

## CHAPTER – 2

# ACIDS, BASES AND SALTS

### ACIDS

Acid is a substance which furnishes  $H^+$  ions or  $H_3O^+$  ions when dissolved in water. Acids have one or more replaceable hydrogen atoms. The word acid is derived from the Latin name 'acidus' which means sour taste. Substances with 'sour taste' are acids. Lemon juice, vinegar and grape juice have sour taste, so they are acidic. They change blue litmus to red. They are colourless with phenolphthalein and pink with methyl orange. There are many substances which contain acid and hence taste sour, such as curd, tamarind, lemon, etc.

### CLASSIFICATION OF ACIDS

1. **Based on their sources :** Acids are classified into two types namely organic acids and inorganic acids.

**Organic acids:-** Acids present in plants and animals (living beings) are **organic acids** eg.  $HCOOH$ ,  $CH_3COOH$  (Weak acids).

**Inorganic acids:-** Acids from rocks and minerals are **inorganic acids** or mineral acids eg.  $HCl$ ,  $HNO_3$ ,  $H_2SO_4$  (Strong acids).

2. **Based on their basicity**

**Monobasic acid:** - It is an acid which gives one hydrogen ion per molecule of the acid in solution eg.  $HCl$ ,  $HNO_3$ .

**Dibasic acid:-** It is an acid which gives two hydrogen ions per molecule of the acid in solution e.g.,  $H_2SO_4$ ,  $H_2CO_3$ .

**Tribasic acid:-** It is an acid which gives three hydrogen ions per molecule of the acid in solution. e.g.,  $H_3PO_4$ .

3. **Based on ionisation**

Acids are classified into two types based on ionisation.

**Strong acids:-** These are acids which ionise completely in water eg.  $HCl$

**Weak acids:-** These are acids which ionise partially in water eg.  $CH_3COOH$

4. **Based on concentration:-** Depending on the percentage or amount of acid dissolved in water acids are classified into concentrated acid and dilute acid.

**Concentrated acid:-** It is an acid having a relatively high percentage of acid in its aqueous solution.

**Dilute acid:-** It is an acid having a relatively low percentage of acid in aqueous solution.

### INTEXT QUESTIONS PAGE NO. 18

**Question 1: You have been provided with three test tubes. One of them contains distilled water and the other two contain an acidic solution and a basic solution, respectively. If you are given only red litmus paper, how will you identify the contents of each test tube?**

**Answer :** If the colour of red litmus paper gets changed to blue, then it is a base and if there is no colour change, then it is either acidic or neutral. Thus, basic solution can be easily identified.

Let us mark the three test tubes as A, B, and C. A drop of the solution in A is put on the red litmus paper. Same is repeated with solution B and C. If either of them changes colour to blue, then it is basic. Therefore, out of three, one is eliminated. Out of the remaining two, any one can be acidic or neutral. Now a drop of basic solution is mixed with a drop of each of the remaining two solutions separately and then the nature of the drops of the mixtures is checked. If the colour of red litmus turns blue, then the second solution is neutral and if there is no change in colour, then the second solution is acidic. This is because acidic and basic solutions neutralize each other. Hence, we can distinguish between the three types of solutions.

## **CHEMICAL PROPERTIES OF ACIDS**

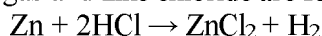
### **REACTION OF ACIDS WITH METAL:**

Acids give hydrogen gas along with respective salt when they react with a metal.

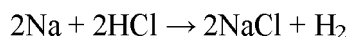
Metal + Acid → Salt + Hydrogen

#### **Example:**

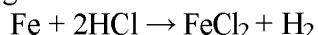
- Hydrogen gas and zinc chloride are formed when hydrochloric acid reacts with zinc metal.



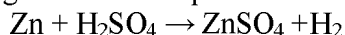
- Hydrogen gas and sodium chloride are formed when hydrochloric acid reacts with sodium metal.



- Hydrogen gas and iron chloride are formed when hydrochloric acid reacts with iron.



- Hydrogen gas and zinc sulphate are formed when zinc metal reacts with sulphuric acid



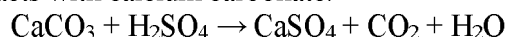
### **REACTION OF ACIDS WITH METAL CARBONATE:**

Acids give carbon dioxide gas and respective salts along with water when they react with metal carbonates.

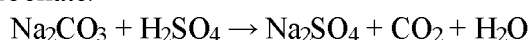
Metal carbonate + Acid → Salt + Carbon dioxide + Water

#### **Examples:**

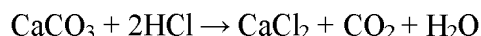
- Sulphuric acid gives calcium sulphate, carbon dioxide gas, calcium sulphate and water when it reacts with calcium carbonate.



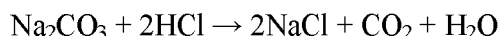
- Sulphuric acid gives sodium sulphate, carbon dioxide gas and water when it reacts with sodium carbonate.



- Hydrochloric acid gives carbon dioxide gas, calcium chloride and water when it reacts with calcium carbonate.



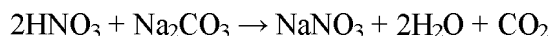
- Hydrochloric acid gives carbon dioxide gas, sodium chloride along with water when reacts with sodium carbonate.



- Hydrochloric acid gives carbon dioxide, magnesium chloride and water when it reacts with magnesium carbonate.



- Nitric acid gives sodium nitrate, water and carbon dioxide gas when it reacts with sodium carbonate.



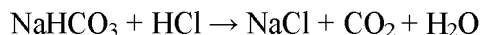
### **REACTION OF ACID WITH HYDROGEN CARBONATES (BICARBONATES):**

Acids give carbon dioxide gas, respective salt and water when they react with metal hydrogen carbonate.

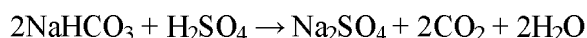
Acid + Metal hydrogen carbonate → Salt + Carbon dioxide + Water

#### **Examples:**

- Hydrochloric acid gives carbon dioxide, sodium chloride and water when it reacts with sodium bicarbonate.

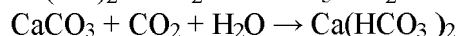
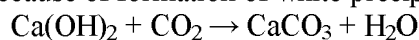


- Sulphuric acid gives sodium sulphate, carbon dioxide gas and water when it reacts with sodium bicarbonate.



- Sodium bicarbonate is also known as sodium hydrogen carbonate, baking soda, baking powder, bread soda and bicarbonate of soda.

The gas evolved because of reaction of acid with metal carbonate or metal hydrogen carbonate turns lime water milky. This shows that the gas is carbon dioxide gas. This happens because of formation of white precipitate of calcium carbonate.



But when excess of carbon dioxide is passed through lime water, it makes milky colour of lime water disappear. This happens because of formation of calcium hydrogen carbonate.

As calcium hydrogen carbonate is soluble in water, thus the milky colour of solution mixture disappears.

### **REACTION OF ACID WITH MARBLE AND EGG SHELL:**

Since, marble and egg shell are made of calcium carbonate, hence when acid is poured over marble or egg shell, bubbles of carbon dioxide are formed.

#### **USES OF ACIDS**

- Sulphuric acid (King of chemicals) is used in car battery and in the preparation of many other compounds.
- Nitric acid is used in the production of ammonium nitrate which is used as fertilizer in agriculture.
- Hydrochloric acid is used as cleansing agent in toilet.
- Tartaric acid is a constituent of baking powder.
- Salt of benzoic acid (sodium benzoate) is used in food preservation.
- Carbonic acid is used in aerated drinks.

#### **BASES**

Base is a substance which releases hydroxide ions when dissolved in water. It is a substance which is bitter in taste and soapy to touch (e.g. Washing soda, caustic soda and caustic potash). They change red litmus to blue. They are pink with phenolphthalein and yellow with methyl orange.

#### **CLASSIFICATION OF BASES**

##### **1. Based on ionisation**

**Strong bases:-** These are bases which ionise completely in aqueous solution eg. NaOH, KOH.

**Weak bases:-** These are bases which ionise partially in aqueous solution eg.  $\text{NH}_4\text{OH}$ ,  $\text{Ca}(\text{OH})_2$ .

## 2. Based on their acidity

**Monoacidic base:-** It is a base which ionises in water to give one hydroxide ion per molecule eg.  $\text{NaOH}$ ,  $\text{KOH}$ .

**Diacidic base:-** It is a base which ionises in water to give two hydroxide ions per molecule eg.  $\text{Ca}(\text{OH})_2$ ,  $\text{Mg}(\text{OH})_2$ .

**Triacidic base:-** It is a base which ionises in water to give three hydroxide ions per molecule eg.  $\text{Al}(\text{OH})_3$ ,  $\text{Fe}(\text{OH})_3$ .

## 3. Based on the concentration:

Depending on the percentage or amount of base dissolved in water, bases are classified as concentrated alkali and dilute alkali.

**Concentrated alkali:-** It is an alkali having a relatively high percentage of alkali in its aqueous solution.

**Dilute alkali:-** It is an alkali having a relatively low percentage of alkali in its aqueous solution.

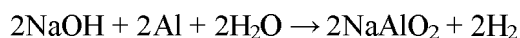
### **REACTION OF BASE WITH METALS:**

When alkali (base) reacts with metal, it produces salt and hydrogen gas.

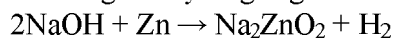
Alkali + Metal  $\rightarrow$  Salt + Hydrogen

#### **Example:**

- Sodium aluminate and hydrogen gas are formed when sodium hydroxide reacts with aluminium metal.



- Sodium hydroxide gives hydrogen gas and sodium zincate when reacts with zinc metal.



### **REACTION OF BASE WITH OXIDES OF NON-METALS:**

Non-metal oxides are acidic in nature. For example; carbon dioxide is a non-metal oxide.

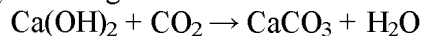
When carbon dioxide is dissolved in water it produces carbonic acid.

Therefore, when a base reacts with non-metal oxide both neutralize each other resulting respective salt and water are produced.

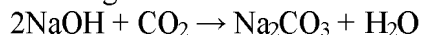
Base + Non-metal oxide  $\rightarrow$  Salt + Water

#### **Example:**

- Calcium hydroxide gives calcium carbonate and water when it reacts with carbon dioxide.



- Sodium hydroxide gives sodium carbonate and water when it reacts with carbon dioxide.



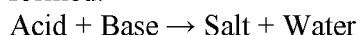
### **USES OF BASES**

- Sodium hydroxide is used in the manufacture of soap.
- Calcium hydroxide is used in white washing the buildings.

- Magnesium hydroxide is used as a medicine for stomach troubles.
- Ammonium hydroxide is used to remove grease stains from clothes.

### **NEUTRALISATION REACTION:**

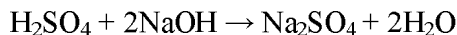
An acid neutralizes a base when they react with each other and respective salt and water are formed.



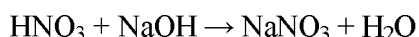
Since in the reaction between acid and base both neutralize each other, hence it is also known as neutralization reaction.

#### **Example:**

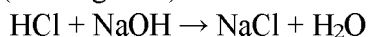
- Sodium sulphate and water are formed when sulphuric acid reacts with sodium hydroxide (a base).



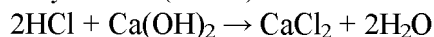
- In similar way, when nitric acid reacts with sodium hydroxide, sodium nitrate and water are formed.



- Sodium chloride and water are formed when hydrochloric acid reacts with sodium hydroxide (a strong base).



- In similar way, calcium chloride is formed along with water when hydrochloric acid reacts with calcium hydroxide (a base).



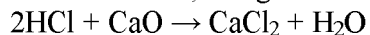
### **REACTION OF ACID WITH METAL OXIDES:**

Metal oxides are basic in nature. Thus, when an acid reacts with a metal oxide both neutralize each other. In this reaction, respective salt and water are formed.

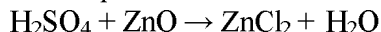


#### **Example:**

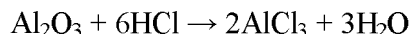
- Calcium is a metal, thus calcium oxide is a metallic oxide which is basic in nature. When an acid; such as hydrochloric acid; reacts with calcium oxide, neutralization reaction takes place and calcium chloride; along with water; is formed.



- Similarly, when sulphuric acid reacts with zinc oxide, zinc sulphate and water are formed.



- When hydrochloric acid reacts with aluminium oxide, aluminium chloride and water are formed.



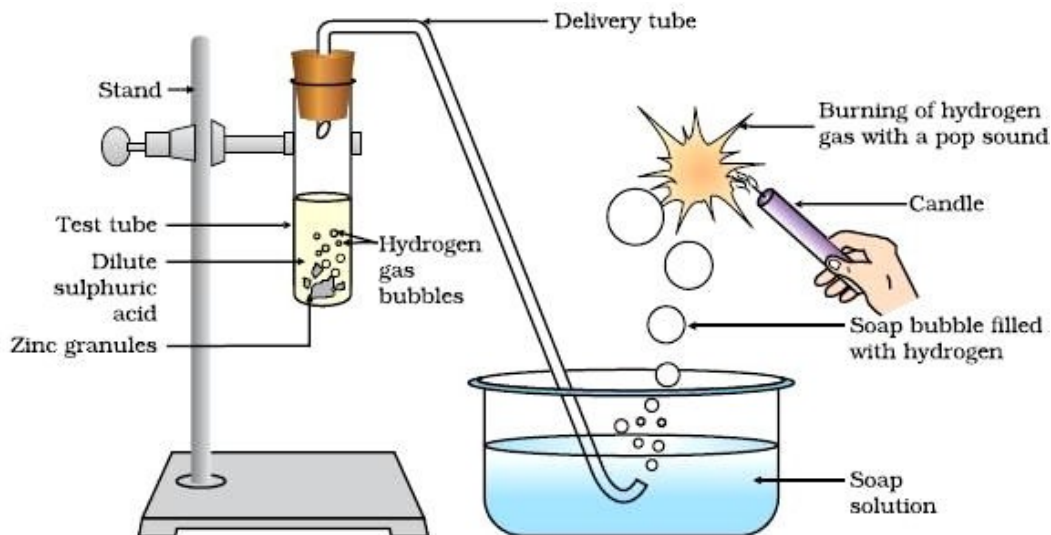
### **INTEXT QUESTIONS PAGE NO. 22**

**Question 1: Why should curd and sour substances not be kept in brass and copper vessels?**

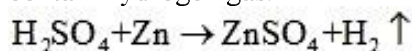
**Answer :** Curd and other sour substances contain acids. Therefore, when they are kept in brass and copper vessels, the metal reacts with the acid to liberate hydrogen gas and harmful products, thereby spoiling the food.

**Question 2: Which gas is usually liberated when an acid reacts with a metal? Illustrate with an example. How will you test for the presence of this gas?**

**Answer :** Hydrogen gas is usually liberated when an acid reacts with a metal.



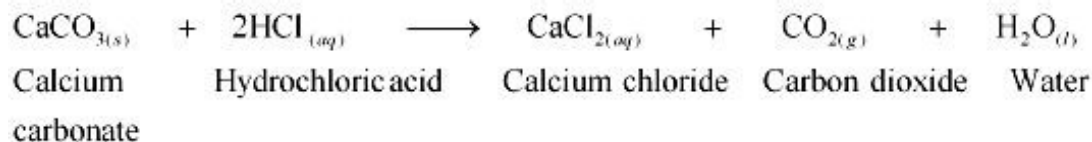
Take few pieces of zinc granules and add 5 ml of dilute  $\text{H}_2\text{SO}_4$ . Shake it and pass the gas produced into a soap solution. The bubbles of the soap solution are formed. These soap bubbles contain hydrogen gas.



We can test the evolved hydrogen gas by its burning with a pop sound when a candle is brought near the soap bubbles.

**Question 3: Metal compound A reacts with dilute hydrochloric acid to produce effervescence. The gas evolved extinguishes a burning candle. Write a balanced chemical equation for the reaction if one of the compounds formed is calcium chloride.**

**Answer :**



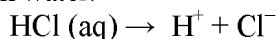
## COMMON IN ACID AND BASE

Acids give hydrogen gas when they react with metal. This shows that all acids contain hydrogen. For example: Hydrochloric acid ( $\text{HCl}$ ), sulphuric acid ( $\text{H}_2\text{SO}_4$ ), nitric acid ( $\text{HNO}_3$ ), etc.

When an acid is dissolved in water, it dissociates hydrogen. The dissociation of hydrogen ion in aqueous solution is the common property in all acids. Because of dissociation of hydrogen ion in aqueous solution, an acid shows acidic behavior.

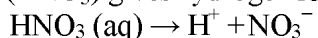
### Example:

- Hydrochloric acid ( $\text{HCl}$ ) gives hydrogen ion ( $\text{H}^+$ ) and chloride ion ( $\text{Cl}^-$ ) when it is dissolved in water.

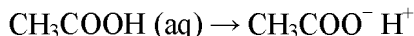


- Sulphuric acid ( $\text{H}_2\text{SO}_4$ ) gives hydrogen ion ( $\text{H}^+$ ) and sulphate ion ( $\text{SO}_4^{2-}$ ) in water.  $\text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{H}^+ + \text{SO}_4^{2-}$

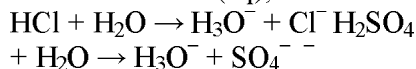
- Nitric acid ( $\text{HNO}_3$ ) gives hydrogen ion ( $\text{H}^+$ ) and nitrate ion ( $\text{NO}_3^-$ ) in water.



- Acetic acid ( $\text{CH}_3\text{COOH}$ ) gives acetate ion ( $\text{CH}_3\text{COO}^-$ ) and hydrogen ion ( $\text{H}^+$ ).



- Hydrogen ion which is produced by acid (when acid is combined with water molecule), exists in the form of hydronium ion ( $\text{H}_3\text{O}^+$ ) in aqueous solution. That's why hydrogen ion is always written with suffix (aq), such as  $\text{H}^+$  (aq).



Thus, because of dissociation of hydrogen ions; acid shows its acidic behavior.

Acids conduct electricity in their aqueous solution because of dissociation of hydrogen ion. Hydrogen ion in aqueous solution conducts electricity.

A dry acid, such as dry hydrochloric acid does not change the colour of blue litmus paper to red because a dry acid does not dissociate hydrogen ion. This is the cause that a moist litmus paper is used to check the acidic or basic character of a gas.

#### **Acidic behavior of carbon dioxide gas:**

Carbon dioxide gas produces carbonic acid when dissolved in water. This carbonic acid dissociates hydrogen ion and carbonate ion in the aqueous solution.



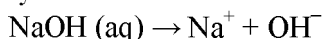
#### **Are all compounds which contain hydrogen, necessarily acids?**

No, all compounds which contain hydrogen are not acid. For example; glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ ), methyl alcohol ( $\text{CH}_3\text{OH}$ ), etc. are not acid in spite of the fact that they contain hydrogen. This is because these compounds do not dissociate hydrogen ion in their aqueous solution.

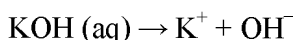
#### **Common in all Base:**

A base dissociates hydroxide ion in water, which is responsible for the basic behavior of a compound. Example:

When sodium hydroxide is dissolved in water, it dissociates hydroxide ion and sodium ion.



Similarly, when potassium hydroxide is dissolved in water, it dissociates hydroxide ion and potassium ion.



Thus, base shows its basic character because of dissociation of hydroxide ion.

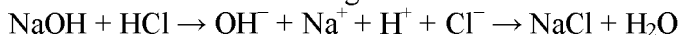
#### **NEUTRALISATION REACTION:**

When an acid reacts with a base, the hydrogen ion of acid combines with the hydroxide ion of base and forms water. As these ions combine together and form water; instead of remaining free, thus both neutralize each other.



#### **Example:**

- When sodium hydroxide (a base) reacts with hydrochloric acid, sodium hydroxide breaks into sodium ion and hydroxide ion and hydrochloric acid breaks into hydrogen ion and chloride ion. Hydrogen ion and hydroxide ion combine together and form water, while sodium ion and chloride ion combine together and form sodium chloride.



#### **DILUTION OF ACID AND BASE:**

The concentration of hydrogen ion in an acid and hydroxide ion in a base; per unit volume; shows the concentration of acid or base.

By mixing of acid to water, the concentration of hydrogen ion per unit volume decreases. Similarly, by addition of base to water the concentration of hydroxide ion per unit volume decreases. This process of addition of acid or base to water is called dilution and the acid or base is called diluted.

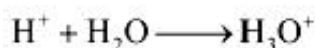
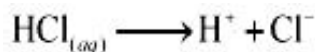
The dilution of acid or base is exothermic. Thus, acid or base is always added to water and water is never added to acid or base. If water is added to a concentrated acid or base a lot of heat is generated, which may cause splashing out of acid or base and may cause severe damage as concentrated acid and base are highly corrosive.

### **INTEXT QUESTIONS PAGE NO. 25**

**Question 1: Why do HCl, HNO<sub>3</sub>, etc., show acidic characters in aqueous solutions while solutions of compounds like alcohol and glucose do not show acidic character?**

**Answer :** The dissociation of HCl or HNO<sub>3</sub> to form hydrogen ions always occurs in the presence of water. Hydrogen ions (H<sup>+</sup>) combine with H<sub>2</sub>O to form hydronium ions (H<sub>3</sub>O<sup>+</sup>).

The reaction is as follows:



Although aqueous solutions of glucose and alcohol contain hydrogen, these cannot dissociate in water to form hydrogen ions. Hence, they do not show acidic character.

**Question 2: Why does an aqueous solution of an acid conduct electricity?**

**Answer :** Acids dissociate in aqueous solutions to form ions. These ions are responsible for conduction of electricity.

**Question 3: Why does dry HCl gas not change the colour of the dry litmus paper?**

**Answer :** Colour of the litmus paper is changed by the hydrogen ions. Dry HCl gas does not contain H<sup>+</sup> ions. It is only in the aqueous solution that an acid dissociates to give ions. Since in this case, neither HCl is in the aqueous form nor the litmus paper is wet, therefore, the colour of the litmus paper does not change.

**Question 4: While diluting an acid, why is it recommended that the acid should be added to water and not water to the acid?**

**Answer :** Since the process of dissolving an acid in water is exothermic, it is always recommended that acid should be added to water. If it is done the other way, then it is possible that because of the large amount of heat generated, the mixture splashes out and causes burns.

**Question 5: How is the concentration of hydronium ions (H<sub>3</sub>O<sup>+</sup>) affected when a solution of an acid is diluted?**

**Answer :** When an acid is diluted, the concentration of hydronium ions (H<sub>3</sub>O<sup>+</sup>) per unit volume decreases. This means that the strength of the acid decreases.

**Question 6: How is the concentration of hydroxide ions (OH<sup>-</sup>) affected when excess base is dissolved in a solution of sodium hydroxide?**

**Answer :** The concentration of hydroxide ions (OH<sup>-</sup>) would increase when excess base is dissolved in a solution of sodium hydroxide.



## STRENGTH OF ACID AND BASE

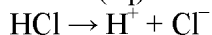
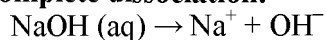
Acids in which complete dissociation of hydrogen ion takes place are called strong acid. Similarly, bases in which complete dissociation of hydroxide ion takes place are called strong base.

In mineral acids, such as hydrochloric acid, sulphuric acid, nitric acid, etc. hydrogen ion dissociates completely and hence they are considered as strong acid. Since, in organic acids hydrogen ions do not dissociate completely, so they are weak acid.

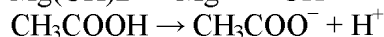
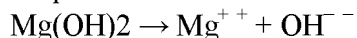
Alkalis are water soluble base, thus in alkali; complete dissociation of hydroxide ions takes place and they are considered as strong base.

The complete dissociation of hydrogen ions or hydroxide ions is shown by a single arrow. The incomplete dissociation of hydrogen ions or hydroxide ions is denoted by double arrow.

### Example of complete dissociation:



Example of incomplete dissociation:



Although acetic acid being an organic acid is a weak acid, but concentrated acetic acid is corrosive and can damage the skin if poured over it.

## pH – MEASUREMENT OF STRENGTH OF ACID AND BASE

pH stands for the power of hydrogen ion concentration in a solution. pH values decide whether a solution is acidic or basic or neutral. pH scale was introduced by S.P.L. Sorenson. It is mathematically expressed as

$$\text{pH} = -\log_{10}[\text{H}^+]$$

For neutral solution  $[\text{H}^+] = 10^{-7}\text{M}$ ;  $\text{pH} = 7$

For acidic solution  $[\text{H}^+] > 10^{-7}\text{M}$ ;  $\text{pH} < 7$

For basic solution  $[\text{H}^+] < 10^{-7}\text{M}$ ;  $\text{pH} > 7$

When  $\text{OH}^-$  ions are taken into account the pH expression is replaced by pOH

$$\text{pOH} = -\log_{10}[\text{OH}^-]$$

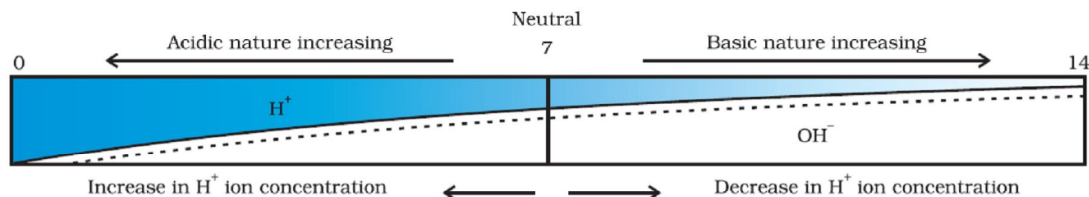
The strength of acid or base depends upon the hydrogen ion concentration. If the concentration of hydrogen ion is greater than hydroxide ion, the solution is called acidic. If the concentration of hydrogen ion is smaller than the hydroxide ion, the solution is called basic. If the concentration of hydrogen ion is equal to the concentration of hydroxide ion, the solution is called neutral solution.

pH is a scale which quantifies the concentration of hydrogen ion in a solution. The range of pH scale is between 0 to 14.

The pH value decreases with increase in hydrogen ion concentration. If the value of pH is 0, this shows maximum hydrogen ion concentration. pH value equal to 14 shows lowest hydrogen ion concentration. pH value equal to 7 shows the hydrogen ion concentration is equal to hydroxide ion concentration.

A neutral solution, such as distilled water has value of hydrogen ion concentration equal to 7 on pH scale. The acidic solution has value of hydrogen ion concentration less than 7 on pH scale. The basic solution has value of hydrogen ion concentration greater than 7 on pH scale.

In pH scale 'p' stands for 'potenz'. Potenz is a German word which means 'power' or 'potential'. Here; 'H' stands for hydrogen ion. Thus, pH means the potential of hydrogen or power of hydrogen.



## IMPORTANCE OF pH IN EVERYDAY LIFE

### 1. pH in human body

- Using pH factor the healthiness of our body is predicted. At pH level 6.9, the body becomes prone to viral infections like colds, cough and flu. Cancer cells thrive inside the body at a pH of 5.5.
- The pH of a normal, healthy human skin is 4.5 to 6. Proper skin pH is essential for a healthy complexion.
- pH of stomach fluid is approximately 2.0. This fluid is essential for the digestion of food.
- Human blood pH range is 7.35 to 7.45. Any increase or decrease in this value, leads to diseases. The ideal pH for blood is 7.4.
- pH of normal saliva ranges between 6.5 to 7.5.
- White enamel coating in our teeth is calcium phosphate, hardest substance in our body. It does not dissolve in water. If pH of mouth falls below 5.5, the enamel gets corroded. Toothpastes are generally basic, and is used for cleaning the teeth, can neutralize the excess acid and prevent tooth decay.

### 2. pH in soil

- In agriculture, the pH of soil is very important. Citrus fruits require slightly alkaline soil, while rice requires acidic soil and sugar cane requires neutral soil.

### 3. pH in rain water

- pH of rain water is approximately 7 showing high level of its purity and neutrality. If rain water is polluted by  $\text{SO}_2$  and  $\text{NO}_2$ , acid rain occurs, bringing the pH value less than 7.

## INDICATOR:

Substances which show the acidic or basic behavior of other substance by change in colour are known as indicator.

Type of Indicator: There are many types of indicators. Some common types of indicators are

- Natural
- Olfactory Indicator
- Synthetic Indicator
- Universal Indicator

## **NATURAL INDICATOR**

Indicators obtained from natural sources are called natural indicators. Litmus, turmeric, red cabbage, China rose, etc. are some common natural indicators used widely to show the acidic or basic character of substances.

### **LITMUS**

Litmus is obtained from lichens. The solution of litmus is purple in colour. Litmus paper comes in two colour – blue and red.

- An acid turns blue litmus paper red.
- A base turns red litmus paper blue.

### **TURMERIC**

Turmeric is another natural indicator. Turmeric is yellow in colour. Turmeric solution or paper turns reddish brown with base. Turmeric does not change colour with acid.

### **RED CABBAGE**

The juice of red cabbage is originally purple in colour. Juice of red cabbage turns reddish with acid and turns greenish with base.

## **OLFACTORY INDICATORS**

Substances which change their smell when mixed with acid or base are known as olfactory indicators. For example onion, vanilla, clove, etc.

### **ONION**

Paste or juice of onion loses its smell when added with base. It does not change its smell with acid.

### **VANILLA**

The smell of vanilla vanishes with base, but its smell does not vanish with an acid. Olfactory indicators are used to ensure the participation of visually impaired students in laboratory.

## **SYNTHETIC INDICATOR**

Indicators that are synthesized in laboratory are known as synthetic indicators. For example; phenolphthalein, methyl orange, etc.

Phenolphthalein is a colourless liquid. It remains colourless with acid but turns into pink with a base.

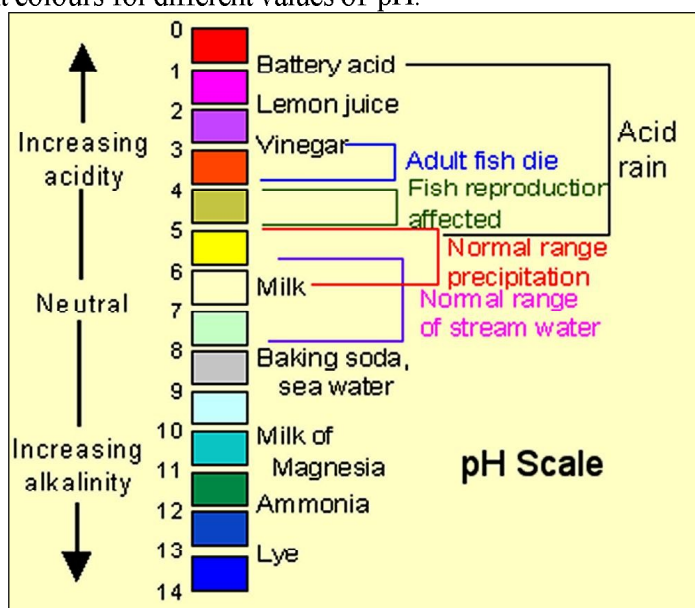
Methyl orange is originally orange in colour. It turns into red with acid and turns into yellow with base.

<b>Indicator</b>	<b>Original colour</b>	<b>Acid</b>	<b>Base</b>
Red litmus	Red	No change	Blue
Blue litmus	Blue	Red	No change
Turmeric	Yellow	No change	Reddish brown
Red cabbage juice	Purple	Reddish	Greenish yellow
Phenolphthalein	Colourless	Colourless	Pink
Methyl orange	Orange	Red	Yellow
Onion	n/a	No change	Smell vanishes
Vanilla	n/a	No change	Smell vanishes

## UNIVERSAL INDICATOR:

Using a litmus paper, phenolphthalein, methyl orange, etc. only the acidic or basic character of a solution can be determined, but use of these indicators does not give the idea about the strength of acid or base. So, to get the strength as well as acidic and basic nature of a given solution universal indicator is used.

Universal indicator shows different colour over the range of pH value from 1 to 14 for a given solution. Universal indicator is available both in the form of strips and solution. Universal indicator is the combination of many indicators, such as water, propanol, phenolphthalein, sodium salt, sodium hydroxide, methyl red, bromothymol blue monosodium salt, and thymol blue monosodium salt. The colour matching chart is supplied with universal indicator which shows the different colours for different values of pH.



## INTEXT QUESTIONS PAGE NO. 28

**Question 1:** You have two solutions, A and B. The pH of solution A is 6 and pH of solution B is 8. Which solution has more hydrogen ion concentration? Which of this is acidic and which one is basic?

**Answer :** A pH value of less than 7 indicates an acidic solution, while greater than 7 indicates a basic solution. Therefore, the solution with pH = 6 is acidic and has more hydrogen ion concentration than the solution of pH = 8 which is basic.

**Question 2:** What effect does the concentration of  $H^+_{(aq)}$  ions have on the nature of the solution?

**Answer :** Concentration of  $H^+_{(aq)}$  can have a varied effect on the nature of the solution. With an increase in  $H^+$  ion concentration, the solution becomes more acidic, while a decrease of  $H^+$  ion causes an increase in the basicity of the solution.

**Question 3:** Do basic solutions also have  $H^+_{(aq)}$  ions? If yes, then why are these basic?

**Answer :** Yes, basic solution also has  $H^+_{(aq)}$  ions. However, their concentration is less as compared to the concentration of  $OH^-$  ions that makes the solution basic.

**Question 4:** Under what soil condition do you think a farmer would treat the soil of his fields with quick lime (calcium oxide) or slaked lime (calcium hydroxide) or chalk (calcium carbonate)?

**Answer :** If the soil is acidic and improper for cultivation, then to increase the basicity of soil, the farmer would treat the soil with quick lime or slaked lime or chalk.

## **SALT**

Salts are the ionic compounds which are produced after the neutralization reaction between acid and base. Salts are electrically neutral. There are number of salts but sodium chloride is the most common among them. Sodium chloride is also known as table salt or common salt. Sodium chloride is used to enhance the taste of food.

### **CHARACTERISTICS OF SALT:**

- Most of the salts are crystalline solid
- Salts may be transparent or opaque
- Most of the salts are soluble in water
- Solution of salts conducts electricity. Salts conduct electricity in their molten state also
- The salt may be salty, sour, sweet, bitter and umami (savoury)
- Neutral salts are odourless
- Salts can be colourless or coloured

### **Classification of salts**

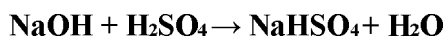
#### **1. Normal salts**

A normal salt is obtained by complete neutralization of an acid by a base



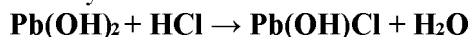
#### **2. Acid salts**

Acid salts are derived by the partial replacement of hydrogen ions of an acid by a metal. When a calculated amount of a base is added to a polybasic acid, acid salt is obtained, as follows.



#### **3. Basic salts**

Basic salts are formed by the partial replacement of hydroxide ions of a diacidic or triacidic base by an acid radical. A basic salt may further reacts with an acid to give a normal salt.



**Diacidic base                  Basic salt**

#### **4. Double salts**

Double salts are formed by the combination of saturated solution of two simple salts in equimolar ratio followed by crystallization. e.g. potash alum

### **FAMILY OF SALT:**

Salts having common acidic or basic radicals are said to belong to same family.

#### **Example**

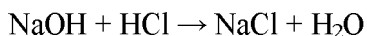
- Sodium chloride (NaCl) and Calcium chloride (CaCl<sub>2</sub>) belong to chloride family.
- Calcium chloride (CaCl<sub>2</sub>) and calcium sulphate (CaSO<sub>4</sub>) belong to calcium family.
- Zinc chloride (ZnCl<sub>2</sub>) and Zinc sulphate (ZnSO<sub>4</sub>) belong to zinc family.

### **ACIDIC, BASIC AND NEUTRAL SALTS**

#### **NEUTRAL SALT**

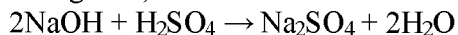
Salts produced because of reaction between strong acid and strong base are neutral in nature. The pH of value of such salts is equal to 7, i.e. neutral. Example; Sodium chloride, sodium sulphate, potassium chloride, etc.

Sodium chloride (NaCl) is formed after the reaction between hydrochloric acid (a strong acid) and sodium hydroxide (a strong base).

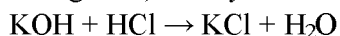


### **SODIUM SULPHATE ( $\text{Na}_2\text{SO}_4$ )**

It is formed after the reaction between sodium hydroxide (a strong base) and sulphuric acid (a strong acid).



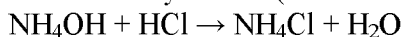
Potassium chloride (KCl): It is formed after the reaction between potassium hydroxide (a strong base) and hydrochloric acid (a strong acid).



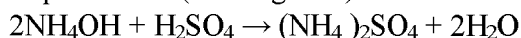
### **ACIDIC SALT**

Salts which are formed after the reaction between a strong acid and weak base are called acidic salt. The pH value of acidic salt is lower than 7. Example: ammonium sulphate, ammonium chloride, etc.

Ammonium chloride is formed after reaction between hydrochloric acid (a strong acid) and ammonium hydroxide (a weak base).



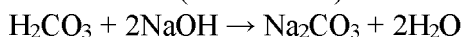
Ammonium sulphate is formed after reaction between ammonium hydroxide (weak base) and sulphuric acid (a strong acid).



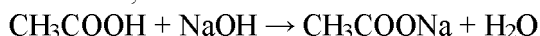
### **BASIC SALT**

Salts which are formed after the reaction between weak acid and strong base are called basic salt. For example; sodium carbonate, sodium acetate, etc.

Sodium carbonate is formed after the reaction between sodium hydroxide (a strong base) and carbonic acid (a weak base).



Sodium acetate is formed after the reaction between a strong base, sodium hydroxide and a weak acid, acetic acid.



### **CAUSE OF FORMATION OF ACIDIC, BASIC AND NEUTRAL SALT:**

When a strong acid reacts with a weak base, the base is unable to fully neutralize the acid. Due to this an acidic salt is formed in this case.

When a strong base reacts with a weak acid, the acid is unable to fully neutralize the base. Due to this a basic salt is formed in this case.

When equally strong acid and base react they fully neutralize each other. Due to this a neutral salt is formed in this case.

### **pH Value Of Salt:**

- Neutral salt: The pH value of a neutral salt is almost equal to 7.
- Acidic salt: The pH value of an acidic salt is less than 7.
- Basic salt: The pH value of a basic salt is more than 7.

### **COMMON SALT (SODIUM CHLORIDE)**

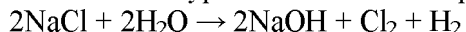
Sodium chloride (NaCl) is also known as common or table salt. It is formed after the reaction between sodium hydroxide and hydrochloric acid. It is a neutral salt. The pH value of sodium

chloride is about 7. Sodium chloride is used to enhance the taste of food. Sodium chloride is used in manufacturing of many chemicals.

### **IMPORTANT CHEMICALS FROM SODIUM CHLORIDE:**

#### **SODIUM HYDROXIDE (NaOH)**

Sodium hydroxide is a strong base. It is also known as caustic soda or lye. It is obtained by the electrolytic decomposition of solution of sodium chloride (brine). In the process of electrolytic decomposition of brine (aqueous solution of sodium chloride), brine decomposes to form sodium hydroxide. In this process, chlorine is obtained at anode and hydrogen gas is obtained at cathode as byproducts. This whole process is known as Chlor-Alkali process.



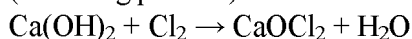
#### **USE OF PRODUCTS AFTER THE ELECTROLYSIS OF BRINE:**

- Hydrogen gas is used as fuel, margarine, in making of ammonia for fertilizer, etc.
- Chlorine gas is used in water treatment, manufacturing of PVC, disinfectants, CFC, pesticides. It is also used in manufacturing of bleaching powder and hydrochloric acid.
- Sodium hydroxide is used for de-greasing of metals, manufacturing of paper, soap, detergents, artificial fibres, bleach, etc.

#### **BLEACHING POWDER (CaOCl<sub>2</sub>):**

Bleaching powder is also known as chloride of lime. It is a solid and yellowish white in colour. Bleaching powder can be easily identified by the strong smell of chlorine.

When calcium hydroxide (slaked lime) reacts with chlorine, it gives calcium oxychloride (bleaching powder) and water is formed.



Aqueous solution of bleaching powder is basic in nature. The term bleach means removal of colour. Bleaching powder is often used as bleaching agent. It works because of oxidation. Chlorine in the bleaching powder is responsible for bleaching effect.

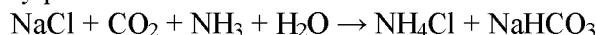
#### **USE OF BLEACHING POWDER:**

- Bleaching powder is used as disinfectant to clean water, moss remover, weed killers, etc.
- Bleaching powder is used for bleaching of cotton in textile industry, bleaching of wood pulp in paper industry.
- Bleaching powder is used as oxidizing agent in many industries, such as textiles industry, paper industry, etc.

#### **BAKING SODA (NaHCO<sub>3</sub>)**

Baking soda is another important product which can be obtained using byproducts of chlor-alkali process. The chemical name of baking soda is sodium hydrogen carbonate (NaHCO<sub>3</sub>) or sodium bicarbonate. Bread soda, cooking soda, bicarbonate of soda, sodium bicarb, bicarb of soda or simply bicarb, etc. are some other names of baking soda.

Baking soda is obtained by the reaction of brine with carbon dioxide and ammonia. This is known as Solvay process.



In this process, calcium carbonate is used as the source of CO<sub>2</sub> and the resultant calcium oxide is used to recover ammonia from ammonium chloride.

#### **PROPERTIES OF SODIUM BICARBONATE:**

- Sodium bicarbonate is white crystalline solid, but it appears as fine powder.

- Sodium hydrogen carbonate is amphoteric in nature.
- Sodium hydrogen carbonate is sparingly soluble in water.
- Thermal decomposition of sodium hydrogen carbonate (baking soda).
- When baking soda is heated, it decomposes into sodium carbonate, carbon dioxide and water.



Sodium carbonate formed after thermal decomposition of sodium hydrogen carbonate; decomposes into sodium oxide and carbon dioxide on further heating.



This reaction is known as dehydration reaction.

#### USE OF BAKING SODA:

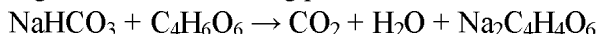
- Baking soda is used in making of baking powder, which is used in cooking as it produces carbon dioxide which makes the batter soft and spongy.
- Baking soda is used as antacid.
- Baking soda is used in toothpaste which makes the teeth white and plaque free.
- Baking soda is used in cleansing of ornaments made of silver.
- Since, sodium hydrogen carbonate gives carbon dioxide and sodium oxide on strong heating, thus it is used as fire extinguisher.

#### BAKING POWDER:

Baking powder produces carbon dioxide on heating, so it is used in cooking to make the batter spongy. Although baking soda also produces carbon dioxide on heating, but it is not used in cooking because on heating; baking soda produces sodium carbonate along with carbon dioxide. The sodium carbonate; thus produced; makes the taste bitter.



Baking powder is the mixture of baking soda and a mild edible acid. Generally, tartaric acid is mixed with baking soda to make baking powder.



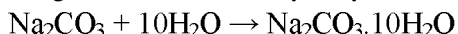
When baking powder (mixture of baking soda and an edible acid) is heated, the sodium carbonate formed because of heating of baking soda neutralizes after reacting with tartaric acid and sodium tartarate salt is formed. The smell of sodium tartarate is pleasant and taste is good. This makes the cake or any other food tasty.

#### WASHING SODA (SODIUM CARBONATE)

Sodium carbonate is manufactured by the thermal decomposition of sodium hydrogen carbonate obtained by Solvay process.



The sodium carbonate obtained in this process is dry. It is called soda ash or anhydrous sodium carbonate. Washing soda is obtained by rehydration of anhydrous sodium carbonate.



Since there are 10 water molecules in washing soda, hence it is known as Sodium bicarbonate decahydrate.

Sodium carbonate is a crystalline solid and it is soluble in water when most of the carbonates are insoluble in water.

#### USE OF SODIUM CARBONATE:

- It is used in cleaning of cloths; especially in rural areas.
- In making of detergent cake and powder.



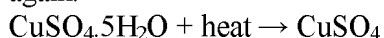
- In removing permanent hardness of water.
- It is used in glass and paper industries.

Water of crystallization: Many salts contain water molecule and are known as hydrated salts. The water molecule present in salt is known as water of crystallization.

### Examples:

#### **COPPER SULPHATE PENTAHYDRATE (CuSO<sub>4</sub>.5H<sub>2</sub>O)**

Blue colour of copper sulphate is due to presence of 5 molecules of water. When copper sulphate is heated, it loses water molecules and turns into grey-white colour, which is known as anhydrous copper sulphate. After adding water; anhydrous copper sulphate becomes blue again.

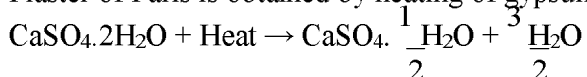


#### **FERROUS SULPHATE HEPTAHYDRATE (FeSO<sub>4</sub>.7H<sub>2</sub>O)**

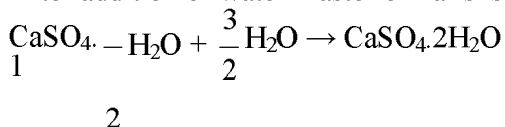
The green colour of Ferrous sulphate heptahydrate; commonly known as ferrous sulphate; is due to the presence of 7 molecules of water in it.

#### **PLASTER OF PARIS**

Plaster of Paris is obtained by heating of gypsum, a hydrated salt of calcium.



After addition of water Plaster of Paris is again converted into gypsum.



Plaster of Paris is used in making of toys, designer false ceiling, etc. Doctors use Plaster of Paris to set the fractured bone.

### **INTEXT QUESTIONS PAGE NO. 33**

**Question 1: What is the common name of the compound CaOCl<sub>2</sub>?**

**Answer :** The common name of the compound CaOCl<sub>2</sub> is bleaching powder.

**Question 2: Name the substance which on treatment with chlorine yields bleaching powder?**

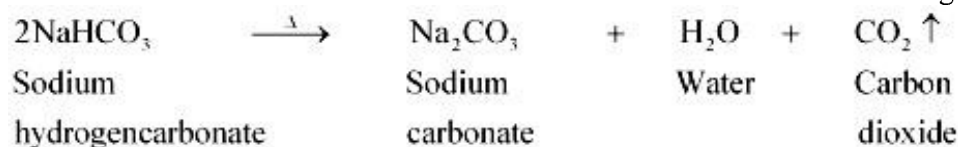
**Answer :** Calcium hydroxide [Ca (OH)<sub>2</sub>], on treatment with chlorine, yields bleaching powder.

**Question 3: Name the sodium compound which is used for softening hard water.**

**Answer :** Washing soda (Na<sub>2</sub>CO<sub>3</sub>.10H<sub>2</sub>O) is used for softening hard water.

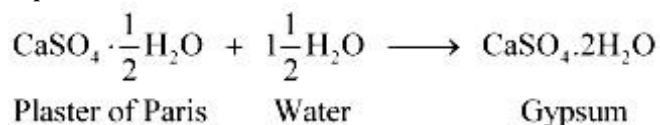
**Question 4: What will happen if a solution of sodium hydrocarbonate is heated? Give the equation of the reaction involved.**

**Answer :** When a solution of sodium hydrocarbonate (sodium hydrogencarbonate) is heated, sodium carbonate and water are formed with the evolution of carbon dioxide gas.



**Question 5: Write an equation to show the reaction between Plaster of Paris and water.**

**Answer :** The chemical equation for the reaction of Plaster of Paris and water can be represented as



### **EXERCISE QUESTIONS PAGE NO. 34 and 35**

**Question 1: A solution turns red litmus blue, its pH is likely to be**

(a) 1 (b) 4 (c) 5 (d) 10

**Answer :** (d) Bases turn red litmus blue and acids turn blue litmus red. Basic solution has a pH value more than 7. Since the solution turns red litmus blue, its pH is likely to be 10.

**Question 2: A solution reacts with crushed egg-shells to give a gas that turns lime-water milky. The solution contains**

(a) NaCl (b) HCl (c) LiCl (d) KCl

**Answer :** (b) The solution contains HCl.

**Question 3: 10 mL of a solution of NaOH is found to be completely neutralised by 8 mL of a given solution of HCl. If we take 20 mL of the same solution of NaOH, the amount of HCl solution (the same solution as before) required to neutralise it will be**

(a) 4 mL (b) 8mL (c) 12 mL (d) 16 mL

**Answer :** (d) 16 mL of HCl solution will be required.

**Question 4: Which one of the following types of medicines is used for treating indigestion?**

(a) Antibiotic      (b) Analgesic      (c) Antacid      (d) Antiseptic

**Answer :** (c) Antacid is used for treating indigestion.

**Question 5: Write word equations and then balanced equations for the reaction taking place when –**

(a) dilute sulphuric acid reacts with zinc granules.

(b) dilute hydrochloric acid reacts with magnesium ribbon.

(c) dilute sulphuric acid reacts with aluminium powder.

(d) dilute hydrochloric acid reacts with iron filings.

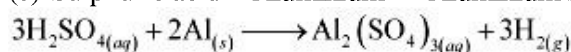
**Answer :** (a) Sulphuric acid + Zinc → Zinc sulphate + Hydrogen



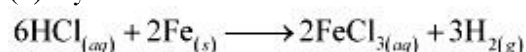
(b) Hydrochloric acid + Magnesium → Magnesium chloride + Hydrogen



(c) Sulphuric acid + Aluminium → Aluminium sulphate + Hydrogen



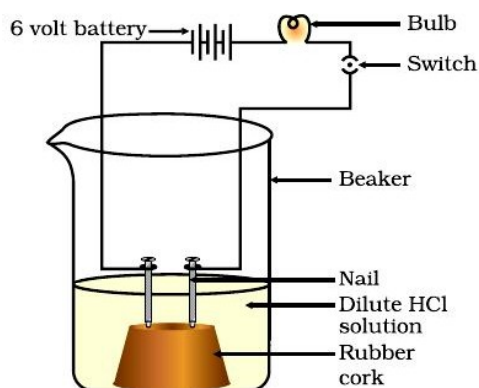
(d) Hydrochloric acid + Iron → Ferric chloride + Hydrogen



**Question 6: Compounds such as alcohols and glucose also contain hydrogen but are not categorized as acids. Describe an activity to prove it.**

**Answer :** Two nails are fitted on a cork and are kept it in a 100 mL beaker. The nails are then connected to the two terminals of a 6-volt battery through a bulb and a switch. Some dilute HCl is poured in the beaker and the current is switched on. The same experiment is then performed with glucose solution and alcohol solution.

### Observations:



### Result:

HCl dissociates into  $\text{H}^+$  and  $\text{Cl}^-$  ions. These ions conduct electricity in the solution resulting in the glowing of the bulb. On the other hand, the glucose solution does not dissociate into ions. Therefore, it does not conduct electricity.

### Conclusion:

From this activity, it can be concluded that all acids contain hydrogen but not all compounds containing hydrogen are acids.

That is why, though alcohols and glucose contain hydrogen, they are not categorised as acids.

### Question 7: Why does distilled water not conduct electricity, whereas rain water does?

**Answer :** Distilled water is a pure form of water and is devoid of any ionic species. Therefore, it does not conduct electricity. Rain water, being an impure form of water, contains many ionic species such as acids and therefore it conducts electricity.

### Question 8: Why do acids not show acidic behaviour in the absence of water?

**Answer :** Acids do not show acidic behaviour in the absence of water because the dissociation of hydrogen ions from an acid occurs in the presence of water only. It is the hydrogen ions that are responsible for the acidic behaviour.

### Question 9: Five solutions A, B, C, D and E when tested with universal indicator showed pH as 4, 1, 11, 7 and 9, respectively. Which solution is

- (a) neutral?
- (b) strongly alkaline?
- (c) strongly acidic?
- (d) weakly acidic?
- (e) weakly alkaline?

**Arrange the pH in increasing order of hydrogen-ion concentration.**

**Answer :**

- (a) Neutral  $\rightarrow$  Solution D with pH 7
- (b) Strongly alkaline  $\rightarrow$  Solution C with pH 11
- (c) Strongly acidic  $\rightarrow$  Solution B with pH 1
- (d) Weakly acidic  $\rightarrow$  Solution A with pH 4
- (e) Weakly alkaline  $\rightarrow$  Solution E with pH 9

The pH can be arranged in the increasing order of the concentration of hydrogen ions as:  $11 < 9 < 7 < 4 < 1$

**Question 10: Equal lengths of magnesium ribbons are taken in test tubes A and B. Hydrochloric acid (HCl) is added to test tube A, while acetic acid (CH<sub>3</sub>COOH) is added to test tube B. In which test tube will the fizzing occur more vigorously and why?**

**Answer :** The fizzing will occur strongly in test tube A, in which hydrochloric acid (HCl) is added. This is because HCl is a stronger acid than CH<sub>3</sub>COOH and therefore produces hydrogen gas at a faster speed due to which fizzing occurs.

**Question 11: Fresh milk has a pH of 6. How do you think the pH will change as it turns into curd? Explain your answer.**

**Answer :** The pH of milk is 6. As it changes to curd, the pH will reduce because curd is acidic in nature. The acids present in it decrease the pH.

**Question 12: A milkman adds a very small amount of baking soda to fresh milk.**

**(a) Why does he shift the pH of the fresh milk from 6 to slightly alkaline?**

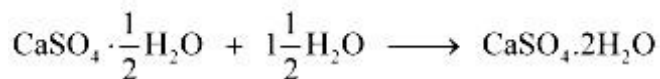
**(b) Why does this milk take a long time to set as curd?**

**Answer :** (a) The milkman shifts the pH of the fresh milk from 6 to slightly alkaline because in alkaline condition, milk does not set as curd easily.

(b) Since this milk is slightly basic than usual milk, acids produced to set the curd are neutralized by the base. Therefore, it takes a longer time for the curd to set.

**Question 13: Plaster of Paris should be stored in a moisture-proof container. Explain why?**

**Answer :** Plaster of Paris (POP) should be stored in a moisture-proof container because Plaster of Paris, a powdery mass, absorbs water (moisture) to form a hard solid known as gypsum.



Plaster of Paris      Water                      Gypsum

**Question 14: What is a neutralization reaction? Give two examples.**

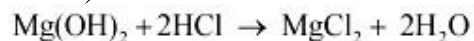
**Answer :** A reaction in which an acid and base react with each other to give a salt and water is termed as neutralization reaction. In this reaction, energy is evolved in the form of heat.

For example:(i)



(Base) (Acid)                      (Salt) (Water)

(ii) During indigestion (caused due to the production of excess of hydrochloric acid in the stomach), we administer an antacid (generally milk of magnesia, Mg(OH)<sub>2</sub> which is basic in nature). The antacid neutralizes the excess of acids and thus gives relief from indigestion.



**Question 15: Give two important uses of washing soda and baking soda.**

**Answer :** Two important uses of washing soda and baking soda are as follows:

**(1) Washing soda:**

- (a) It is used in glass, soap, and paper industries.
- (b) It is used to remove permanent hardness of water.

**(2) Baking soda:**

- (a) It is used as baking powder. Baking powder is a mixture of baking soda and a mild acid known as tartaric acid. When it is heated or mixed in water, it releases CO<sub>2</sub> that makes bread or cake fluffy.
- (b) It is used in soda-acid fire extinguishers.

**ASSIGNMENT QUESTIONS SET – 1**  
**CHAPTER – 2**  
**ACIDS, BASES AND SALTS**

**VERY SHORT ANSWER TYPE QUESTIONS**

1. Name two natural indicators.
2. Name two indicators that are usually used in chemical laboratories to indicate acidic/basic nature of a solution.
3. What is the general name of bases that are soluble in water?
4. What is an acid?
5. Define base
6. What is the action of an acid on blue litmus paper?
7. Name two natural substances that contain acid.
8. What is the oxide of a metal called?
9. Are all bases alkalis?
10. Which type of substance is used to indicate an acid or a base?
11. What is the common element present in all acids?
12. Give the name and formula of two mineral acids.
13. Common salt contains a substance which is hygroscopic. Name the substance and write its formula.
14. Name any two organic acids.
15. What is the common to all bases?
16. Name two sources of common salt.
17. How do metals react with acid?
18. Name two metals that react with a base to produce hydrogen gas.
19. Which gas is evolved when sodium carbonate reacts with hydrochloric acid?
20. What happens when carbon dioxide gas is passed into lime water?
21. Name a sodium compound which loses its water of crystallization on exposure to air.
22. A compound of metal is obtained mainly from sea water. Write the name and formula of the compound.
23. What is the common name and formula of sodium hydroxide?
24. What is the reaction called in which an acid and a base nullify the effect of each other?
25. Name the salt which was an important symbol in India's struggle for freedom?
26. Name a sodium compound used as a cleansing agent for domestic purposes.
27. Why does an aqueous solution of an acid conduct electricity?

28. The pH of a solution is 4. What is the nature of the solution?
29. A solution reacts with crushed egg-shells to give a gas that turns lime water milky. Say, whether the solution contains an acid or a base.
30. Which type of medicine is used to treat indigestion?
31. Which compound of a metal is a constituent of many dry soap powders?
32. Name the acid which is used as a bathroom cleaner.
33. What is the action of litmus on an aqueous solution of ammonium chloride?
34. Why is a basic substance used to treat a honey-bee sting?
35. A solution turns blue litmus red. What is its pH value?
36. Which one is more acidic, pH = 2 or pH = 5?
37. Which one of the two solutions is more basic, pH = 8 or pH = 11?
38. What is the nature of the salt which dissolves in water to produce a solution which turns blue litmus to red?
39. A milkman adds some baking soda to fresh milk. How will the pH of the fresh milk change?
40. What is the pH of a solution which is neither acidic nor basic?
41. What is the chemical formula of common salt?
42. Name the process by which sodium hydroxide is made by electrolysis of brine?
43. Give the chemical name and formula of washing soda?
44. Mention the property of sodium carbonate that makes it useful as an ingredient for dry soap powders.
45. Name the carbonate of a metal which is soluble in water.
46. What is soda ash?
47. State whether the aqueous solution of washing soda is acidic or alkaline?
48. Name the substance which on being treated with chlorine yields bleaching powder.
49. Write the chemical formula of plaster of paris.
50. Write an equation to show the reaction between plaster of paris and water.
51. Write the chemical formula of quicklime.
52. Name a compound of calcium which is used for whitewashing.
53. Which compound of calcium is used for making cement and glass?
54. Write an equation to show the reaction between quicklime and water.
55. Which compound of calcium is used to produce limelight?
56. Write the chemical name and formula of baking soda?
57. Name a compound of sodium which is used in fire extinguisher.
58. Write the chemical name and formula of bleaching powder?

59. Two solutions have pH number 4 and 9 respectively which solution has more  $H^+$  ion concentration?
60. Which compound of calcium is used for disinfecting water?
61. Why should cured and sour substances not be kept in brass and copper vessel?
62. Name a compound of calcium which hardens on being mixed with water.
63. Write down the molecular formula for one strong and one weak acid.
64. Explain why plaster of Paris should be stored in a moisture proof container?
65. Name the gas evolved when dil. sulphuric acid acts on sodium carbonate.
66. What is the use of common salt in soap industry?
67. Which compound of calcium is used in paper and textile industries?
68. What do you observe when a burning candle is brought near the test-tube containing hydrogen gas?
69. Name the indicator used to measure pH values over the whole range.
70. A white, solid substance is used to disinfect water, and it makes wool shrink-proof. Name the substance.
71. How many water of crystallization are present in copper sulphate crystals?
72. Write the name and formula of a compound which contains ten molecules of water of crystallization?
73. Name a sodium compound which is used in softening hard water.
74. A white powdery substance smells of chlorine and is used for disinfecting drinking water. What is the name of substance?
75. What happens when anhydrous copper sulphate is moistened with water?
76. Name the substance produced by the action of chlorine on dry slaked lime.
77. Name the compound of calcium used for bleaching cloth.
78. A compound is used to make casts for statues and for holding broken limbs and joints in place. What is this compound?
79. Write chemical equation to represent the action of dilute hydrochloric acid on bleaching powder?
80. Represent the reaction between plaster of Paris and water in the form of an equation.

### SHORT ANSWER TYPE QUESTIONS

1. What is an acid? Give some examples of organic and inorganic acids.
2. What is a base? Give examples?
3. What is an indicator? Give some examples of indicators?
4. What is litmus?

5. Describe some natural acid-base indicators, other than litmus.
6. What are olfactory indicators?
7. What do you mean by concentrated and dilute acid solutions?
8. Explain why brass and copper vessels are not used to keep curd and sour substances?
9. Name the gas which is liberated when metals react with an acid. Give an example. How is the presence of the gas tested?
10. HCl, HNO<sub>3</sub> etc. show acidic behavior in aqueous solutions but aqueous solutions of alcohol and glucose do not behave like acids. Explain why?
11. What would be the nature of solutions when the following salts are dissolved separately in water?
  - (i) NaCl
  - (ii) Na<sub>2</sub>CO<sub>3</sub>
  - (iii) CH<sub>3</sub>COONa
  - (iv) CuSO<sub>4</sub>
  - (v) (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>
  - (vi) Na<sub>2</sub>SO<sub>4</sub>
12. What are the functions of sodium chloride in human body?
13. Given below are the pH values of four different liquids : 7.0, 14.0, 4.0, 2.0  
Which of these could be that of
  - (i) lemon juice.
  - (ii) distilled water
  - (iii) 1 M sodium hydroxide solution
  - (iv) tomato juice
14. Why does an aqueous solution of an acid conduct electricity?
15. During the dilution of an acid, it is advised that acid should be added to water, not water to acid. Why?
16. An acid solution is diluted with water. How does the concentration of hydrogen ions change?
17. What is the pH of a solution?
18. A metal compound when treated with dilute hydrochloric acid forms calcium chloride and a gas. The gas evolved extinguishes a burning splinter. Write the equation for the reaction that occurs.
19. Why does the colour of dry litmus paper not change in contact with dry HCl gas?
20. How does the concentration of OH<sup>-</sup> ions change when excess of base is dissolved in a solution of sodium hydroxide?



21. What will happen if solid sodium hydrogencarbonate or a solution of it is heated? Give the equation of the reaction involved?
22. Give two important uses of washing soda.
23. Give two important uses of baking soda.
24. A baker found that the cake prepared by him was hard and small in size. Which ingredient had he forgotten to add that would have made the cake fluffy? Give reasons.
25. How is soda ash obtained from washing soda crystals? Support your answer by a chemical equation.
26. How does a fire extinguisher work?
27. Why is an aqueous solution sodium carbonate alkaline in nature?
28. A given compound of sodium is used to remove hardness of water and also as a reagent in the laboratory. Identify the compound and mention two of its uses.
29. How is bleaching powder prepared? Give the reaction.
30. What happens when bleaching powder is left exposed to air?
31. State three important uses of bleaching powder?
32. (i) Name the chemical used in hospitals for setting fractured bones.  
(ii) State the name of the above chemical and its formula.  
(iii) How is the above compound prepared?
33. What is gypsum? What happens when gypsum is heated to 393k?
34. Explain giving reasons: "Potassium hydrogentartrate is a component of baking powder used in making cakes".
35. A white amorphous powder emits a greenish yellow gas having a smell of chlorine. It is used to remove yellowness of white clothes in laundries. Identify the powder. Write the chemical equation involved in its preparation.
36. You are provided with two solutions A and B having pH 6 and 8 respectively. Which of the solutions does contain more  $H^+$  ion concentration? Which of them is acidic and which one basic?
37. Do basic solution also have  $H^+$  ions. If yes, then why are they basic?
38. What do the farmers do to treat the soil when it becomes too acidic?
39. What effect does a bee-sting produce on human body? What is its remedy?
40. What is the chemical substance injected into a man's skin when (a) an ant stings him (b) a nettle-leaf stings him?  
Suggest remedy to get relief from the effects of the stings.
41. How are the lives of aquatic animals affected with change in pH of the river water?
42. Explain the following: "Distilled water does not conduct electricity, but rain water does".

43. Why is an aqueous solution of sodium chloride neutral, whereas that of ammonium chloride acidic?
44. An efflorescent white, crystalline substance dissolves in water to produce an alkaline solution. The substance is used as a cleansing agent. Identify the substance and mention two uses of it.
45. A white, powdery compound of calcium is used for making toys and casts of statues. It hardens when mixed with water. Identify the compound. Write the chemical equation of its preparation.
46. What is the chemical formula of plaster of paris? How is it prepared? State the common and the chemical names of the compound formed when plaster of paris mixed with water?
47. State two uses of the following:
- Sodium hydroxide
  - Chlorine
  - Hydrogen
  - Hydrochloric acid
48. (a) What is the common name of the compound  $\text{CaOCl}_2$ .  
(b) Name the raw material used for the preparation of plaster of paris.  
(c) Which property of plaster of paris is utilized in making casts for broken limbs in hospitals?
49. What happens when a cold and concentrated solution of sodium chloride reacts with ammonia and carbon dioxide? Write the chemical equation of the reaction which takes place.
50. Write the chemical formula of ammonium chloride. Explain why an aqueous solution of ammonium chloride is acidic in nature? Illustrate your answer with the help of a chemical equation.

### LONG ANSWER TYPE QUESTIONS

- What is baking soda? How is it obtained from sodium chloride? Mention any two uses of baking soda.
- What is the commercial name of bleaching powder? How is bleaching powder prepared? What are its different uses?
- What do you mean by the strength of an acid? What are strong and weak acids?
- What do you mean by the strength of a base? What are strong and weak base?

5. Three test tubes A, B and C contain distilled water, a basic solution and an acid solution separately. How would you identify the contents of the test tubes with the help of a red litmus paper only?
  6. What are the different uses of sodium carbonate (Washing soda)?
  7. State the important properties of washing soda.
  8. What happens when carbon dioxide gas is passed through limewater? Give equations for the reactions that take place.
  9. With the help of universal indicator the pH values of solutions A, B, C, D and E were found to be 5, 2, 12, 7 and 10 respectively. Say which solution is
    - (i) neutral
    - (ii) strongly base
    - (iii) strongly acidic
    - (iv) weakly acid
    - (v) weakly basicArrange the pH in the increasing order of  $H^+$  ions configuration.
  10. Discuss briefly the reactions occurring when a concentrated solution of sodium chloride (brine) is electrolyzed?
  11. Explain how is washing soda produced using sodium chloride as one of the raw materials?
  12. (a) What is a salt? Give the names and formula of any two salts. Also name the acids and bases from which these salts may be obtained.  
(b) What is meant by hydrated and anhydrous salts? Explain with example.
  13. (a) What is plaster of paris? Write its chemical formula.  
(b) How is plaster of paris prepared? Write the chemical equation of the reaction involved.  
(c) Explain why plaster of paris should be stored in a moisture proof container.  
(d) State two important uses of plaster of paris.
  14. (a) What is bleaching powder? Write its chemical formula.  
(b) How is bleaching powder prepared? Write the chemical equation of the reaction involved.  
(c) State two important uses of bleaching powder.
  15. (a) What happens when zinc granules are heated with sodium hydroxide solution? Write chemical equation of the reaction which takes place.  
(b) What happens when bases react with nonmetals oxides? Explain with the help of an example. What does this reaction tell us about the nature of non-metal oxides?
- .....

**ASSIGNMENT QUESTIONS SET – 2**  
**CHAPTER – 2**  
**ACIDS, BASES AND SALTS**

1. The colour of neutral litmus solution is  
a) red (b) blue (c) purple (d) yellow
2. Which of the following indicators is an olfactory indicator?  
(a) litmus (b) vanilla (c) turmeric (d) phenolphthalein
3. Which one is suitable method to find the accurate pH value?  
(a) pH meter (b) pH paper (c) Universal indicator (d) Litmus solution
4. Which one of the following statements is correct about universal indicator?  
(a) It is a mixture of HCl and NaOH  
(b) It is a mixture of many indicators  
(c) It is a solution of phenolphthalein in alcohol  
(d) It is a solution of phenolphthalein in water.
5. Which of the following properties are shown by dilute HCl?  
(1) It turns blue litmus red  
(2) It turns red litmus blue  
(3) It reacts with zinc and a gas is evolved  
(4) It reacts with solid sodium carbonate to give brisk effervescence  
(a) 1 and 2 (b) 1 and 3 (c) 1, 3 and 4 (d) 2, 3 and 4
6. A teacher gave two test tubes – one containing water and the other containing sodium hydroxide solution to two students. Then he asked them to identify the test tube containing sodium hydroxide solution. Which one of the following can be used for correctly identifying the test tube containing the solution of sodium hydroxide?  
(a) Blue litmus (b) Red litmus (c) Sodium carbonate solution (d) Dilute HCl
7. Metallic oxides are \_\_\_\_\_ in nature, but non-metallic oxides are \_\_\_\_\_ in nature. The information in which alternative completes the given statement?  
(a) neutral, acidic (b) acidic, basic (c) basic, neutral (d) basic, acidic
8. When a drop of unknown solution X is placed on a strip of pH paper, a deep red colour is produced. This sample is which one of these?  
(a) NaOH (b) HCl (c) Water (d) CH<sub>3</sub>COOH
9. A student tests a sample drinking water and reports its pH value as 6 at room temperature. Which one of the following might have been added in water?  
(a) Calcium chloride (b) Sodium chloride (c) Sodium bicarbonate (d) Bleaching powder
10. Solid sodium bicarbonate was placed on a strip of pH paper. The color of the strip  
(a) turned red (b) did not change (c) turned green and slightly yellow (d) turned pink
11. Four drops of red litmus solution were added to each of the following samples. Which one turns red litmus blue?  
(a) Alcohol (b) Distilled water (c) Sodium hydroxide sol (d) HCl

12. The pH of which of the following samples can not be found directly using pH paper?  
(a) Lemon juice (b) Dilute HCl (c) Solid sodium bicarbonate (d) Solution of a detergent.
13. Which of the following natural sources contains oxalic acid?  
(a) lemon (b) orange (c) tomato (d) tamarind
14. The acid found in an ant sting is  
(a) acetic acid (b) citric acid (c) tartaric acid (d) methanoic acid
15. To relieve pain caused due to acidity, we can take  
(a) sour milk (b) lemon juice (c) orange juice (d) milk of magnesia
16. What are the products obtained when potassium sulphate reacts with barium iodide in an aqueous medium?  
(a) KI and BaSO<sub>4</sub> (b) KI, Ba and SO<sub>2</sub> (c) K, I<sub>2</sub> and BaSO<sub>4</sub> (d) K, Ba, I<sub>2</sub> and SO<sub>2</sub>
17. Which of the following salts is basic in nature?  
(a) NH<sub>4</sub>NO<sub>3</sub> (b) Na<sub>2</sub>CO<sub>3</sub> (c) Na<sub>2</sub>SO<sub>4</sub> (d) NaCl
18. Which of the following salts has the minimum pH value?  
(a) (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> (b) NaHCO<sub>3</sub> (c) K<sub>2</sub>SO<sub>4</sub> (d) NaCl
19. You are given four unknown solutions I, II, III, and IV. The pH values of these solutions are found to be 3, 7, 8, and 10 respectively. Among the given solutions, which solution has the highest hydrogen ion concentration?  
(a) I (b) II (c) III (d) IV
20. Which one of the following is required to identify the gas evolved when dilute hydrochloric acid reacts with zinc metal?  
(a) blue litmus paper (b) red litmus paper (c) a burning slinter (d) lime water
21. Zinc reacts with an acid as well as with a base to liberate hydrogen. On the basis of this what should be the nature of the zinc metal?  
(a) basic (b) acidic (c) amphoteric (d) neutral
22. When you test the solutions of sodium bicarbonate, sodium hydroxide, hydrochloric acid and acetic acid with universal indicator, in which case would you get a red colour?  
(a) sodium bicarbonate (b) hydrochloric acid (c) sodium hydroxide (d) acetic acid
23. The pH of a sample of pure water is 7 at room temperature. What is its pH when a pinch of solid sodium bicarbonate is dissolved in it?  
(a) vary near to 7 (b) less than 7 (c) more than 7 (d) exactly 7
24. If an unknown solution turns blue litmus red, then the pH of the solution is more likely to be (a) 12 (b) 10 (c) 7 (d) 4
25. What is the pH of a 0.00001 molar HCl solution?  
(a) 1 (b) 9 (c) 5 (d) 4
26. There are alternate acid base theories that define an acid as any species that can {hint: According to Bronsted-Lowry theory, an acid is any species that can donate a proton to another species.}  
(a) donate a proton (2) donate an electron (c) accept a proton (d) accept an electron

27. What happens when a solution of an acid is mixed with a solution of a base in a test tube?
- The temperature of the solution increases
  - The temperature of the solution decreases
  - The temperature of the solution remains the same
  - Salt formation takes place
- (a) (i) only (b) (i) and (iii)  
(c) (ii) and (iii) (d) (i) and (iv)
28. An aqueous solution turns red litmus solution blue. Excess addition of which of the following solution would reverse the change?
- Baking powder
  - Lime
  - Ammonium hydroxide solution
  - Hydrochloric acid
29. During the preparation of hydrogen chloride gas on a humid day, the gas is usually passed through the guard tube containing calcium chloride. The role of calcium chloride taken in the guard tube is to
- absorb the evolved gas
  - moisten the gas
  - absorb moisture from the gas
  - absorb  $\text{Cl}^-$  ions from the evolved gas
30. Compounds such as alcohols and glucose contain hydrogen but are not categorized as acids. Describe an activity to prove it.
31. Why does distilled water not conduct electricity, whereas rain water does?
32. Why do acids not show acidic behavior in the absence of water?
33. Five solutions A, B, C, D and E when tested with universal indicator showed pH as 4, 1, 11, 7 and 9, respectively, which solution is: a) neutral b) strongly alkaline? c) strongly acidic d) weakly acidic e) weakly alkaline  
Arrange the pH in increasing order of hydrogen ion concentration.
34. What is a neutralization reaction? Give two examples.
35. What happens when an acid or base is mixed with water?
36. Equal lengths of magnesium ribbons are taken in test tubes A and B. Hydrochloric acid is added to test tube A, while acetic acid is added to test tube B. The concentrations taken for both the acids are same in which test tube the reaction occur more vigorously and why?
37. Fresh milk has a pH of 6. How does the pH change as it turns to curd? Explain your answer.
38. A milkman adds a very small amount of baking soda to fresh milk.
- Why does he shift the pH of the fresh milk from 6 to slightly alkaline?
  - Why does this milk take a long time to set as curd?
39. Why does tooth decay start when the pH of mouth is lower than 5.5?

40. How does the flow of acid rain water into a river make the survival of aquatic life in a river difficult?
41. Dry hydrogen chloride gas does not turn blue litmus whereas hydrochloric acid does. Why?
42. What is meant by “water of crystallization” of a substance? Describe an activity to demonstrate water of crystallization.
43. Plaster of paris should be stored in a moisture – proof container. Explain why?
44. What is baking powder? How does it make the cake soft and spongy?
45. Give two important uses of washing soda and baking soda.
46. WHO AM I?
- I can roughly measure pH value from 0-14.
  - I am called antichlor and am used to remove excess chlorine from clothes when treated with bleaching powder.
  - I am a product of gypsum and am used to making chalks and fire proof materials.
  - I am a compound of calcium and can be used for disinfecting drinking water as well as for decolourisation.
  - I give different smell in acid and base solution.
  - I am an oxide capable of showing properties for both acids and bases.
  - I am a covalent compound and conducts electricity in aqueous medium.
  - I am a salt of potassium hydroxide and nitric acid.
  - I am the term used when a solid becomes liquid when exposed to moist air.
  - I am derived from tomato and turn blue litmus into red.
47. The colour of methyl orange indicator in acidic medium is: ( )  
a) Yellow b) green c) orange d) red
48. The colour of phenolphthalein indicator in basic solution is: ( )  
a) Yellow b) green c) pink d) orange
49. What is the colour methyl orange in alkaline medium? ( )  
a) orange b) yellow c) red d) blue
50. A solution turns red litmus blue, its pH will be: ( )  
a) 1 b) 4 c) 5 d) 10
51. A solution reacts with crushed egg-shells to give a gas that turns lime-water Milky, the solution contains: ( )  
a) NaCl b) HCl c) LiCl d) KCl
52. Why is universal indicator a better one than litmus paper? ( )  
a) Litmus paper can only be used for acids.  
b) Litmus paper can only be used for alkalis.  
c) Universal indicator goes green if something is neutral.  
d) Universal indicator is useful for all ranges of pH of the solution.
53. Water soluble bases are known as? ( )  
a) neutral b) base c) acid d) alkali

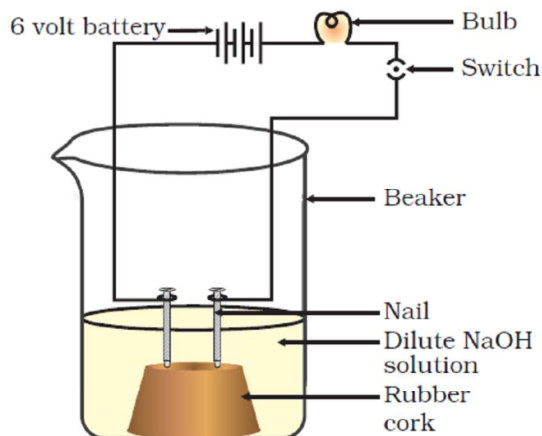
54. Which of one of the following pairs of substances when mixed together produces table salt. ( )
- Sodium thiosulphate and sulphur dioxide
  - Hydrochloric acid and sodium hydroxide
  - Chlorine and oxygen
  - Nitric acid and sodium hydrogen carbonate
55. What colour would hydrochloric acid (pH=1) turn universal indicator. ( )
- Orange
  - purple
  - yellow
  - red
56. Which one of the following medicines is used for treating indigestion. ( )
- Antibiotic
  - analgesic
  - antacid
  - antiseptic
57. If magnesium reacts with hydrochloric acid, what gas is produced? ( )
- Hydrogen
  - oxygen
  - carbon dioxide
  - chlorine
58. Which of the following is the most accurate way of representing neutralization? ( )
- Acid + base  $\rightarrow$  neutral solution
  - Acid + base  $\rightarrow$  salt + water
  - Acid + base  $\rightarrow$  sodium chloride + hydrogen
  - Acid + base  $\rightarrow$  acid solution
59. Classify the following examples as acid, base or salt:
- |                                |       |                  |       |                     |       |
|--------------------------------|-------|------------------|-------|---------------------|-------|
| Mg(OH) <sub>2</sub>            | _____ | KCl              | _____ | HCl                 | _____ |
| H <sub>3</sub> PO <sub>4</sub> | _____ | HBr              | _____ | Al(OH) <sub>3</sub> | _____ |
| KNO <sub>2</sub>               | _____ | NaCl             | _____ |                     |       |
| Ba(OH) <sub>2</sub>            | _____ | HFO <sub>4</sub> | _____ |                     |       |
60. Fill in the following blanks:
- A \_\_\_\_\_ taste is a characteristic property of all acids in aqueous solution.
  - Acids react with some metals to produce \_\_\_\_\_ gas
  - Aqueous acid solutions conduct electricity because they have \_\_\_\_\_
  - Acid reacts with base to produce a \_\_\_\_\_ and water.
  - Acid turn methyl orange to \_\_\_\_\_ colour.
  - Bases tend to taste \_\_\_\_\_ and feel \_\_\_\_\_
  - Aqueous basic solutions conduct electricity because they have \_\_\_\_\_.
  - Bases react with \_\_\_\_\_ to produce a salt and \_\_\_\_\_
  - Bases turn phenolphthalein to \_\_\_\_\_ colour.
61. Match the following:
- |                     |     |   |
|---------------------|-----|---|
| a) Plaster of Paris | ( ) | 1) CaO                                    |
| b) Gypsum           | ( ) | 2) NaHCO <sub>3</sub>                     |
| c) Bleaching powder | ( ) | 3) Na <sub>2</sub> CO <sub>3</sub>        |
| d) Baking soda      | ( ) | 4) CaSO <sub>4</sub> · ½ H <sub>2</sub> O |
| e) Washing soda     | ( ) | 5) CaSO <sub>4</sub> · 2 H <sub>2</sub> O |
62. Which of the following salts does not contain water of crystallisation?
- Blue vitriol
  - Baking soda
  - Washing soda
  - Gypsum



63. 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
64. Calcium phosphate is present in tooth enamel. Its nature is  
(a) basic (b) acidic (c) neutral (d) amphoteric
65. 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
66. Which of the following gives the correct increasing order of acidic strength?  
(a) Water < Acetic acid < Hydrochloric acid  
(b) Water < Hydrochloric acid < Acetic acid  
(c) Acetic acid < Water < Hydrochloric acid  
(d) Hydrochloric acid < Water < Acetic acid
67. If a few drops of a concentrated acid accidentally spills 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 hydrogencarbonate  
(c) After washing with plenty of water apply solution of sodium hydroxide on the hand  
(d) Neutralise the acid with a strong alkali
68. Sodium hydrogencarbonate 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)
69. Common salt besides being used in kitchen can also be used as the raw material for making  
(i) washing soda  
(ii) bleaching powder  
(iii) baking soda  
(iv) slaked lime  
(a) (i) and (ii) (b) (i), (ii) and (iv)  
(c) (i) and (iii) (d) (i), (iii) and (iv)
70. 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

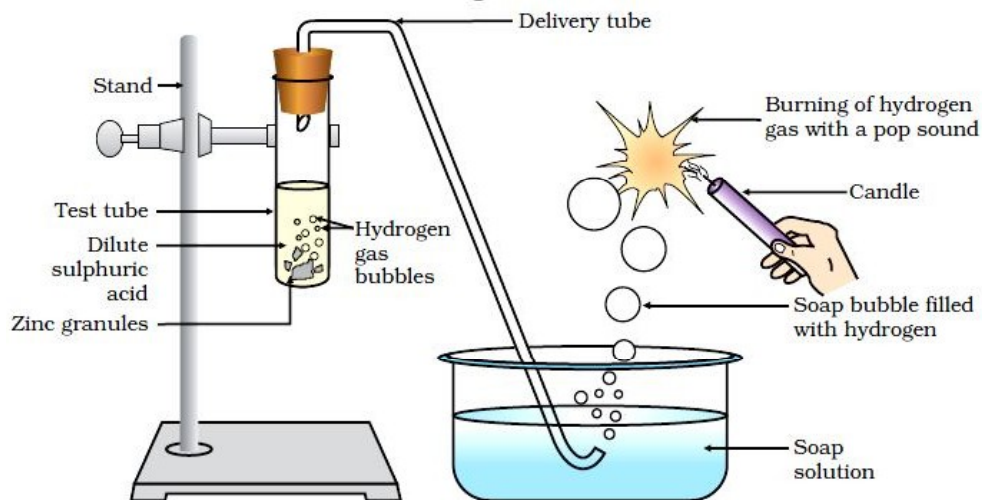
71. To protect tooth decay we are advised to brush our teeth regularly. The nature of the tooth paste commonly used is
- (a) acidic
  - (b) neutral
  - (c) basic
  - (d) corrosive
72. Which of the following statements is correct about an aqueous solution of an acid and of a base?
- (i) Higher the pH, 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)
73. 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
74. Which of the following phenomena occur, when a small amount of acid is added to water?
- (i) Ionisation
  - (ii) Neutralisation
  - (iii) Dilution
  - (iv) Salt formation
- (a) (i) and (ii) (b) (i) and (iii)  
(c) (ii) and (iii) (d) (ii) and (iv)
75. 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
76. Which of the following substance will not give carbon dioxide on treatment with dilute acid?
- (a) Marble
  - (b) Limestone
  - (c) Baking soda
  - (d) Lime
77. Which of the following is acidic in nature?
- (a) Lime juice
  - (b) Human blood
  - (c) Lime water
  - (d) Antacid
78. In an attempt to demonstrate electrical conductivity through an electrolyte, the following apparatus (see below Figure) was set up. 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) (ii) only (c) (iv) only



79. Which of the following is used for dissolution of gold?
- (a) Hydrochloric acid
  - (b) Sulphuric acid
  - (c) Nitric acid
  - (d) Aqua regia
80. Which of the following is not a mineral acid?
- (a) Hydrochloric acid
  - (b) Citric acid
  - (c) Sulphuric acid
  - (d) Nitric acid
81. Which among the following is not a base?
- (a) NaOH
  - (b) KOH
  - (c)  $\text{NH}_4\text{OH}$
  - (d)  $\text{C}_2\text{H}_5\text{OH}$
82. 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 metals react with acids to give salt and hydrogen
  - (d) Some non metal oxides react with water to form an acid
83. Which of the following is(are) true when  $\text{HCl}$  (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 water molecule
- (a) (i) only (b) (iii) only
  - (c) (ii) and (iv) (d) (iii) and (iv)

84. Which of the following statements is true for acids?
- Bitter and change red litmus to blue
  - Sour and change red litmus to blue
  - Sour and change blue litmus to red
  - Bitter and change blue litmus to red
85. Which of the following are present in a dilute aqueous solution of hydrochloric acid?
- $\text{H}_3\text{O}^+ + \text{Cl}^-$
  - $\text{H}_3\text{O}^+ + \text{OH}^-$
  - $\text{Cl}^- + \text{OH}^-$
  - unionised HCl
86. Identify the correct representation of reaction occurring during chloralkali process
- $2\text{NaCl}(\text{l}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow 2\text{NaOH}(\text{l}) + \text{Cl}_2(\text{g}) + \text{H}_2(\text{g})$
  - $2\text{NaCl}(\text{aq}) + 2\text{H}_2\text{O}(\text{aq}) \rightarrow 2\text{NaOH}(\text{aq}) + \text{Cl}_2(\text{g}) + \text{H}_2(\text{g})$
  - $2\text{NaCl}(\text{aq}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow 2\text{NaOH}(\text{aq}) + \text{Cl}_2(\text{aq}) + \text{H}_2(\text{aq})$
  - $2\text{NaCl}(\text{aq}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow 2\text{NaOH}(\text{aq}) + \text{Cl}_2(\text{g}) + \text{H}_2(\text{g})$
87. What will be the action of the following substances on litmus paper? Dry HCl gas, Moistened  $\text{NH}_3$  gas, Lemon juice, Carbonated soft drink, Curd, Soap solution.
88. 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.
89. A student prepared solutions of (i) an acid and (ii) a base in two separate beakers. She forgot to label the solutions and litmus paper is not available in the laboratory. Since both the solutions are colourless, how will she distinguish between the two?
90. How would you distinguish between baking powder and washing soda by heating?
91. 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.
92. In one of the industrial processes used 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 reactions involved.
93. What are strong and weak acids? In the following list of acids, separate strong acids from weak acids. Hydrochloric acid, citric acid, acetic acid, nitric acid, formic acid, sulphuric acid.
94. 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.
95. In the following schematic diagram for the preparation of hydrogen gas as shown in below Figure, what would happen if following changes are made?



- (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.
96. For making cake, baking powder is taken. If at home your 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?
97. 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. Identity X, Y, G and Z.
98. 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.
99. 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 is left in 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? Give the reaction involved.
100. Identify the compound X on the basis of the reactions given below. Also, write the name and chemical formulae of A, B and C.

