

HALOGENS

Introduction

- They produce salts with metals. Halos-genes is meaning of 'salt former' in Greek language.
- They have 7 valence electrons.
- They have -1 oxidation state in their stable compounds.
- Atomic number, melting point, boiling point, atomic radius, atomic weight increases from fluorine to iodine.
- Astatine is a radioactive element.
- Fluorine is the most active nonmetal.
- Ionization energy and electro negativity decrease from top to bottom.
- They are found diatomic molecules or in the form their compounds in the nature.
- Their compounds with hydrogen have acidic character.
- More active halogen eliminates less active one in the compounds.
 $\text{Br}_2(\text{l}) + 2\text{NaI}(\text{aq}) \rightarrow \text{NaBr}(\text{aq}) + \text{I}_2(\text{s})$
- They produce acids by reacting hydrogen H_2 .
 $\text{Br}_2(\text{l}) + \text{H}_2(\text{g}) \rightarrow 2\text{HBr}(\text{g})$
- Acid strength increases from top to bottom in the group.
 $\text{HF} < \text{HCl} < \text{HBr} < \text{HI}$

1. Fluorine

- The word fluorine is derived from the Latin language 'fluere' meaning flowing.
- Discovered by Henry Moissan in 1886 by electrolysis of KHF_2 .
- It is a gas in pale yellow in color and heavier than air.
- It gas only -1 oxidation number in compounds.
- Very important for teeth, but excess amount causes darkening and decay of teeth.
- Extremely reactive element can react with Kr, Xe and Rn.
 $\text{Xe} + 2\text{F}_2 \rightarrow \text{XeF}_4$
- Exist as fluorite (CaF_2), kryolite (Na_3AlF_6), and apatite [$\text{Ca}_5\text{F}(\text{PO}_4)_3$] in nature and in sea water in trace amount.
- Hydrofluoric acid, HF, is the only acid may react with SiO_2 , it is used to decorate glassware.
- Used in manufacture of polymers such as Teflon. F_2 is component of Freon gas, CCl_2F_2 , used in refrigerators.
- It is also used in tooth paste.

2. Chlorine

- A gas, greenish yellow in color.
- It has a characteristic pungent odor.
- It is 2.5 times denser than air.
- Poisonous and soluble in water.
- Discovered in Sweden in 1774 by Carl W.Schele.
- Found in salt beds, sea water (2.8 %) and in salts such as NaCl, KCl and MgCl_2 .
- In laboratory prepared by the reaction;
 $4\text{HCl}(\text{g}) + \text{MnO}_2(\text{s}) \rightarrow \text{MnCl}_2(\text{aq}) + 2\text{H}_2\text{O}(\text{l}) + \text{Cl}_2(\text{g})$
- In industry $\text{Cl}_2(\text{g})$ is prepared by the electrolysis of NaCl.
 $2\text{NaCl}(\text{l}) \rightarrow 2\text{Na}(\text{l}) + \text{Cl}_2(\text{g})$

- It is used in manufacture of dyes, explosives, as a bleaching powder in tap water and swimming pools, insecticides, PVC, artificial rubber and production of various chemicals such as HCl.

Hydrochloric Acid, HCl

- Hydrogen chloride is a gas with an irritating odor. Formed by the reaction of chlorine with hydrogen.
 $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{HCl}(\text{g})$
- It is one of the strong acids.
- It is used in manufacture of PVC, dyes, rubber and medicine.
- It is used to clean rust from metal surfaces. In addition, it is found in our stomach for digestion.

3. Bromine

- A liquid with a dark red color.
- Discovered in France in 1826 by Antoine J. Balard.
- It has a meaning of "dirty odor" in Latin language.
- It is only liquid nonmetal at room temperature.
- Quite denser and can be easily vaporized.
- Very reactive and toxic.
- Exist in sea living, sea water and as magnesium and sodium salts in nature.
- Its main source is sea water.
- It is used in agriculture as drugs, in manufacture of films and drug industry.
- And it is used to protect engines from knocking by adding to fuel-oil.

4. Iodine

- It is a solid with violet-dark in color.
- Discovered in France in 1811 by Bernard Coutrois.
- Iodos means "violet" color in Latin language.
- First halogen found in nature.
- Sublimates easily by releasing violet vapor which has unpleasant odor.
- In the laboratory, elemental iodine is produced by the reaction of; $2\text{NaI}(\text{aq}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{NaCl}(\text{aq}) + \text{I}_2(\text{g})$
- It is used as antiseptic, (tincture of iodine) in medicine.
- Used to detect starch.
- Used in halogen lamps in car headlights.
- Extracted from sea water and sodium iodate (NaIO_3).
- The deficiency of iodine in body causes goiter disease that is why ionized table salt is produced.

5. Astatine

- It is a solid with metallic color.
- Discovered in California in 1940 by Dale Corson.
- All the isotopes are radioactive.
- Almost does not exist in nature.
- Produced artificially.
- Readily dissolved in water and alcohol.