Hydrogen Chloride

1. The drying agent used to dry HCl gas is:
   (A) Conc. H_2SO_4
   (B) ZnO
   (C) Al_2O_3
   (D) CaO

   (2019)

   Answer:
   (A) Conc. H_2SO_4

2. State one observation for each of the following:
   A small piece of zinc is added to dilute hydrochloric acid.

   (2019)

   Answer:
   $Zn + 2HCl > ZnCl_2 + H_2\uparrow$
   Zinc metal dissolves forming a solution with the liberation of hydrogen gas which burns with blue flame and gets extinguished with a pop sound.

3. Dry hydrogen chloride gas can be collected by ……. displacement of air. (downward/upward)

   (2019)

   Answer: Upward

4. Name the acid used for the preparation of hydrogen chloride gas in the laboratory. Why is this particular acid preferred to other acids?

   (2018)

   Answer:
   Sulphuric acid
   [It is preferred to other acids because it is non-volatile acid]

5. Write the balanced chemical equation for the laboratory preparation of hydrogen chloride gas.

   (2018)

   Answer:

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

6. For the preparation of hydrochloric acid in the laboratory:
   (i) Why is direct absorption of hydrogen chloride gas in water not feasible?
   (ii) What arrangement is done to dissolve hydrogen chloride gas in water?
   (2018)

   Answer:
   (i) Direct absorption of hydrogen chloride gas in water is not feasible as it leads to back suction.
   (ii) "Inverted funnel arrangement" is done to dissolve hydrogen chloride gas in water.

7. State one relevant observation for each of the following reactions:
   Action of dilute Hydrochloric acid on iron (II) sulphide.
   (2017)

   Answer:
   Rotten egg smell due to formation of hydrogen sulphide.

8. The aim of the **Fountain Experiment** is to prove that:
   (A) HCl turns blue litmus red
   (B) HCl is denser than air
   (C) HCl is highly soluble in water
   (D) HCl fumes in moist air (2016)

   Answer:
   (C) HCl is highly soluble in water.

9. State your **observations** when:
   dilute Hydrochloric acid is added to copper carbonate.
   (2016)

   Answer:
   A brisk effervescence with the release of colourless, odourless, acidic gas that extinguishes glowing splint i.e., Carbon dioxide gas is evolved.

10. State your **observations** when:
    dilute Hydrochloric acid is added to Sodium thiosulphate
    (2016)

    Answer:
    A colourless gas with the smell of burning sulphur i.e., Sulphur dioxide is released. A yellow crystal settles at the bottom i.e., sulphur.

11. Identify the **gas evolved** and give the **chemical test** in each of the following case:
    1. Dilute hydrochloric acid reacts with sodium sulphite.
    2. Dilute hydrochloric acid reacts with iron (II) sulphide.

    (2016)

    Answer:
    1. Sulphur dioxide gas is evolved. A colourless, gas with the smell of burning sulphur. It turns acidified potassium dichromate orange to green.
    2. Hydrogen sulphide gas is evolved.
       Colourless gas with the smell of rotten eggs. It turns lead acetate paper black.

12. This gas produces dense white fumes with ammonia gas.

(2015)

Answer: **Hydrogen Chloride**

13. The following questions are pertaining to the laboratory preparation of hydrogen chloride gas:
(i) Write the equation for its preparation mentioning the condition required.
(ii) Name the drying agent used and justify your choice.
(iii) State a safety precaution you would take during the preparation of hydrochloric acid.

(2015)

Answer:

(i) $NaCl + \underset{(Conc.)}{H_2SO_4} \xrightarrow{< 200\ ^\circ C} NaHSO_4 + HCl$

(ii) Drying agent is cone, sulphuric acid because it is an acidic drying agent and other drying agents react with HCl.

(iii) The temperature should be raised above 200°C during the preparation of hydrochloric acid because above this temperature it forms sticky substance sodium sulphate that sticks to glass apparatus which becomes difficult to remove and also causes wastage of heat.

14. Write the balanced equation for:
Action of dilute hydrochloric acid on sodium sulphide

(2014)

Answer:

(i) $Cu + 4HNO_3 \longrightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$

(ii) $Mg_3N_2 + 6H_2O \longrightarrow 3Mg(OH)_2 + 2NH_3 \uparrow$

(iii) $C + 2H_2SO_4 \longrightarrow CO_2 + 2H_2O + 2SO_2$

(iv) $Na_2S + 2HCl \longrightarrow 2NaCl + H_2S \uparrow$

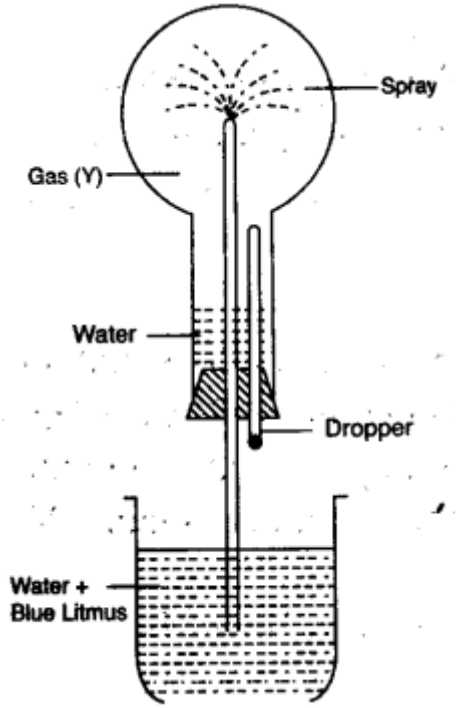
(v) $C_2H_5COONa + NaOH \xrightarrow{CaO} Na_2CO_3 + C_2H_6$

15. Distinguish between:
Sodium nitrate and sodium sulphite (using dilute sulphuric acid)

(2014)

Answer:
Sodium nitrate: Colourless vapours of nitric acid which condenses to form nitric acid.
Sodium sulphite: Colourless, gas with smell of burning sulphur, acidic in nature that is sulphur dioxide is released.

16. Study the figure given below and answer the questions that follow:



1. Identify the gas Y.
2. What property of gas Y does this experiment demonstrate?
3. Name another gas which has the same property and can be demonstrated through this experiment.

Answer:

1. Hydrogen chloride gas (HCl).
2. Y Gas i.e., HCl gas is highly soluble and acidic in nature.
3. Ammonia gas.

17. Give a chemical test to distinguish between the following pairs of compounds:
Hydrogen chloride gas and hydrogen sulphide gas

(2013)

Answer:
Dense white fumes observed when a rod dipped in NH_3 is brought to the mouth of a test tube containing HCl gas. Whereas no such fumes are observed in case of H_2S gas.

18. Give reason:
Hydrogen chloride gas cannot be dried over quick lime

(2012)

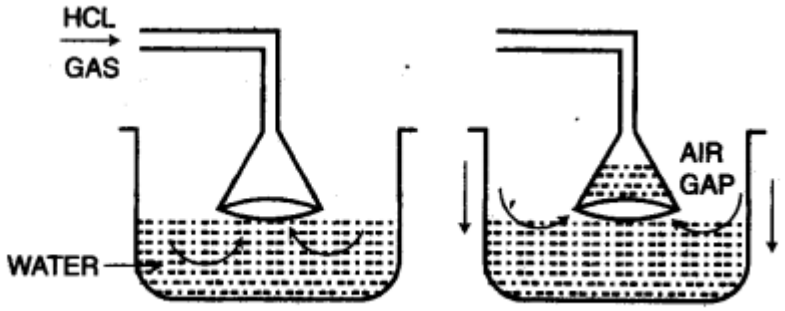
Answer:
Hydrogen chloride is acidic whereas quick lime is basic. So, they will react with each other hence quick lime cannot be used to dry hydrogen chloride.

19. 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 °C (B) above 200 °C.

(2011)

Answer:

(i)



(ii) HCl gas is highly soluble in water almost at the ratio of 1 : 450. So HCl gas undergoes back suction due to which the source of HCl will be affected.

(A) Below 200 °C :

$$NaCl + H_2SO_4 \xrightarrow{\Delta} NaHSO_4 + HCl$$

(B) Above 200 °C :

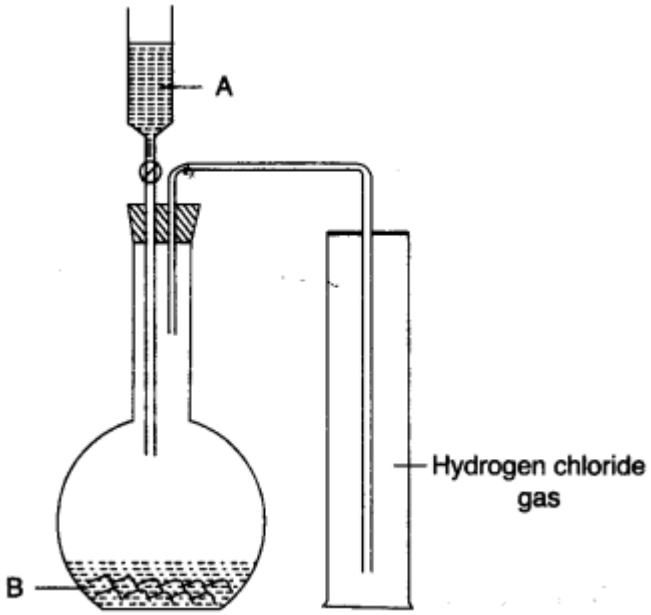
$$2NaCl + H_2SO_4 \longrightarrow Na_2SO_4 + 2HCl$$

20. Hydrogen chloride gas being highly soluble in water is dried by:
(A) Anhydrous calcium chloride (B) Phosphorous penta oxide
(C) Quick lime (D) Concentrated sulphuric acid

(2011)

Answer: (D)

21. 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?

(2010)

Answer:
(i) A = Conc. Sulphuric acid.
B = Sodium chloride.

(ii) $NaCl + H_2SO_4 \xrightarrow[200\ °C]{\text{below}} NaHSO_4 + HCl \uparrow$

(iii) Bring a glass rod dipped in ammonium hydroxide near the mouth of the gas jar, it forms dense white fumes of ammonium chloride.

(iv) Collection of HCl ↑ by upward displacement of air proves that HCl ↑ is denser than air. It is 1-28 times heavier than air.