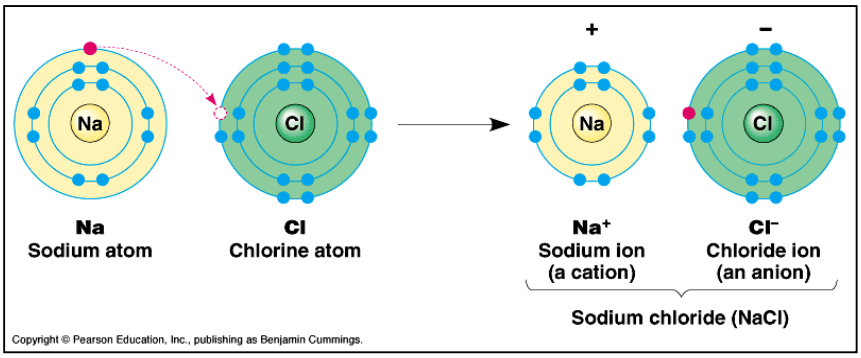
Inorganic Compounds

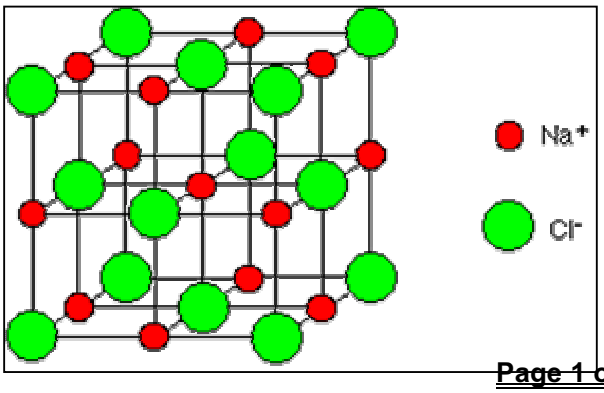
Sodium Chloride (NaCl)

Sodium Chloride is a either a Colourless or white crystalline solid which is formed when sodium (Na) and Chlorine (Cl) are mixed together to form Sodium Chloride (NaCl). It is held together by an ionic bond whic h is produced by electrostatic attraction between oppositely charged ions. So dium chloride is taken as a typical ionic compound. Compounds such as Sodium Chloride consist of a giant lattice of ions. Sodium chloride is described as having a giant ionic structure. An ionic compound such as sodium chloride is held together by an ionic bond. This type of bond is formed when oppositely charged ions attract. An ion or charged atom is formed when the atom gains or losses one or more electrons. It is called a cation if a positive charge exists and an anion if a negative charge exists. Sodium (Na) is an alkali metal that loses an electron to form the positive sodium ion (Na^+). Chlorine (Cl) is a nonmetal and tends to gain an electron to form the negative c hloride ion (Cl^-).



Dot and Cross Diagram of Sodium

The oppositely charged ions Na^+ and Cl^- attract to form an ionic bond. Many sodium and chloride ions are held together this way, resulti ng in a salt with a distinctive crystal shape. The three-dimensional arrangement or crystal lattice of ions in sodium chloride is such that each Na^+ is surrounded by six anions (Cl^-) and each $Cl^-$is surrounded by six cations (Na^+). Thus the ionic compound has a balance of oppositely charged ions and the total positive and negative charges are equal. Below are diagrams which help to further explain this type of bonding. Sodium Chloride is made and produced by the evaporation of seawater or brine from other sources such as brine wells and salt lakes and by mining rock salt (halite). The balanced equation for the formation of Sodium Chloride is $2Na + Cl_2 \rightarrow 2NaCl$.



Crystal Lattice Structure of Sodium Chloride (NaCl)

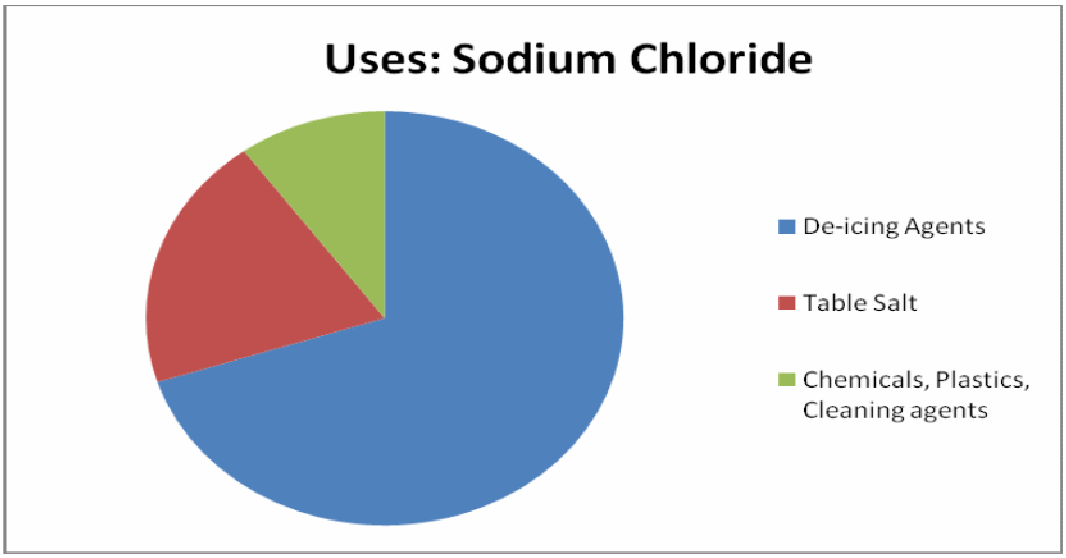
Production in Industry

Salt is a mineral that can be found in either liquid or solid form. It can be found in oceans, lakes, or rock beds buried deep in the earth. Salt is produced by evaporation of seawater or brine from other sources, such as brine wells and salt lakes, and by mining rock salt, called halite. Electrolysis is a method of separating bonded elements and compounds by passing an electric current through them. An ionic compound, in this case salt, is dissolved with an appropriate solvent, su ch as water, so that its ions are available in the liquid. An electrical current is applied between a pair of inert electrodes immersed in the liquid. The negatively charged electrode is called the cathode, and the positively charged one the anode. Each electrode attracts ions which are of the opposite charge. Therefore, positively charged ions (called cations) move towards the cathode, while negatively charged ions (termed anions) move toward the anode. The energy required to separate the ions, and cause them to gather at the respective electrodes, is provided by an electrical power supply. At the probes, electrons are absorbed or released by the ions, forming a collection of the desired element or compound.

Uses

Salt is used in numerous ways including the flavouring and preserving of food and even as a form of money. This salt improves the flavour of food items such as breads and cheeses, and it is an important preservative in meat, dairy products, margarine and other items, because it retards the growth of microorganisms. Salt promotes the natural development of colour in ham and hot dogs and enhances the tenderness of cured meats like ham by causing them to absorb water. In the form of iodized salt, it is a carrier of iodine. (Iodine is necessary for the synthesis of our thyroid hormones which influence growth, development and metabolic rates). The chemical industry uses large amounts of sodium chloride salt to produce other chemicals. Chlorine products are used in metal cleaners, paper bleach, plastics and water treatment. The chemical soda ash, which contains sodium, is used to manufacture glass, soaps, paper, and water softeners. Chemicals produced as a result of sodium chloride reactions are used in ceramic glazes, metallurgy, curing of hides, and photography. Sodium chloride has a large and diverse range of uses. It is spread over roads to melt ice by lowering the melting point (mpt: 32°C) of ice; electrolysis separates the molten ionic compound into its elements. The salt has an important role in the regulation of body fluids. It is used in medicines and livestock feed. In addition, salt caverns are used to store chemicals such as petroleum and natural gas.

Uses	Percentage Use (%)
De-icing Agents	70
Table Salt	20
Chemicals, Plastics, Cleaning agen ts	10



Properties

Melting Point	801 °C
Boiling Point	1413 °C
Solubility in Water	Completely dissolves

Sodium Chloride has a high melting and boiling point as it is an ionic compound. Ionic compounds have strong forces of attraction between the ion s in all directions and form a giant structure. Ionic bonds are strong, all ionic compounds are solid at room temperature and they do not conduct electricity because the ions within them are not free to move. When sodium chloride is dissolved in a solvent such as water, it will conduct electricity because the ions are free to move in the solution. Due to the fact Sodium Chloride is soluble in water due to interactions between ions and polar water molecules, for this fact it can be used in per spiration to ne utralise acidity. This is one of the reasons why it is used in cleaning agents (paper bleach, metal cleaners, water treatment, etc), why it is used for making plastics and also used to defrost snow/ice's melting point to 32°C. Sodium Chloride cannot conduc t electricity when in its solid form because ions are not free to move in crystal lattice. Sodium chloride when molten and dissolved in water can conduct electricity using a process called electrolysis (Electrolysis is a method of separating bonded elemen ts and compounds by passing an electric current through them). This also due to the fact ions are free to move.

Nitric Acid (HNO_3)

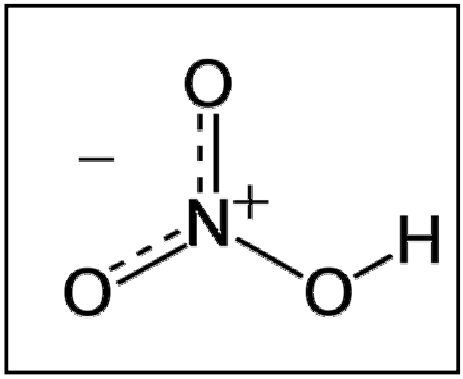
A covalent bond is a strong bond between two non -metal atoms. It consists of a shared pair of electrons. Nitric Acid (HNO_3) is a covalent bond is which can be described as being a colourless, clear liquid acid.

Production in Industry

Formed from the reaction of nitrogen oxides produced by using the Oswald process; An industrial preparation of nitric acid by the oxidatio n of ammonia; the oxidation takes place in successive stages to nitric oxide, nitrogen dioxide, and nitric acid; a catalyst of platinum gauze is used and high temperatures are needed. Ammonia is oxidised to nitric acid in three steps:

$_4NH_3 + {}_5O_2 \rightarrow {}_4NO + {}_6H_2O$
$_2NO + O_2 \rightarrow {}_2NO_2$
$_4NO_2 + O_2 + {}_2H_2O \rightarrow {}_4HNO_3$

When dissolved in water, molecules of nitric acid separate into hydrogen ions (H^+) and nitrate ions (NO_3) because nitric acid molecules separate it makes nitric acid a very strong acid. Nitric acid is often the starting material in the industrial production of nitrates for fertilizers. These nitrogen oxides react with water in the atmosphere and form nitric acid, one cause of acid rain. High levels of nitrates in drinking water can contribute to the formation of nitrosamines, a group of cancer causing compounds.



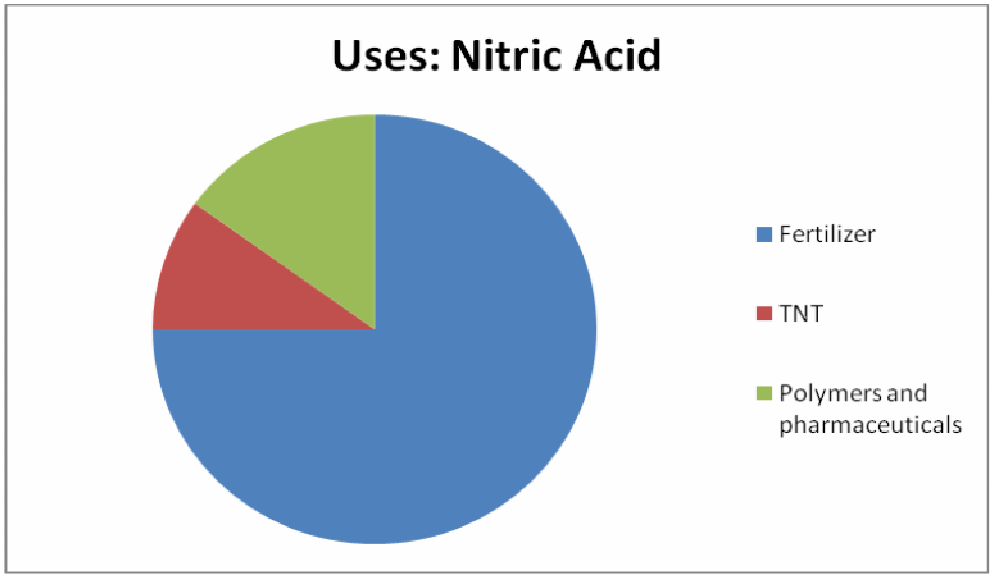
Nitric Acid

Uses

Plants take up nitrogen from the soil in the form of ammonium ions (NH^+) and nitrate ions, and along with carbon containing molecules made during photosynthesis, these ions are used to synthesize amino acids, from which proteins are made. Within the past hundred years the demand for nitrogen fertilizers has grown dramatically as the need for fertilizers for agriculture has grown. The usual manner in which nitrates reach the soil involves the reaction of nitrogen gas and oxygen gas in the atmosphere to form nitrogen dioxide gas (NO_2), which then reacts with atmospheric water, making nitric acid, which provides a natural source of nitrates in water and soil. Many organic nitrates such as nitro glycerine and TNT are also highly explosive.

Nitric Acid is used to make fertilizer and explosives (TNT) and is also used to make salt.

Uses	Percentages use (%)
Fertilizer	75
TNT	10
Polymers and pharmaceuticals	15



Properties

Melting Point	-42°C
Boiling Point	83°C
Solubility in Water	Completely miscible

Covalent bonds such as Nitric acid (HNO_3) generally have a low melting and boiling point this is because they don't have any bonds which need to be broken, because it is an intermolecular force it makes it easy to pull apart the molecules, it is because of this that covalent bonds are easy to break. This is the reason why nitric acid is used to make explosives; Nitric acid is used for nitrating in other production of explosives. When nitro groups are added much oxygen is formed which can cause explosion, and this means that it oxides other atoms very fast. An example of nitrated explosives is nitro glycerine and tri nitro toluene. Nitro glycerine is also produced in the making of pharmaceuticals. Additional use of the acid is as a surface treatment of metal in the steel industry and as a cleaning agent in the food industry. Covalent bonds don't tend to be able to diss olve in water due to the fact water is polar and most covalent compounds are non-polar, however, nitric acid is a polar, so it doesn't dissolve in water, it mixes with the water, which makes it very soluble in water which makes it very ideal for plants it is because of this feature that makes it great for the fertilization of plants. Nitric Acid ionizes readily in solution, forming a good conductor of electricity.

References

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