III)			BCl_3, $AlCl_3$ Al_2O_3					3
14 (IV)		CO		CH_4				4
15 (V)		NO	NH_3 PH_3 As_2O_3	NO_2	N_2O_5 PCl_5			3 and 5
16 (VI)		H_2O H_2S		SO_2		SO_3		2 and 6
17 (VII)	HCl			ClO_2			Cl_2O_7	1 and 7

What is covalent bond?

A covalent bond is a chemical bond that involves the sharing of electron pairs between atoms. These electron pairs are known as shared pairs or bonding pairs, and the stable balance of attractive and repulsive forces between atoms, when they share electrons, is known as covalent bonding. Below on the left is the example of formation of covalent bond in hydrogen molecule. On the right are covalent bonds of oxygen and methane.







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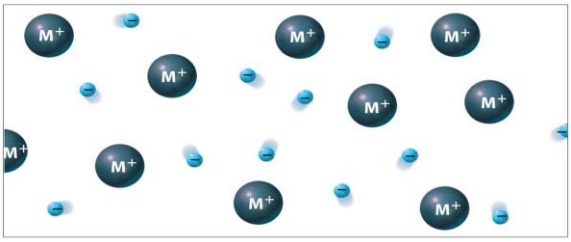
What is metallic bond?

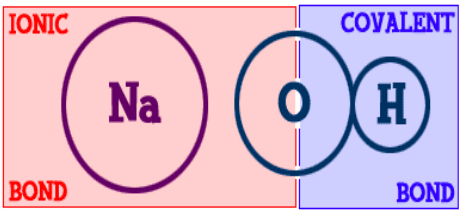
Metallic bonding arises from the electrostatic attractive force between conduction electrons (in the form of an electron cloud of delocalized electrons) and positively charged metal ions. It may be described as the sharing of free electrons among a lattice of positively charged ions (cations).



Compound

A compound is a substance formed when two or more chemical elements are chemically bonded together. Two types of chemical bonds common in compounds are covalent bonds and ionic bonds. The elements in any compound are always present in fixed ratios.

In some cases a compound can contain multiple bonds in it. For example sodium hydroxide (NaOH) has covalent and ionic bond both in it.



You can see the sodium (Na) part on the left and the hydroxide (-OH) part on the right. The bond that binds the hydrogen (H) to the oxygen (O) is covalent. The sodium is bonded to the hydroxide part of the compound with an ionic bond. This is a good example of how there can be different types of bonds within one compound.

What is Van-der-wall force?

Van der Waals force is the residual attractive or repulsive forces between molecules or atomic groups that do not arise from a covalent bond, or electrostatic interaction of ions or of ionic groups with one another or with neutral molecules.

Mixture

A mixture is a material system made up of two or more different substances which are mixed but are not combined chemically. A mixture refers to the physical combination of two or more substances on which the identities are retained and are mixed in the form of solutions, suspensions, and colloids.

Difference between mixture and compound

A compound is a substance in which atoms of different elements are chemically held to one another. A mixture is a substance made by combining two or more different materials in such a way that no chemical reaction occurs.

Compound	Mixture
They are made up of two or more elements combined chemically.	They are made up of two or more substances mixed physically.
The constituents of a compound are present in a fixed ratio.	The constituents of a mixture are present in varying ratios.
Compounds have fixed properties. For example, a particular compound will have fixed temperatures at which it melts and boils.	Mixtures do not have fixed properties. Their properties depend on the nature of their components and the ratios in which they are combined.
A compound can have properties different from its constituents, as a new substance is formed when the constituents are chemically combined.	In mixtures, no new substance is formed. The properties of a mixture are the same as the properties of its constituents.
The constituents of a compound can be separated only by chemical methods.	The constituents of a mixture can be separated easily by physical methods.

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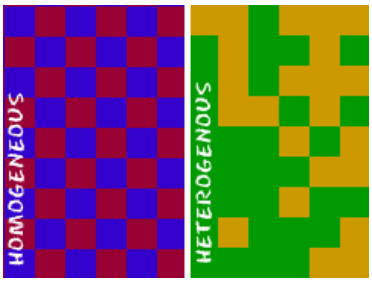
Solution



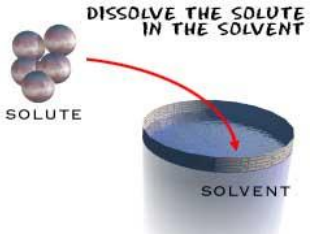
Solution is a type of mixture. Before we dive into solutions, let's separate solutions from other types of mixtures. Solutions are groups of molecules that are mixed and evenly distributed in a system. Scientists say that solutions are **homogenous systems**. Everything in a solution is evenly spread out and thoroughly mixed. Heterogeneous mixtures have a little more of one thing (higher concentration) in one part of the system when compared to another.
Let's compare sugar in water (H2O) to sand in water. Sugar dissolves and is spread throughout the glass of water. The sand sinks to the bottom. The sugar-water is a homogenous mixture while the sand-water is a heterogeneous mixture. Both are mixtures, but only the sugar-water can also be called a solution.

Types of solution

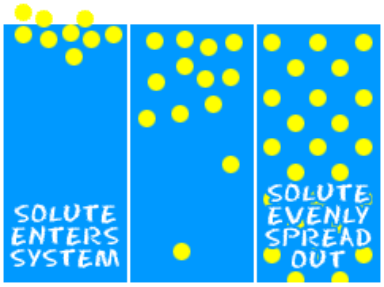
Solutions can be solids dissolved in liquids. Solutions can also be gases dissolved in liquids, such as carbonated water. There can also be gases in other gases and liquids in liquids. If you mix things up and they stay at an even distribution, it is a solution. You probably won't find people making solid-solid solutions. They usually start off as solid/gas/liquid-liquid solutions and then harden at room temperature. Alloys with all types of metals are good examples of solid solutions at room temperature.

SOLUTION	EXAMPLE
Gas-Gas	Air
Gas-Liquid	Carbon Dioxide (CO_2) in Soda
Gas-Solid	Hydrogen (H_2) in Palladium (Pd) Metal
Liquid-Liquid	Gasoline
Liquid-Solid	Dental Fillings
Solid-Solid	Metal Alloys Such as Sterling Silver

Making Solutions



A simple solution is basically two substances that are evenly mixed together. One of them is called the solute and the other is the solvent. A solute is the substance to be dissolved (sugar). The solvent is the one doing the dissolving (water). As a rule of thumb, there is usually more solvent than solute. Be patient with the next sentence as we put it all together. The amount of solute that can be dissolved by the solvent is defined as solubility. That's a lot of "sol" words.



So, How do you make that solution? Mix the two liquids and stir. It's that simple. Science breaks it into three steps. When you read the steps, remember...
Solute=Sugar, Solvent=Water, System=Glass.
1. The solute is placed in the solvent and the concentrated solute slowly breaks into pieces. Stirring the liquid, the mixing process happens much faster.
2. The molecules of the solvent begin to move out of the way and they make room for the molecules of the solute. Example: The water has to make room for the sugar molecules to spread out.
3. The solute and solvent interact with each other until the concentration of the two substances is equal throughout the system. The concentration of sugar in the water would be the same from a sample at the top, bottom, or middle of the glass.

Colloids

Science has special names for everything. They also have names for the different types of homogenous mixtures. Solution is the general term used to describe homogenous mixtures with small particles. Colloids are solutions with bigger particles. Colloids are usually foggy or milky when you look at them. In fact, milk is an emulsified colloid.

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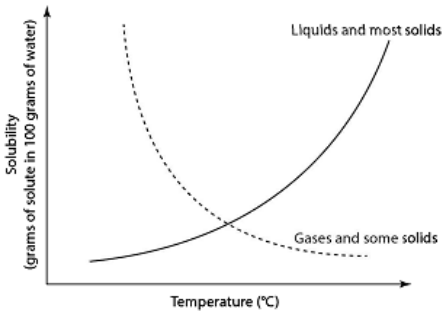
Solubility

Sure. All sorts of things can change the concentrations of substances in solution. Scientists use the word solubility. Solubility is the ability of the solvent (water) to dissolve the solute (sugar). You may have already seen the effect of temperature in your classes. Usually when you heat up a solvent, it can dissolve more solid materials (sugar) and less gas (carbon dioxide). If your friend was mixing sugar and water, she would be able to dissolve a lot more sugar into hot water rather than cold.



Next on the list of factors is pressure. When you increase the surrounding pressure, you can usually dissolve more gases in the liquid. Think about your soda can. It is able to keep the fizz inside, because the contents of the can are under higher pressure. Think about a bottle of soda. The first time you open the bottle, a lot of bubbles come out. If you open and close it over a few hours, fewer and fewer bubbles will come out of the solution. When you opened the bottle the first time, you lost the high pressure that was keeping the carbon dioxide (CO_2) gas in solution.

Last is the structure of the substances. Some things dissolve easier in one kind of substance as opposed to another. Sugar dissolves easily in water and oil does not. Water has a low solubility when it comes to oil. Since oil is not soluble in water, it will never truly dissolve. Oil and water is a mixture, not a solution. The two types of molecules (oil and water) are not evenly distributed in the system.

Saturation

Saturation is the point at which a solution can dissolve no more of that substance and any additional amount of solute will appear as undissolved particles. There are three degrees of saturation.

Unsaturated: If more solute is added to the liquid it would keep dissolving.

Saturated: If the liquid has dissolved the maximum amount of solute it can dissolve at a specific temperature it is called to be saturated.

Supersaturated: The liquid contains more solute than it can theoretically dissolve at a given temperature.

Weak and strong solution (concentration)

A solution can be described as dilute (Weak) or concentrated (Strong). Dilute means that a small amount of solute is dissolved in the solvent. Concentrated means a large amount of solute is dissolved in the solvent. This strength of a solution is known as the concentration of the solution. Concentration of a solution refers to the amount of solute dissolved in a solution.

Formulas and names of compounds

Below are some compounds you may need to know.

Compound	Formula	Compound	Formula
Ammonia	NH_3	Barium chloride	$BaCl_2$
Carbon dioxide	CO_2	Sodium chloride	NaCl
Methane	CH_4	Calcium carbonate	$CaCO_3$
Water	H_2O	Copper carbonate	$CuCO_3$
Hydrochloric acid	HCl	Sodium carbonate	Na_2CO_3
Sulphuric acid	H_2SO_4	Potassium nitrate	KNO_3
Calcium oxide	CaO	Silver nitrate	$AgNO_3$
Iron oxide	Fe_2O_3	Barium sulphate	$BaSO_4$
Lead oxide	PbO	Copper sulphate	$CuSO_4$
Sodium hydroxide	NaOH	Sodium sulphate	Na_2SO_4

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