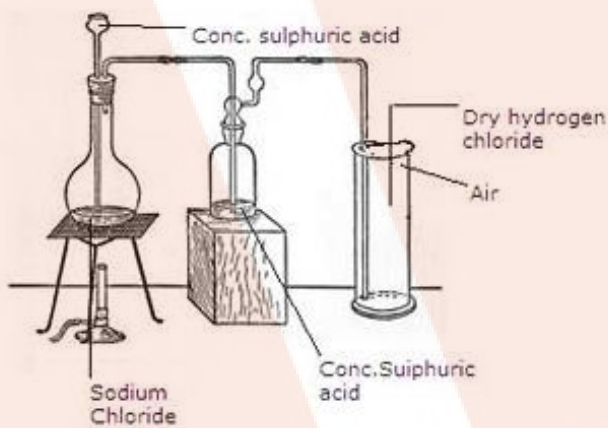


*Book Name: Selina Concise***EXERCISE****Solution 1:**

Labelled Diagram for laboratory preparation of Hydrogen chloride is:

**Solution 2:**

- (a) Hydrogen chloride is dried by passing through conc. Sulphuric acid.
(b) Phosphorous pentoxide and CaO cannot be used to dry HCl because they react with HCl.
- $$2\text{P}_2\text{O}_5 + 3\text{HCl} \rightarrow \text{POCl}_3 + 3\text{HPO}_3$$
- $$\text{CaO} + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O}$$

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Solution 3:

- (a) Anhydrous HCl is poor conductor due to the absence of ions in it whereas aqueous HCl is excellent conductor since it contains ions.
- (b) When the stopper is opened HCl gas comes in contact with water vapors of air and gives white fumes due to the formation of hydrochloric acid.
- (c) A solution of HCl in water gives hydronium ions and conducts electricity, but HCl is also soluble in dry toluene, but in that case it neither (i) turns blue litmus red (ii) nor does it conduct electricity. This indicates the absence of H^+ ions in toluene showing thereby that hydrogen chloride is a covalent compound.
- (d) When ammonium hydroxide is brought near the mouth of HCl, dense white fumes are formed due to the formation of ammonium chloride.
- $$HCl + NH_4OH \rightarrow NH_4Cl + H_2O$$
- (e) Dry hydrogen chloride is not acidic whereas moist Hydrogen chloride is acidic. In presence of a drop of water HCl gas dissolves in water and forms hydrochloric acid which turns blue litmus paper red.
- (f) Hydrogen chloride is not collected over water as it is highly soluble in water.

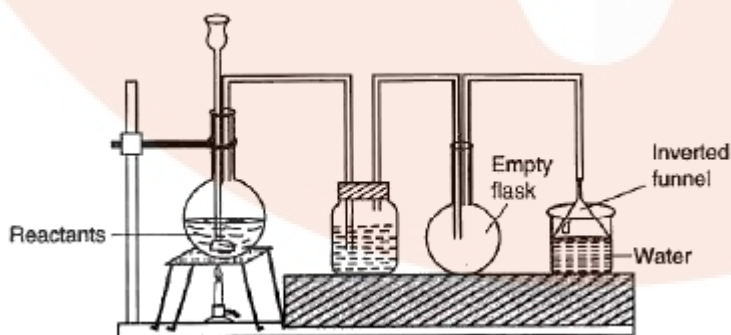
Solution 4:

Difference between Hydrogen chloride gas and Hydrochloric acid is:

Hydrogen chloride gas	Hydrochloric acid
<ol style="list-style-type: none">1. Dry hydrogen chloride gas does not turn blue litmus red due to non-acidic character.2. Hydrogen chloride gas does not conduct electricity.	<ol style="list-style-type: none">1. Being acidic it turns blue litmus red.2. Hydrochloric acid is a good conductor of electricity.

Solution 5:

Hydrochloric acid is prepared by this method.



- (a) The reactants are sodium chloride and Sulphuric acid.
- (b) The empty flask acts as Anti-Suction device. In case the back suction occurs the water will collect in it and will not reach the generating flask.
- (c) The drying agent is Conc. Sulphuric acid. Sulphuric acid is chosen as drying agent because it does not react with HCl.
- (d) The Inverted funnel :
 - Prevents or minimizes back suction of water.
 - Provides a large surface area for absorption of HCl gas.

Solution 6: Equations are:

- (a) $\text{AgNO}_3 + \text{HCl} \rightarrow \text{AgCl} + \text{HNO}_3$
- (b) $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$
- (c) $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
- (d) $\text{ZnCO}_3 + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
- (e) $\text{Pb}(\text{NO}_3)_2 + 2\text{HCl} \rightarrow \text{PbCl}_2 + 2\text{HNO}_3$
- (f) $\text{CuO} + 2\text{HCl} \rightarrow \text{CuCl}_2 + \text{H}_2\text{O}$

Solution 7:

- (c) Chlorine.
 - The compound formed which is strongly acidic in water, is HCl.
 - $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$
- (d) A dilute aqueous solution of hydrochloric acid gets gradually concentrated on distillation, till the concentration of the acid reaches 22.2% HCl by weight which boils at 110°C . When this concentration is reached, no further increase in concentration of the acid becomes possible by boiling. This is because vapours evolved before 110°C are vapours of water but at temperature above 110°C vapours consist mostly of molecules of HCl.

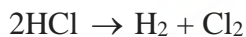
Solution 8:

We can prove that hydrochloric acid contains both hydrogen and chlorine by the following experiment.

Take a voltameter used for electrolysis of water, fitted with platinum cathode and graphite anode. Into the voltameter pour 4 molar HCl and pass direct current.

It is seen that a colourless gas is evolved at cathode and a greenish gas is evolved at anode. When a burning splinter is brought near a colourless gas, it bursts into flame thereby proving that it is hydrogen gas.

When moist starch iodide paper is held in the greenish yellow gas, it turns blue black, thereby proving that the gas is chlorine.



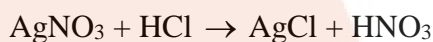
This experiment proves that hydrochloric acid contains both hydrogen and chlorine.

Solution 9:

- (a) Manganese dioxide
- (b) Hydrogen chloride and ammonia
- (c) Hydrogen and oxygen
- (d) AgCl (Silver chloride)
- (e) Aqua regia
- (f) Fountain experiment
- (g) Hydrogen chloride gas

Solution 10:

- (a) An aqueous solution of chlorine is acidic as it dissolves in water to form hydrochloric and hypochlorous acids.
- (b) Silver nitrate reacts with hydrochloric acid to form thick curdy white ppt. of silver chloride whereas silver nitrate does not react with nitric acid.



(White ppt.)

Solution 11:

A is Silver nitrate

B is Hydrochloric acid

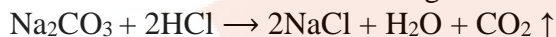
C is Silver chloride

Solution 12:

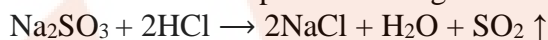
- (f) $\text{NH}_4\text{OH} + \text{HCl} \rightarrow \text{NH}_4\text{Cl} + \text{H}_2\text{O}$
- (g) $\text{NaHSO}_3 + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{SO}_2$
- (h) $\text{Pb}(\text{NO}_3)_2 + 2\text{HCl} \rightarrow \text{PbCl}_2 + 2\text{HNO}_3$
- (i) $\text{Pb}_3\text{O}_4 + 8\text{HCl} \rightarrow 3\text{PbCl}_2 + 4\text{H}_2\text{O} + \text{Cl}_2$
- (j) $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$
- (k) $\text{Ca}(\text{HCO}_3)_2 + 2\text{HCl} \rightarrow \text{CaCl}_2 + 2\text{H}_2\text{O} + 2\text{CO}_2$

Solution 13:

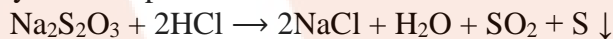
- a. Sodium carbonate on treating with dil. HCl results in the formation of sodium chloride with the liberation of carbon dioxide gas.



Sodium sulphite on treating with dil. HCl results in the formation of sodium chloride with the liberation of sulphur dioxide gas.



- b. Sodium thiosulphate reacts with dil. HCl to produce sulphur dioxide gas and precipitates yellow sulphur.

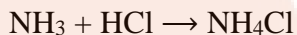


Sulphur is not precipitated when sulphites are treated with dil. HCl.

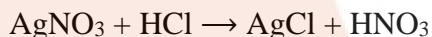
Solution 14:

Three tests are:

HCl gas gives thick white fumes of ammonium chloride when glass rod dipped in ammonia solution is held near the vapours of the acid.



With silver nitrate HCl gives white precipitate of silver chloride. The precipitate is insoluble in nitric acid but soluble in ammonium hydroxide.



A greenish yellow gas is liberated when concentrated hydrochloric acid is heated with oxidizing agent like manganese dioxide.

**Solution 15:**

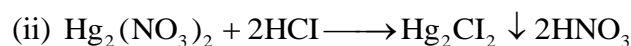
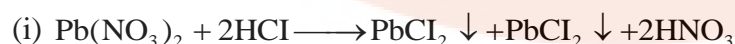
MnO_2 , PbO_2 and red lead react with conc. HCl acid to liberate Cl_2 . This shows that hydrochloric acid is oxidized to chlorine by oxidizing agents.

Solution 16:

HCl dissolves both in water and toluene, when HCl dissolves in water it ionizes and forms hydronium and chloride ions. Whereas this ionization is not observed in toluene hence a solution of HCl in water can be used as an electrolyte.

Solution 17:

Conversion of metallic nitrates to insoluble metallic chlorides using dil. HCl:



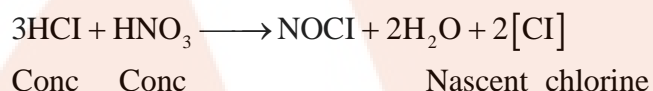
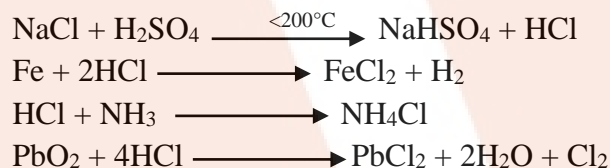
Solution 18:

A mixture having three parts of conc. Hydrochloric acid and one part of conc. Nitric acid is called aqua-regia.

Nitric acid acts as oxidizing agent.

Solution 19:

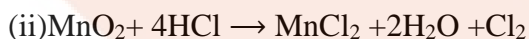
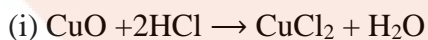
Hydrochloric acid can be converted to nascent chlorine by:

**Solution 20:****Solution (2004) 21:**

Sl. No.	Substances added	Gas evolved	Odour
1	Calcium carbonate	Carbon dioxide	<u>Odourless</u>
2	Magnesium ribbon	<u>Hydrogen</u>	Odourless
3	Manganese(IV) oxide with heating	Cl_2	<u>Strong Pungent odour</u>
4	Sodium sulphide	<u>Hydrogen sulphide</u>	<u>Rotten egg</u>

Solution (2005) 22:

(a)



(b)

(i) The experiment is called Fountain Experiment.

(ii) This experiment shows that hydrogen chloride is highly soluble in water.

(iii) Red

Solution (2007) 23:

- (i) $\text{Fe} + 2\text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2$
- (ii) $\text{NaHCO}_3 + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
- (iii) $\text{FeS} + 2\text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2\text{S}$
- (iv) $\text{Na}_2\text{SO}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{SO}_2$
- (v) $\text{Na}_2\text{S}_2\text{O}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{SO}_2 + \text{S}$

Solution (2008) 24:

When hydrogen chloride is collected by downward delivery or upward displacement, it shows that it is heavier than air.

Solution (2008) 25:

Hydrogen chloride is not collected over water as it is soluble in water.

Solution (2008) 26:

- (i) $\text{Na}_2\text{S}_2\text{O}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{SO}_2 + \text{S}$
- (ii) $\text{Pb}(\text{NO}_3)_2 + 2\text{HCl} \rightarrow \text{PbCl}_2 + 2\text{HNO}_3$