

Study of Components (Hydrogen Chloride)

Lab preparation of HCl

- $NaCl + H_2SO_4 \xrightarrow{200^\circ C} NaHSO_4 + HCl \uparrow$
- Gas is dried by passing through concentrated sulphuric acid
- Collected by upward displacement of air
- Reversible reaction, but goes to completion as HCl constantly escapes as gas
- Why 200°?
 - Above 200°, sodium sulphate is formed, it forms a hard crust & sticks to the test tube
- Why displacement of air and not water?
 - Because HCl is highly soluble in water
- Why sodium chloride?
 - Because it is cheap and abundant
- Why H_2SO_4 as drying agent, why not quick lime?
 - Because other drying agents react with HCl

Preparation of HCl acid from the gas

- What is back suction?
 - The rise of HCl into the delivery tube due to decreased pressure
- What would happen if ordinary glass tubing is used?
 - Water will fill it, pass into generating flask, stop the reaction, generate heat and result in an explosion
- Why the funnel arrangement?
 - To prevent back suction, to provide a large surface area for absorption of HCl gas
- When is HCl acid formed?
 - When HCl gas is passed through water until no more gas is absorbed, HCl acid is formed which contains 36% HCl by weight i.e. an aqueous solution of HCl in water

- What is an azeotropic mixture?
 - An aqueous solution of HCl with 22.2% HCl and 77.8% water by weight; boils at 110°C. This is an azeotropic solution (one which boils without any change in composition). No further concentration is possible after this point by boiling.

To show that HCl gas is highly soluble

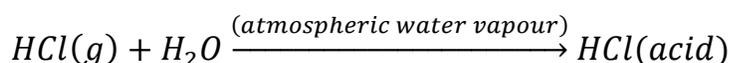
- What happens inside the flask?
 - HCl gas dissolves due to high solubility, pressure decreases
- Why does blue litmus enter flask?
 - Outside pressure is higher, so litmus solution enters through jet tube
- Why does blue litmus become red?
 - HCl gas forms tiny droplets of HCl acid in moist air, and turns blue litmus red due to acidic nature

To show HCl is heavier than air

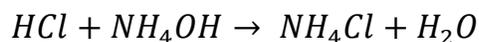
- HCl is 1.28 times heavier than air:
- Blue Litmus must be present as solution

Identification of HCl

- When the jar is filled with HCl, fumes appear above the jar due to formation of HCl acid



- A rod dipped in NH_4OH and brought near the mouth of the gas jar produces dense white fumes of ammonium chloride proving that the jar is filled with HCl



Properties and test of Hydrogen Chloride:

Hydrogen Chloride is a Diatomic Molecule which consists of two atoms. It is a compound of the element's hydrogen and chlorine,

Hydrogen Chloride is a colourless, poisonous gas with an unpleasant, acrid odour. It is highly soluble in water and readily soluble in alcohol and ether. It fumes in moist air. It is not flammable, and the liquid is a poor conductor of electricity.

When hydrogen chloride gas is dissolved in water, hydrochloric acid is formed.

- Molecular Formula: HCl
- Molecular Mass: 36.5
- Bond; Covalent.
- Melting Point: -114 °C
- Boiling Point: -85 °C
- Formula weight 36.46
- Specific gravity or density 1.2
- Flash Point: none

Chemical Properties of HCl

Type of Reaction	Example
With metal	(M + HCl → Metal Chloride + Hydrogen) $2Na + 2HCl \rightarrow 2NaCl + H_2 \uparrow$
With oxides/hydroxides	(MO/MOH + HCl → Metal Chloride + water) $MgO + 2HCl \rightarrow MgCl_2 + H_2O$
With carbonates/bicarbonates	($MCO_3/MHCO_3 + HCl \rightarrow$ Metal Chloride + Water + CO ₂) $CaCO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2 \uparrow$
With sulphites/bisulphites	($MSO_3 + HCl \rightarrow$ Metal Chloride + Water + Sulphur dioxide) $Na_2SO_2 + 2HCl \rightarrow 2NaCl + H_2O + SO_2 \uparrow$
With metal sulphide	(MS + HCl → Metal Chloride + Hydrogen sulphide) $Na_2S + 2HCl \rightarrow 2NaCl + H_2S \uparrow$
With thiosulphate (S is not precipitated when sulphites are treated with HCl, it precipitates only with thiosulphate)	(Thiosulphate + HCl → Metal Chloride + Water + SO ₂ + S↓) $Na_2S_2O_3 + 2HCl \rightarrow 2NaCl + H_2O + S \downarrow$

With nitrates (White precipitate formed with $AgNO_3$ is insoluble in nitric acid, but soluble in NH_4OH and forms a complex salt ($[Ag(NH_3)_2]^+Cl^-$)

(Does not normally react with nitrates, but forms precipitate with ($AgNO_3, Pb(NO_3)_2, Hg(NO_3)_2$)
 $AgNO_3 + HCl \rightarrow AgCl \downarrow + HNO_3$

Reaction with ammonia

When a rod dipped in ammonia is brought near vapours of HCl, dense white fumes of ammonium chloride are formed. This is also a confirmatory test for HCl

