Chapter 2

Acid, Base and Salt

Time Allocation

Teaching periods	= 14
Assessment period	= 02
Weightage	= 15%

MAJOR CONCEPTS:

2.1 Concepts of Acids, Bases
2.2 Concept of pH and pOH
2.3 Salts

STUDENTS LEARNING OUT COMES (SLO'S)

Students will be able to:

- Define and give examples of Arrhenius acids and bases. (Understanding)
- Use the Bronsted-Lowry theory to classify substances as acids or bases, or as proton donors or proton acceptors. (Applying)
- Classify substances as Lewis acids or bases. (Analyzing)
- Write the equation for the self-ionization of wate .(Remembering)
- Give the hydrogen ion or hydroxide ion concentration, classify a solution as neutral, acidic, or basic. (Applying)
- Compute and balance a neutralization reaction. (Applying)
- Define Buffers and give examples. (Understanding)

Introduction:

We use in our daily life a large number of substances such as common salt, sugar, vinegar, lemon and tamarind. Do these all substances have same taste? Some of these compounds have a sour flavor, while others have a bitter flavor, a sweet flavor, or a salty flavor for example curd, vinegar, lemon, and orange juice have a sour flavor, they are acidic. Bitter-gourd, coffee, and chocolate have a bitter flavor, making them basic in nature, but common salt and alum have a salty taste, making them salts. The acids are quite beneficial in the production of homeopathic and allopathic medications, syrups, and tablets. Batteries, paints, paper, fertilizer, detergent, and fertilizer all employ the H_2SO_4 acid.

In our stomach, HCl is utilized to breakdown food. Carbonic, citric, and phosphoric acids are utilized in soda to neutralize gastric acidity. The bases are beneficial in a variety of situations. In the soap and paper industries, sodium hydroxide (NaOH) is utilized. Cement and plaster of Paris are both made from calcium hydroxide ($CaOH_2$). Ammonia is used in the production of fertilizers. Ammonium nitrate, for example, is used in fertilizers, silver bromide is used in photography, and calcium chloride is utilized as a drying agent.

2.1 Concepts of acids and bases

2.1.1 Arrhenius theory of acids and bases (1880s)

The Svante Arrhenius put forwarded a theory related to acids and bases. According to this theory, the acids are those substances that produce Hydrogen (H^+) ions when dissolved in water are called acids (HCl, HNO_3, CH_3COOH, HCN) and bases are those substances that produce hydroxide ions (OH^-) when dissolved in water. (NaOH, KOH, NH_4OH, $Ca(OH)_2$).

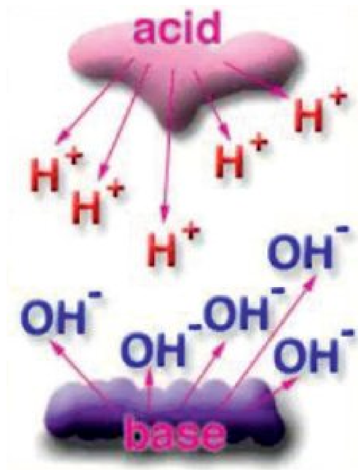


Figure 2.1 Hydrogen and Hydroxide ions of Acid and Base.

Properties of acids are due to presence of Hydrogen ions (H^+)

$$HCl_{(aq)} \longrightarrow H^+_{(aq)} + Cl^-_{(aq)}$$

$$HNO_{3(aq)} \longrightarrow H^+_{(aq)} + NO_3^-{}_{(aq)}$$

Properties of bases are due to presence of Hydroxide ions (OH^-)

$$NaOH_{(aq)} \longrightarrow Na^+_{(aq)} + OH^-_{(aq)}$$

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

A salt is an ionic compound that is formed by the reaction of an acid and base.

$$HBr + KOH \longrightarrow KBr + H_2O$$
$$\text{acid} + \text{base} \longrightarrow \text{salt} + \text{water}$$

Limitations of Arrhenius theory

- Hydrogen ions do not exist in water solution and they react with water to form Hydronium ions (H_3O^+).
- The Arrhenius theory does not explain the basicity of ammonia (NH_3), acidity of Carbon dioxide (CO_2) and other similar compounds.
- It is only applicable in aqueous solutions.

2.1.2 Bronsted-lowry theory of acids and bases (1923)

In 1923 a Danish chemist Bronsted and an English chemist Lowry proposed new definitions of acid and base. According to this theory any substance behaves as an acid when it donates a proton (H^+) to a base and any substance which accepts a proton, it behaves like a base, so acids are proton donor and bases are proton acceptors they both react with water to produce hydronium ions (H_3O^+).

Let us consider the dissolution of hydrogen chloride in water. In this reaction HCl donates its one proton to water (H_2O), and water (H_2O) accepts one proton to become H_3O^+.

$$HCl_{(aq)} + H_2O_{(aq)} \rightleftharpoons H_3O^+_{(aq)} + Cl^-_{(aq)}$$

Thus HCl is a Bronsted acid and H_2O is Bronsted base. H_3O^+ is Conjugated acid and Cl^- is a Conjugated base.
Let us consider another following reaction

$$\underset{\text{Acid}}{CH_3COOH_{(aq)}} + \underset{\text{Base}}{H_2O_{(aq)}} \rightleftharpoons \underset{\text{Conjugated Base}}{CH_3COO^-_{(aq)}} + \underset{\text{Conjugated Acid}}{H_3O^+_{(aq)}}$$

It is a reversible reaction. In the forward reaction acetic acid is an acid which is donating proton while water is a base and accepting proton. Like this we have pairs of conjugated acid-base pairs. Conjugated acid is produced by accepting proton by a base and conjugated base is produced by donating proton from an acid.

Conjugated acid-base pair

$$CH_3COOH_{(aq)} + H_2O_{(aq)} \rightleftharpoons CH_3COO^-_{(aq)} + H_3O^+_{(aq)}$$

Acid Base Conjugated Base Conjugated Acid

Conjugated acid-base pair

Table 2.1 Bronsted –Lowry conjugated acid-base pairs

Acid		Base		Conjugated acid		Conjugated base
HCl	+	H_2O	$\rightleftharpoons$	H_3O^+	+	Cl^-
H_2SO_4	+	H_2O	$\rightleftharpoons$	H_3O^+	+	HSO^-_4
HSO^-_4	+	H_2O	$\rightleftharpoons$	H_3O^+	+	SO_4^{2-}
CH_3COOH	+	H_2O	$\rightleftharpoons$	H_3O^+	+	CH_3COO^-
NH^+_4	+	H_2O	$\rightleftharpoons$	H_3O^+	+	NH_3
H_2O	+	CN^-	$\rightleftharpoons$	HCN	+	OH^-
HCl	+	NH_3	$\rightleftharpoons$	NH_4^+	+	Cl^-

Limitations of Bronsted-Lowry concept

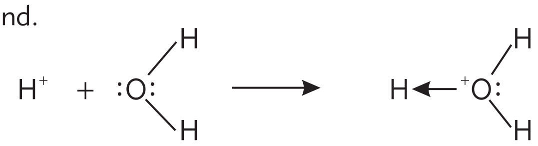
- It could not explain the acidic nature of compounds having no tendency to lose H^+ ions. Examples CO_2, $AlCl_3$, SO_3.
- It could not explain the basic nature of compounds having OH^- ions, Examples NaOH, Ca $(OH)_2$, KOH.

2.1.3 Lewis theory of Acid-Base (1923)

Gilbert N. Lewis put forwarded his definitions of acids and bases in the year 1923. According to this theory,

"An acid is a substance that is capable of accepting an electron pair, and base is a substance that is capable of donating an electron pair." Thus, a Lewis acid is an electron pair acceptor, and a Lewis base is an electron pair donor.

The proton (H^+) is capable of accepting a pair of electrons while H_2O is capable of donating a pair of electrons to form a covalent bond. So, according to the Lewis concept, H^+ is a Lewis acid and H_2O is a Lewis base. In the Lewis sense, it is the formation of a coordinate covalent or "donor-acceptor" bond.



Lewis acid   Lewis base   Adduct

Consider the reaction,

$$:NH_3 + BF_3 \longrightarrow H_3N:\rightarrow BF_3 \text{ or } H_3NBF_3$$

base   acid   product

$:NH_3$ is a donor of electron pair and BF_3 is acceptor of a pair of electrons. So, according to the Lewis concept, NH_3 is a Lewis base, and BF_3 is Lewis acid.

Limitations of Lewis Acid and Base concept

- It could not explicate the release of energy during the formation of a covalent bond.
- It could not clarify the shapes of molecules and amount of energy released during covalent bond formation.
- It could not explain the nature of attractive forces between the constituent atoms of a molecule.

Table 2.2 Summarized form of acid base theories.

The Arrhenius theory	The Bronsted-Lowry theory	The Lewis Theory
Acids are substances that produce Hydrogen ion and Bases are substances that produce Hydroxyl (OH^-) when dissolved in water.	An acid is a proton donor (H^+). and A base is proton acceptor.	Acids are electron pair acceptors. and Bases are electron pair donors.
HCl and NaOH	NH_3 and H_2O	BF_3 and NH_3

Balancing of neutralization reaction

As we know that a neutralization reaction takes place by the reaction of an acid and a base in aqueous solution producing a salt and water. A neutralization reaction shown by a balanced chemical equation which have equal number of atoms as well as positive and negative charges on reactants and product sides. The balancing of a neutralization involves the equal consumption of H^+ and OH^- in aqueous solution due to this we have to look the acidity of base and basicity of acid in balancing equation. For example, in chemical equation of neutralization of sodium hydroxide and hydro chloric acid is as follows

$$NaOH + HCl \longrightarrow NaCl + H_2O$$

NaOH and HCl are neutralizing each other in ratio 1:1, because one mole of NaOH releases one mole of OH^- and one mole of HCl releases one mole of H^+. Similarly, NaOH or KOH when reacted with HBr, HI, HNO_3 shows ratio of 1:1. One mole of each HI, HNO_3 and HBr releases one mole of H^+.

Test Yourself

1. Why Arrhenius theory is only applicable on aqueous solutions?
2. Write down conjugated acid and conjugated base of following reactants?
   (I) $HCl + H_2O$ (II) $H_2SO_4 + H_20$ (III) $NH_4^+ + H_2O$

2.2 Concept of pH and pOH

Water ionization:

The water is a neutral liquid which posses equal number of hydrogen(H^+)and hydroxide ion (OH^-) due to this pure water is consider as a weak electrolyte. It ionize according to following reaction,

$$H_2O_{(aq)} \rightleftharpoons H^+_{(aq)} + OH^-_{(aq)}$$

The equilibrium constant of (K_c) of water is given by,

$$K_c = \frac{[H^+][OH^-]}{[H_2O]}$$

The square brackets represents the molar concentration of species and its units are mole dm^{-3}. As we know that ionization of water is very small so the concentration is approximately unchanged and consider as constant (Kw) so, the equation will be

$$K_c[H_2O] = [H^+][OH^-]$$

$$K_c[H_2O] = K_w$$

$$K_w = [H^+][OH^-]$$

Where K_w is ionic product constant of water and its value is $1 \times 10^{-14} (mol\ dm^{-3})^2$.

pH and pOH

The concept of pH was first introduced by th Danish chemist Soren Peder Lauritz Sorensen at the Carlsberg Laboratory in 1909."pH" is an abbreviation for "potential hydrogen" and is a scale used for measuring the relative acidity or alkalinity of a liquid solution.

pH: A measurement of the concentration of Hydrogen ions (H^+) in a solution. It may also be defined as "the negative logarithm of Hydrogen ion concentration".
Mathematically

$$pH = -\log [H^+]$$

pOH: A measurement of the concentration of Hydroxyl ions (OH^-) in a solution. It may also be defined as "the negative logarithm of Hydroxyl ion concentration".
Mathematically

$$pOH = -\log [OH^-]$$

pH Scale: The pH scale measures the acidity or basicity of a substance. The scale has values ranging from zero (the most acidic) to 14 (the most basic). The pH of different solutions can be measured by pH paper, pH indicator and pH meter.

Table 2.3 Relationship between $[H^+]$, the $[OH^-]$, and pH of solutions

	$[H^+]$ (mol dm^{-3})	$[OH^-]$ (mol dm^{-3})	pH	Aqueous system
Increasing acidity ↑	1×10^{0}	1×10^{-14}	0.0	1M HCl (0.0)
	1×10^{-1}	1×10^{-13}	1.0	0.1M HCl (1.0)
	1×10^{-2}	1×10^{-12}	2.0	Gastric juice (1.6–1.8)
	1×10^{-3}	1×10^{-11}	3.0	Lemon juice (2.3), vinegar (2.4–3.4)
	1×10^{-4}	1×10^{-10}	4.0	Soda water (3.8), tomato juice (4.2)
	1×10^{-5}	1×10^{-9}	5.0	Black coffee (5.0)
	1×10^{-6}	1×10^{-8}	6.0	Milk (6.3–6.6), urine(5.5–7.0)
Neutral	1×10^{-7}	1×10^{-7}	7.0	Pure water (7.0), saliva (6.2–7.4)
	1×10^{-8}	1×10^{-6}	8.0	Blood (7.35–7.45), bile (7.8–8.6)
	1×10^{-9}	1×10^{-5}	9.0	Sodium bicarbonate (8.4), sea water (8.4)
	1×10^{-10}	1×10^{-4}	10.0	Milk of magnesia (10.5)
	1×10^{-11}	1×10^{-3}	11.0	Household ammonia (11.5)
	1×10^{-12}	1×10^{-2}	12.0	Washing soda (12.0)
	1×10^{-13}	1×10^{-1}	13.0	0.1M NaOH (13.0)
Increasing basicity ↓	1×10^{-14}	1×10^{0}	14.0	1M NaOH (14.0)

Note: pH + pOH = 14

Example. 1

A solution of HCl has pH of 2.3: calculate its pOH and $[H^+]$?

Solution: pH + pOH = 14

pOH = 14

-pH,

pOH = 14-2.3,

pOH = 11.7

pH = -log $[H^+]$,

$10^{x} = [H^+]$,

$10^{-pH} = [H^+]$,

$10^{-2.3} = [H^+]$,

Example. 2

Find pH, pOH, $[OH^-]$ and $[H^+]$ of 2.46 x 10^{-9} M KOH solution?

Solution: $KOH \longrightarrow K^+ + OH^-$

$[2.46 \times 10^{-9}]$

$[H^+][OH^-] = 1 \times 10^{-14}$ pH = -log $[H^+]$

$H^+ = \frac{1 \times 10 - 14}{2.46 \times 10^{-9}}$ pH = -log $[4.07 \times 10^{-6}]$

$[H^+] = 4.07 \times 10^{-6}$ pH = 5.39

$[OH^-] = 2.46 \times 10^{-9}$

pH + pOH = 14   pOH = 14 - pH,

pOH = 14-5.39,

pOH = 8.61

Test Yourself

1. Why pure water is consider as weak electrolyte?
2. What is the pH value of following?
   Lemon Juice, Soda Water, Black Coffee, Milk, Washing Soda

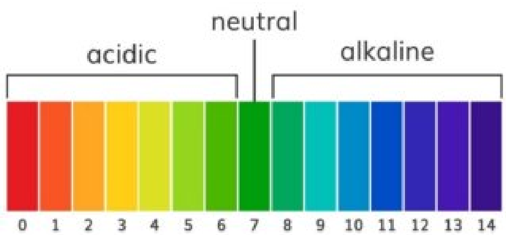


Figure 2.2 pH scale

2.3 Salts

Salt is an ionic compound that contains a cation (from base) and an anion (from acid).

It is present in large quantities in seawater, where it is the main mineral constituent. Salt is important for animal life and saltiness is one of the basic human tastes. Salt is an ionic compound that has a cation other than H^+ and an anion other than OH^- and is obtained along with water in the neutralization reaction between acids and bases.

Examples: NaCl, $CuCl_2$ etc.

$$\textbf{Acid + Base} \longrightarrow \textbf{Salt + water}$$

$$NaOH + HCl \longrightarrow NaCl + H_2O$$
(Sodium chloride)

$$2KOH + H_2SO_4 \longrightarrow K_2SO_4 + 2H_2O$$
(Potassium sulphate)

$$Ca(OH)_2 + 2HNO_3 \longrightarrow Ca(NO_3)_2 + 2H_2O$$
(Calcium nitrate)

2.3.1 Preparation of Salts

1. Salts are produced by the action of acids on metals, metal oxides, metal hydroxide, metal carbonates and metal bi carbonates

$$CaO_{(s)} + H_2SO_{4(aq)} \longrightarrow CaSO_{4(s)} + H_2O_{(l)}$$
(Calcium oxide) (Calcium sulphate)

$$KOH_{(aq)} + HNO_{3(aq)} \longrightarrow KNO_{3(aq)} + H_2O_{(l)}$$
(Potassium hydroxide) (Potassium nitrate)

$$BaCO_{3(s)} + 2HCl_{(aq)} \longrightarrow BaCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$$
(Barium carbonate) (Barium chloride)

2. Salts are produced by the action of a base with an acid or a metal with a base

$$H_2SO_{4(aq)} + 2NaOH_{(aq)} \longrightarrow Na_2SO_{4(aq)} + 2H_2O_{(l)}$$
(Sodium sulphate)

2.3.2 Types of Salts

(I) Acidic salt: Acidic salts are those salts which are distinctly acidic in nature they produce acidic solution when dissolved in water. For example NH_4Cl, $Ca(NO_3)_2$, $NaHSO_4$, NaH_2PO_4. Such salts solution have pH less than 7.

(ii) Basic salt: Basic salts are those salts which are distinctly basic in nature they produce alkaline solution when dissolved in water. For example CH_3COONa, K_2CO_3, Na_2CO_3, KCN. Such salts solution have pH more than 7.

(iii) Neutral salt: Neutral salts are those salts which are formed by the complete neutralization of a strong base and strong acid. The aqueous solutions of these salts are neutral to litmus paper. For example NaCl, KCl, K_2SO_4, $NaNO_3$. Such salts are neutral with pH 7.

2.3.3 Uses of some salts

Salts play an important role in our daily life. The following are some uses of salts

1. Most of the chemical fertilizers used in agriculture by farmers are salts. for example: ammonium chloride, ammonium nitrate, ammonium phosphate, potassium chloride and nitrogen, phosphorus and potassium (NPK) fertilizers.
2. Certain salts are used as pesticides to kill or destroy insects, pests, weeds and fungi. For examples: Copper (II) sulphate, Iron (II) sulphate and mercury chloride.
3. In medical field hydrated calcium sulphate, $CaSO_4.2H_2O$, is found in plaster of Paris. It is used to make plaster casts for supporting broken bones.
4. Patients suffering from anemia use iron (II) sulphate heptahydrate, $FeSO_4.7H_2O$ is an ingredient in 'iron pills' as food supplement.
5. Sodium hydrogen carbonate is an ingredient in anti-acids. This salt can neutralize the excess acid secreted by the stomach.
6. Barium sulphate is used to make barium meals for patients who need to take an X-ray of their stomach. The salt helps to make internal soft organs like intestines appear on X-ray films.
7. Potassium per manganate (VII) can kill bacteria and hence is suitable for use as a disinfectant.

2.3.4 Concept of buffers

There are two key terms associated with buffers. A buffer is an aqueous solution that has a highly stable pH. A buffering agent is a weak acid and its conjugated base or weak base and its conjugated acid. That helps to maintain the pH of an aqueous solution after adding another acid or base. If you add an acid or a base to a buffered solution, its pH will not change significantly. Similarly, adding water to a buffer or allowing water to evaporate will not change the pH of a buffer. "So a buffer is a solution that can resist pH change upon the addition of acidic or basic components. It is able to neutralize small amounts of added acid or base, thus maintaining the pH of the solution relatively stable."

- The pH of a buffer is independent of ionic strength.
- The pH of a buffer is dependent on temperature.

Test Yourself

1. Which of the following are salt?
   HCl , NaCl, NaOH, KOH, K_2SO_4, KNO_3 ,HNO_3, $BaCl_2$
2. List down the types of Salts?

Do You Know?

Types of buffer

There are two types of buffers

Acidic buffer

are made from a weak acid and its salts

Example:

CH_3COOH-CH_3COONa

• CH_3COOH - weak acid

• $CH_3COO^-Na^+$

SALT(CONJUGATED BASE)

Basic buffer

are made from a weak base and its salts

Example:

NH_3-NH_4Cl

• NH_3-weak base

• NH_4Cl^-

SALT(CONJUGATED acid)

Society, Technology and Science

pH dependent food

The food we eat are considered as acidic, alkaline or neutral, such as meat, fish, dairy products, eggs and grains are acidic. Natural fats, starch and sugar are neutral in nature while fruits, nuts, legumes and vegetables are alkaline in nature. The pH of acidic food is 0 to 7 while the neutral food has exact pH 7 and alkaline food is from pH 7 to 14. A healthy human body required a controlled pH level in the serum upto 7.4, which is slightly alkaline.

Harmful effects of acid rain

It affects both animals and humans' respiratory systems.

Acid rain has an impact on the aquatic ecology when it falls and runs into rivers and ponds. It creates water pollution by changing the chemical composition of the water to a state that is damaging to the aquatic ecosystem's ability to exist.

Acid rain also causes water pipelines to corrode, resulting in heavy metals such as iron, lead, and copper seeping into drinking water.

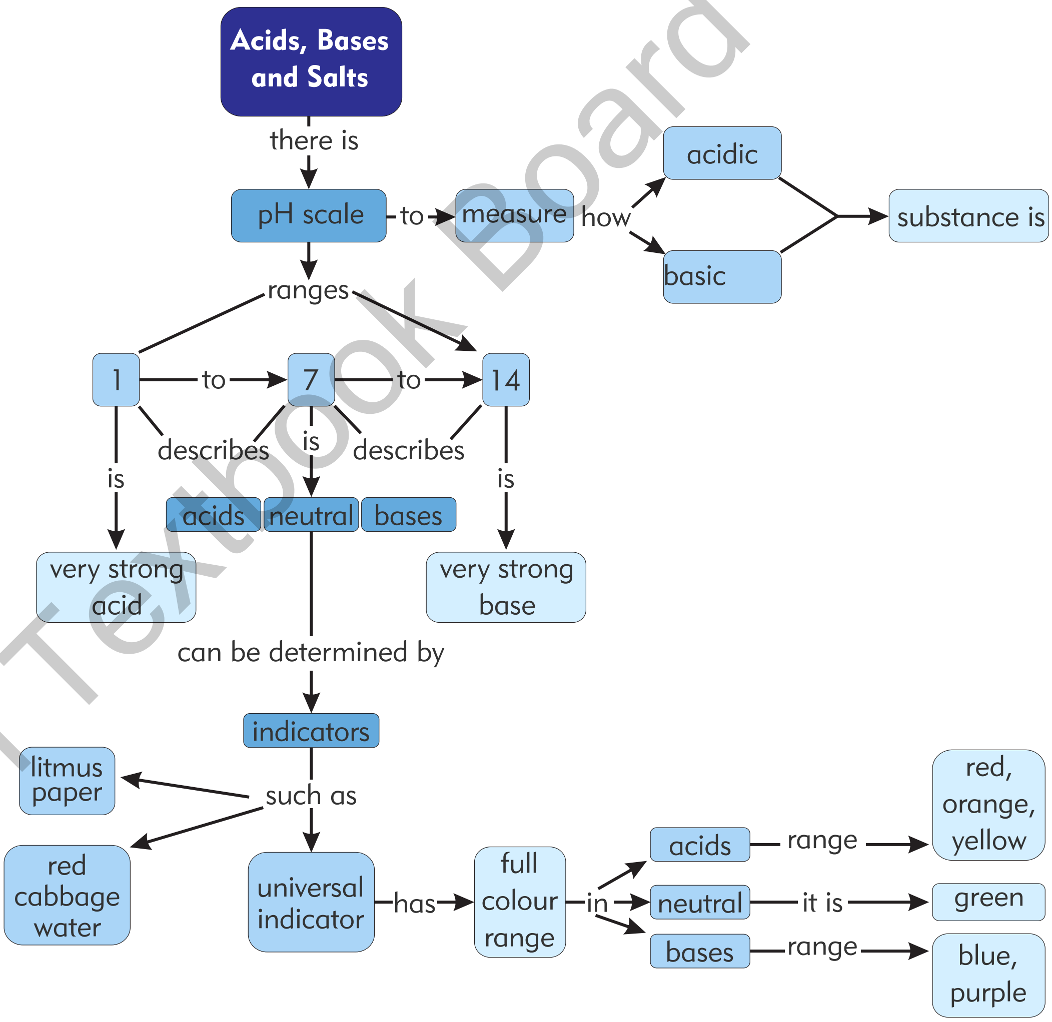
It causes damage to stone and metal structures and monuments.

Stomach acidity

Stomach acid, also known as gastric acid, is a colorless, watery fluid generated by the lining of the stomach. It's very acidic and aids digestion by breaking down meals. This makes it easier for your body to absorb nutrients when food passes through your digestive tract.

Laying on your back or bending down at the waist after eating a large meal. Snacking right before night. Consuming citrus, tomato, chocolate, mint, garlic, onions, or spicy or fatty meals. Consuming alcoholic beverages, carbonated beverages, coffee, or tea etc.

CONCEPT MAP FOR ACID AND BASE



Summary

- Acids are sour in taste, give H^+ ion in aqueous solution and change the color of blue litmus paper to red.
- Acids are corossive.
- Bases are bitter in taste, give OH^- ion in aqueous solution and change the color of red litmus paper to blue.
- According to Arrhenius theory acids gives H^+ ion in aqueous solution while base gives OH^- ion in aqueous solution.
- According to Brønsted-Lowry theory acids are proton donor and bases are proton acceptor.
- Conjugate acid is specie which is formed as a result of acceptance of proton by a base.
- Conjugate base is specie which is formed as a result of donation of proton from the acid.
- Lewis acid is a substance that can accept a pair of electron to form a coordinate covalent bond.
- Lewis base is a substance that can donate a pair of electron to form a coordinate covalent bond.
- Water is amphoteric in nature it behaves like an acid as well as base.
- Ionization constant for water is also called as ion product constant for water. Its value is 1×10^{-14} at 25° C.
- In pure water the $[H^+] = [OH^-] = 1 \times 10^{-7}$, that why water is neutral has pH=7.
- Acids have pH less than 7.
- Bases have pH greater than 7.
- pH of solution can be measured in several ways for e.g. by using litmus paper, universal indicator paper, indicators and by pH meter.
- Indicators are weak organic acid or base which change their color over small range of pH.
- A titration is a technique where a solution of known concentration is used to determine the concentration of an unknown solution. Typically, the titrant (the known solution) is added from a burette to a known quantity of the analyte (the unknown solution) until the reaction is complete.
- Salt is a product of acid base reaction. It's a combination of cation (from base) and anion (from acid).
- Neutralization is a reaction between acid and base to produce salt and water.
- Acidic salt contains one or more replaceable H atom.
- Buffer solution is solution which resists the change in pH of solution against the addition of small amount of acid or abase.

Exercise

SECTION- A: MULTIPLE CHOICE QUESTIONS

Encircle the correct answer in each case.

1. **Corrosive effect on skin is caused by:**
   (a) acid (b) base (c) salt (d) both a & b

2. **Preservatives are used to preserve :**
   (a) acids (b) bases (c) food (d) water

3. **Which of the following is not an Arrhenius acid:**
   (a)HCl (b) CO_2 (c) HNO_3 (d) H_2SO_4

4. **NH_3 can be a base according to :**
   (a) Arrhenius theory (b) Bronsted- lowery theory
   (c) Lewis theory (d) both b and c

5. **Which of the following is a Lewis base?**
   (a) HNO_3 (b) CN^- (c) HCl (d) $AlCl_3$

6. **A substance that can donate a pair of electron to form coordinate covalent bond:**
   (a) Lewis acid (b) Lewis base
   (c) Bronsted- Lowery acid (d) Bronsteed-Lowery base

7. **If pH value is greater than 7, then solution is :**
   (a) acidic (b) basic (c) amphoteric (d) neutral

8. Salt among following is :
   (a) HCl (b) KCl (c) HNO_3 (d) H_2SO_4

9. **Substances that react with both acids and bases are called :**
   (a) conjugate acids (b) conjugate bases
   (c) amphoteric substances (d) Buffers

10. **The reaction of acid and base to form salt and water is called :**
    (a) hydration (b) Neutralization (c) hydrolysis (d) both a & c

SECTION- B: SHORT QUESTIONS:

1. Discuss the properties of acid and base.
2. Elaborate the Arrhenius concept of acid and base with suitable example.
3. What is Bronsted –lowery acid- base theory?
4. What are conjugate acid base pairs? Explain with examples.
5. Classify the following solutions as acidic, basic or neutral.

   A solution that has $[H^+] = 1\times10^{-4}$ mol. dm^{-3}

   A solution that has $[H^+] = 1\times10^{-11}$ mol. dm^{-3}

   A solution that has $[OH^-] = 1\times10^{-9}$ mol. dm^{-3}

   A solution that has $[OH^-] = 1\times10^{-3}$ mol. dm^{-3}
6. Elaborate the ionization equation of water.
7. Define the following terms;

   (a) pH (b) Indicator (c) Neutralization (d) Titration
8. Define buffers. What is the composition of buffers? Discuss its importance in our daily life.

SECTION- C: DETAILED QUESTIONS:

1. Describe salts, preparation of salts and types of salts.
2. Explain in detail that how water ionization is related with pH of solution?
3. Discuss in detail how different solutions in aqueous system exhibit increase in acidity and increase in basicity on the basis of H^+ and OH^-?
4. What do you mean by balancing of neutralization reaction with the help of examples?
5. Write down the uses of salt in daily life.

SECTION- D: Numerical

1. Calculate pH of 5M solution of NaOH.
2. A solution of H_2SO_4 has pH of 1.05 calculate its pOH and $[H^+]$.
3. The hydrogen ion concentration of a solution is 1×10^{-8} mol. dm^{-3}. what is pH of the solution?