

GRADE 10TH SCIENCE
CHAPTER 2

ACIDS, BASES AND SALTS

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Acids, Bases and Salts Class 10 Important Questions

Very Short Answer Type

Question 1.

How is the concentration of hydronium (H_3O^+) ions affected when a solution of an acid is diluted? (2017 OD)

Answer:

When an acid solution is diluted with water then concentration of (H_3O^+) ions gets decreased.

Question 2.

Why does dry HCl gas not change the colour of the dry litmus paper?

Answer:

Since HCl gas gives H^+ ions only with H_2O molecules to behave as an acid. The dry HCl does not change the colour of dry litmus paper as it needs moisture or water for its acidic action.

Question 3.

Two solutions A and B have pH values of 5 and 8 respectively. Which solution will be basic in nature?

Answer:

Solution B will be basic in nature as its pH value is 8.

Question 4.

Fresh milk has a pH of 6. When it changes into curd (yoghurt), will its pH value increase or decrease? Why?

Answer:

When milk changes into curd, its pH value will decrease because curd contains lactic acid (pH < 6 of acids).

Short Answer Type I

Question 1.

State the number of water molecules present in crystals of washing soda and plaster of paris. What are these water molecules called as? (2013)

Answer:

- Washing soda crystals contain 10 molecules of water ($\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$).



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- Plaster of Paris crystals contain 1/2 molecule of water ($\text{CaSO}_4 \cdot 1/2 \text{H}_2\text{O}$ or $2\text{CaSO}_4 \cdot \text{H}_2\text{O}$).

The water molecules, which form part of the structure of a crystal, are called water of crystallization.

Question 2.

Two solutions A and B have pH 3 and 5 respectively. Which of the two solutions has more hydrogen ion concentration and which one is more acidic? Give reason for your answer. (2013)

Answer:

pH of solution A = 3,

pH of solution B = 5

Solution A is more acidic as solution A has more hydrogen ion concentration, because the pH of a solution is inversely proportional to the concentration of hydrogen ions in it. That is, a solution having low concentration of hydrogen ions has a higher pH value.

Question 3.

Explain why an aqueous solution of sodium sulphate is neutral while an aqueous solution of sodium carbonate is basic in nature. (2014)

Answer:

Aqueous solution of sodium sulphate gets hydrolysed to form sodium hydroxide and sulphuric acid which are strong base and strong acid respectively. So its aqueous solution is neutral.

When sodium carbonate is dissolved in water, it gets hydrolysed to some extent and forms sodium hydroxide and carbonic acid. Now sodium hydroxide is a strong base which is fully ionised and gives a large amount of hydroxide ions $[\text{OH}^- (\text{aq})]$. On the other hand, carbonic acid is a weak acid which is only slightly ionised and hence gives a small amount of hydrogen ions $[\text{H}^+ (\text{aq})]$. The mixture contains more of hydroxide ions than hydrogen ions, so it is basic in nature.

Question 4.

Name the gas which is usually produced when dil. sulphuric acid reacts with a metal. Illustrate it with an example. How will you test the evolution of this gas? (2015)

Answer:

Metals react with dil. sulphuric acid to give metal sulphates and hydrogen gas.

For example, $\text{Zn (s)} + \text{H}_2\text{SO}_4 (\text{aq}) \rightarrow \text{ZnSO}_4 (\text{aq}) + \text{H}_2 \uparrow$ (Hydrogen gas)



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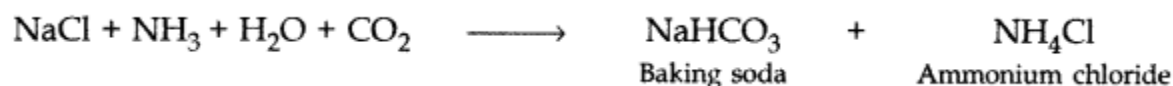
Test for hydrogen gas: Take about 5 ml of dilute sulphuric acid in a test tube and add a few pieces of zinc granules to it. Hydrogen gas is evolved which forms bubbles in the soap solution. Bring a burning candle near hydrogen gas-filled bubble. It burns with a pop sound.

Question 5.

Write a chemical equation to describe how baking soda is produced on a large scale. Also write chemical name of the products obtained. (2014)

Answer:

The chemical name of baking soda is sodium bicarbonate (NaHCO_3) or sodium hydrogen carbonate. Sodium hydrogen carbonate is produced on a large scale by reacting a cold and concentrated solution of sodium chloride (called brine) with ammonia and carbon dioxide.



Short Answer Type II

Question 1.

- (a) Write the name given to bases that are highly soluble in water? Give an example. (2012, 2014)
- (b) How is tooth decay related to pH? How can it be prevented?
- (c) Why does bee sting cause pain and irritation? Rubbing of baking soda on the sting area gives relief. How?

Answer:

(a) Water soluble bases are called alkalis, e.g., NaOH, KOH.

(b) Tooth decay starts when the pH of the mouth is lower than 5.5. Bacteria present in the mouth produce acids by the degradation of sugar and food particles remaining in the mouth after eating. This can be prevented by cleaning the mouth and teeth using toothpaste which are generally basic and can neutralize the excess acid.

(c) When a honey bee stings a person, it injects an acidic liquid into the skin which causes immense pain and irritation. Rubbing a mild base like baking soda solution on the stung area of the skin gives relief. This is because, being a base, baking soda neutralises the acidic liquid injected by bee sting and cancels its effect.

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Question 2.

(a) You are given two solutions A and B. The pH of solution A is 6 and pH of solution B is 8.

(i) Identify the acidic and basic solution.

(ii) Which solution has more H^+ ion concentration? Give reason for your answer.

(b) Why is HCl a stronger acid than acetic acid? Explain. (2012)

Answer:

(a) Solution A: pH = 6

Solution B: pH = 8

(i) A is acidic solution whereas B is basic solution.

(ii) Solution A has more H^+ ion concentration because higher the hydronium ion concentration, lower is the pH value.

(b) HCl is a stronger acid than acetic acid because strength of acid depends on the number of H^+ ions produced. When same concentration of HCl and acetic acid are taken then these two produce different amounts of hydrogen ions. HCl produces more H^+ ions and is said to be a strong acid while acetic acid gives less H^+ ions, therefore said to be a weak acid.

Question 3.

State reason for the following: (2014)

(i) dry HCl gas does not change the colour of the dry blue litmus paper.

(ii) alcohol and glucose also contain hydrogen, but do not conduct electricity.

(iii) Conc. of H_3O^+ ion is affected when a solution of an acid is diluted.

Answer:

(i) Dry HCl gas does not contain any hydrogen ions in it, so it does not show acidic behaviour. Dry HCl gas does not change the colour of dry blue litmus paper because it has no hydrogen ions [H^+ (aq)] in it. However, when HCl gas dissolves in water, it forms hydrogen ions and hence shows acidic behaviour.

(ii) The aqueous solutions of glucose and alcohol do not show acidic character because their hydrogen does not separate out as hydrogen ions [H^+ (aq) ions] on dissolving in water. Hence, they do not conduct electricity.

(iii)

- An acid is a substance which dissociates on dissolving in water to produce hydrogen ions [H^+ (aq) ions],



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- Hydrogen ions do not exist as H^+ ions in a solution, they attach themselves to the polar water molecules to form hydronium ions, H_3O^+ .
 $H^+ + H_2O \rightarrow H_3O^+$
- When a solution of an acid is diluted, the number of $[H_3O^+]$ ions per unit volume decreases. Thus pH of the solution increases.

Question 4.

Illustrate any three chemical properties of acids. With examples. (2014)

Answer:

Chemical properties of acids:

- Acids react with metals to form H_2 gas.
 $Zn + 2HCl \rightarrow ZnCl_2 + H_2 \uparrow$
- Acids turn blue litmus into red.
- Acids react with bases to form salt and water (neutralization reaction).

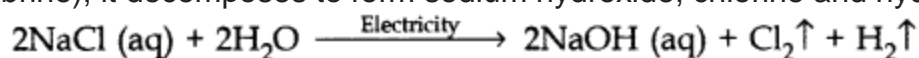


Question 5.

Which three chemical substances are obtained when electricity is passed through an aqueous solution of brine? Write one industrial use of each. (2015)

Answer:

When electricity is passed through a concentrated solution of sodium chloride (called brine), it decomposes to form sodium hydroxide, chlorine and hydrogen gas.



- Use of Sodium hydroxide ($NaOH$). It is used for making soaps and detergents.
- Use of Chlorine (Cl_2). It is used in the production of bleaching powder.
- Use of hydrogen gas (H_2). It is used to make ammonia for fertilisers; used as a fuel or margarine.

Question 6.

When soap is scrubbed on a stain of curry on a white cloth, why does it become reddish-brown, and turns yellow again when the cloth is washed with plenty of water? (2015)

Answer:

Curry contains turmeric which acts as an acid-base indicator. Turmeric contains a yellow dye, which turns red in basic solutions when soap is scrubbed on a stain of curry on a white cloth. This is due to the fact that soap solution is basic in nature which changes the colour of turmeric in the curry stain to red-brown. This stain turns to yellow

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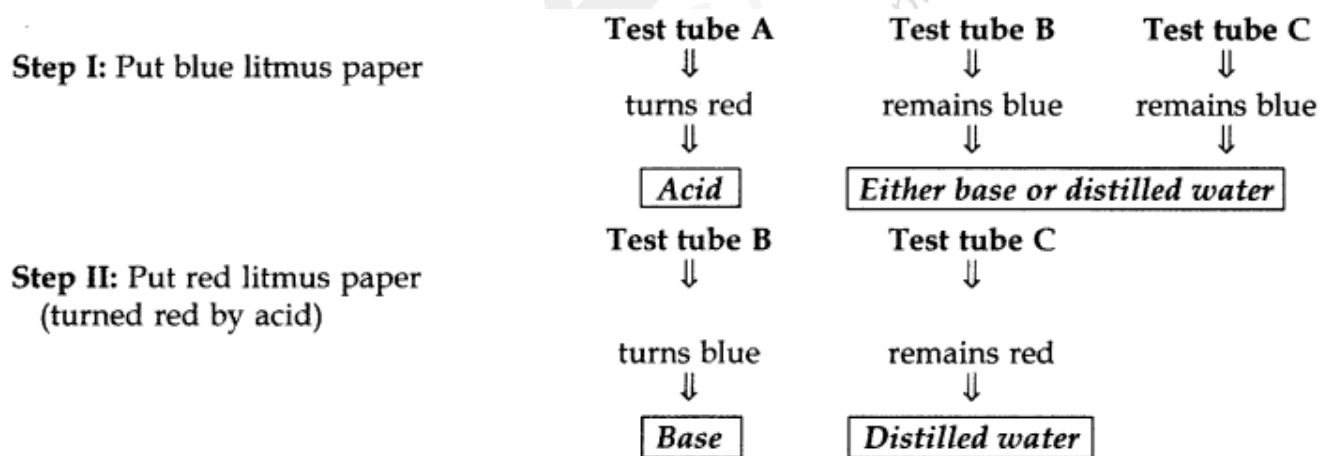
again when the cloth is rinsed with plenty of water because then the basic soap gets removed with water.

Question 7.

You are provided with three test tubes C, A and B which contain distilled water, acidic solution and basic solution. If you are given blue litmus paper only, how will you identify the contents of each test tube? (2015)

Answer:

- First, take three strips of blue litmus paper and dip one in each test tube.
- The liquid in test tube A turns blue litmus to red. It means test tube A contains acid because (acid turns blue litmus to red).
- If other two test tubes do not change the colour of blue litmus paper, it shows that one of them contains a base and the other contains distilled water.
- Now put the blue litmus paper which is turned red by the acid of test tube A in the remaining two test tubes.
- If the liquid of test tube B turns that red litmus paper to blue again, it shows that it is a base.
- The liquid in test tube C does not turn the colour of either blue litmus or red litmus thus is distilled water.



Question 8.

Write the chemical name of Plaster of Paris. Write the chemical equation of its preparation. Why should Plaster of Paris be stored in a dry place? (2017 D)

Answer:

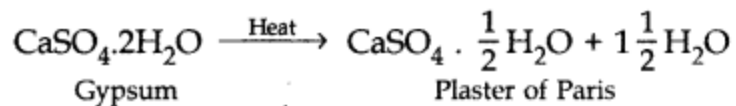
Chemical name of Plaster of Paris is calcium sulphate hemihydrate and its formula is $\text{CaSO}_4 \cdot \frac{1}{2} \text{H}_2\text{O}$.

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Preparation:



Long Answer Type

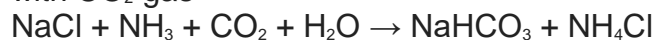
Question 1.

- Write the chemical name and chemical formula of washing soda.
- How is it obtained from sodium chloride? Give equations of the reactions.
- Why it is called a basic salt? Give its any one use. (2012)

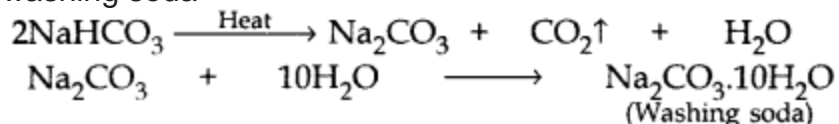
Answer:

(a) Chemical name of washing soda: Sodium carbonate decahydrate
Chemical formula of washing soda: $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$

(b) Washing soda is produced by Solvay process by the reaction of ammonical brine with CO_2 gas



NaHCO_3 on heating produces Na_2CO_3 (soda ash) which on recrystallisation produces washing soda



(c) Washing soda is a basic salt because it is a salt of a strong base (NaOH) and weak acid (H_2CO_3) with pH value more than 7.

Use: Washing soda is used for softening hard water.

Question 2.

Write the chemical name of $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ and Na_2CO_3 . Write the significance of $10\text{H}_2\text{O}$. Mention the term used for water molecules attached with a salt. With the help of chemical equation, explain the method of preparation of both $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ and Na_2CO_3 . Also list two uses of $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$. (2012)

Answer:

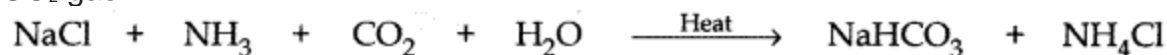
- Chemical name of $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$: Sodium Carbonate Decahydrate (Washing soda)
- Na_2CO_3 : Sodium Carbonate (Soda ash)



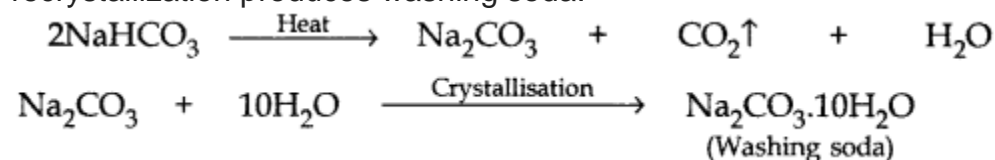
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- $10\text{H}_2\text{O}$ is the water of crystallization of sodium carbonate. Water of crystallization is the fixed number of water molecules present in one formula unit of a salt. Thus '10' water molecules are present in one formula unit of sodium carbonate.

Washing soda is produced by Solvay process, by the reaction of ammonical brine with CO_2 gas.



NaHCO_3 on heating produces Na_2CO_3 (Sodium carbonate, called soda ash) which on recrystallization produces washing soda.



Washing soda is a basic salt.

Some important uses of washing soda:

- Washing soda is used in the glass, soap and paper industries.
- It is used in the manufacture of borax compound.
- It is used as a cleansing agent for domestic purposes.
- It is used for removing permanent hardness of water.

Question 3.

(a) Identify the compound of calcium which is yellowish white powder and is used for disinfecting drinking water. Write its chemical name and formula. How is it manufactured? Write the chemical equation for the reaction involved. Also list two other uses of the compound.

(b) Write the balanced chemical equation of Chlor-alkali process. (2012)

Answer:

(a)

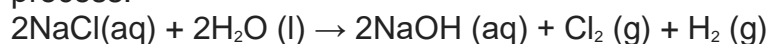
- Compound is bleaching powder.
- Chemical name: Calcium oxychloride
- Formula: CaOCl_2
- It is produced by the action of chlorine on dry slaked lime $\text{Ca}(\text{OH})_2$.
 $\text{Ca}(\text{OH})_2 + \text{Cl}_2 \rightarrow \text{CaOCl}_2 + \text{H}_2\text{O}$

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Uses:

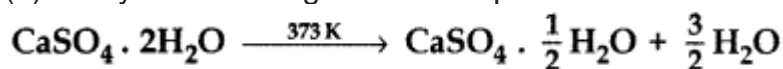
- It is used to bleach wood pulp in paper factories.
- It is used as an oxidizing agent in many chemical industries.

(b) When electricity is passed through an aqueous solution of sodium chloride (called brine), it decomposes to form sodium hydroxide. This process is called chlor-alkali process.



Question 4.

(a) Study the following chemical equation:



Name the reactant and the product and mention one use of the product.

(b) The following salts are formed by the reaction of an acid with a base:

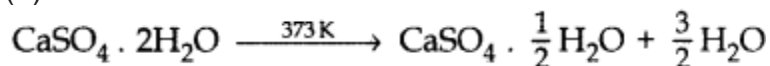
(i) Sodium chloride (ii) Ammonium nitrate

Identify the acid and the base and tabulate your answer in the format given below:

S.No.	Salt	Acid	Base	Nature
1.	Sodium chloride			
2.	Ammonium nitrate			

Answer:

(a)



Reactant: Gypsum

Product: Plaster of Paris and water

Use: Plaster of Paris is used in hospitals for setting fractured bones in the right position to ensure correct healing.

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(b)

S.No.	Salt	Acid	Base	Nature
1.	Sodium chloride	Hydrochloric Acid (HCl)	Sodium hydroxide (NaOH)	Neutral
2.	Ammonium nitrate	Nitric acid (HNO ₃)	Ammonium hydroxide (NH ₄ OH)	Acidic

Question 5.

(a) A student dropped a few pieces of marble in dilute hydrochloric acid contained in a test tube. The evolved gas was passed through lime water. What change would be observed in lime water? Write balanced chemical equations for both the changes observed.

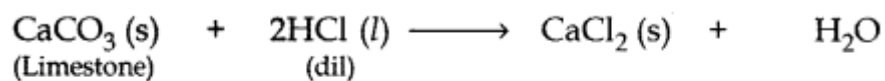
(b) State the chemical property in each case on which the following uses of baking soda are based:

(i) as an antacid

(ii) as a constituent of baking powder. (2014)

Answer:

(a) When a piece of marble (CaCO₃) is dropped in dil HCl, CO₂ gas will be evolved which turns lime water milky.



Formation of CaCO₃ white ppt makes the lime water milky.

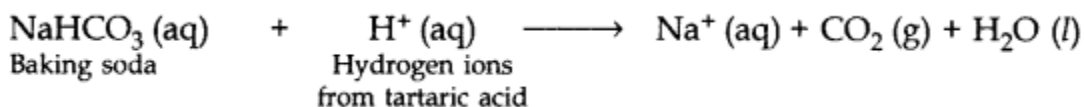
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(b) (i) Being alkaline, sodium hydrogen carbonate (baking soda) neutralises the excess acid present in the stomach and relieves indigestion.

(ii) Baking powder is a mixture of baking soda and a mild edible acid such as tartaric acid. When baking powder mixes with water (present in dough made for baking cake or bread), then sodium hydrogen carbonate reacts with tartaric acid to evolve CO_2 gas.



Question 6.

(a) Define a universal indicator. Mention its one use. (2015)

(b) Solution A gives pink colour when a drop of phenolphthalein indicator is added to it. Solution B gives red colour when a drop of methyl orange is added to it. What type of solutions are A and B and which one of the solutions A and B will have a higher pH value?

(c) Name one salt whose solution has pH more than 7 and one salt whose solution has pH less than 7.

Answer:

(a) Universal indicator is a mixture of many different indicators which gives different colours at different pH values of the entire pH scale. It shows different colours at different concentrations of hydrogen ions in a solution.

(b) Solution A gives pink colour when a drop of phenolphthalein indicator is added, therefore A is a base.

Solution B gives red colour when a drop of methyl orange is added to it, therefore B is an acid. Hence, solution A will have less concentration of hydrogen ion than B.

Thus, A will have pH more than 7 because pH value of

- an acid solution < 7 ;
- a base solution > 7 ; and
- a neutral solution $= 7$.

(c)

- The salts of strong acids and weak bases give acidic solution having pH less than 7. Example, NH_4Cl , Ammonium Chloride will have pH less than 7.
- The salts of weak acids and strong bases give basic solution having pH more than 7. Example, Na_2CO_3 , Sodium Carbonate will have pH more than 7.

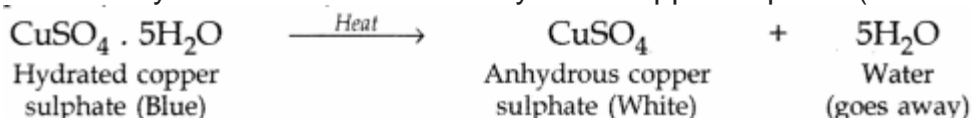


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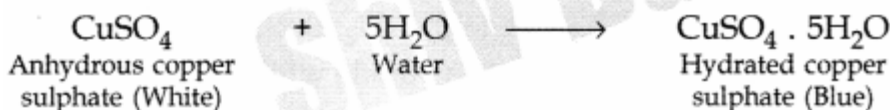
- Question 7.
 - The blue colour of crystals of a substance changed on heating in a closed test tube but the colour was regained after sometime on cooling. Name the substance and write its chemical formula. Explain the phenomenon involved.
 - Write name and chemical formula of two such compounds whose one formula unit is associated with 10 and 2 water molecules respectively. (2015)

Answer:

The substance is Copper sulphate crystals ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) which are blue in colour. When copper sulphate crystals are heated strongly, they lose all the water of crystallisation and form anhydrous copper sulphate (which is white):



- Thus, on strong heating, blue copper sulphate crystals turn white due to the loss of water of crystallisation. The dehydration of copper sulphate crystals is a reversible process. So when water is added to anhydrous copper sulphate, it gets hydrated and turns blue due to the formation of hydrated copper sulphate.



- (b) Chemical formula of two such compounds whose one formula unit is associated with 10 and 2 water molecules respectively

Washing soda – $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$
(Sodium Carbonate Decahydrate)

Gypsum – $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
(Calcium Sulphate Dihydrate)

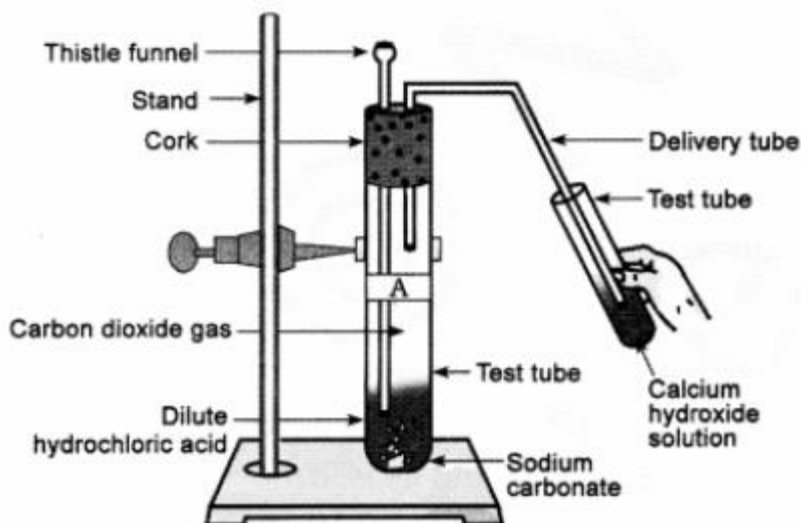
- Question 8.
Write an activity to show the reaction of acids with metal carbonates and metal hydrogen carbonate salts. (2017D)
Answer:
Take two test tubes. Mark them as 'A' and 'B'. Take about 0.5 gm of sodium carbonate in the test tube 'A' and 0.5 gm of sodium hydrogen carbonate in test tube 'B'. Add about 2 ml of dilute HCl acid to both of these test tubes. Pass the gas produced in each case through lime water as shown in the figure. Lime water in each case will turn milky due to the production of CO_2 gas in each of the test

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tubes.



- Reactions occurring in the above activity:
Test tube 'A' $\text{Na}_2\text{CO}_3 (\text{s}) + 2\text{HCl} (\text{aq}) \rightarrow 2\text{NaCl} (\text{aq}) + \text{CO}_2 (\text{g}) + \text{H}_2\text{O} (\text{l})$
Test tube 'B' $\text{NaHCO}_3 (\text{s}) + \text{HCl} (\text{aq}) \rightarrow \text{NaCl} (\text{aq}) + \text{CO}_2 (\text{g}) + \text{H}_2\text{O} (\text{l})$
- On passing the gas evolved through the lime water:
$$\text{Ca}(\text{OH})_2 (\text{aq}) + \text{CO}_2 (\text{g}) \longrightarrow \text{CaCO}_3 (\text{s}) + \text{H}_2\text{O}$$

lime water white ppt.
(milkiness)
- But on passing excess CO_2 gas through the lime water, milkiness disappears due to the formation of soluble CaHCO_3
$$\text{CaCO}_3 + \text{CO}_2 + \text{H}_2\text{O} \longrightarrow \text{Ca}(\text{HCO}_3)_2 (\text{aq})$$

Calcium hydrogen-carbonate

This activity shows that metal carbonates and metal hydrogen carbonates react with acids to form salt, CO_2 and water.

- Question 9.
(a) What is the importance of pH in everyday life? (2017 OD)
(b) How are sodium hydroxide and Cl_2 (Chlorine) gas produced from common salt. What is this process called?

Answer:

- (a) (i) Living organisms can survive only in a narrow range of pH change. Acidic rain water when flows into the rivers, it lowers the pH value of river water and makes the survival of aquatic life in such river water difficult. Plants require a specific pH range for their healthy growth.
- (ii) Our stomach and intestines work in a specific pH range. Stomach acts in slightly acidic medium while small intestine digests the food in slightly alkaline medium.

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- (iii) Tooth decay starts when the pH of the mouth is lower than 5.5.
- (b) When electricity is passed through an aqueous solution of sodium chloride (called brine), it decomposes to form sodium hydroxide. This process is called Chlor-alkali process because the products formed are chlorine and alkali NaOH.
$$2\text{NaCl (aq)} + 2\text{H}_2\text{O (l)} \rightarrow 2\text{NaOH (aq)} + \text{Cl}_2\text{(g)} + \text{H}_2\text{(g)}$$

Cl₂ gas is given off at the anode and H₂ gas at the cathode while sodium hydroxide solution is formed near the cathode.

