Science

Elements

Chemical element, also called element, any substance that cannot be decomposed into simpler substances by ordinary chemical processes. Elements are the fundamental materials of which all matter is composed.

At present there are 118 known chemical elements. About 20 percent of them do not exist in nature (or are present only in trace amounts) and are known only because they have been synthetically prepared in the laboratory. Of the known elements, 11 (hydrogen, nitrogen, oxygen, fluorine, chlorine, and the six noble gases) are gases under ordinary conditions, two (bromine and mercury) are liquids (two more, cesium and gallium, melt at about or just above room temperature), and the rest are solids. Elements can combine with one another to form a wide variety of more complex substances called compounds.

The number of possible compounds is almost infinite; perhaps a million are known, and more are being discovered every day. When two or more elements combine to form a compound, they lose their separate identities, and the product has characteristics quite different from those of the constituent elements. The gaseous elements hydrogen and oxygen, for example, with quite different properties, can combine to form the compound water, which has altogether different properties from either oxygen or hydrogen. Water clearly is not an element because it consists of, and actually can be decomposed chemically into, the two substances hydrogen and oxygen; these two substances, however, are elements because they cannot be decomposed into simpler substances by any known chemical process. Most samples of naturally occurring matter are physical mixtures of compounds. Seawater, for example, is a mixture of water and a large number of other compounds, the most common of which is sodium chloride, or table salt. Mixtures differ from compounds in that they can be separated into their component parts by physical processes; for example, the simple process of evaporation separates water from the other compounds in seawater.

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The Atomic Nature Of The Elements

Paralleling the development of the concept of elements was an understanding of the nature of matter. At various times in history, matter has been considered to be either continuous or discontinuous. Continuous matter is postulated to be homogeneous and divisible without limit, each part exhibiting identical properties regardless of size. This was essentially the point of view taken by Aristotle when he associated his elemental qualities with continuous matter. Discontinuous matter, on the other hand, is conceived of as particulate—that is, divisible only up to a point, the point at which certain basic units called atoms are reached. According to this concept, also known as the atomic hypothesis, subdivision of the basic unit (atom) could give rise only to particles with profoundly different properties. Atoms, then, would be the ultimate carriers of the properties associated with bulk matter.

The atomic hypothesis is usually credited to the Greek philosopher Democritus, who considered all matter to be composed of atoms of the four elements—earth, air, fire, and water. But Aristotle's concept of continuous matter generally prevailed and influenced thought until experimental findings in the 16th century forced a return to the atomic theory. Two types of experimental evidence gave support to the atomic hypothesis: first, the detailed behaviour of gaseous substances and, second, the quantitative weight relationships observed with a variety of chemical reactions. The English chemist John Dalton was the first to explain the empirically derived laws of chemical combination by postulating the existence of atoms with unique sets of properties. At the time, chemical combining power (valence) and relative atomic weights were the properties of most interest. Subsequently numerous independent experimental verifications of the atomic hypothesis were carried out, and today it is universally accepted. Indeed, in 1969 individual uranium and thorium atoms were actually observed by means of an electron microscope.

Mixtures

Mixtures are absolutely everywhere you look. Most things in nature are mixtures. Look at rocks, the ocean, or even the atmosphere. They are all mixtures, and mixtures are about physical

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properties, not chemical ones. That statement means the individual molecules enjoy being near each other, but their fundamental chemical structure does not change when they enter the mixture. If the chemical structure changed, it would be called a reaction.

There are an infinite number of mixtures. Anything you can combine is a mixture. Think of everything you eat. Just think about how many cakes there are. Each of those cakes is made up of a different mixture of ingredients. Even the wood in your pencil is considered a mixture. There is the basic cellulose of the wood, but there are also thousands of other compounds in that pencil. Solutions are also mixtures, but all of the molecules are evenly spread out through the system. They are called homogenous mixtures.

If you put sand into a glass of water, it is considered to be a mixture. You can always tell a mixture, because each of the substances can be separated from the group in different physical ways. You can always get the sand out of the water by filtering the water away. If you were busy, you could just leave the sand and water mixture alone for a few minutes. Sometimes mixtures separate on their own. When you come back, you will find that all of the sand has sunk to the bottom. Gravity was helping you with the separation. Don't forget that a mixture can also be made of two liquids. Even something as simple as oil and water is a mixture.

Alloys

There are a few more words you might hear when people talk about mixtures. We can't cover all of them, but we'll give you a quick overview of the biggies. Alloys are basically a mixture of two or more metals. Don't forget that there are many elements on the periodic table. Elements like calcium (Ca) and potassium (K) are considered metals. Of course, there are also metals like silver (Ag) and gold (Au). You can also have alloys that include small amounts of non-metallic elements like carbon (C). Metals are the key thing to remember for alloys.

Emulsions

Let's finish up with a little information on emulsions. These special colloids (another type of mixture) have a mixture of oils and waters. Think about a bottle of salad dressing. Before you mix

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it, there are two separate layers of liquids. When you shake the bottle, you create an emulsion. As time passes, the oil and water will separate, because emulsions are mixtures.

Compounds

Compounds are defined as substances composed of two or more different elements that are chemically combined. Both salt and water are compounds. Some important chemical compound and their uses are as follows:-

- NaCl sodium chloride (table salt, used in solutions for contact lens)
- ZnO zinc oxide (used in some sunscreens and diaper rash ointment)
- NaF sodium fluoride (active ingredient in toothpaste)
- SeS selenium sulfide (in selsium blue shampoo)
- NaNO2 sodium nitrite (preservation in meat such as bacon)
- NaClO sodium hypochlorite (bleach)
- N2O dinitrogen oxide (laughing gas used for some dental work)
- Baking powder NaHCO3; sodium bicarbonate Used for baking for cooking, releases CO2 in reaction with other ingredients
- Soap Esters Used for bathing and washing clothes
- Detergent Sodium sulphate, sodium hydroxide and phosphatecompounds Used for washing clothes
- Toothpaste Calciuym carbonate, sodium flouride Used for cleaning teeth while brushing
- Vinegar C2H4O2 acetic acid, ethanoic acid Used as preservative and for seasoning foods. Utilized for various household cleaning uses.
- Graphite Carbon Used in Pencil
- Alcohol Ethanol(C2H6O) Used in alcoholic drinks
- Bleaching Powder NaOCl Commonly used domestic bleach. Used for cleaning purposes
- Sugar Sucrose; C12H22O11 Used in cooking as sweetner
- Aspirin C9H8O4; acetyl salicylic acid Used in various medicines
- Mouthwash H2O2; hydrogen peroxide, Used for personal hygiene.
- Caustic soda NaOH; sodium hydroxide It's a highly corrosive alkali which is used for cleaning, unblocking sinks, drains and toilets.
- Moth balls C6H4Cl2; 1,4-dichlorobenzene Have strong pungent smell and is used for
- Chalk CaCO3; calcium carbonate Uses incl. blackboard chalk, pavement (or, in USA, "sidewalk") chalk, gymnastics and rock-climbing, and sometimes in toothpaste.

Mixtures

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A mixture is a material made up of two or more different substances which are mixed. A mixture refers to the physical combination of two or more substances in which the identities are retained and are mixed in the form of solutions, suspensions and colloids.

A solution is a homogeneous mixture of two or more substances and can either be in the gas phase, the liquid phase, the solid phase. The enthalpy change of solution refers to the amount of heat that is released or absorbed during the dissolving process (at constant pressure). This enthalpy of solution (ΔHsolution) can either be positive (endothermic) or negative (exothermic). When understanding the enthalpy of solution, it is easiest to think of a hypothetical three-step process happening between two substances.

- Step 1: Breaking up the Solute
- Step 2: Breaking up the Solvent
- Step 3: Combining the Two Together

A suspension is a heterogeneous mixture in which some of the particles settle out of the mixture upon standing. The particles in a suspension are far larger than those of a solution and thus gravity is able to pull them down out of the dispersion medium (water). The typical diameter for the dispersed particles (the sand) of a suspension is about 1000 times greater than those of a solution (less than approximately two nanometers for particles in solution, compared to greater than 1000 nanometers for particles in suspension). Unlike in a solution, the dispersed particles can be separated from the dispersion medium by filtering. Suspensions are heterogeneous because at least two different substances in the mixture can be identified.Ex Milk,Paint etc

A colloid is one of the three primary types of mixtures, with the other two being a solution and suspension. A colloid is a solution that has particles ranging between 1 and 1000 nanometers in diameter, yet are still able to remain evenly distributed throughout the solution. These are also known as colloidal dispersions because the substances remain dispersed and do not settle to the bottom of the container. In colloids, one substance is evenly dispersed in another. The substance being dispersed is referred to as being in the dispersed phase, while the substance in which it is dispersed is in the continuous phase.

Properties of Colloids

To be classified as a colloid, the substance in the dispersed phase must be larger than the size of a molecule but smaller than what can be seen with the naked eye. This can be more precisely quantified as one or more of the substance's dimensions must be between 1 and 1000 nanometers. If the dimensions are smaller than this the substance is considered a solution and if they are larger than the substance is a suspension.

Classifying Colloids

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