Acids, Bases And Salts

Multiple Choice Questions

Question 1.
What happens when a solution of an acid is mixed with a solution of a base in a test tube?

(i) The temperature of the solution increases.

(ii) The temperature of the solution decreases.

(iii) The temperature of the solution remains the same.

(iv) Salt formation takes place.
A. Only (i)

B. (i) and (iii)

C. (ii) and (iii)

D. (i) and (iv)

Answer:
When an acid reacts with a base, a neutral salt is formed by the neutralisation process. As neutralisation process is an exothermic reaction, the temperature of the solution increases.

Note:

(i) An acid reacts with a base to form salt and water. This reaction is called the neutralisation reaction. Such a reaction is always exothermic in nature. Hence, the temperature of the solution increases.

(ii) In an exothermic reaction, heat is liberated thereby increasing the temperature.

Question 2.
An aqueous solution turns red litmus solution blue. Excess addition of which of the following solution would reverse the change?
A. Baking Powder

B. Lime

C. Ammonium hydroxide solution

D. Hydrochloric acid

Answer:
The aqueous solution is a base as it turns red litmus solution blue. An acidic solution such as hydrochloric acid would reverse the change. In contrast, hydrochloric acid would turn blue litmus solution to red.

Other options such as baking powder, lime and ammonium hydroxide solution are basic compounds. So, these substances would not be able to reverse the change. These substances would only change red litmus solution to blue.

Question 3.
During the preparations of hydrogen chloride gas on a humid day, the gas is usually passed through the guard tube containing calcium chloride. The role of the calcium chloride taken in the guard tube is to
A. absorb the evolved gas

B. moisten the gas

C. absorb moisture from the gas

D. absorb Cl- ions from the evolved gas

Answer:
Calcium chloride is a good dehydrating agent. It absorbs moisture or water content from the gas making it dry. Calcium chloride is widely used as a desiccant for drying gases and liquid hydrocarbons in many industries due to its ability to absorb water.

Question 4.
Which of the following salts does not contain water of crystallization?
A. Blue vitriol

B. Baking soda

C. Washing soda

D. Gypsum

Answer:
Baking soda does not contain water of crystallization. The chemical formula of baking soda is $NaHCO_3$. Its formula does not show any association with water molecules.

Other three contain water of crystallization blue vitriol ($CuSO_4 .5H_2O$), washing soda ($Na_2CO_3 .10H_2O$) and gypsum ($CaSO_4 .2H_2O$).

Note:

The number of water molecules that are attached to a molecule of salt is called its water of crystallization. It is also known as water of hydration. This is necessary to maintain the crystalline structure of a salt. The salts that contain water of crystallization are called hydrated salts.

Question 5.
Sodium carbonate is a basic salt because it is a salt of
A. Strong acid and strong base

B. Weak acid and weak base

C. Strong acid and weak base

D. Weak acid and strong base

Answer:
Sodium carbonate (Na_2CO_3) is the salt formed by the combination of a weak acid such as carbonic acid (H_2CO_3) and a strong base such as sodium hydroxide (NaOH).

$$\underset{\text{Sodium Hydroxide}}{2NaOH} + \underset{\text{Carbonic Acid}}{H_2CO_3} \longrightarrow \underset{\text{Sodium Carbonate (Salt)}}{Na_2CO_3} + \underset{\text{Water}}{2H_2O}$$

Note: The salt formed by the combination of weak acid and a strong base is basic in nature. Basic salts have pH more than 7.

Question 6.
Calcium phosphate is present in tooth enamel. Its nature is
A. basic

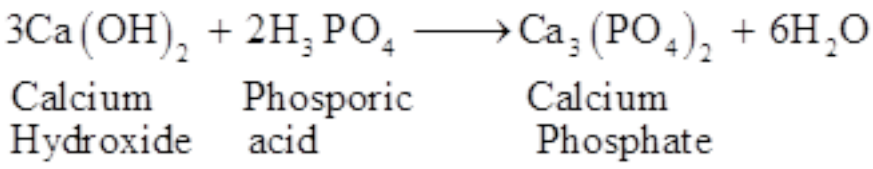
B. acidic

C. neutral

D. amphoteric

Answer:
Calcium phosphate Ca3(PO4)2 is basic salt, as it is formed by the combination of a weak acid (phosphoric acid) and slightly stronger base (calcium hydroxide). Bacteria feed on sugars commonly found in foods and produce acids in the mouth decreasing the pH level to 5.5 or lower thus eroding the enamel that is basic in nature.

Note:



Question 7.
A sample of soil is mixed with water and allowed to settle. The clear supernatant solution turns the pH paper yellowish-orange. Which of the following would change the colour of this pH paper to greenish-blue?
A. Lemon Juice

B. Vinegar

C. Common salt

D. An antacid

Answer:
A weak base turns the pH paper greenish-blue. Antacids usually contain weak base such as Mg(OH) 2. So, an antacid would change the colour of this pH paper to greenish- blue. Other options such as lemon juice and vinegar contain acids and common salt is a neutral salt.

Question 8.
Which of the following gives the correct increasing order of acid strength?
A. Water < acetic acid < hydrochloride acid

B. Water < hydrochloride acid < acetic acid

C. Acetic acid < water < hydrochloride acid

D. Hydrochloride acid < water < acetic acid

Answer:
The increasing order of acid strength is water < acetic acid < hydrochloride acid. Hydrochloride acid is a mineral acid and ionises completely in water. A solution hydrochloric acid will have a much higher concentration of H+ ions and hence lower the

pH level. That's why it is a strong acid. Acetic acid is an organic acid and ionises only partially in water. That's why it is a weak acid. Water is almost neutral in nature. In pure water number of positive hydrogen ions is equal to the negative ions.

Question 9.
If a few drops of concentrated acid accidentally spill over the hand of a student, what should be done?
A. Wash the hand with saline solution

B. Wash the hand immediately with plenty of water and apply a paste of sodium hydrogen carbonate

C. After washing with plenty of water apply solution of sodium hydroxide on the hand

D. Neutralise the acid with a strong alkali

Answer:
Wash the hand immediately with plenty of water as it helps to wash away most of the acid. Thereafter apply a paste of baking soda ($NaHCO3$) to neutralise the little acid if any, left over the hand. Baking soda has weak basic properties that is used to neutralise the acid. Here, a strong base cannot be used to neutralise the acid as it can corrode the skin.

Question 10.
Sodium hydrogen carbonate, when added to acetic acid, evolves a gas. Which of the following statements are true about the gas evolved?

(i) It turns lime water milky.

(ii) It extinguishes a burning splinter.

(iii) It dissolves in a solution of sodium hydroxide.

(iv) It has a pungent odour.
A. (i) and (ii)

B. (i), (ii) and (iii)

C. (ii), (iii) and (iv)

D. (i) and (iv)

Answer:
When sodium hydrogen carbonate is added to acetic acid, carbon dioxide ($CO2$) gas is evolved.

$NaHCO_3 + CH_3COOH \rightarrow CH_3COONa + H_2O + CO_2$

(Sodium hydrogen carbonate + Acetic acid = Sodium acetate + water + carbon dioxide)

Carbon dioxide supports all the above three properties. CO_2 turns lime water milky, it is a non-supporter of combustion and is absorbed by strong alkalis such as NaOH.

Question 11.
Common salt besides being used in kitchen can also be used as the raw material for making

(i) Washing soda

(ii) bleaching soda

(iii) Baking soda

(iv) slaked lime
A. (i) and (ii)

B. (i), (ii) and (iv)

C. (i), (ii) and (iii)

D. (i), (iii) and (iv)

Answer:
Common salt (NaCl) is formed by reaction between hydrochloric acid (HCl) and sodium hydroxide (NaOH). It serves as an important raw material for the production of various chemical compounds such as caustic soda (sodium hydroxide), washing soda (sodium carbonate), baking soda (sodium bicarbonate) used in various industries. Chlorine gas obtained is used for making bleaching powder (calcium hypochlorite)

Question 12.
One of the constituents of baking powder is sodium hydrogen carbonate, the other constituent is
A. Hydrochloric acid

B. Tartaric acid

C. Acetic acid

D. Sulphuric acid

Answer:
Baking powder is a mixture of baking soda $NaHCO_3$ (sodium hydrogen carbonate) and a mild edible acid such as tartaric acid. When baking powder is mixed with water, sodium hydrogen carbonate reacts with tartaric acid and accepts hydrogen ions from it. This process releases carbon dioxide gas which is trapped in the dough when baking powder is used to make bread and cake. The trapping the carbon dioxide makes the dough rise and hence the bread is soft and fluffy.

Question 13.
To protect tooth decay we are advised to brush our teeth regularly. The nature of toothpaste commonly used is
A. Acidic

B. Neutral

C. Basic

D. Corrosive

Answer:
Toothpastes we generally contain mild bases such as sodium fluoride or sodium bicarbonate in their composition. The base reacts with the acid formed during tooth decay and neutralises its bad effects thus, preventing tooth decay.

Note:

When we eat sweet things, the pH of our mouth falls below 5.5 (moderately acid) as the oral bacteria releases lactic acid while acting on sugars. The acidic conditions are capable to corrode the enamel as these are made up of calcium phosphate. This makes the tooth decay.

Question 14.
Which of the following statements is correct about an aqueous solution of an acid and a base?

(i) Higher the pH, stronger the acid

(ii) Higher the pH, weaker the acid

(iii) Lower the pH, stronger the base

(iv) Lower the pH, weaker the base
A. (i) and (iii)

B. (ii) and (iii)

C. (i) and (iv)

D. (ii) and (iv)

Answer:
When the pH of an aqueous solution is higher, acidic properties are weak. Thus it is a base. When the pH an aqueous solution is lower, basic properties are weak. Thus it is an acid.

Note:

A pH scale is used to measure the acidic and basic strength of an aqueous solution. This scale is marked from 0 to 14. A solution is neutral if its pH value is 7. An acidic solution has a pH less than 7. This means an acidic solution has more concentration of H+ ions. A basic solution has a pH more than 7. This means a basic solution has more concentration of OH– ions.

Question 15.
The pH of the gastric juices released during digestion is
A. less than 7

B. more than 7

C. equal to 7

D. equal to 0

Answer:
When we eat, our stomach releases hydrochloric acid that helps in digestion. Acids always have pH less than 7. The pH of stomach varies between 1 and 5. The pH of the stomach and the acid present in the stomach need not necessarily be the same.

Question 16.
Which of the following phenomena occur when a small amount of acid is added to water?

(i) Ionisation (ii) Neutralisation

(iii) Dilution (iv) Formation
A. (i) and (ii)

B. (i) and (iii)

C. (ii) and (iii)

D. (ii) and (iv)

Answer:
(i) When a small amount of acid such as hydrochloric acid is added to water, individual ions of the acid are dissociated. This process is known as ionisation. So hydrochloric acid separates into positively charged hydrogen ions and negatively charged chlorine ions.

$$HCl + H_2O \longrightarrow H^+ + Cl^- + H_2O$$
$$H_2O + H^+ \longrightarrow H_3O^+ (\text{hydroniumion})$$

(iii) Mixing of an acid with water is also called dilution. Addition water results in the decrease in the concentration of ions, (H3O+) per unit volume.

Question 17.
Which one of the following can be used as an acid-base indicator by a visually impaired student?
A. Litmus

B. Turmeric

C. Vanilla essence

D. Petunia leaves

Answer:
Vanilla essence serves as an olfactory indicator. An olfactory indicator is a substance whose smell differs in when added to acids and bases respectively. Vanilla essence has a characteristic pleasant smell. When added to a basic solution such as sodium hydroxide solution, the characteristic smell of vanilla essence vanishes. When added to an acidic solution such as hydrochloric acid, however, the characteristic pleasant smell of vanilla essence remains. This is how it helps such students to identify acids and bases.

Question 18.
Which of the following substances will not give carbon dioxide on treatment with dilute acid?
A. Marble

B. Limestone

C. Baking soda

D. Lime

Answer:
Lime (CaO) is the base that reacts with a dilute acid such as HCl to form a salt called calcium chloride. It is an exothermic reaction and releases water but no carbon dioxide. Mable or limestone (CaCO3) or baking soda (NaHCO3) react with HCl to release CO2.

Question 19.
Which of the following is acidic in nature?
A. Lime juice

B. Human blood

C. Baking soda

D. Antacid

Answer:
Lime juice is acidic in nature. It has high amount of citric acid present in it.

Human blood is slightly basic (i.e., having ph7.8). Lime water, baking soda and antacid are also basic in nature as they contain more of hydroxide (OH-) ions.

Question 20.
In an attempt to demonstrate electric conductivity through an electrolyte, the following apparatus (figure) was set up.

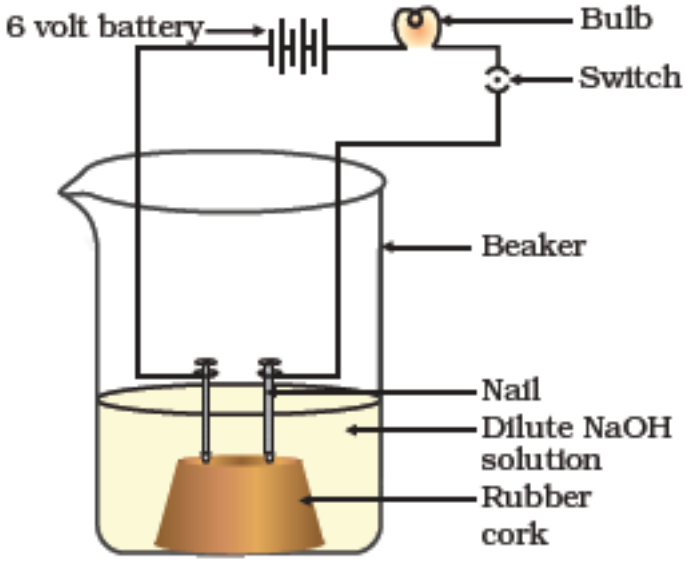


Fig. 2.1

Which among the following statement(s) is/are correct?
(i) Bulb will not glow because electrolyte is not acidic.
(ii) Bulb will glow because NaOH is a strong base and furnishes ions for conduction.

(iii) Bulb will not glow because circuit is incomplete.
(iv) Bulb will not glow because it depends upon the type of electrolytic solution.
A. (i) and (iii)
B. (ii) and (iv)
C. Only (ii)
D. Only (iv)

Answer:
Bulb will glow as NaOH is a strong base that dissociates completely in water to furnish OH- and Na+ ions. It is thus a strong electrolyte and conducts electricity through it. Strong acids and bases are good conductors of electricity.

$NaOH \rightarrow Na^{++}OH^{-}$

Question 21.
Which of the following is used for dissolution of gold?
A. Hydrochloride acid

B. Sulphuric acid

C. Nitric acid

D. Aqua- regia

Answer:
Aqua-regia is used for the dissolution of gold. It is a solution of concentrated HNO3 and concentrated HCl in the ratio of 1:3. Thus this solution is strongly acidic and is used to dissolve gold.

$$\underset{1:3}{\text{Aqua}-\text{regia} = \left[\text{Conc.}\,HNO_3 + \text{conc}\,HCl\right]}$$

Question 22.
Which of the following is not a mineral acid?
A. Hydrochloride acid

B. Citric acid

C. Sulphuric acid

D. Nitric acid

Answer:

Citric acid is not a mineral acid. It is an organic acid or edible acid that is derived from organic compounds.

Note:

Mineral acids or inorganic acids are generally prepared from inorganic compounds such as minerals present in the earth's crust. For examples, HCl (hydrochloride acid), H2SO4 (sulphuric acid) and HNO3 (nitric acid) are mineral acids. These acids dissolve in water to produce H+ ions.

Edible acids or organic acids are produced by plants or animals, for example, acetic acid, citric acid and lactic acid are edible acids. These acids are corrosive in nature.

Question 23.
Which among the following is not a base?
A. NaOH

B. KOH

C. NH4OH

D. C2H5OH

Answer:
C2H5OH is not a base. C2H5OH or ethyl alcohol has a functional OH– group. It cannot dissociate ions in a solution. Thus it cannot be a basic compound.

Question 24.
Which of the following statements is not correct?
A. All metal carbonates react with acid to give a salt, water and carbon dioxide.

B. All metal oxides react with water to give salt and acid.

C. Some metal react with acids to give salt and hydrogen.

D. Some non-metal oxides react with water to from an acid.

Answer:
Not all metal oxides are insoluble in water. Some metal oxides such as Na2O and CaO dissolve in water to form alkalis. When Na2O reacts with water, NAOH is formed.

$$Na_2O(s) + H_2O(1) \longrightarrow 2NaOH(aq)$$

Question 25.
Match the chemical substances given in column I with their appropriate application given in Column II.

Column I	Column II
A. Bleaching powder	1. Preparation of glass
B. Baking soda	2. Production of $H_2$and Cl_2
C. Washing soda	3. Decolourisation
D. Sodium chloride	4. Antacid

Codes

A B C D A B C D
A. 2 1 4 3

B. 3 2 4 1

C. 3 4 1 2

D. 2 4 1 3

Answer:
Bleaching powder (CaOCl2) is used bleach clothes and removes colour from clothes. It decomposes on reaction with water and releases chlorine which acts as oxidising, bleaching and disinfecting agent. Baking soda is a natural antacid. It is used to relieve

acidity in stomach and heart burn. Washing soda is used in the preparation of glass, soap and paper industries. Sodium chloride is used to produce H2 and Cl2 gases. Aqueous sodium chloride on electrolysis yields hydrogen and chlorine.

Question 26.
Equal volumes of hydrochloric acid and sodium hydroxide solution of same concentration are mixed and the pH of the resulting solution is checked with a pH paper. What would be the colour obtained? (You may use colour guide given in figure of NCERT Book (Science Class X) on page 26).
A. Red

B. Yellow

C. Yellowish green

D. Blue

Answer:
When equal volumes of hydrochloric acid (strong acid) and sodium hydroxide (strong base) solution of same concentration are mixed, the result is salt and water. This is a neutralisation reaction.

$$\underset{\text{strong acid}}{HCl} + \underset{\text{Strong base}}{NaOH} \longrightarrow \underset{\text{Sodium chloride neutral}}{NaCl} + H_2O$$

The aqueous solution of NaCl is neutral with pH 7. The colour of this solution obtained is yellowish green.

Question 27.
Which of the following is/are true when HCl (g) is passed through water?

(i) It does not ionise in the solution as it is a covalent compound.

(ii) It ionises in the solution.

(iii) It gives both hydrogen and hydroxyl ion in the solution.

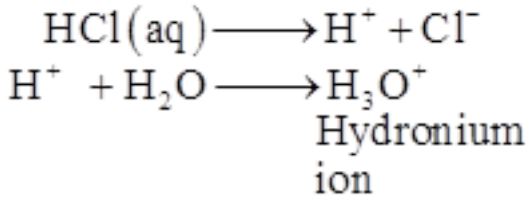
(iv) It forms hydronium ion in the solution due to the combination of hydrogen ion with a water molecule.
A. Only (i)

B. Only (iii)

C. (ii) and (iv)

D. (iii) and (iv)

Answer:
HCl ionises completely in water to produce H+ and Cl– ions as it is a strong acid. This H+ ion combines with water molecules to produce hydronium ions.



Question 28.
Which of the following statement is true for acids?
A. Bitter and change red litmus to blue

B. Sour and change red litmus to blue

C. Sour and change blue litmus to red

D. Bitter and change blue litmus to red

Answer:
Acids turn blue litmus solution to red. They have a sour taste as in case of vinegar and are sticky to touch. On the other hand, bases turn red litmus solution to blue. They are bitter in taste as in case of baking soda and are slippery to touch.

Question 29.
Which of the following are present in a dilute aqueous solution of hydrochloride acid?
A. H3O+ + Cl-

B. H3O+ + OH-

C. Cl- + OH-

D. Unionised HCl

Answer:

HCl is a strong acid. When HCl is mixed with water, its molecules dissociate completely to furnish H+ ions and Cl– ions. This H+ ion combines with water molecules to produce hydronium ions.

$$HCl + H_2O \longrightarrow H^+ + Cl^- + H_2O$$
$$H_2O + H^+ \longrightarrow H_3O^+ \text{ (Hydronium ion)}$$

Question 30.
Identify the correct representation of reaction occurring during chloralkali process.

A. $2NaCl(1) + 2H_2O(1) \longrightarrow 2NaOH(1) + Cl_2(g) + H_2(g)$

B. $2NaCl(aq) + 2H_2O(aq) \longrightarrow 2NaOH(aq) + Cl_2(1) + H_2(aq)$

C. $2NaCl(aq) + 2H_2O(1) \longrightarrow 2NaOH(aq) + Cl_2(aq) + H_2(aq)$

D. $2NaCl(aq) + 2H_2O(1) \longrightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$

Answer:
$$2NaCl(aq) + 2H_2O(1) \longrightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$$

Chloralkali is a process used in industries to produce chlorine and sodium hydroxide (caustic soda). This happens by the electrolysis of NaCl (commonly known as brine).

Short Answer Questions

Question 1.

Match the acids given in Column I with their correct source given in Column II.

Column I	Column II
A. Lactic acid	1. Tomato
B. Acetic acid	2. Lemon
C. Citric acid	3. Vinegar
D. Oxalic acid	4. Curd

Answer:

Column I	Column II
A. Lactic acid	4. Curd
B. Acetic acid	3. Vinegar
C. Citric acid	2. Lemon
D. Oxalic acid	1. Tomato

Lactic acid: Sources – Lactic acid is found in products such as cheese, yogurt, soy sauce and pickled vegetables; Acetic acid: Sources - Acetic acid is found in condiments such as ketchup, mayonnaise and mustard; Citric acid: Sources - Citric acid is found in citrus fruits, tomatoes and pineapples; Oxalic acid: Sources - Oxalic acid is found in leafy green vegetables and beets.

Question 2.

Match the important chemicals given in Column I with the chemical formulae given in Column II.

Column I	Column II
A. Plaster of Paris	1. $Ca(OH)_2$
B. Gypsum	2. $CaSO_4.\frac{1}{2}H_2O$
C. Bleaching powder	3. $CaSO_4.2H_2O$
D. Slaked lime	4. $CaCl_2$

Answer:

Column I	Column II
A. Plaster of paris	2. $CaSO_4 . \frac{1}{2} H_2O$
B. Gypsum	3. $CaSO_4 . 2H_2O$
C. Bleaching powder	4. $CaCl_2$
D. Slaked lime	1. $Ca(OH)_2$

Question 3.
What will be the action of the following substances on litmus paper?

Dry HCl gas, moistened NH3 gas, lemon juice, carbonated soft drink, curd, soap solution

Answer:
(i) Dry HCl gas: No change on litmus paper. This is because litmus paper changes colour only if ions such as hydrogen (H+) or hydronium (H3O+) ions are present in a solution. HCl can only furnish ions when it reacts with water. Thus, dry HCl gas does not change the colour of litmus paper.

(ii) Moistened NH3 gas: Red litmus turns blue as it is basic in nature

(iii) Lemon Juice: Blue litmus turns red as it contains citric acid

(iv) Carbonated soft drinks: Blue litmus turns red as it contains carbonic acid

(v) Curd: Blue litmus turns red as it contains lactic acid

(vi) Soap solution: Red litmus turns blue as it is basic in nature.

Question 4.
Name the acid present in ant sting and give its chemical formula. Also give the common method to get relief from the discomfort caused by the ant sting.

Answer:
An acid called formic acid (or methanoic acid) is present in ant stings. The chemical formula of formic acid is HCOOH. To get relief from the discomfort caused by the ant stings, apply baking soda on the affected area. Baking soda is basic in nature and it reacts with acid to produce neutral salt.

Question 5.
What happens when nitric acid is added to egg shell?

Answer:
Egg shells are rich in calcium carbonate (CaCO3). When nitric acid reacts with calcium carbonates, calcium nitrate, water and CO2 gas is formed. Formation of CO2 gas causes brisk effervescence. The chemical equation for this reaction is

$$\underset{\text{Calcuim Carbonate}}{CaCO_3(s)} + \underset{\text{Nitric acid}}{2HNO_3(aq)} \longrightarrow \underset{\text{Calcuim nitrate}}{Ca(NO_3)_2(aq)} + \underset{\text{Carbon dioxide}}{CO_2(g)} + \underset{\text{Water}}{H_2O(1)}$$

Question 6.
A student prepared solution of (i) an acid and (ii) a base in two separate beakers. She forgot to label the solution and litmus paper is not available in the laboratory. Since, both the solutions are colourless, how will she distinguish between the two?

Answer:

In the absence of litmus, other natural or synthetic substances can be used to test acid and bases. Such substances are called indicators. Indicators such as methyl orange and phenolphthalein can be used to test the nature of a solution. These indicators show change in their colour in acidic, neutral and basic solutions. We can also use natural indicators such as turmeric and grape juice.

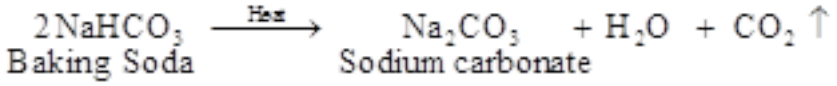
A few indicators with characteristic colour change are shown below.

S. No	Indicator	Colour in acidic solution	Colour in neutral solution	Colour in basic solution
1.	Litmus	Red	Purple	Blue
2.	Phenolphthalein	Colourless	Colourless	Pink
3.	Methyl orange	Red/Pink	Orange	Yellow
4.	Turmeric juice	Yellow	Yellow	Reddish brown

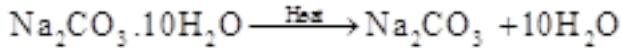
Question 7.

How will you distinguish between baking powder and washing soda by heating?

Answer:
Baking soda (NaHCO3) on heating produces carbon dioxide (CO2). Carbon dioxide turns lime water milky. It can also extinguish a burning matchstick.



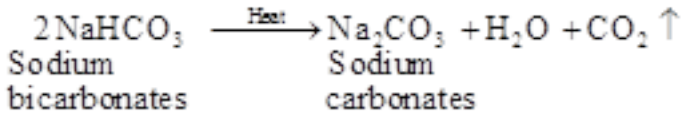
Whereas heating washing soda (Na2CO3.10H2O) does not produce any such gas and hence there is no effect on lime water or a burning matchstick. The water of crystallisation in washing soda is released due to heating and the salt becomes anhydrous white powder called soda ash.



Question 8.
Salt A commonly used in bakery products on heating gets converted into another salt B which itself is used for removal of hardness of water and a gas C is evolved. The gas C when passed through lime water, turns it milky. Identify A, B and C.

Answer:
Salt A is sodium bicarbonate (NaHCO3) as it is commonly used in bakery products and on heating produces Na2CO3. Salt B is sodium carbonate Na2CO3 as it is used for removal of hardness of water. Gas C is carbon dioxide (CO2) as it turns lime water milky.

This can be shown as a chemical equation:



Question 9.
In one of the industrial process for manufacture of sodium hydroxide, a gas X is formed as by-product. The gas X reacts with lime water to give a compound Y which is used as a bleaching agent in chemical industry. Identify X and Y giving the chemical equation of the reaction involved.

Answer:

During the manufacture of sodium hydroxide (NaOH), hydrogen gas (H2) and chlorine gas Cl2 (X) are formed as by-products. Chlorine gas reacts with lime water [Ca(OH) 2]to produce bleaching powder (CaOCl2), a bleaching agent.

Thus X is chlorine gas (Cl2 gas). Y is calcium oxychloride or bleaching powder (CaOCl2).

The chemical equation for the preparation of sodium hydroxide is as follows:

$$2NaCl(aq) + 2H_2O(l) \longrightarrow 2NaOH(aq) + \underset{(x)}{Cl_2\ (g)} + H_2(g)$$

$$Cl_2 + \underset{\text{Lime water}}{Ca(OH)_2} \longrightarrow \underset{\substack{(y)\\ \text{Bleaching powder}}}{CaOCl_2} + H_2O$$

Question 10.
Fill in the missing data in the given table.

Name of the salt		Formula	Salt obtained from	
			Base	Acid
(i)	Ammonium chloride	NH_4Cl	NH_4OH	-
(ii)	Copper sulphate	-	-	H_2SO_4
(iii)	Sodium chloride	NaCl	NaOH	-
(iv)	Magnesium nitrate	$Mg(NO_3)_2$	-	HNO_3
(v)	Potassium sulphate	K_2SO_4	-	-
(vi)	Calcuim nitrate	$Ca(NO_3)_2$	$Ca(OH)_2$	-

Answer:

(i) Acid : HCl $\left[\because\ NH_4OH + HCl \longrightarrow NH_4Cl + H_2O\right]$

(ii) Formula : CuSO4

Base : Cu(OH)2 $\left[\because\ Cu(OH)_2 + H_2SO_4 \longrightarrow CuSO_4 + 2H_2O\right]$

(iii) Acid : HCl $\left[\because\ NaOH + HCl \longrightarrow NaCl + H_2O\right]$

(iv) Base : Mg(OH)2 $\left[\because\ Mg(OH)_2 + 2HNO_3 \longrightarrow Mg(NO_3)_2 + 2H_2O\right]$

(v) Base : KOH

Acid : H2SO4 $\left[\because\ 2KOH + H_2SO_4 \longrightarrow K_2SO_4 + 2H_2O\right]$

(vi) Acid : HNO3 $\left[\because\ Ca(OH)_2 + 2HNO_3 \longrightarrow Ca(NO_3)_2 + 2H_2O\right]$

Question 11.

What are strong and weak acids? In the following list of acids, separate strong acids from weak acids.

Hydrochloride acid, citric acid, acetic acid, nitric acid, formic acid, sulphuric acid.

Answer:

Strong acids Acids that dissociates into hydrogen ions completely in an aqueous solution are strong acids. These hydrogen ions attach themselves to the water molecules producing a high concentration of H3O+ ions. Acids such as HCl, H2SO4 HNO3 are strong acids.

Weak acids Acids that do not dissociate completely into hydrogen ions in an aqueous solution are weak acids. Acids such as acetic acid and carbonic acid are weak acids.

Strong acids	Weak acids
Hydrochloric acid	Citric acid
Nitric acid	Acetic acid
Sulphuric acid	Formic acid

Question 12.
When zinc metal is treated with a dilute solution of a strong acid, a gas is evolved, which is utilised in the hydrogenation of oil. Name the gas evolved. Write the chemical equation of the reaction involved and also write a test to detect the gas formed.

Answer:
When zinc metal reacts with a dilute solution of strong acid [such as hydrochloric acid HCl], a salt (ZnCl2) is formed and hydrogen gas is evolved which is used in the hydrogenation of oil.

$$\underset{}{Zn} + \underset{\text{Dil hydrochloric acid}}{2HCl} \longrightarrow \underset{\text{Zinc Chloride}}{ZnCl_2} + H_2\uparrow$$

To test the presence of H2 gas, bring a burning splinter or a matchstick near the mouth of the test tube, you will see that the gas burns with a pop sound.

Long Answer Questions

Question 1.
In the following schematic diagram for the preparation of hydrogen gas as shown in the figure, what would happen if the following changes are made?

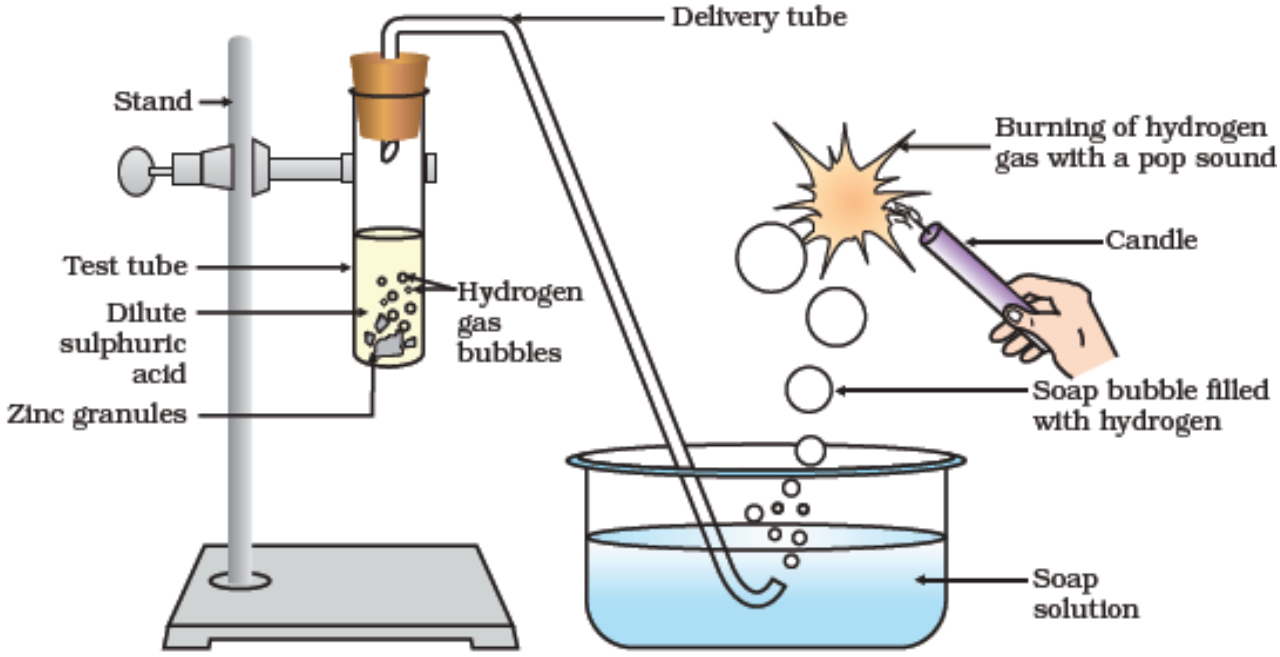


Fig. 2.3

(a) In place of zinc granules, same amount of zinc dust is taken in the test tube.
(b) Instead of dilute sulphuric acid, dilute hydrochloric acid is taken.
(c) In place of zinc, copper turnings are taken.
(d) Sodium hydroxide is taken in place of dilute sulphuric acid and the tube is heated.

Answer:
When same amount of zinc dust is taken in the test tube in place of zinc granules, the reaction rate is comparatively faster because zinc dust has larger surface rea than zinc granules. Also the hydrogen gas will evolve with greater speed when zinc dust is used in place of zinc granules.

(b) With dilute hydrochloric acid, zinc chloride is formed instead of zinc sulphate. Almost same amount of hydrogen gas is evolved in both the cases.

Zn + 2HCl⇨ZnCl2 + H2O

(c) If copper turnings are taken instead of zinc, no reaction will take place. Hydrogen gas will not evolve. This is because copper does not react with dilute acids of H2SO4 or HCl under normal conditions because copper lies at lower position in the reactivity series.

(d) If sodium hydroxide is taken in place of dilute sulphuric acid and the tube is heated, sodium zincate is formed along with hydrogen gas. Heating of test tube will just increase the rate of reaction thus increasing the formation of hydrogen gas.

$$Zn + \underset{\text{Sodium hydroxide}}{2NaOH} \longrightarrow \underset{\text{Sodium zincate}}{Na_2ZnO_2} + \underset{\text{Hydrgoen gas}}{H_2\uparrow}$$

Question 2.
For making cake, baking powder is taken. If at your home mother uses baking soda instead of baking powder in cake.

(a) How will it affect the taste of the cake and why?

(b) How can baking soda be converted into baking powder?

(c) What is the role of tartaric acid added to baking soda?

Answer:
While making cake if baking soda is used instead of baking powder the cake will taste bitter. Baking soda (NaHCO3) is a base and we know that bases are bitter. In case of baking powder, tartaric acid neutralizes the bitter taste of baking soda. On heating baking powder produces sodium carbonate, carbon dioxide and water. Sodium carbonate makes the cake taste bitter.

2NaHCO3 + Heat ⇨ Na2CO3 + CO2 + H2O

(b) Baking soda can be converted into baking powder by adding tartaric acid and starch.

(c) Tartaric acid produces hydrogen ions when it reacts with water. Hydrogen ions produced by tartaric acid reacts with sodium bicarbonate and gives carbon dioxide which makes the dough soft and fluffy. Tartaric acid also neutralizes sodium carbonate (formed as a result of heating baking soda) to form sodium tartarate that has pleasant smell and good taste.

2NaHCO3 + C4H6O6⇨ 2CO2 + 2H2O + Na2C4H4O6

Question 3.
A metal carbonate X on reacting with an acid gives a gas which when passed through a solution Y gives the carbonate back. On the other hand, a gas G that is obtained at anode during electrolysis of brine is passed on dry Y, it gives a compound Z, used for disinfecting drinking water. Identify X, Y, G , and Z.

Answer:
X is calcium carbonate. When calcium carbonate reacts with acid such as hydrochloric acid, carbon dioxide is released.

$$CaCO_3 + \text{Dil. } 2HCl \longrightarrow CaCl_2 + H_2O + CO_2\uparrow$$

Solution Y is lime water [Ca(OH)2]. When CO2 is passing through lime water, it turns milky due to the formation of calcium carbonate.

$$\underset{Y}{Ca(OH)_2} + CO_2 \longrightarrow \underset{X}{CaCO_3}\downarrow + H_2O$$

During electrolysis of brine, chlorine (G) gas is deposited at anode.

$$\underset{\text{Sodium chloride (brine)}}{2NaCl} + 2H_2O \xrightarrow{\text{Electrolysis}} 2NaOH + \underset{\text{Chlorine gas (G)}}{Cl_2(g)} + H_2\ (g)$$

When chlorine gas is passed through dry slaked lime Ca(OH)2 (Y), it produces bleaching powder (Z). Bleaching powder is used for disinfecting drinking water.

$$Ca(OH) + Cl2 \longrightarrow CaOCl2 + H2O$$

Bleaching Powder (Z)

Hence, Z is calcium oxychloride (CaOCl2) or bleaching powder.

To sum up,

1. Metal carbonate (X) is calcium carbonate.

2. Solution (Y) is lime water (calcium hydroxide).

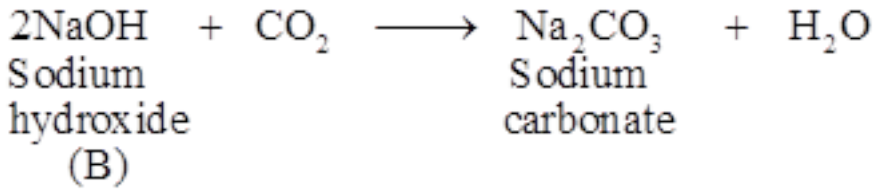
3. Gas (G) is chlorine gas.

4. Dry (Y) is dry calcium hydroxide (dry slaked lime).

5. Compound (Z) is bleaching powder (calcium oxychloride).

Question 4.
A dry pellet of a common base B, when kept in open absorbs moisture and turns sticky. The compound is also a by-product of chloralkali process. Identify B. What type of reaction occurs when B is treated with an acidic oxide? Write a balanced chemical equation for one such solution.

Answer:
Base B is sodium hydroxide (NaOH). Dry pellets of sodium hydroxide (NaOH) absorb moisture from the atmosphere and becomes sticky. It is also a by-product of chloralkali process. The acidic oxide such as CO2 reacts with a base such as NaOH to give salt (sodium carbonate) and water. Such reaction is called neutralisation reaction.



Thus, ‘B’ is NaOH and reaction between ‘B’ and acidic oxide is called a neutralization reaction.

Question 5.
A sulphate salt of group 2 element of the periodic table is a white, soft substance, which can be moulded into different shapes by making its dough. When this compound left is open for some time, it becomes a solid mass and cannot be used for moulding purposes. Identify the sulphate salt and why does it show such a behaviour?

Answer:
The group 2 element is calcium. The sulphate salt of calcium is calcium sulphate that is a soft substance. It is also known as Plaster of Paris. It can be moulded into various shapes because of presence half water of crystallization. When left in open for sometime, this soft mass hardens and cannot be further remoulded. This is called gypsum.

$$CaSO_4 \cdot \frac{1}{2}H_2O + 1\frac{1}{2}H_2O \longrightarrow CaSO_4 \cdot 2H_2O$$

(Plaster of paris) Sulphate salt (soft) — water — Gypsum (hard mass sets as)

Question 6.
Identify the compound X on the basis of the reactions given below. Also write the name and chemical formulae of A, B and C.

X + Zn⇨A + H2

X + HCl⇨B + H2O

X + CH3COOH⇨C + H2O

Answer:
Compound X is NaOH (sodium hydroxide).

$$2NaOH + Zn \longrightarrow \underset{\text{Sodium zincate (A)}}{Na_2ZnO_2} + H_2\,(g)$$

$$NaOH + HCl \longrightarrow \underset{\text{Sodium chloride (B)}}{NaCl} + H_2O$$

$$NaOH + CH_3COOH \longrightarrow \underset{\text{Sodium acetate (C)}}{CH_3COONa} + H_2O$$