TENDER HEART HIGH SCHOOL, SECTOR-H 30.09.24

CLASS- X SUBJECT- CHEMISTRY

CHAPTER- 8 TEACHER- ANAMIKA

Good morning to all the students!

Students this lesson is for class-X for the subject of chemistry, Topic:- 'Occurrence of hydrogen chloride' which is covered in 'chapter-8 'Study of compounds A. Hydrogen chloride' starting on page no-141 of your Text-Book titled - concise chemistry by selina publication and is being submitted to you.

Hydrogen Chloride

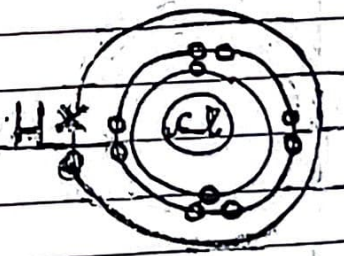
Molecular formula:- HCl

Molecular Mass:- 36.5

Bond:- Covalent

H :Cl: or H-Cl

Dot diagram or Lewis structure



Orbital Diagram

Occurrence:-

1. Hydrogen chloride gas occurs in free state in volcanic emissions.

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2. 0.2-0.4 % of HCl is present in gastric juice of mammals and it helps in digestion.

General Preparation Of Hydrogen Chloride Gas

1. By synthesis (Direct combination)

(i) In the presence of diffused sunlight moist hydrogen gas combines with chlorine

Hydrogen + chlorine → Hydrogen chloride

$$H_2(g) + Cl_2(g) \xrightarrow[\text{sunlight}]{\text{Diffused}} 2HCl(g)$$

Note:- The reaction is explosive in direct sunlight but it is negligible in the dark.

(ii) Burning jet of hydrogen also burns in chlorine forming hydrogen chloride.

2. By heating metallic chloride with conc. sulphuric acid

Metal chloride	+	Sulphuric acid [conc]		Salt	+	Hydrogen chloride
NaCl	+	H_2SO_4	$\xrightarrow{<200^\circ C}$	$NaHSO_4$	+	$HCl(g)$
2NaCl	+	H_2SO_4	$\xrightarrow{\text{above } 200^\circ C}$	Na_2SO_4	+	$2HCl(g)$
$CuCl_2$	+	H_2SO_4	$\xrightarrow{\Delta}$	$CuSO_4$	+	$2HCl(g)$

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Laboratory Preparation Of Hydrogen Chloride

In the laboratory, hydrogen chloride gas can be prepared by the action of concentrated sulphuric acid on sodium chloride.

Reactants :- Sodium chloride and concentrated sulphuric acid.

Procedure :- Set up the apparatus as shown in the figure-1 which is drawn below

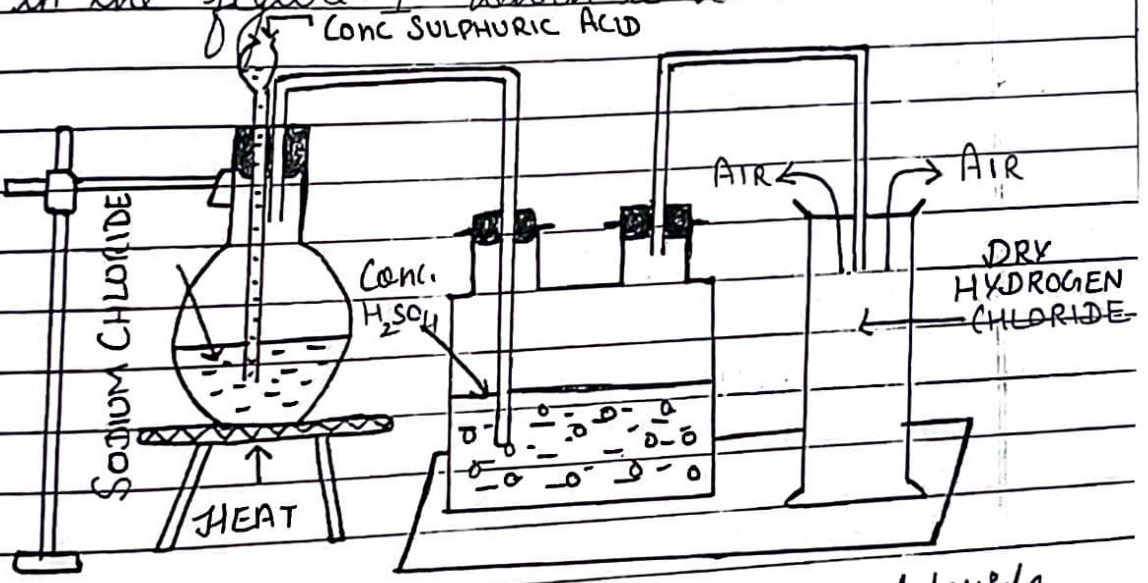

Fig-1 Preparation of hydrogen chloride gas from common salt.

Place some common salt in a flask and pour concentrated sulphuric acid through the thistle funnel. The reaction proceeds slowly in the cold. On heating the mixture

gently there is effervescence and HCl gas is evolved in a controlled manner.

The gas is dried by passing through a washer bottle containing concentrated sulphuric acid.

It is collected by upward displacement of air in a gas jar.

Reaction :-

$$NaCl + H_2SO_4 \xrightarrow{<200^\circ C} NaHSO_4 + HCl\uparrow$$

Though it is a reversible reaction, yet it goes to completion as hydrogen chloride continuously escapes as a gas.

The reaction can occur upto the stage of formation of sodium sulphate on heating above 200°C

$$NaHSO_4 + NaCl \xrightarrow{\text{above } 200^\circ C} Na_2SO_4 + HCl\uparrow$$

Or

$$2NaCl + \underset{(Conc.)}{H_2SO_4} \xrightarrow{\text{above } 200^\circ C} Na_2SO_4 + 2HCl$$

Purification Of HCl gas :-

It is dried by passing through conc. sulphuric acid.

The other drying agents like phosphorus pentaoxide (P_2O_5) and quick lime (CaO) cannot be used, since they react with hydrogen chloride.

$$2P_2O_5 + 3HCl \rightarrow POCl_3 + 3HPO_3$$
$$CaO + 2HCl \rightarrow CaCl_2 + H_2O$$

Collection :- 1) Hydrogen chloride gas is collect-ed by the downward delivery (upward displacement of air) as it is 1.28 times heavier than air.

2) It is not collected over water, since it is highly soluble in water.

Identification :-

When the jar is completely filled with hydrogen chloride, fumes appear above the jar's mouth.

In order to know whether the gas jar is

full. Bring a rod dipped in ammonium hydroxide near its mouth.

$$HCl + NH_4OH \rightarrow NH_4Cl + H_2O$$

Dense white fumes of ammonium chloride will be produced showing thereby that the jar is full of hydrogen chloride gas.

Precautions:-

1. The lower end of the thistle funnel must be dipped in conc. sulphuric acid.
2. Delivery tube should be dipped in drying agent i.e., conc. H_2SO_4
3. Temperature is maintained at nearly 200°C

At higher temperature i.e., above 200°C
(i) the apparatus which is made of glass may crack.
(ii) fuel is wasted
(iii) sodium sulphate formed, forms a hard crust which sticks to the glass and is difficult to remove.

⇒ Physical Properties Of Hydrogen Chloride Gas.

1. Colour	Colourless gas
2. Smell	pungent choking smell
3. Taste	sour (acidic) in taste
4. Physiological nature	It is corrosive in nature. It irritates nose, throat & lungs
5. Density	It is about one and a quarter times heavier than air (V.D of HCl is 18.25 and that of air 14.4)
6. Boiling point	-83°C
7. Melting point	-113°C
8. Liquefaction and solidification	When subjected to a high pressure (40 atm.) at low temperature (10°C), it is liquefied to a colourless liquid.
9. Solubility	Hydrogen chloride gas is highly soluble in water (1 volume of water dissolves 452 volumes of the gas at room temperature). HCl being polar covalent compound is soluble in organic non-polar solvents also such as acetone and toluene.