2 ACIDS AND BASES

THEORY

2.1 INTRODUCTION

Everyday you use various kinds of substances such as water, food, medicines, fuel and clothes. All these are chemical substances, i.e., made up of atoms of one or more elements.

A number of substances you consume such as lemon, curd, tamarind, fruit juice, common salt, sugar and vinegar have different tastes. You must have noticed that they may taste sour, bitter, sweet or salty.

You must be wondering why different substances have different tastes. This is because the chemical nature of these substances is not the same. It differs from substance to substance.

On the basis of chemical nature, chemical substances can be broadly classified as acidic, basic and neutral substances.

vinegar lemon juice


curd

Some acidic substances

milk of magnesia


cleaning solution


soap

Some basic substances

Advance Learning

- **Atom**
  The smallest particle of an element that takes part in a chemical reaction is an atom.
- **Element**
  Element is the basic constituent of all matter.
- **Chemical Compound**
  A substance whose each molecule contains two or more atoms of different elements in a fixed ratio is a chemical compound.

2.2 ACIDS

The term acid is derived from the Latin word acidus meaning sour. Lemons, oranges and grapes taste sour because they contain citric acid. Tamarind and vinegar contain tartaric acid and acetic acid respectively.

Definition :

"An acid is defined as a substance which gives H^+ ions on dissolution in water."

e.g.

$$\underset{\text{hydrochloric acid}}{HCl} \xrightarrow{\text{Water}} H^+ + Cl^-$$

$$\underset{\text{acetic acid}}{CH_3COOH} \xrightarrow{\text{Water}} CH_3COO^- + H^+$$

Nitric acid (HNO_3), Phosphoric acid (H_3PO_4) , formic acid (HCOOH) etc. have one and sulphuric acid (H_2SO_4) has two replaceable hydrogen atom, thus they are acids.

- **Vitamin C which is very important for our body is also an organic acid known as ascorbic acid.**

Examples of some important acids and their sources :

S.No.	Name acid	Substances in which its is found
1.	Acetic acid	Vinegar
2.	Ascorbic acid (Vitamin C)	Amla, citrus fruits
3.	Citric acid	Citrus fruits such as lemon and orange
4.	Formic acid	Ant's sting or Bee's sting
5.	Lactic acid	Sour milk, curd
6.	Hydrochloric acid	Gastric juice (present in the stomach)
7.	Malic acid	Apple
8.	Oxalic acid	Spinach
9.	Tannic acid	Tea
10.	Tartaric acid	Tamarind (imli), grapes, raw mango

Classification of Acids:

(a) On the basis of occurrence:

(i) Mineral acids : Acids which are obtained from the minerals present in earth's crust are called mineral acids.

e.g. HCl, H_2SO_4, HNO_3 etc.

(ii) Organic acids : Acids that are found in animals and plants are known as organic acids.

e.g. Lactic acid , citric acid, tartaric acid, acetic acid and formic acid.

(b) On the basis of strength:

(i) Strong Acids :

Acids, which almost completely ionise (break up into ions) in water, are called strong acids.

e.g. Hydrochloric acid (HCl), sulphuric acid (H_2SO_4), nitric acid (HNO_3) etc.

$$HCl + Water \longrightarrow H^+(aq) + Cl^-(aq)$$

$$H_2SO_4 + Water \longrightarrow 2H^+(aq) + SO_4^{2-}(aq)$$

(ii) Weak Acids:

Acids, which partially ionise in water, are called weak acids.

e.g. Carbonic acid (H_2CO_3), phosphoric acid (H_3PO_4), formic acid (HCOOH), acetic acid (CH_3COOH).

$CH_3COOH + Water \longrightarrow CH_3COO^-(aq) + H^+(aq)$ (Partially ionised)

- The sharp pain caused by the sting of ants and bees is due to formic acid, which they push into the body or spray on the skin.
- Acids like conc. H_2SO_4 and conc. HNO_3 are corrosive in nature. They destroy organic matter like clothes, paper, wood and cause burn to human skin.
- In general mineral acids are strong while organic acids are weak.

(c) On the basis of concentration :

(i) Concentrated acid :

The acid containing very less amount of water is called concentrated acid. HCl is prepared by dissolving HCl gas in water. The solution of this acid is called conc. HCl.

(ii) Dilute acid : The acid containing excess amount of water is called dilute acid. Strength can be decreased by dissolving the acid in more water. In a laboratory, we generally use either concentrated acid or it's solution diluted to a definite strength.

Dilution of acids :

It is always desirable to add acid to water, keeping the solution continuously stirred, while preparing dilute solutions of acids, specially mineral acids. We should always slowly add acid to water; otherwise, so much heat is produced during the dilution process that the container, specially that of glass, may break. The hot contents may also cause an explosion and spill on our clothes and body. This may result into serious acid burns.

(d) On the basis of basicity :

(i) Monobasic Acids :

When one molecule of an acid on complete ionisation produces one hydronium ion (H_3O^+) in aqueous solution, the acid is said to be a monobasic acid.

Examples of Monobasic Acids.

Some examples of monobasic acids are :

(i) Hydrochloric acid (HCl)
(ii) Hydrobromic acid (HBr)
(iii) Nitric acid (HNO_3)
(iv) Acetic acid (CH_3COOH)
(v) Formic acid (HCOOH)

(ii) Dibasic Acids :

When one molecule of an acid on complete ionisation produces two hydronium ions (H_3O^+) in aqueous solution, the acid is said to be a dibasic acid.

Examples of Dibasic Acids :

Some examples of dibasic acids are :

(i) Sulphuric acid (H_2SO_4)
(ii) Sulphurous acid (H_2SO_3)
(iii) Carbonic acid (H_2CO_3)
(iv) Oxalic acid [$(COOH)_2$]
(v) Hydrofluoric acid (HF)

(iii) Tribasic Acids :

When one molecule of an acid on complete ionisation produces three hydronium ions (H_3O^+) in aqueous solution, the acid is said to be a tribasic acid.

An example of tribasic acids is Phosphoric acid (H_3PO_4).

(iv) Tetrabasic Acids :

When one molecule of an acid on complete ionisation produces four hydronium ions (H_3O^+) in aqueous solution, the acid is said to be a tetrabasic acid.

An example of tetrabasic acids is silicic acid (H_4SiO_4)

- The atmosphere of Venus is made up of thick white and yellow clouds of Oil of Vitriol (H_2SO_4).

2.3 BASES

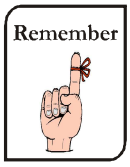
These chemical substances are bitter in taste and soapy to touch . The chemical nature of such substances is basic.

Definition :

A base is a compound which gives hydroxyl group (OH^-) on dissolution in water are known as bases.

e.g.

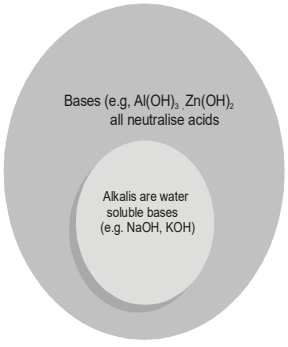
Sodium hydroxide	NaOH
Calcium hydroxide	$Ca(OH)_2$
Aluminium hydroxide	$Al(OH)_3$



- **Alkalis :**

Bases which dissolves in water are called alkalis. e.g. KOH, NaOH.

All alkalis are bases but all bases are not alkalis. e.g. $Al(OH)_3$ is a base, but not an alkali.



Examples of some important bases and their uses :

S.N.	Chemical Name	Commercial Name	Chemical Formula	Uses
1.	Sodium hydroxide	Caustic soda	NaOH	In manufacturing of soap, paper pulp,rayon, refining of petroleum etc.
2.	Potassium hydroxide	Caustic potash	KOH	In alkaline storage batteries, manufacture of soap, absorbing CO_2 gas etc.
3.	Calcium hydroxide	Slaked lime	$Ca(OH)_2$	In manufacture of bleaching powder, softening of hard water etc.
4.	Magnesium hydroxide	Milk of magnesia	$Mg(OH)_2$	As an antacid to remove acidity from stomach.
5.	Aluminium hydroxide	–	$Al(OH)_3$	As foaming agent in fire extinguishers.
6.	Ammonium hydroxide	–	NH_4OH	In removing grease stains from clothes and in cleaning window panes.

- Sodium carbonate (Na_2CO_3) is commonly called Washing soda.
- Sodium bicarbonate($NaHCO_3$) is commonly called baking soda.
- CaO is used to neutralize acidic nature of soil.
- $Ca(OH)_2$ is used to prepare mortar, bleaching powder and to neutralize acid in water supplies.
- KOH (caustic potash) is used to conduct electricity between two electrodes.

- Both NaOH and KOH are deliquescent in nature which means that they absorb moisture from air.

Classification of Bases :

(i) On the basis of strength :

(1) Strong Bases : Bases which are almost completely dissociated in water are known as strong bases.
e.g. Sodium hydroxide (NaOH), potassium hydroxide (KOH), barium hydroxide $Ba(OH)_2$ etc .

$NaOH(s) + Water \longrightarrow Na^+(aq) + OH^-(aq)$

$KOH(s) + Water \longrightarrow K^+(aq) + OH^-(aq)$

(2) Weak Bases : Bases which dissolve in water only slightly and produce a low concentration of hydroxide ions are called weak bases.
e.g. Ammonium hydroxide (NH_4OH), silver hydroxide (AgOH) etc.

(ii) On the Basis of their Concentration :

By the term concentration, we mean the amount of water present in the given sample of alkali solution in water. On the basis of concentration, the alkalis can be classified as under :

(1) Concentrated alkali :

A solution of alkali having a relatively high percentage of alkali in its aqueous solution is known as concentrated alkali.

(2) Dilute alkali :

A solution of alkali having a relatively low percentage of alkali in its aqueous solution is known as a dilute alkali.

If the concentration of alkali in the solution is less than 1 mole per litre, then it is considered to be a dilute alkali.

(iii) On the Basis of their Acidity :

The number of hydroxide (OH^-) ions produced by one molecule of an alkali on complete dissociation in water or the number of hydrogen ions (of an acid) with which a molecule of that alkali reacts to produce salt and water only is known as acidity of an alkali.

For water insoluble hydroxides, acidity of the base is equal to the number of OH^- ions present in one molecule of that base.

On the basis of acidity, the bases can be classified as under :

(1) Monoacidic Bases (or alkalis) :

When one molecule of the base on complete ionisation produces one hydroxide (OH^-) ion in aqueous solution, the base or alkali is said to be monoacidic base.

OR

A monoacidic base (or alkali) may be defined as one whose one molecule reacts with one hydrogen (H^+) ion completely to form salt and water as the only products.

Examples of Monoacidic Bases (or alkalis) :

Sodium hydroxide (NaOH), Potassium hydroxide (KOH), Ammonium hydroxide (NH_4OH). All these substances produce only one hydroxyl ion on complete ionisation in aqueous solution.

$NaOH(aq.) \longrightarrow Na^+(aq) + OH^-(aq)$

$KOH(aq.) \longrightarrow K^+(aq) + OH^-(aq)$

The dissociation of monoacidic bases or alkalis takes place in a single step.

(2) Diacidic Bases (or alkalis) :

When one molecule of a base or alkali on complete ionisation produces two hydroxide (OH^-) ions in aqueous solution, the base or alkali is said to be diacidic.

Examples of Diacidic Bases

$Ca(OH)_2(aq) \longrightarrow Ca^{2+}(aq) + 2OH^-(aq)$

Calcium hydroxide

$Mg(OH)_2(aq) \longrightarrow Mg^{2+}(aq) + 2OH^-(aq)$

Magnesium hydroxide

One molecule of both the bases are producing $2OH^-$ ions in aqueous solution, therefore, these are termed as diacidic bases .

(3) Triacidic Bases :

When one molecule of a base or alkali on complete ionisation produces three hydroxide (OH^-) ions in aqueous solution, the base or alkali is said to be triacidic base.

Examples of Triacidic Bases :

$$Al(OH)_3(aq) \longrightarrow Al^{3+}(aq) + 3OH^-(aq)$$

Aluminium hydroxide

$$Al(OH)_3 + 3HCl(aq) \longrightarrow AlCl_3 + 3H_2O$$

In the above equations, one molecule of $Al(OH)_3$ is producing three OH^- ions and one molecule of $Al(OH)_3$ is reacting with three hydrogen (H^+) ions to form salt and water only, therefore, it is termed as a triacidic base.

2.4 INDICATORS

It is not possible to taste each and every substance to identify its chemical nature and also, it may be dangerous to touch each and every substance.

To overcome this problem, special types of substances called indicators are used to get to know the chemical nature of substances.

An indicator is a substance which indicates the nature of particular solution whether acidic, basic or neutral. Hence they indicate the change in nature of the solution from acidic to basic and vice versa. Indicators are basically coloured organic substances.

(a) Different types of indicators :

(i) Litmus : Litmus is a purple dye which is extracted from a plant 'lichen'. It can also be applied on paper in the form of strips and is available as blue and red strips. A blue litmus strip, when dipped in an acid solution acquires red colour. Similarly a red strip when dipped in a base solution becomes blue.

Lichen (a plant)

Red and blue litmus papers

ACTIVITY–1

To test the chemical nature of a few substances.

- Collect lemon juice, lime water, tap water, washing soda solution, milk of magnesia, and sugar solution in separate test tubes.
- With the help of dropper, one by one, put a drop of each solution on separate red and blue litmus papers.
- Record your observations in Table.

S.N.	Solution	Effect on red litmus paper	Effect on blue litmus paper	Chemical nature
1.	Lemon juice	Red	Red	Acidic
2.	Lime water	Blue	Blue	Basic
3.	Tap water	No change	No change	Neutral
4.	Washing soda solution	Blue	Blue	Basic
5.	Milk of magnesia	Blue	Blue	Basic
6.	Sugar solution	No change	No change	Neutral

(ii) Phenolphthalein : It is also an organic dye. In neutral or acidic solution, it remains colourless while in the basic solution, the colour of indicator changes to pink.

(iii) Methyl Orange : Methyl orange is an orange coloured dye and keeps this colour in the neutral or basic medium. In the acidic medium the colour of indicator becomes red.

(iv) Red Cabbage Juice : It is purple in colour in neutral medium and turns red or pink in the acidic medium. In the basic or alkaline medium, its colour changes to green.

(v) Turmeric juice : It is yellow in colour and remains as such in the neutral and acidic medium. In the basic medium its colour becomes reddish or deep brown.

(vi) China Rose : Extract of china rose (Gudhal) petals is of pink colour. It will change into dark pink (magenta) in acidic solution and green in basic solution.

ACTIVITY–2

To test the nature of different sbstances using temeric as an indicator.

- Make turmeric paste in a bowl
- Now leave it to dry for 15-20 minutes.
- cut thin strips of yellow turmeric paper
- Collect lemon juice, lime water, tap water, washing soda solution, milk of magnesia and sugar solution in separate test tubes
- With the help of dropper, one by one, put a drop of each solution on the thin strip of yellow turmeric paper.
- Record your observation in Table

S.N.	Solution	Effect on Yellow turmeric paper	Chemical nature
1.	Lemon juice	Yellow	Acidic
2.	Lime water	Reddish brown	Basic
3.	Tap water	Yellow	Neutral
4.	Washing soda solution	Reddish brown	Basic
5.	Milk of magnesia	Reddish brown	Basic
6.	Sugar solution	Yellow	Neutral

Colour of indicators in acidic and basic medium

S.N.	Indicator	Colour in acidic medium	Colour in basic medium
1.	Blue litmus	Red	Blue
2.	Red litmus	Red	Blue
3.	Turmeric	Yellow	Raddish-brown
4.	China rose	Dark pink(magenta)	Green
5.	Methyl orange	Red	Orange
6.	Phenolphthalein	Colourless	Pink

ACTIVITY–3

To observer the effect of various indicators on acidic and basic solution

- Collect 5 mL each of dilute sulphuric acid, dilute sodium hydroxide, dilute hydrochloric acid, dilute potassium hydroxide, dilute nitric acid, dilute ammonium hydroxide and dilute calcium hydroxide in separate test tubes.
- One by one test the acidic or basic nature of each of the sample solutions with blue litmus paper, red litmus paper, phenolphthalein, methyl orange, China rose and turmeric indicators.
- Record your observation in Table

S. N.	Sample	Effect on blue litmus paper	Effect on red litmus paper	Effect on phenolph-thalein	Effect on methyl orange	Effect on China rose	Effect on turmeric
1.	Dilute sulphuric acid	red	red	colourless	red	dark pink	yellow
2.	Dilute sodium hydroxide	blue	blue	pink	orange	green	reddish brown
3.	Dilute hydrochloric acid	red	red	colourless	red	dark pink	yellow
4.	Dilute potassium hydroxide	blue	blue	pink	orange	green	reddish brown
5.	Dilute nitric acid	red	red	colourless	orange	dark pink	yellow
6.	Dilute ammonium hydroxide	blue	blue	pink	orange	green	reddish brown
7.	Dilute calcium hydroxide	blue	blue	pink	orange	green	reddish brown

2.5 NEUTRALISATION

The reaction between an acid and a base is known as neutralisation. Salt and water are produced in this process with the evolution of heat. Evolved heat is known as heat of neutralisation .

Acid + Base $\longrightarrow$ Salt + Water

e.g.

$$\underset{\text{Hydrochloric acid}}{HCl} + \underset{\text{Sodium hydroxide}}{NaOH} \longrightarrow \underset{\text{Sodium chloride}}{NaCl} + \underset{\text{water}}{H_2O} + 57.1\ kJ$$

Where 57.1kJ energy is the heat of neutralisation for above reaction. This value remains same if both acid and base are strong. If one out of these is weak then amount of energy released will be lesser than 57.1 kJ

ACTIVITY–4

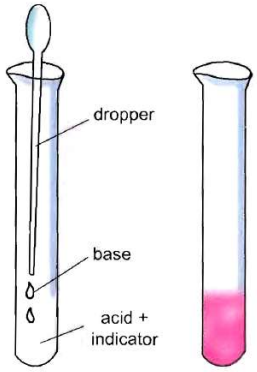
Aim : To observe the neutralization reaction.

Procedure :

- Take a test tube and fill it one-fourth with dilute hydrochloric acid (HCl).
- With the help of a dropper, add 2–3 drops of phenolphthalein indicator (colourless) to it.
- Gently shake the test tube.
- Note down its colour.

You will observe that the solution is colourless.

- Now put a drop of dilute sodium hydroxide with the help of a dropper and shake it gently.
- Continue adding dilute sodium hydroxide and shaking it till the pink colour just appears.
- At this point, the solution is just neutral.
- Add a drop of dilute hydrochloric acid to it
- What do you observe now ?



Neutralization reaction

You will notice that the pink colour disappears.

- Again add a drop of dilute sodium hydroxide.

You will notice that the pink colour reappears.

This happens because phenolphthalein is colourless in an acidic medium and pink in a basic medium.

Inference : Drop by drop addition of dilute sodium hydroxide neutralizes dilute hydrochloric acid.

(a) Neutralisation in everyday life:

(i) Indigestion : People particularly of old age suffer from acidity problems in the stomach which is caused mainly due to release of excessive gastric juices containing HCl. The acidity is neutralised by antacid tablets which contain sodium hydrogen carbonate (baking soda, $NaHCO_3$), magnesium hydroxide (milk of magnesia, $Mg(OH)_2$) etc.

(ii) Ant and bee sting : The stings of bees and ants contain formic acid. Its corrosive and poisonous effect can be neutralised by rubbing soap which contains NaOH (an alkali) or by rubbing baking soda ($NaHCO_3$) or by calamine solution ($ZnCO_3$). The stings of wasps contain an alkali and its poisonous effect can be neutralised by an acid like acetic acid (present in vinegar).


Ant sting


Bee sting

(iii) Soil treatment : Farmers generally neutralize the effect of acidity in the soil caused by acid rain by adding slaked lime (Calcium hydroxide, $Ca(OH)_2$) to the soil.

(iv) Factory wastes : The wastes of many factories contain acids. If they are allowed to flow into the water bodies, the acids will kill fish and other organisms. The factory wastes are, therefore, neutralised by adding basic substances.

POINTS TO REMEMBER

- **Atom :** The smallest particle of an element that takes part in a chemical reaction is an atom.
- **Element :** Element is the basic constituent of all matter.
- **Chemical Compound :** A substance whose each molecule contains two or more atoms of different elements in a fixed ratio is a chemical compound.
- **Acid :** The substance which contains hydrogen and produces H^+ ions in aquesous solution is called Acid. Acids are sour in taste.
- **Base:** The substance which produces OH^- ions in aqueous solution is called the chemical substances which are bitter in taste and soapy base touch.
- **Alkalis :** Bases which dissolves in water are called alkalis.
- **Neutralisation :** The reaction between an acid and a base is known as neutralisation.
- **Antacid :** It is a medicine that neutralize acid formed in the stomach.
- Litmus, turmeric and china rose petal are naturally occurring indicators, while methyl orange and phenolphthalein are prepared in laboratories.
- On the basis of chemical nature, all chemical substances are broadly classified as acidic, basic and neutral substances.
- **Acid Rain :** When pollutent like sulphur dioxide and nitrogen oxides dissolve in rain water, it forms an acid. The rain of that acid is called acid rain.

CONCEPT APPLICATION LEVEL - I [NCERT Questions]

Q.1 State differences between acids and bases?

Ans.

	Acids		Bases
(i)	Acids are sour to taste	(i)	Bases are bitter to taste
(ii)	Acid turns blue litmus to red	(ii)	Base turns red litmus to blue
(iii)	Acid is a substance which contains H^+ ions	(ii)	Bases are substances which contains hydroxyl (OH^-) ions.

Q.2 Ammonia is found in many household products, such as window cleaners. It turns red litmus blue. What is its nature?

Ans. Ammonia has basic nature.

Q.3 Name the source from which litmus solution is obtained. What is the use of this solution?

Ans. Litmus solution is extracted from lichens. It is used to determine whether the given solution is acidic or basic.

Q.4 Is the distilled water acidic/basic/neutral? How would you verify it?

Ans. Distilled water will be neutral. We can verify it by showing that neither blue nor red litmus paper changes its colour when dipped in it.

Q.5 Describe the process of neutralisation with the help of an example.

Ans. The reaction between an acid and a base is known as neutralisation. Salt and water are produced in this process with the evolution of heat.Antacids like milk of magnesia (magnesium hydroxide), baking soda, etc. which contain a base are used for reducing acidity in stomach when excessive acid released by glands.

Q.6 Dorji has a few bottles of soft drink in his restaurant. But, unfortunately, these are not labelled. He has to serve the drinks on the demand of customers. One customer wants acidic drink, another wants basic and third one wants neutral drink. How will Dorji decide which drink is to be served to whom?

Ans. Dorji can decide with the help of litmus paper:
(i) The drink which would turn a red litmus blue would be basic.
(ii) If the drink turns a blue litmus to red would be acidic.
(iii) The drink which would not affect both red and blue litmus would be neutral.

Q.7 Explain why:
(a) An antacid tablet is taken when you suffer from acidity.
(b) Calamine solution is applied on the skin when an ant bites.
(c) Factory waste is neutralised before disposing it into the water bodies.

Ans. (a) We take an antacid such as milk of magnesia to neutralise the excessive acid released in stomach.
(b) Ant injects an acidic liquid (Formic acid) into the skin on biting which causes inflammation, to the skin. The effect of the acid can be neutralised by rubbing. Calamine solution which contains zinc carbonate, is a very weak base and causes no harm to the skin
(c) The wastes of factories contain acids. If acids are disposed off in the water body, the acids will harm the organisms. So factory wastes are neutralised by adding basic substances.

Q.8 Three liquids are given to you. One is hydrochloric acid, another is sodium hydroxide and third is a sugar solution. How will you identify them? You have only turmeric indicator.

Ans.

S.N.	Name of the solution	Effect on turmeric indicator
1.	Hydrochloric acid solution	Yellow
2.	Sodium hydroxide solution	Reddish-brown
3.	Sugar solution	Yellow

Q.9 Blue litmus paper is dipped in a solution. It remains blue. What is the nature of the solution? Explain.

Ans. It can be identified on the basis of the following observations :

(i) Bases change the colour of litmus paper to blue. As the colour of blue litmus paper is not affected, the solution must be basic.

(ii) If the solution is neutral, even then colour of litmus will not change.

Q.10 Consider the following statements :

(a) Both acids and bases change colour of all indicators.

(b) If an indicator gives a colour change with an acid, it does not give a change with a base.

(c) If an indicator changes colour with a base, it does not change colour with an acid.

(d) Change of colour in an acid and a base depends on the type of the indicator.

Which of these statements are correct?

(i) All four (ii) (a) and (d) (iii) (b) and (c) (iv) only (d)

Ans. (ii) (a) and (d)

CONCEPT APPLICATION LEVEL - II

VERY SHORT ANSWER TYPE QUESTION

Q.1 Name the source from which litmus solution is obtained ?

Ans. Litmus is extracted from lichen plant

Q.2 Name the acid present in :

(i) Tomato (ii) Vinegar (iii) Apples (iv) Tamarind

Ans. (i) Ascorbic acid (ii) Acetic acid (iii) malic acid (iv) Tartaric acid

Q.3 What is deliquescence ?

Ans. The process by which a substance absorbs moisture from the atmosphere until it dissolves in the absorbed water and forms a solution is known as deliquescence.

SHORT ANSWER TYPE QUESTION

Q.4 What will be the litmus test for a solution of vitamin C ?

Ans. Since vitamin C is present in ascorbic acid so litmus paper will convert into red.

Q.5 What colour change occurs when a stain of turmeric is washed with soap ?

Ans. When stain of turmeric is washed with soap, stain is converted into reddish brown colour

Q.6 Name three organic and three inorganic acids.

Ans. Organic acids : (i) Acetic acid (ii) Tartaric acid (iii) Ascorbic acid

Inorganic acids : (i) hydrochloric acid (ii) Sulphuric acid (iii) Nitric acid

LONG ANSWER TYPE QUESTION

Q.7 Describe the process of neutralization with the help of an example.

Ans. The reaction between an acid and a base is known as neutralisation. Salt and water are produced in this process with the evolution of heat. Evolved heat is known as heat of neutralisation .

Acid + Base $\longrightarrow$ Salt + Water

eg.

Indigestion : People particularly of old age suffer from acidity problems in the stomach which is caused mainly due to release of excessive gastric juices containing HCl. The acidity is neutralised by antacid tablets which contain sodium hydrogen carbonate (baking soda), magnesium hydroxide etc.

Q.8 What are indicators ? Name any three indicators and state the colour change which takes place in (i) acids (ii) bases.

Ans. An indicator is a substance which indicates the nature of particular solution whether acidic, basic or neutral. Hence they indicate the change in nature of the solution from acidic to basic and vice versa. Indicators are basically coloured organic substances.

S.N.	Indicator	Colour in acidic medium	Colour in basic medium
1.	Blue litmus	Red	Blue
2.	Red litmus	Red	Blue
3.	Turmeric	Yellow	Raddish-brown

Q.9 Explain why :

(a) An antacid tablet is taken when you suffer from acidity.

(b) Calamine solution is applied on the skin when an ant bites

Ans. (a) People particularly of old age suffer from acidity problems in the stomach which is caused mainly due to release of excessive gastric juices containing HCl. The acidity is neutralised by antacid tablets which contain sodium hydrogen carbonate (baking soda), magnesium hydroxide etc.

(b) The stings of bees and ants contain formic acid. Its corrosive and poisonous effect can be neutralised by rubbing soap which contains NaOH (an alkali) or by rubbing baking soda ($NaHCO_3$) or by calamine solution ($ZnCO_3$). The stings of wasps contain an alkali and its poisonous effect can be neutralised by an acid like acetic acid (present in vinegar).

CONCEPT APPLICATION LEVEL - III

SECTION–A

FILL IN THE BLANKS :

Q.1 When acid and base react, _____ and _____are formed.

Q.2 China rose _____ in acidic medium and _____ in basic medium.

Q.3 _____ are used to test acidic and basic nature of solution.

Q.4 Calamine solution contains _____

Q.5 _____ indicator is redish-brown in basic medium.

TRUE (T) OR FALSE (F) :

Q.6 Bases turn blue litmus red. [ ]

Q.7 Phenolphthalein is colourless in basic medium. [ ]

Q.8 If soil is too acidic, quicklime is added to it. [ ]

Q.9 Sulphuric acid is present in the stomach. [ ]

Q.10 China rose has different colour in acidic, basic and neutral medium. [ ]

MATCH THE GIVEN COLUMNS :

Q.11

	Column-A	Column-B
1	A substance which turns turmeric solution reddish brown	a. Base
2	A reaction between an acid and a base.	b. Acetic acid
3	An acid present in vinegar	c. Neutralisation
4	An indicator derived from lichen	d. Ant
5.	An insect whose sting contains acid	e. Litmus

Q.12

	Column-A		Column-B
1.	Tartaric acid	a.	Soap
2.	Calcium hydroxide	b.	Curd
3.	Formic acid	c.	Unripe mangoes
4.	Sodium hydroxide	d.	Ant sting
5.	Lactic acid	e.	Lime water

Q.13

	Column-A		Column-B
1.	Tamarind	a.	Acetic acid
2.	Vinegar	b.	Lactic acid
3.	Lemon	c.	Tartaric acid
4.	Sour milk	d.	Citric acid
5.	Apple	e.	Malic acid

SECTION–B

MULTIPLE CHOICE QUESTIONS :

Q.1 Lime water is -
(A) dilute solution of $Ca(OH)_2$ (B) $Mg(OH)_2$ solution
(C) NaOH solution (D) KOH solution

Q.2 Which of the following is a base and not an alkali ?
(A) NaOH (B) KOH (C) $Fe(OH)_3$ (D) None of these

Q.3 Nature of aqueous solution of Ammonia is -
(A) acidic (B) basic (C) neutral (D) None of these

Q.4 Neutralization reaction is an example of -
(A) Exothermic reaction (B) Endothermic reaction
(C) Oxidation (D) None of these

Q.5 An indicator that turns reddish brown when dissolved in soap solution is -
(A) litmus (B) china rose (C) turmeric powder (D) None of these

Q.6 Which of the following is not an indicator ?
(A) Methyl orange (B) Litmus (C) China rose (D) Sunflower

Q.7 Which of the following is a strong acid ?
(A) Acetic acid (B) Citric acid (C) Nitric acid (D) Tartaric acid

Q.8 Acetic acid is used -
(A) as soda water (B) for preparing soaps
(C) in flavouring food items (D) to manufacture detergents.

Q.9 The acid present in lemon is -
(A) citric acid (B) oxalic acid (C) acetic acid (D) hydrochloric acid

Q.10 ..... is known as ascorbic acid which is present in citrus fruits.
(A) Vitamin D (B) Vitamin C (C) Vitamin A (D) Vitamin K

Q.11 When a drop of phenolphthalein is introduced in lime water, the solution turns.
(A) blue (B) red (C) milky (D) pink

Q.12 Acids are ---------- in taste while bases are ---------- in taste.
(A) sweet, salty (B) sweet, sour (C) sour, salty (D) sour, bitter

Q.13 A base which dissolves in water is called -
(A) a soluble base (B) an alkali (C) an acid (D) an oxide

Q.14 Choose the correct statement (s)
(i) Most of the acids are water soluble.
(ii) Acids react with metallic oxides and hydroxides form metallic salt and water only.
(iii) Acids react with metallic carbonates to form metallic salt and hydrogen gas and water.
(iv) Acetic acid is used as a food preservative.
(A) (i) & (ii) only (B) (iii) & (iv) (C) (i), (ii) & (iv) (D) All the above

Q.15 Match the following compounds with their use:

(i) Caustic soda	(a) Bleaching powder
(ii) Phosphoric acid	(b) Dyeing industry
(iii) Calcium hydroxide	(c) Manufacture of medicine
(iv) Hydrochloric acid	(d) Manufacture of phosphatic fertilizers

(A) (i)-(b), (ii)-(d),(iii)-(a),(iv)-(c) (B) (i)-(c), (ii)-(a), (iii)-(d),(iv)-(b)
(C) (i)-(c),(ii)-(d),(iii)-(a),(iv)-(b) (D) (i)-(b),(ii)-(a),(iii)-(d),(iv)-(c)

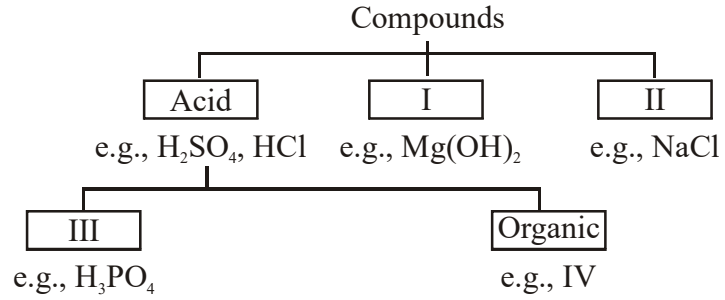
Q.16 Acidic soil which is not good for healthy growth of plants , is neutralized by
(A) potassium hydroxide (KOH) (B) calcium oxide (CaO)
(C) sodium hydroxide (NaOH) (D) magnesium hydroxide ($Mg(OH)_2$)

Q.17 The acid present in our stomach which helps in digestion of food -
(A) sulphuric acid (H_2SO_4) (B) nitric acid (HNO_3)
(C) hydrochloric acid (HCl) (D) phosphoric acid (H_3PO_4)

Q.18 When turmeric stain on white clothes is washed with soap it turns red in colour because -
(A) soap solution is acidic (B) soap solution is neutral
(C) soap solution is basic (D) both (A) and (B)

Q.19 When magnesium oxide (MgO) react with water to form magnesium hydroxide [$Mg(OH)_2$], a base, it turns _____ litmus to _____ .
(A) blue, red (B) blue, colourless (C) red, blue (D) colourless, blue

Q.20 Observe the given flow chart carefully and mark the option that best represents I, II, III and IV



[SOF-2010]

	I	II	III	IV
(A)	Mineral	Base	Salt	Acetic acid
(B)	Mineral	Salt	Base	Acetic acid
(C)	Salt	Base	Acetic acid	Mineral
(D)	Base	Salt	Mineral	Acetic acid

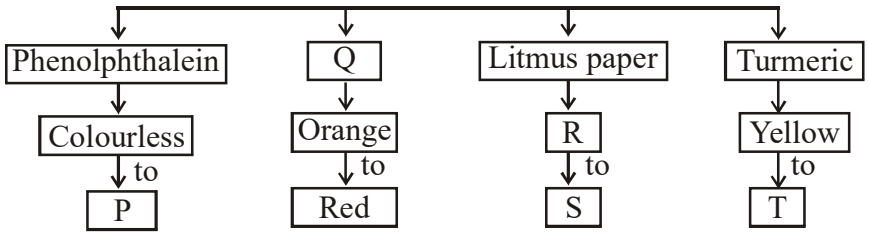
Q.21 Rishi burnt a magnesium ribbon, and it burnt with a dazzling white flame. A powdery ash was formed. He collected the ash and dissolved it in water. The product formed and nature of the product could be _____. **[SOF-2011]**

(A) MgO, acidic (B) MgO, basic (C) $Mg(OH)_2$, basic (D) $Mg(OH)_2$, acidic

Q.22 In summers, if milk is not refrigerated, it becomes sour. Which of the following is added by milkmen to fresh milk to prevent the milk from spoiling ? **[SOF-2011]**

(A) Caustic soda (B) Potash alum (C) Baking soda (D) Lime water

Q.23 When acids are added to different indicators, some colour changes occur. These colour changes are listed below. **[SOF-2011]**



identify P, Q, R, S and T respectively.

	P	Q	R	S	T
(A)	Colourless	Methyl orange	Blue	Red	Yellow
(B)	Colourless	China rose	Blue	Red	Yellow
(C)	Pink	Methyl orange	Blue	Red	Reddish-brown
(D)	Pink	China rose	Red	Blue	Reddish-brown

ANSWER KEY

CONCEPT APPLICATION LEVEL - III

SECTION–A

FILL IN THE BLANKS :

Q.1 Salt and water Q.2 Dark pink, Green Q.3 Indicators
Q.4 $ZnCO_3$ Q.5 Turmeric

TRUE (T) OR FALSE (F) :

Q.6 F Q.7 F Q.8 T Q.9 F Q.10 T

MATCH THE GIVEN COLUMNS :

Q.11 (1) $\rightarrow$ a, (2) $\rightarrow$ c, (3) $\rightarrow$ b, (4) $\rightarrow$ e, (5) $\rightarrow$ d
Q.12 (1) $\rightarrow$ c, (2) $\rightarrow$ e, (3) $\rightarrow$ d, (4) $\rightarrow$ a, (5) $\rightarrow$ b
Q.13 (1) $\rightarrow$ c, (2) $\rightarrow$ a, (3) $\rightarrow$ d, (4) $\rightarrow$ b, (5) $\rightarrow$ e

SECTION–B

MULTIPLE CHOICE QUESTIONS :

Q.1	A	Q.2	C	Q.3	B	Q.4	A	Q.5	C	Q.6	D	Q.7	C
Q.8	C	Q.9	A	Q.10	B	Q.11	D	Q.12	D	Q.13	B	Q.14	C
Q.15	C	Q.16	B	Q.17	C	Q.18	C	Q.19	C	Q.20	D	Q.21	B
Q.22	C	Q.23	A										