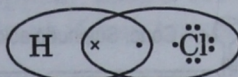


# Hydrogen Chloride

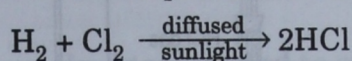
## IMPORTANT POINTS TO REMEMBER

1. **Hydrogen chloride** gas was first prepared by **Glauber**. **Humphry Davy** proved the gas to be compound of hydrogen and chlorine.

2. It is a **polar covalent compound**.



3. It is **synthesized** from its elements in the presence of diffused sunlight.



4. Hydrogen chloride is prepared in laboratory by the reaction of **metallic chloride** with **concentrated Sulphuric acid** (Fig. 1)

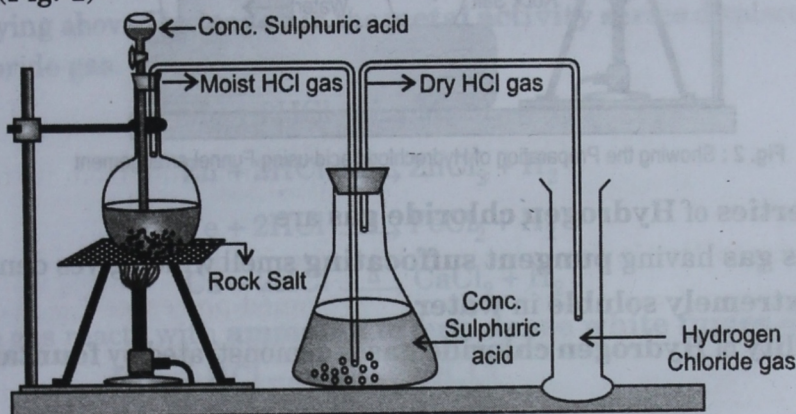
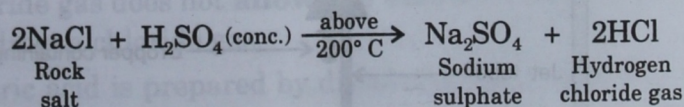
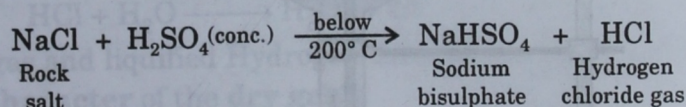


Fig. 1 : Preparation of Hydrogen Chloride gas

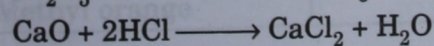
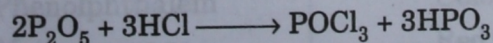
Reactants used for the preparation of Hydrogen chloride gas are **Sodium chloride** and **concentrated Sulphuric acid**. **Sodium chloride** is **preferred** over other **metallic chlorides** as it is **easily and cheaply** available.



5. Precautions observed during the laboratory preparation of Hydrogen chloride gas.

- The reaction mixture should not be **heated beyond 200°C**. As above **200°C** a **sticky mass** of Sodium sulphate is formed which sticks to **glass apparatus** and is difficult to remove.
- Heat energy is wasted if heated above 200 °C.

6. Hydrogen chloride gas is **dried** by passing through **concentrated Sulphuric acid**. It is not dried by passing through Phosphorous pentoxide and Calcium oxide as both of these drying agents undergo chemical reaction with Hydrogen chloride gas.



7. Hydrogen chloride gas is **collected** by **upward displacement of air** as the gas is **heavier** than air and it is not collected over water as it is highly or extremely soluble in water. Therefore it forms Hydrochloric acid.
8. When the gas jar is **completely filled** with the gas then **dense white fumes** appear at the mouth of the jar.
9. In order to know whether the gas jar is full of Hydrogen chloride gas then bring a glass rod **dipped in Ammonium hydroxide** near the **mouth of the gas jar**. If **dense white fumes** appear **immediately**, then it shows that the gas jar is **full of Hydrogen chloride gas**.
10. Hydrogen chloride gas is **dissolved in water** with the help of special arrangement called **funnel arrangement** to prevent the **back suction of water** and gives greater surface area for the absorption of gas.

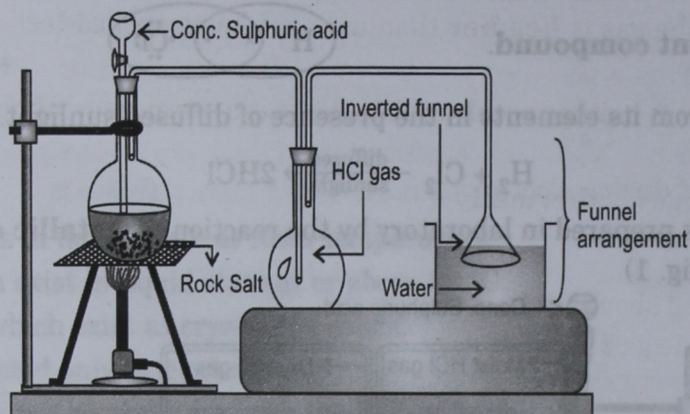


Fig. 2 : Showing the Preparation of Hydrochloric acid using Funnel arrangement

11. The **physical properties** of **Hydrogen chloride gas** are

- (a) It is a **colourless gas** having **pungent suffocating** smell which gives dense **fumes** in **moist air**.
- (b) It is **highly or extremely soluble** in **water**.

The **extreme solubility** of **Hydrogen chloride gas** is demonstrated by **fountain experiment**. (Fig. 3)

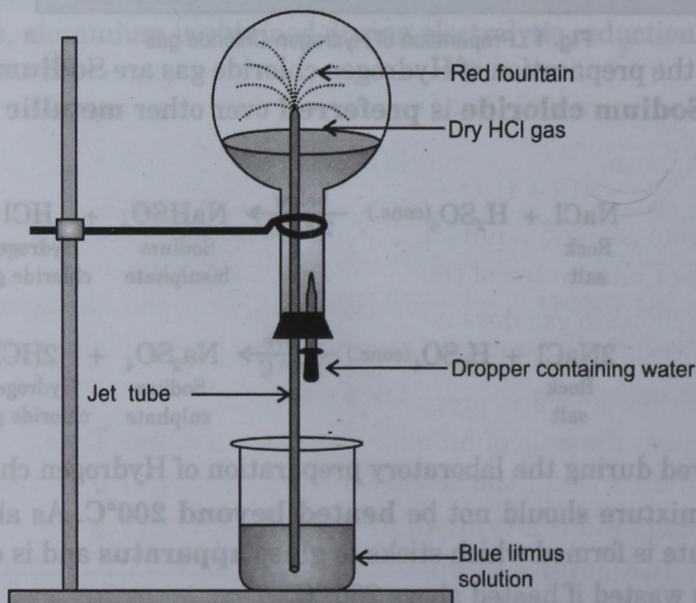


Fig. 3 : Fountain experiment to demonstrate extreme solubility of HCl gas

(c) Hydrogen chloride gas is **heavier** than **air**. Set up the apparatus as shown in fig. 4

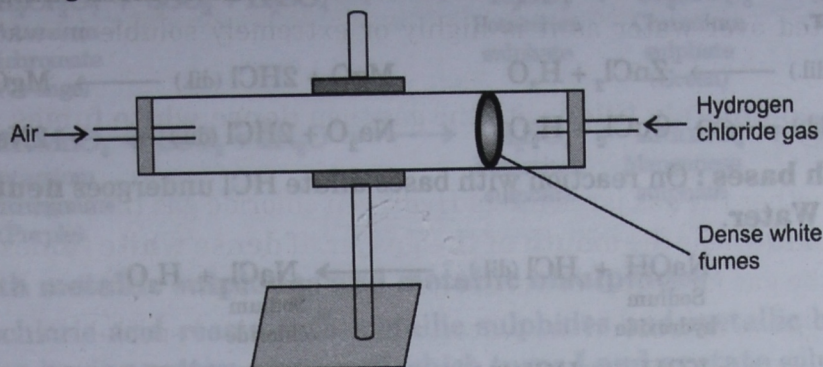
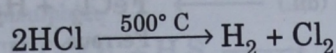


Fig. 4 : Showing Hydrogen chloride gas is heavier than air

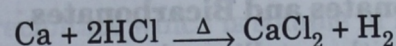
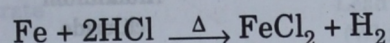
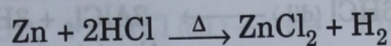
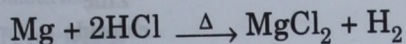
It is seen that the **dense white fumes** appear **more closer** to the **Hydrogen chloride gas** suggesting that the gas is **heavier** than **air** as it has travelled **less distance** as compared to air (Fig. 4).

12. Hydrogen chloride gas is neither **combustible** nor it is a **supporter of combustion**. It **extinguishes** the **burning splinter**.

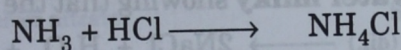
13. Hydrogen chloride gas is **thermally decomposed** to give **Chlorine**.



14. **Metals** which are lying above **Hydrogen** in the **metal activity series** displace **Hydrogen** when heated with hydrogen chloride gas.



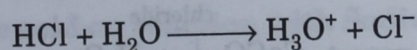
15. Hydrogen chloride gas reacts with **ammonia** to form **dense white fumes** of Ammonium chloride.



Dense white fumes

16. Hydrogen chloride gas is a **polar covalent compound** which on dissolving in water produces **ions**.

17. Hydrogen chloride gas on **dissolving in water** produces **strong, monobasic acid (Hydrochloric acid)**.



18. Dry Hydrogen chloride gas and liquified Hydrogen chloride gas has no **effect on litmus**, showing the **neutral (non-acidic) character** of the **dry gas**.

19. Liquified Hydrogen chloride gas does not **allow the electric current** to pass through it, showing the **covalent nature** of Hydrogen chloride gas.

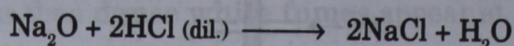
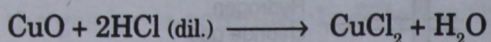
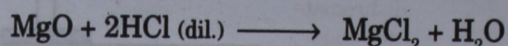
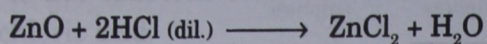
20. In laboratory Hydrochloric acid is prepared by dissolving Hydrogen chloride gas in water. The gas is dissolved in Water with the help of funnel arrangement in order to prevent the back suction of Water and provides maximum area for the absorption of Hydrogen chloride gas.

21. **Dilute Hydrochloric acid** is a **typical acid**. So, it undergoes the following reactions :

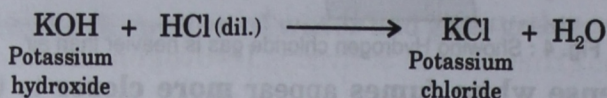
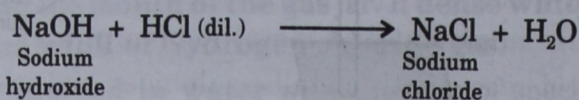
(a) **Reaction with Indicator** : Dilute solution of Hydrochloric acid is strongly acidic and it shows characteristic colours with indicators.

Indicator	Colour change
Blue litmus	Red
Phenolphthalein	Colourless
Methyl orange	Red or pink

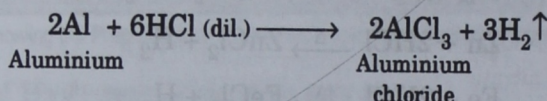
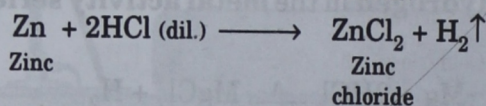
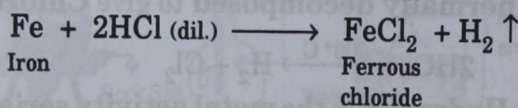
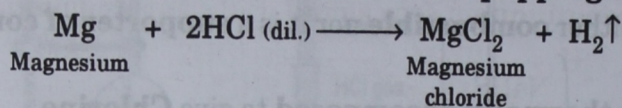
(b) **Reaction with metallic oxides** : On reaction with metallic oxides dilute Hydrochloric acid forms **Salt and Water**.



(c) **Reaction with bases** : On reaction with bases dilute HCl undergoes **neutralization reaction** to form **Salt and Water**.

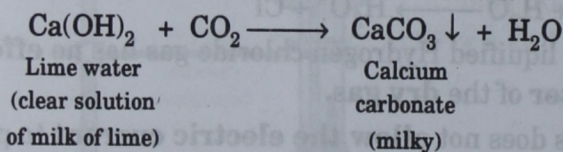
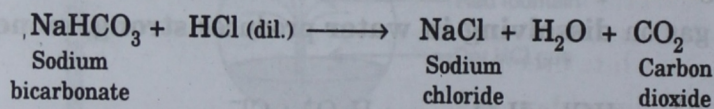
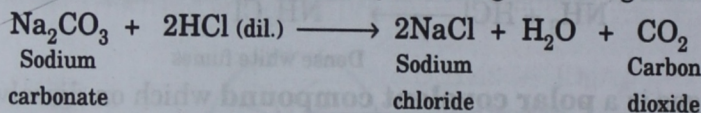


(d) **Reaction with the active metals** : Dilute Hydrochloric acid reacts with active metals to liberate a **colourless and odourless gas** which **burns** with a **popping sound**.



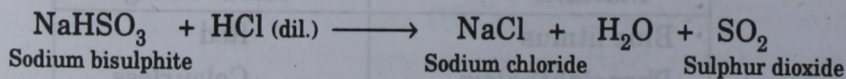
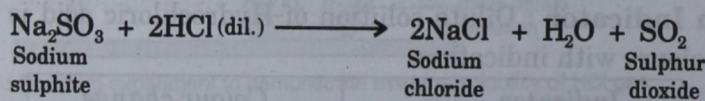
(e) **Reaction with metallic Carbonates and Bicarbonates** :

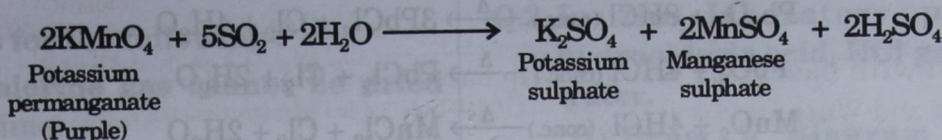
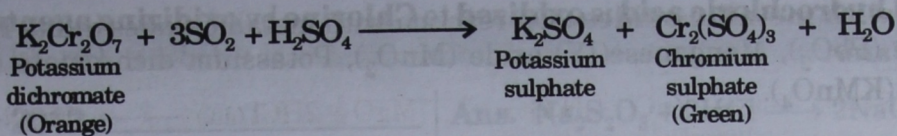
Dilute Hydrochloric acid reacts with metallic carbonates and bicarbonates to liberate **colourless and odourless gas** which turns **lime water milky** showing that the gas evolved is **Carbon dioxide**.



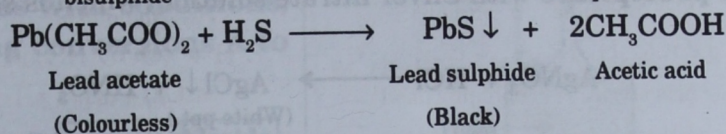
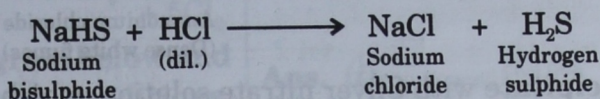
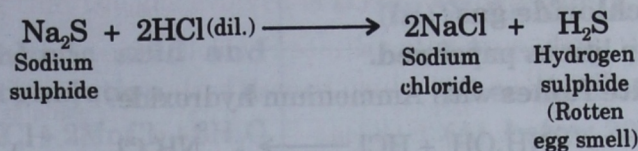
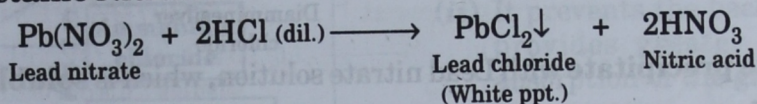
(f) **Reaction with metallic sulphites and metallic bisulphites** :

Dilute Hydrochloric acid reacts with metallic sulphites and metallic bisulphites to liberate a **colourless gas** having **burning Sulphur smell** which turns acidified **Potassium dichromate** from **orange** to **green** and **Potassium permanganate** solution from **purple** to **colourless** i.e. it **decolourises**, showing that the gas evolved is **Sulphur dioxide**.

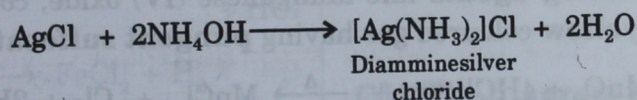
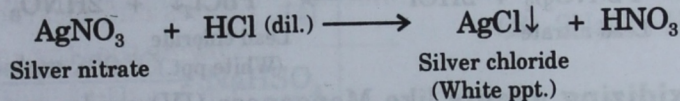


**(g) Reaction with metallic sulphides and metallic bisulphides :**

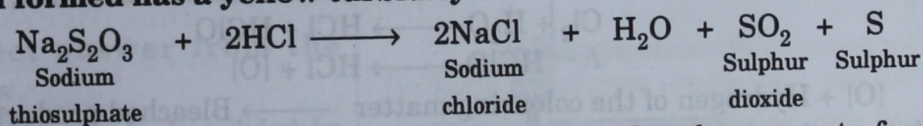
Dilute Hydrochloric acid reacts with metallic sulphides and metallic bisulphides to liberate a **colourless gas** having **rotten egg smell** which turns **Lead acetate** solution from **colourless** to **shining black**, showing that the gas evolved is **Hydrogen sulphide**.

**(h) Reaction with metallic Nitrates :**

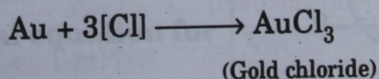
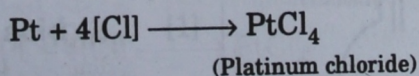
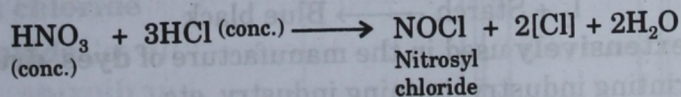
Lead chloride is a white precipitate which is soluble in hot water but insoluble in cold water.



Silver chloride is a white precipitate which is soluble in excess of Ammonium hydroxide.

**(i) Dilute hydrochloric acid on reaction with Sodium thiosulphate produces Sulphur dioxide and the solution formed has a yellow turbidity.**

**22. Aqua-regia** is **three parts** of **concentrated Hydrochloric acid** and **one part** of **concentrated Nitric acid**. It is used for dissolving **noble metals** like **Gold** and **Platinum**.





## PREVIOUS YEARS' QUESTIONS

2012

Q1. Give reasons for the following :

Hydrogen chloride gas cannot be dried over quick lime. [1]

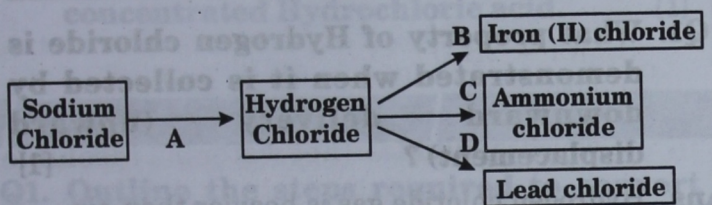
Ans. Hydrogen chloride gas cannot be dried over quicklime as it reacts with it to form calcium chloride.

Q2. Give balanced equation for the following reaction :

Concentrated hydrochloric acid and Potassium permanganate solution. [1]

Ans.  $2\text{KMnO}_4 + 16\text{HCl} \longrightarrow 2\text{KCl} + 2\text{MnCl}_2 + 8\text{H}_2\text{O} + 5\text{Cl}_2$

Q3. Refer to the flow chart diagram below and give balanced equations with conditions, if any, for the following conversions A to D.



[4]

Ans. A :  $\text{NaCl} + \text{H}_2\text{SO}_4 \xrightarrow{\text{below } 200^\circ\text{C}} \text{NaHSO}_4 + \text{HCl}$

B :  $\text{Fe} + 2\text{HCl} \xrightarrow{\text{Conc.}} \text{FeCl}_2 + \text{H}_2$

C :  $\text{NH}_3 + \text{HCl} \longrightarrow \text{NH}_4\text{Cl}$

D :  $\text{Pb}(\text{NO}_3)_2 + 2\text{HCl} \longrightarrow \text{PbCl}_2 + 2\text{HNO}_3$

2011

Q1. Choose the correct answer from the options given below.

Hydrogen Chloride gas being highly soluble in water is dried by

(a) Anhydrous Calcium chloride

(b) Phosphorus penta oxide

(c) Quick lime

(d) Concentrated sulphuric acid [1]

Ans. (d) Concentrated sulphuric acid.

Q.2 Write the balanced chemical equation for the following reaction :

Sodium thiosulphate is reacted with dilute hydrochloric acid. [1]

Ans.  $\text{Na}_2\text{S}_2\text{O}_3 + 2\text{HCl} \longrightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{SO}_2 + \text{S}$

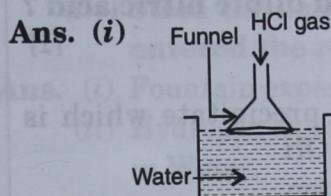
Q.3 In the laboratory preparation of hydrochloric acid, HCl gas is dissolved in water.

(i) Draw a diagram to show the arrangement used for the absorption of HCl in water.

(ii) Why is such an arrangement necessary? Give two reasons.

(iii) Write the chemical equations for the laboratory preparation of HCl gas when the reactants are:

(A) below  $200^\circ\text{C}$  (B) above  $200^\circ\text{C}$  [5]



Ans. (i)

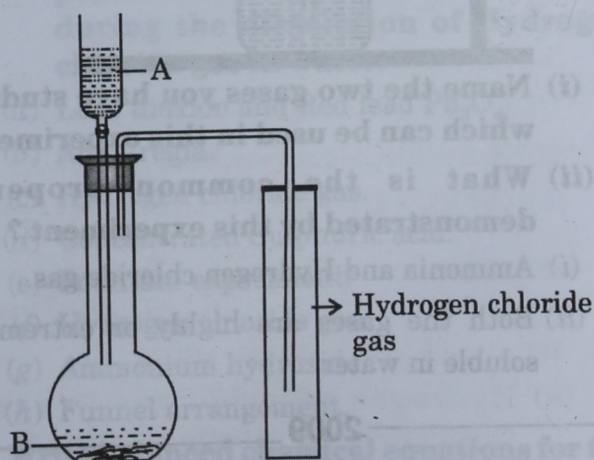
(ii) It prevents the back suction of water and provides greater surface area for the absorption of the gas.

(iii) (A)  $\text{NaCl} + \text{H}_2\text{SO}_4 \xrightarrow{\text{below } 200^\circ\text{C}} \text{NaHSO}_4 + \text{HCl}$

(B)  $2\text{NaCl} + \text{H}_2\text{SO}_4 (\text{Conc.}) \xrightarrow{\text{above } 200^\circ\text{C}} \text{Na}_2\text{SO}_4 + 2\text{HCl}$

2010

Q1. The diagram shows an apparatus for the laboratory preparation of hydrogen chloride.



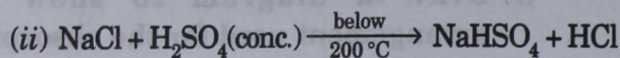
(i) Identify A and B.

(ii) Write the equation for the reaction.

(iii) How would you check whether or not the gas jar is filled with hydrogen chloride ?

(iv) What does the method of collection tell you about the density of hydrogen chloride ? [5]

Ans. (i) A : conc. Sulphuric acid and B : NaCl



(iii) Bring a glass rod dipped in  $\text{NH}_4\text{OH}$  in contact with the mouth of gas jar, if dense white fumes appear immediately then the gas jar is filled with HCl.

(iv) HCl is heavier than air.

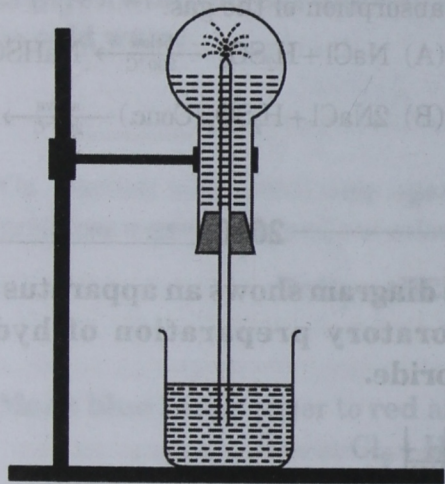
Q2. By the addition of only one solution how would you distinguish between dilute hydrochloric acid and dilute nitric acid ? [1]

Ans. Silver nitrate solution

HCl – will give white precipitate which is soluble in excess of  $\text{NH}_4\text{OH}$

$\text{HNO}_3$  – No visible reaction

Q3. The diagram shows a simple arrangement of the fountain experiment :



(i) Name the two gases you have studied which can be used in this experiment.

(ii) What is the common property demonstrated by this experiment ? [3]

Ans. (i) Ammonia and Hydrogen chloride gas.

(ii) Both the gases are highly or extremely soluble in water.

2009

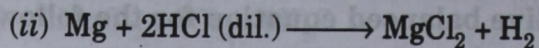
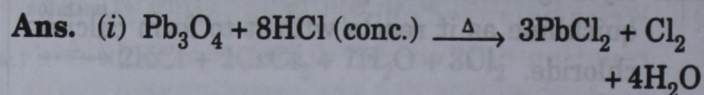
Q1. Name the gas evolved (formula not acceptable) by the action of concentrated Sulphuric acid on Sodium chloride [1]

Ans. Hydrogen chloride gas.

Q2. Write fully balanced chemical equation for the following. [2]

(i) Red lead is warmed with concentrated Hydrochloric acid.

(ii) Magnesium metal is treated with dilute Hydrochloric acid.



Q3. Correct the following statement.

Hydrochloric acid is prepared in the laboratory by passing Hydrogen chloride directly through water [1]

Ans. Hydrochloric acid is prepared in the laboratory by passing hydrogen chloride through water by funnel arrangement.

2008

Q1. What property of Hydrogen chloride is demonstrated when it is collected by downward delivery (upward displacement) ? [1]

Ans. Hydrogen chloride gas is heavier than air.

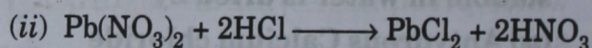
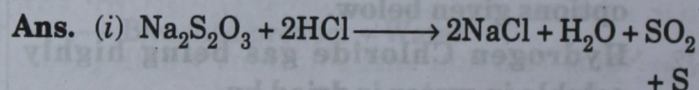
Q2. Why is Hydrogen chloride not collected over water ? [1]

Ans. Hydrogen chloride is not collected over water as it is highly or extremely soluble in water.

Q3. Write the equations for the following reactions : [2]

(i) Dilute Hydrochloric acid and Sodium thiosulphate.

(ii) Dilute Hydrochloric acid and Lead nitrate solution.



2007

Q1. Write balanced chemical equations for the reaction of dilute Hydrochloric acid with each of the following : [5]

(i) Iron

(ii) Sodium hydrogen carbonate

(iii) Iron(II) sulphide

(iv) Sodium sulphite

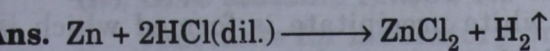
(v) Sodium thiosulphate solution



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

2006

**Q1. Write balanced chemical equation for the reaction of Zinc and dilute Hydrochloric acid. [1]**

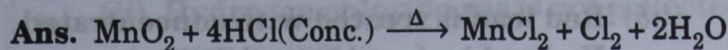


**Q2. What do you observe when Hydrochloric acid is added to Silver nitrate solution ? [1]**

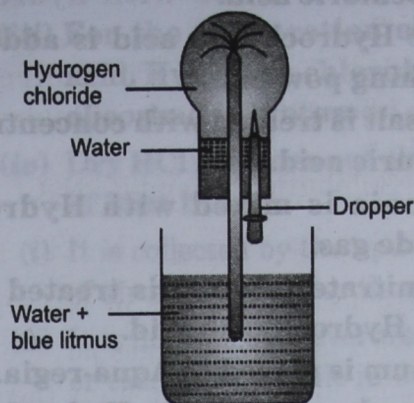
ns. White precipitate appears which is soluble in excess of Ammonium hydroxide.

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**Q1. Write balanced equation for the following reaction : Manganese(IV) oxide and concentrated Hydrochloric acid. [1]**



Q2.



- (i) Name the experiment illustrated above.  
 (ii) Which property of Hydrogen chloride is demonstrated by this experiment ?  
 (iii) State the colour of the water that has entered the round-bottomed flask. [3]

Ans. (i) Fountain experiment.

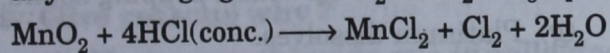
(ii) Hydrogen chloride gas is extremely soluble in Water.

(iii) Red.

## IMPORTANT QUESTIONS

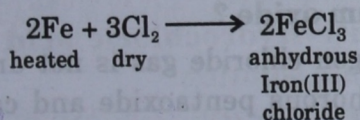
**Q1. Outline the steps required to convert Hydrogen chloride to anhydrous Iron(III) chloride. Write the equations for the reactions which take place.**

Ans. Prepare Chlorine by reacting conc. HCl with any oxidizing agent. ( $\text{MnO}_2$ ,  $\text{PbO}_2$ ,  $\text{Pb}_3\text{O}_4$ )



Pass Chlorine through conc.  $\text{H}_2\text{SO}_4$ , to dry it.

Pass dry Chlorine over heated Iron



**Q2. Name two aqueous solutions which give white precipitate with dil. Hydrochloric acid ?**

Ans. Lead nitrate solution and Silver nitrate solution.

**Q3. Name the following :**

(a) Two compounds of Lead which combine with conc. HCl to liberate Chlorine.

(b) Solvent for noble metal.

(c) The gas obtained when rock salt reacts with conc. Sulphuric acid.

(d) Drying agent for Hydrogen chloride gas.

(e) The experiment which demonstrates extreme solubility of Hydrogen chloride gas.

(f) A polar covalent compound which on dissolving in water produces ions.

(g) Solvent for Silver chloride.

(h) Name the arrangement used for the prevention of back suction of water during the dissolution of Hydrogen chloride gas in water.

Ans. (a) Lead dioxide and Red lead  $\text{Pb}_3\text{O}_4$ .

(b) Aqua-regia.

(c) Hydrogen chloride gas.

(d) Concentrated Sulphuric acid.

(e) Fountain experiment.

(f) Hydrogen chloride gas.

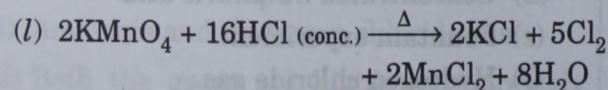
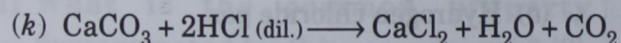
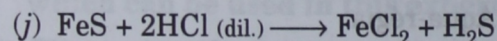
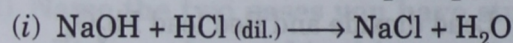
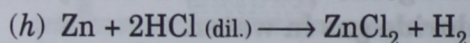
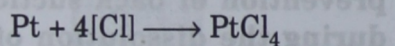
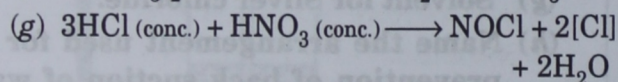
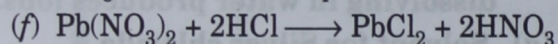
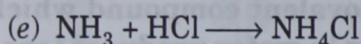
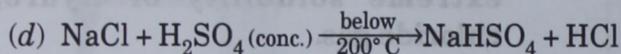
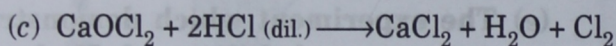
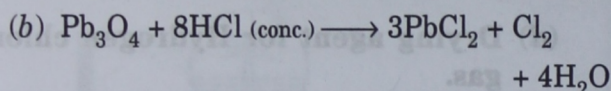
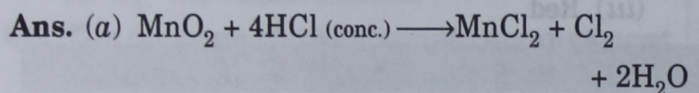
(g) Ammonium hydroxide.

(h) Funnel arrangement.

**Q4. Write balanced chemical equations for the following :**

(a) Manganese dioxide is treated with concentrated Hydrochloric acid.

- (b) Red lead is treated with concentrated Hydrochloric acid.
- (c) Dilute Hydrochloric acid is added to Bleaching powder.
- (d) Rock salt is treated with concentrated Sulphuric acid.
- (e) Ammonia is mixed with Hydrogen chloride gas.
- (f) Lead nitrate solution is treated with dilute Hydrochloric acid.
- (g) Platinum is placed in Aqua-regia.
- (h) Zinc is placed in dilute Hydrochloric acid solution.
- (i) Sodium hydroxide is treated with dilute Hydrochloric acid.
- (j) Iron(II) sulphide is treated with dilute Hydrochloric acid.
- (k) Dilute Hydrochloric acid is slowly added over marble chips.
- (l) Potassium permanganate is treated with conc. Hydrochloric acid.



**Q5.** What will you observe when

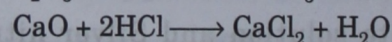
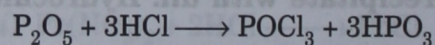
- (a) Hydrogen chloride gas is passed through Silver nitrate solution ?
- (b) Hydrogen chloride gas comes in contact with Ammonia solution ?

- (c) Hydrogen chloride gas is passed through Lead nitrate solution and the product thus formed is heated ?
- (d) Manganese dioxide is treated with concentrated Hydrochloric acid ?
- (e) Copper oxide is treated with concentrated Hydrochloric acid ?
- (f) Magnesium strip is dropped in dilute Hydrochloric acid ?
- (g) Platinum is added to Aqua-regia ?

- Ans.** (a) A white precipitate is formed which is soluble in excess of Ammonium hydroxide.
- (b) Dense white fumes are observed.
- (c) A white precipitate is formed which gets dissolved on heating.
- (d) Black coloured Manganese dioxide on reacting with concentrated Hydrochloric acid gives light brown coloured solution with the evolution of greenish yellow coloured gas.
- (e) Black coloured Copper oxide on reacting with conc. Hydrochloric acid gives blue coloured solution with the evolution of greenish yellow coloured gas which turns moist Starch iodide paper blue-black, turns moist blue litmus to red and finally bleaches it to white, *i.e.*, it decolourizes.
- (f) Magnesium metal slowly dissolves with the evolution of a colourless and odourless gas which burns off with a popping sound.
- (g) Platinum dissolves.

**Q6.** Why hydrogen chloride gas is not dried by using phosphorous pentaoxide and calcium oxide ?

- Ans.** Hydrogen chloride gas is not dried by using phosphorous pentaoxide and calcium oxide because both the drying agents undergo chemical reaction with the gas.



**Q7.** State the colour changes observed when dilute Hydrochloric acid is added to the following indicators

- (i) Neutral litmus solution
- (ii) Alkaline phenolphthalein solution
- (iii) Methyl orange solution

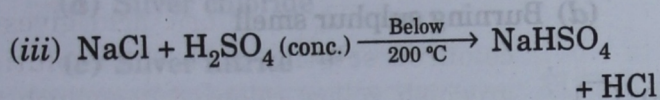
- Ans. (i) it turns red  
 (ii) It gets decolourized  
 (iii) it turns red or pink

**Q8. The following questions are related with the laboratory preparation of Hydrochloride acid.**

- (i) Name the reactants used during the laboratory preparation of Hydrochloride acid.  
 (ii) Give suitable reason for choosing the reactants for laboratory preparation.  
 (iii) Write balanced chemical equation for the reaction taking place below 200°C  
 (iv) Why the temperature of the reaction must be maintained below 200 °C ?

Ans. (i) Sodium chloride and concentrated Sulphuric acid.

(ii) Sodium chloride is preferred as it is easily, cheaply available concentrated sulphuric acid is preferred as it is least volatile acid.



(iv) The temperature of the reaction is maintained below 200 °C because  
 1. On heating lot of fuel is wasted  
 2. A sticky mass of Sodium sulphate is formed which destroys the glass apparatus.

**Q9. Give reasons why ?**

- (i) Hydrogen chloride gas is collected by the upward displacement of air.

(ii) Hydrogen chloride gas is not collected over water.

(iii) For the preparation of Hydrochloric acid, Hydrogen chloride is not directly absorbed in water.

(iv) Dry HCl gas does not change the colour of blue litmus.

Ans. (i) It is collected by the upward displacement of air as it is heavier than Air.

(ii) It is not collected over water as it is highly or extremely soluble in water.

(iii) As the direct absorption Leads to the back suction of Water.

(iv) Dry HCl gas does not change the colour of blue litmus as Hydrogen ions are not formed in the dry state.

**Q10. Name the gas evolved when Hydrochloric acid is added to**

(i) Magnesium

(ii) Calcium bicarbonate

(iii) Sodium bicarbonate

(iv) Sodium sulphite

(v) Zinc sulphide

(vi) Manganese (IV) oxide

(vii) Sodium thiosulphate

Ans. (i) Hydrogen

(ii) Carbon dioxide

(iii) Carbon dioxide

(iv) Sulphur dioxide

(v) Hydrogen sulphide

(vi) Chlorine

(vii) Sulphur dioxide

## Let's Recall

Fill Your Answer in the Space Given for Each Question.

**Q1. Match the following :**

**A.**

**Column-I**

- (i) Aqua-regia
- (ii) Chlorine
- (iii) Concentrated  $H_2SO_4$
- (iv) Hydrogen chloride gas
- (v) Fountain experiment

**Column-II**

- (a) Extreme solubility
- (b) Drying agent
- (c) Fumes in moist air
- (d) Gold and Platinum
- (e) Greenish yellow colour.

Ans. (i)  (ii)  (iii)  (iv)  (v)

**B.**

**Column-I**

- (i) Hydrogen sulphide
- (ii) Carbon dioxide
- (iii) Sulphur dioxide
- (iv) Hydrogen

**Column-II**

- (a) Colourless gas burns with pop sound.
- (b) Rotten egg smell
- (c) Colourless, odourless gas
- (d) Burning sulphur smell

Ans. (i)  (ii)  (iii)  (iv)

**Q2. Fill in the blanks.**

- (i) Hydrogen chloride gas is a \_\_\_\_\_ compound which on dissolving in water produces \_\_\_\_\_.
- (ii) Hydrochloric acid on reacting with \_\_\_\_\_ produces greenish yellow coloured gas.
- (iii) Hydrogen chloride gas is collected by \_\_\_\_\_ of air as it is \_\_\_\_\_ than air.
- (iv) Hydrogen chloride gas is not collected over \_\_\_\_\_ as it is \_\_\_\_\_ soluble in water.
- (v) On adding Silver nitrate to Hydrochloric acid, a \_\_\_\_\_ precipitate is obtained which is soluble in \_\_\_\_\_.

**Q3. State whether the following statements are True or False.**

- (i) Ammonia mixes with hydrogen chloride gas to produce dense white fumes.
- (ii) Chlorine turns moist starch Iodide paper green.
- (iii) Dry Hydrogen chloride gas is acidic in nature.
- (iv) Hydrogen chloride gas is collected over Water.
- (v) Hydrogen chloride gas is dried by using concentrated Sulphuric acid.
- (vi) Liquified Hydrogen chloride is an electrolyte.

(vii) During the laboratory preparation of Hydrogen chloride gas concentrated Sulphuric acid is used as it is a least volatile acid.

**Q4. Each question has four options, out of which only one option is correct. Dark the bubble for correct answer.**

(i) Manganese(IV) oxide, Lead(IV) oxide, Potassium permanganate, Potassium dichromate are commonly called as

- (a) reducing agents                      (b) oxidizing agents  
(c) least volatile acids                (d) organic compounds.

Ans.

- (a)                      (b)                      (c)                      (d)

(ii) Hydrogen chloride gas on mixing with ammonia produces dense white fumes due to the formation of

- (a) Ammonium hydroxide                (b) Nitrogen  
(c) Ammonium chloride                (d) Sulphur dioxide

Ans.

- (a)                      (b)                      (c)                      (d)

(iii) A salt of silver which is soluble in excess of Ammonium hydroxide

- (a) Silver chloride                      (b) Silver nitrate  
(c) Silver nitrite                        (d) None of these

Ans.

- (a)                      (b)                      (c)                      (d)

(iv) Chlorine acts as

- (a) acidic and bleaching agent                (b) basic gas only  
(c) acidic gas only                        (d) both (b) and (c).

Ans.

- (a)                      (b)                      (c)                      (d)

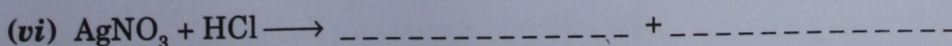
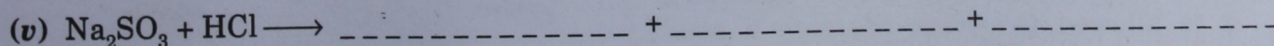
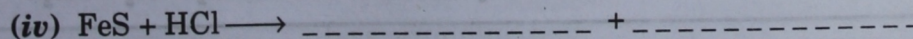
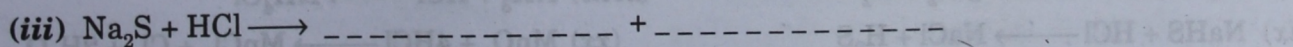
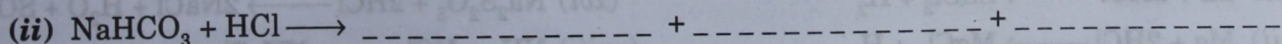
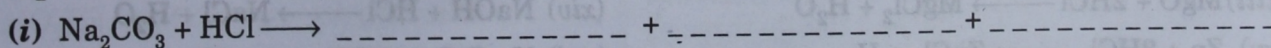
(v) Two black coloured oxidizing agents which react with concentrated hydrochloric acid to obtain chlorine are

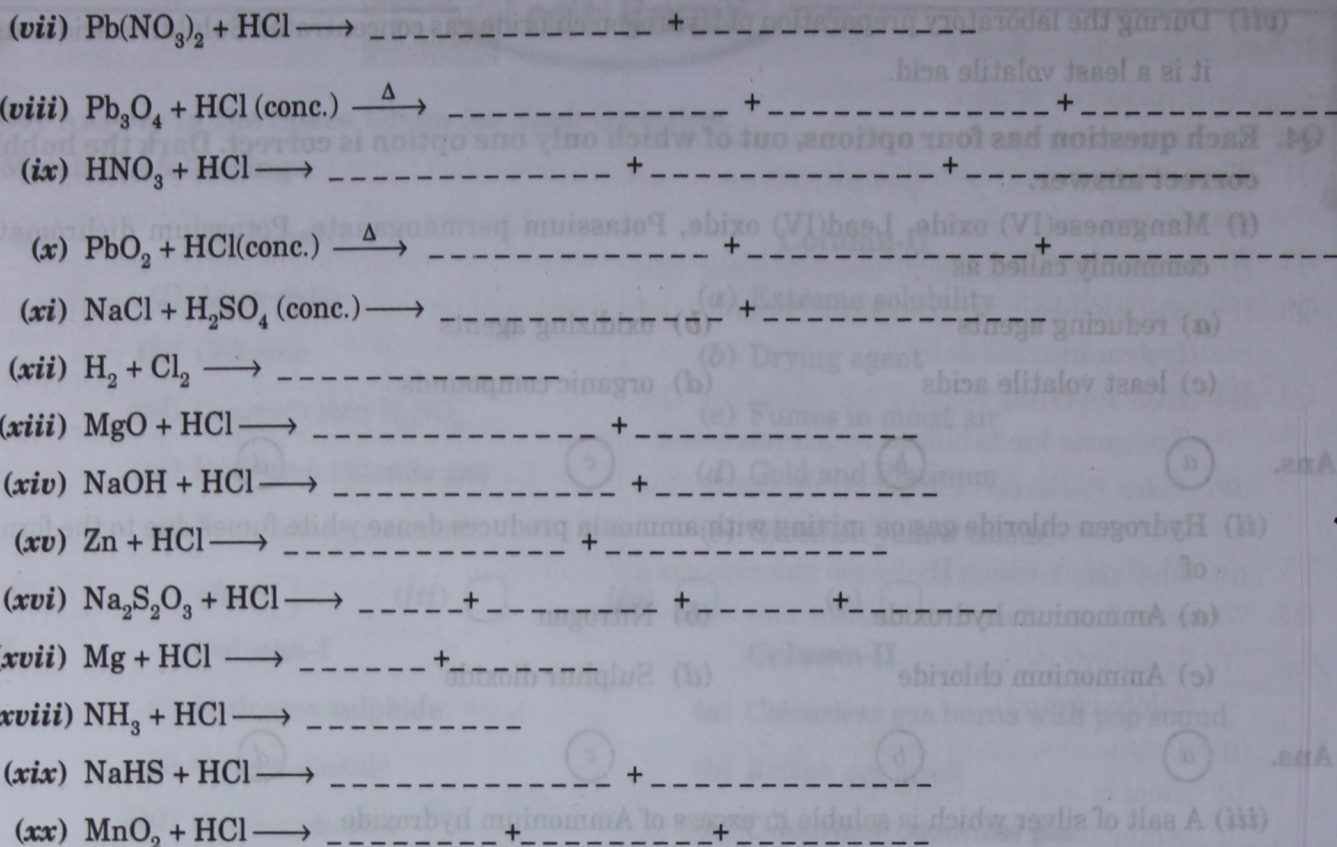
- (a)  $Pb_3O_4$  and  $MnO_2$                       (b)  $PbO_2$  and  $CuO$   
(c)  $MnO_2$  and  $CuO$                         (d)  $MnO_2$  and  $K_2Cr_2O_7$ .

Ans.

- (a)                      (b)                      (c)                      (d)

**Q5. Complete and balance the following equations**





## ANSWERS

1. A (i) d (ii) e (iii) b (iv) c (v) a  
 B (i) b (ii) c (iii) d (iv) a
2. (i) polar covalent, ions (ii) oxidizing agents  
 (iii) upward displacement, heavier (iv) water, highly or extremely (v) white, Ammonium hydroxide
3. (i) True (ii) False (iii) False (iv) False (v) True (vi) False (vii) True
4. (i) b (ii) c (iii) a (iv) a (v) c
5. (i)  $\text{Na}_2\text{CO}_3 + 2\text{HCl} \longrightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$  (ii)  $\text{NaHCO}_3 + \text{HCl} \longrightarrow \text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$   
 (iii)  $\text{Na}_2\text{S} + 2\text{HCl} \longrightarrow 2\text{NaCl} + \text{H}_2\text{S}$  (iv)  $\text{FeS} + 2\text{HCl} \longrightarrow \text{FeCl}_2 + \text{H}_2\text{S}$   
 (v)  $\text{Na}_2\text{SO}_3 + 2\text{HCl} \longrightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{SO}_2$  (vi)  $\text{AgNO}_3 + \text{HCl} \longrightarrow \text{AgCl} + \text{HNO}_3$   
 (vii)  $\text{Pb}(\text{NO}_3)_2 + 2\text{HCl} \longrightarrow \text{PbCl}_2 + 2\text{HNO}_3$  (viii)  $\text{Pb}_3\text{O}_4 + 8\text{HCl}(\text{conc.}) \xrightarrow{\Delta} 3\text{PbCl}_2 + \text{Cl}_2 + 4\text{H}_2\text{O}$   
 (ix)  $\text{HNO}_3 + 3\text{HCl} \longrightarrow \text{NOCl} + 2[\text{Cl}] + 2\text{H}_2\text{O}$  (x)  $\text{PbO}_2 + 4\text{HCl}(\text{conc.}) \xrightarrow{\Delta} \text{PbCl}_2 + \text{Cl}_2 + 2\text{H}_2\text{O}$   
 (xi)  $\text{NaCl} + \text{H}_2\text{SO}_4(\text{conc.}) \longrightarrow \text{NaHSO}_4 + \text{HCl}$  (xii)  $\text{H}_2 + \text{Cl}_2 \longrightarrow 2\text{HCl}$   
 (xiii)  $\text{MgO} + 2\text{HCl} \longrightarrow \text{MgCl}_2 + \text{H}_2\text{O}$  (xiv)  $\text{NaOH} + \text{HCl} \longrightarrow \text{NaCl} + \text{H}_2\text{O}$   
 (xv)  $\text{Zn} + 2\text{HCl} \longrightarrow \text{ZnCl}_2 + \text{H}_2$  (xvi)  $\text{Na}_2\text{S}_2\text{O}_3 + 2\text{HCl} \longrightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{SO}_2 + \text{S}$   
 (xvii)  $\text{Mg} + 2\text{HCl} \longrightarrow \text{MgCl}_2 + \text{H}_2$  (xviii)  $\text{NH}_3 + \text{HCl} \longrightarrow \text{NH}_4\text{Cl}$   
 (xix)  $\text{NaHS} + \text{HCl} \longrightarrow \text{NaCl} + \text{H}_2\text{S}$  (xx)  $\text{MnO}_2 + 4\text{HCl} \longrightarrow \text{MnCl}_2 + \text{Cl}_2 + 2\text{H}_2\text{O}$

# Self Evaluation Test

Time : 30 minutes

Marks : 25

- Q1.** What nature of hydrogen chloride gas is exhibited when liquified hydrogen chloride gas does not conduct electricity ? 1
- Q2.** What is the purpose of concentrated hydrochloric acid in the preparation of aqua-regia ? 1
- Q3.** How will you distinguish between Sodium sulphite and Sodium thiosulphate using dilute Hydrochloric acid ? 1
- Q4.** Name the following : 4
- (i) Two compounds of lead which react with concentrated Hydrochloric acid to liberate Chlorine.
  - (ii) A gas which gives dense white fumes with Hydrogen chloride gas.
  - (iii) A strong monobasic acid of Hydrogen chloride gas.
  - (iv) Method by which Hydrogen chloride gas is dissolved in Water.
- Q5.** Write balanced chemical equations for the following reactions : 5
- (i) Lead nitrate is added to dilute Hydrochloric acid.
  - (ii) dilute hydrochloric acid is added to Sodium thiosulphate solution.
  - (iii) Calcium carbonate is added to dilute Hydrochloric acid.
  - (iv) Gold is added to aqua-regia
  - (v) Ammonia mixes with Hydrogen chloride gas.
- Q6.** What do you observe when 5
- (i) Moist blue litmus paper is introduced in the jar of Chlorine ?
  - (ii) Moist starch iodide paper is introduced in the jar of Chlorine ?
  - (iii) Sulphur dioxide is passed through acidified Potassium dichromate solution ?
  - (iv) Hydrogen chloride gas is passed through Silver nitrate solution and the product thus formed is treated with excess of Ammonium hydroxide ?
  - (v) Moist blue litmus paper is introduced in the jar of Hydrogen chloride gas ?
- Q7.** The following questions are related with the preparation and properties of hydrogen chloride gas in laboratory : 8
- (i) Name two compounds which react in laboratory to produce Hydrogen chloride gas.
  - (ii) Write balanced chemical equation for the reaction taking place in (i) above.
  - (iii) How is Hydrogen chloride gas collected, tested and dried ?
  - (iv) What does the method of collection suggest about the density of the gas ?
  - (v) What can you say about the solubility of Hydrogen chloride gas ? Name the experiment which demonstrates such solubility.
  - (vi) Name the solution formed when Hydrogen chloride gas is dissolved in water.