



Class: 10th

Subject: Chemistry

Chapter 10: Acid, Bases And Salts

Important MCQs:

1. Which of the following statements is true about strong acids and bases?

- (a) They ionize partially in water
- (b) They do not ionize at all
- (c) They ionize completely in water
- (d) They produce salts directly

2. According to the Arrhenius concept, an acid:

- (a) Donates proton
- (b) Produces OH^- ions
- (c) Produces H^+ ions in aqueous solution
- (d) Accepts electron pair

3. In Bronsted-Lowry concept, base is defined as:

- (a) Electron donor
- (b) Proton donor
- (c) Proton acceptor
- (d) Proton neutralizer

4. The Bronsted-Lowry concept is applicable in:

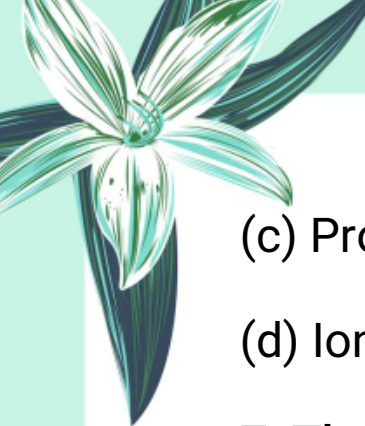
- (a) Only aqueous solution
- (b) Only gaseous states
- (c) Non-aqueous solutions
- (d) Metallic solutions only

5. Which of the following is amphoteric in nature?


- (a) HCl
- (b) NaOH
- (c) H_2O
- (d) KNO_3

6. According to Lewis concept, a base is:


- (a) Electron pair acceptor
- (b) Electron pair donor

- 
- (c) Proton donor
 - (d) Ion producer in water


7. The product formed in a Lewis acid-base reaction is called:

- 
- (a) Salt
 - (b) Water
 - (c) Adduct
 - (d) Buffer

8. What does the pH scale measure?

- 
- (a) Concentration of OH^- ions
 - (b) Concentration of H_2O
 - (c) Negative logarithm of H^+ ions
 - (d) Positive logarithm of salt

9. A substance with a pH of 3 is:

- 
- (a) Neutral
 - (b) Basic
 - (c) Strongly acidic
 - (d) Weakly basic

10. Which of the following is a normal salt?

(a) NaHSO_4

(b) NH_4Cl

(c) NaCl ✓

(d) $\text{Al}(\text{OH})_2\text{Cl}$

11. Which of the following is a general property of acids?

(a) Bitter taste

(b) Slippery touch

(c) Turns blue litmus red ✓

(d) Produces OH^- ions

12. Which acid produces CH_3COO^- and H^+ ions when dissolved in water?

(a) HCl

(b) HNO_3

(c) CH_3COOH ✓

(d) H_2SO_4



13. Which base dissociates in aqueous solution to give OH^- ions?

(a) NaCl

(b) NaOH ✓

(c) HNO_3

(d) CH_3COOH

14. Which of the following turns red litmus paper blue?

(a) HCl

(b) NaOH ✓

(c) H_2SO_4

(d) CH_3COOH

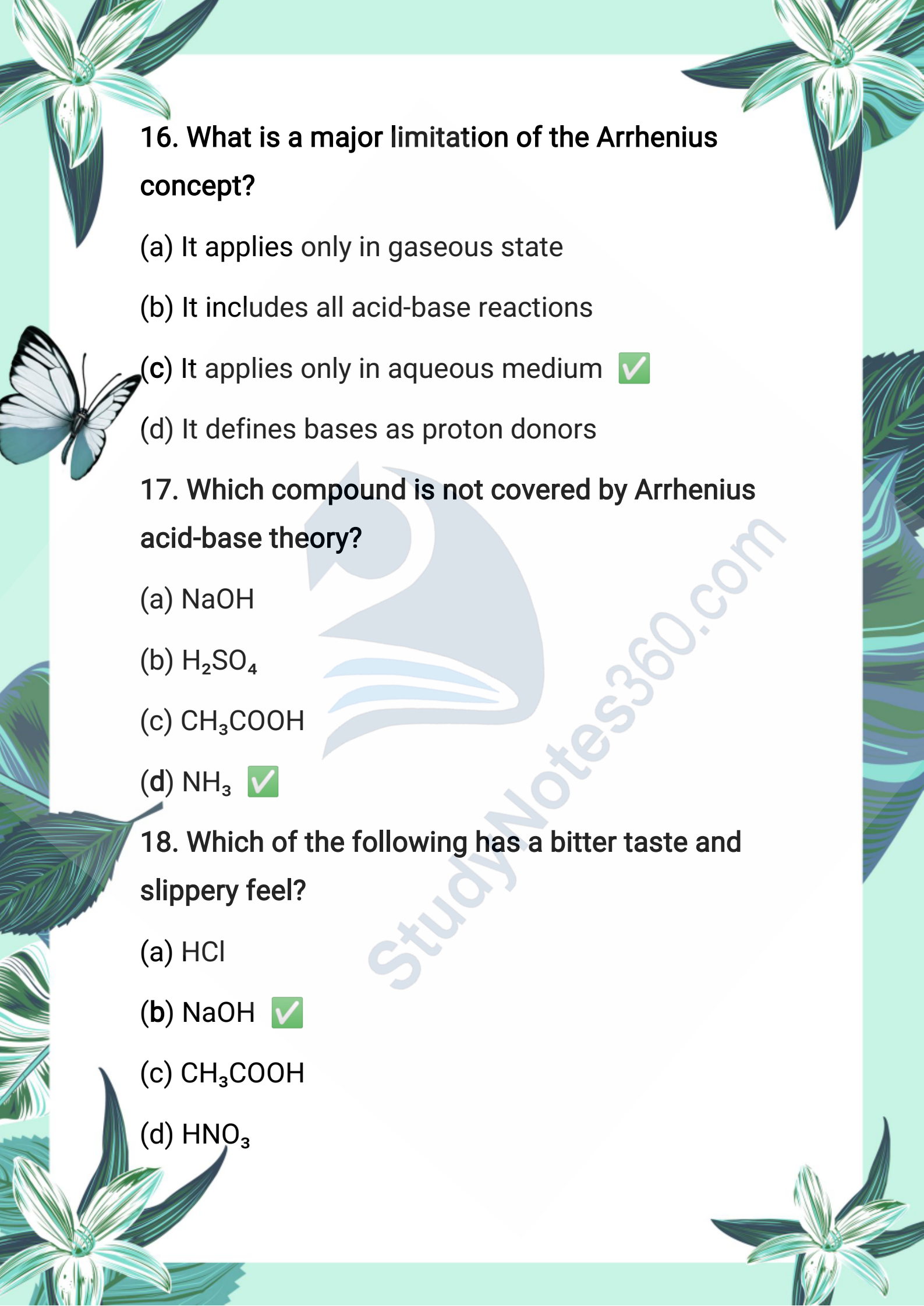
15. According to Arrhenius concept, which of the following acts as an acid?

(a) NaOH

(b) KOH

(c) HNO_3 ✓

(d) NH_3



16. What is a major limitation of the Arrhenius concept?

- (a) It applies only in gaseous state
- (b) It includes all acid-base reactions
- (c) It applies only in aqueous medium
- (d) It defines bases as proton donors

17. Which compound is not covered by Arrhenius acid-base theory?

- (a) NaOH
- (b) H_2SO_4
- (c) CH_3COOH
- (d) NH_3

18. Which of the following has a bitter taste and slippery feel?

- (a) HCl
- (b) NaOH
- (c) CH_3COOH
- (d) HNO_3

19. Which statement is true according to Arrhenius concept?

- (a) Bases donate H^+ ions
- (b) Acids accept OH^- ions
- (c) Acids give H^+ ions in water
- (d) Bases do not conduct electricity

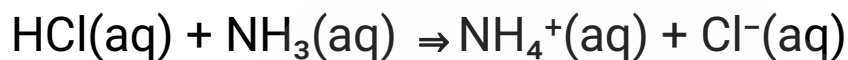
20. Which of the following is a corrosive acid in concentrated form?

- (a) NaOH
- (b) KOH
- (c) HCl
- (d) NH_4OH

21. According to Bronsted-Lowry concept, an acid is a substance that:

- (a) Accepts a proton
- (b) Donates a proton
- (c) Accepts electrons
- (d) Donates electrons

22. Which of the following is a Bronsted-Lowry base in the reaction?



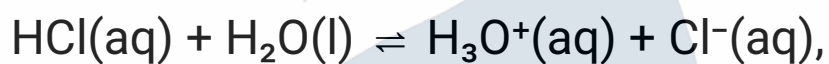
(a) HCl

(b) NH_4^+

(c) NH_3 ✓

(d) Cl^-

23. In the reaction:



Which is the conjugate acid?

(a) HCl

(b) Cl^-

(c) H_2O

(d) H_3O^+ ✓

24. Which pair represents a conjugate acid-base pair?

(a) HCl / NaCl

(b) H_2O / H_3O^+ ✓

(c) H_2 / Cl_2

(d) $\text{NH}_4^+ / \text{H}_2\text{O}$

25. A substance that can act both as an acid and a base is called:

(a) Amphibolic

(b) Neutralizer

(c) Amphoteric

(d) Buffer

26. In the reaction:



CH_3COOH acts as:

(a) Base

(b) Conjugate base

(c) Acid

(d) Amphoteric

27. Which of the following is a limitation of Bronsted-Lowry concept?

(a) It does not explain redox reactions

- (b) It only applies to aqueous solutions
- (c) It excludes substances like SO_3 that act as acids without donating protons
- (d) It does not recognize conjugate pairs

28. According to Lewis concept, a Lewis base is a substance that:

- (a) Donates a proton
- (b) Accepts a proton
- (c) Donates an electron pair
- (d) Accepts an electron pair

29. Which of the following is a Lewis acid?

- (a) NH_3
- (b) Cl^-
- (c) BF_3
- (d) OH^-

30. In Lewis acid-base reaction between NH_3 and BF_3 , the product formed is:

- (a) Salt

(b) Buffer

(c) Adduct

(d) Precipitate

31. Which gas is evolved when zinc reacts with dilute sulphuric acid?

(a) Oxygen

(b) Hydrogen

(c) Sulphur dioxide

(d) Carbon dioxide

32. In the reaction: $2Al + 6HCl \Rightarrow 2AlCl_3 + 3H_2$, HCl acts as:

(a) Oxidizing agent

(b) Reducing agent

(c) Salt

(d) Base

33. When calcium carbonate reacts with HCl, which gas is released?

(a) Hydrogen



(b) Sulphur dioxide

(c) Carbon dioxide

(d) Oxygen

34. Which of the following is a product when an acid reacts with a metal carbonate?



(a) Water only

(b) Salt and oxygen

(c) Salt, carbon dioxide and water

(d) Salt and hydrogen gas

35. Which reaction represents neutralization?

(a) $\text{FeS} + \text{H}_2\text{SO}_4 \Rightarrow \text{FeSO}_4 + \text{H}_2\text{S}$

(b) $\text{NaOH} + \text{HCl} \Rightarrow \text{NaCl} + \text{H}_2\text{O}$

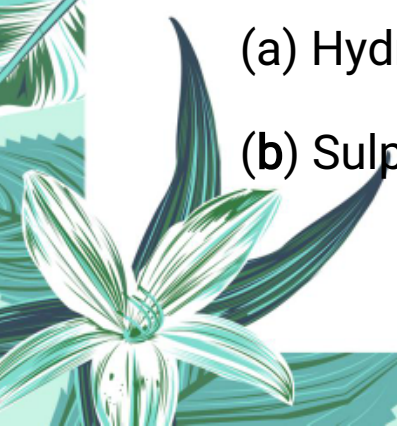
(c) $\text{NH}_4\text{Cl} + \text{NaOH} \Rightarrow \text{NH}_3 + \text{H}_2\text{O} + \text{NaCl}$

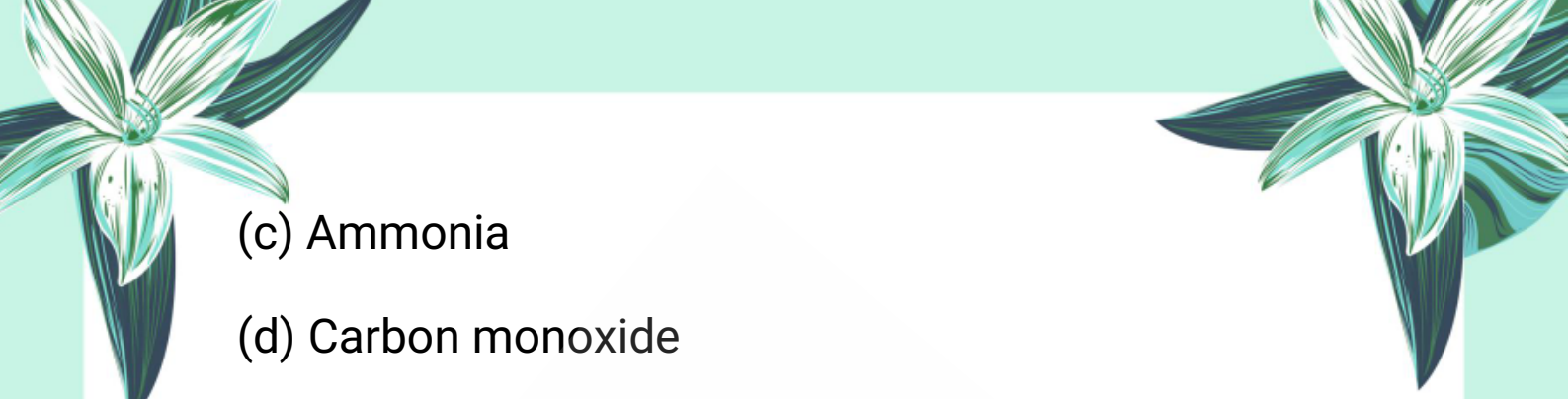
(d) $\text{CaCO}_3 + \text{HCl} \Rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{CaCl}_2$

36. Which gas is evolved when acids react with sulphites?


(a) Hydrogen

(b) Sulphur dioxide




- 
- (c) Ammonia
(d) Carbon monoxide

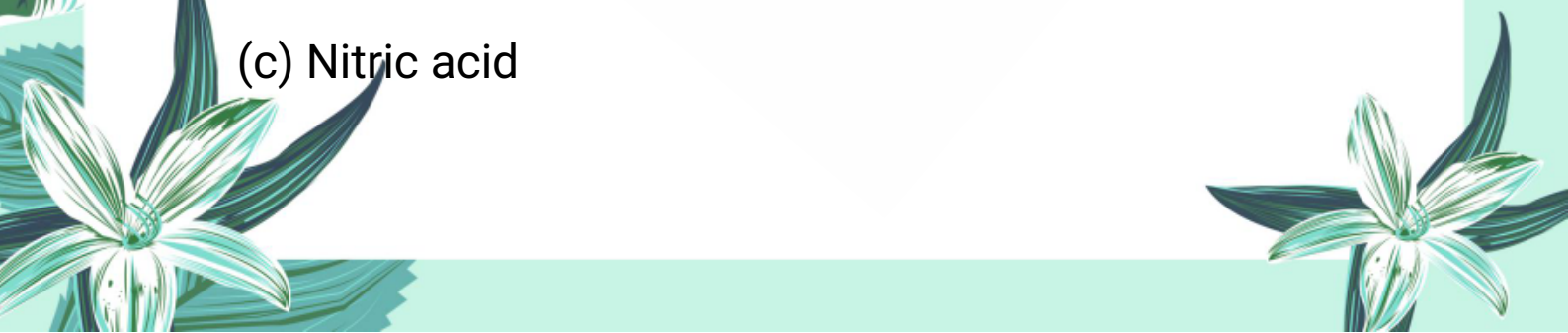
37. What is the gas evolved when FeS reacts with dilute sulphuric acid?

- 
- (a) H_2
(b) H_2S ✓
(c) NH_3
(d) SO_2

38. Which acid is used in food preservation and flavouring?

- 
- (a) Sulphuric acid
(b) Nitric acid
(c) Acetic acid ✓
(d) Hydrochloric acid

39. Which acid is used in lead storage batteries?

- 
- (a) Acetic acid
(b) Sulphuric acid ✓
(c) Nitric acid



(d) Hydrochloric acid

40. Which base is used to remove grease stains from clothes?

(a) Magnesium hydroxide

(b) Ammonium hydroxide

(c) Calcium hydroxide

(d) Sodium hydroxide



41. Ammonia gas is evolved when alkalis react with:

(a) Carbonates

(b) Acids

(c) Ammonium salts

(d) Hydroxides

42. Which of the following forms a white precipitate with NaOH?

(a) CuSO_4

(b) $\text{Pb}(\text{NO}_3)_2$

(c) FeCl_3



(d) FeSO_4

43. What is the value of ionic product of water (K_w) at 25°C ?

(a) 1×10^{-12}

(b) 1×10^{-14} ✓

(c) 1×10^{-7}

(d) 1×10^{-1}

44. What is the pH of pure water at 25°C ?

(a) 6

(b) 8

(c) 7 ✓

(d) 14

45. What does the "p" in pH stand for?

(a) Percentage

(b) Positive

(c) Negative logarithm ✓

(d) Potential

46. Which of the following is true about a neutral solution?

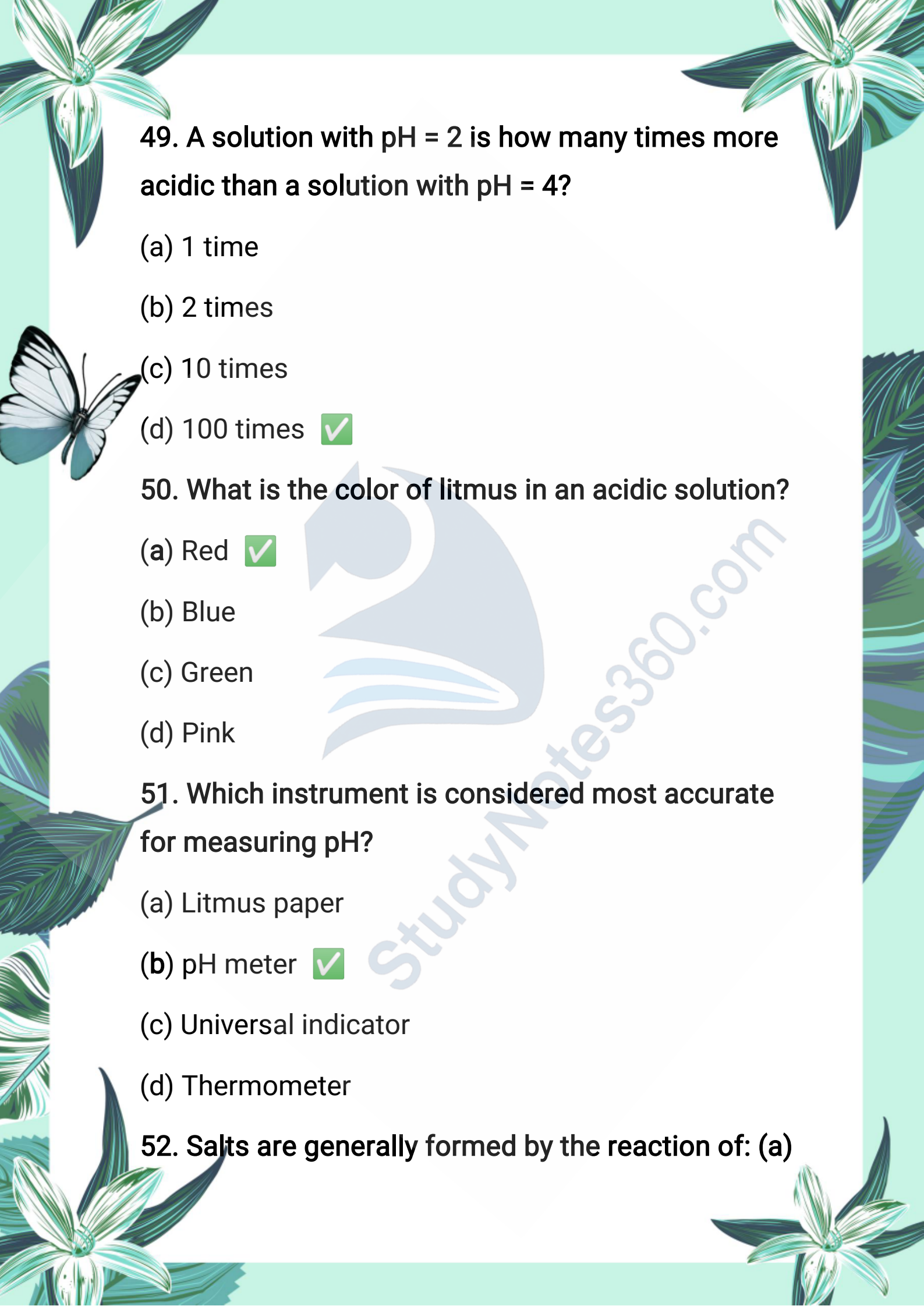
- (a) $\text{pH} > 7$
- (b) $\text{pH} < 7$
- (c) $\text{pOH} > \text{pH}$
- (d) $\text{pH} = 7$ ✓

47. What is the relationship between pH and pOH at 25°C?

- (a) $\text{pH} + \text{pOH} = 10$
- (b) $\text{pH} - \text{pOH} = 14$
- (c) $\text{pH} + \text{pOH} = 14$ ✓
- (d) $\text{pH} \times \text{pOH} = 14$

48. Which of the following is a correct expression for pH?

- (a) $\text{pH} = \log[\text{H}^+]$
- (b) $\text{pH} = [\text{H}^+] \times 10$
- (c) $\text{pH} = -\log[\text{H}^+]$ ✓
- (d) $\text{pH} = 1/[\text{H}^+]$



49. A solution with $\text{pH} = 2$ is how many times more acidic than a solution with $\text{pH} = 4$?

- (a) 1 time
- (b) 2 times
- (c) 10 times
- (d) 100 times

50. What is the color of litmus in an acidic solution?

- (a) Red
- (b) Blue
- (c) Green
- (d) Pink

51. Which instrument is considered most accurate for measuring pH ?

- (a) Litmus paper
- (b) pH meter
- (c) Universal indicator
- (d) Thermometer

52. Salts are generally formed by the reaction of: (a)



Base with base

(b) Acid with metal oxide

(c) Acid with base

(d) Salt with acid

53. The positive part of a salt is known as:



(a) Acidic radical

(b) Non-metal

(c) Basic radical

(d) Neutral ion

54. Which of the following is a salt of hydrochloric acid?

(a) Potassium nitrate

(b) Sodium chloride

(c) Zinc sulphate

(d) Calcium phosphate

55. Salts are composed of:

(a) Only cations

(b) Only anions



(c) Protons and neutrons

(d) Cations and anions

56. The salt NaCl is formed from:

(a) Sodium and Nitric acid

(b) Sodium and Acetic acid

(c) Sodium and Hydrochloric acid

(d) Potassium and Hydrochloric acid

57. Salts are usually:

(a) Covalent compounds

(b) Molecular compounds

(c) Ionic compounds

(d) Organic compounds

58. Which of the following salts contains water of crystallization?

(a) NaCl

(b) KNO_3

(c) $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

(d) ZnCl_2

59. The method used to prepare insoluble salts is:

- (a) Evaporation
- (b) Neutralization
- (c) Direct displacement
- (d) Double displacement

60. Which salt is formed when HNO_3 reacts with Na_2CO_3 ?

- (a) NaNO_3
- (b) NaCl
- (c) Na_2SO_4
- (d) NaOH

61. Which of the following is a normal salt?

- (a) NaH_2PO_4
- (b) KCl
- (c) KHSO_4
- (d) $\text{Al}(\text{OH})_2\text{Cl}$

62. KHSO_4 is an example of:

- (a) Basic salt

(b) Complex salt

(c) Acidic salt

(d) Neutral salt

63. $\text{Al}(\text{OH})_2\text{Cl}$ is a/an:

(a) Double salt

(b) Mixed salt

(c) Acidic salt

(d) Basic salt

64. Which is a double salt?

(a) Bleaching powder

(b) Potash alum

(c) KHSO_4

(d) Silver nitrate

65. Which of the following is a complex salt?

(a) NaCl

(b) $\text{K}_3[\text{Fe}(\text{CN})_6]$

(c) CaCl_2

(d) NaHCO_3



Exercise Short Questions:

1. Name three common household substances having:

Answer:



(a) pH value greater than 7 (Basic):

Examples:

- Baking soda (Sodium bicarbonate)
- Soap solution
- Bleach

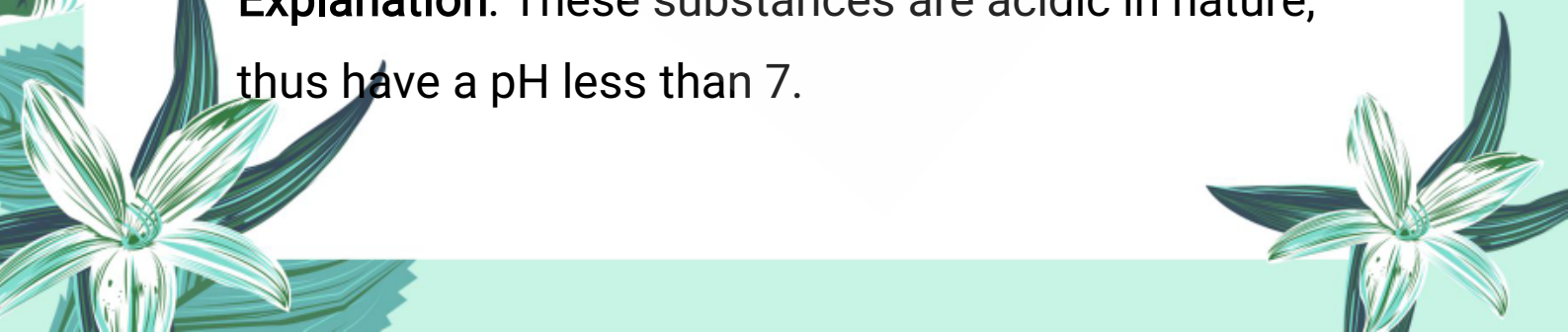
Explanation: These substances have alkaline properties, hence their pH is greater than 7.

(b) pH value less than 7 (Acidic):

Examples:

- Lemon juice
- Vinegar
- Tomato juice

Explanation: These substances are acidic in nature, thus have a pH less than 7.



(c) pH value equal to 7 (Neutral):

Example: Pure water

Explanation: Water is a neutral substance, hence its pH is exactly 7.

2. Define a base and explain that all alkalies are bases, but all bases are not alkalies.

Definition of Base:

A base is a substance that accepts protons (H^+ ions) or produces hydroxide ions (OH^-) in aqueous solution.

Explanation:

Alkalies are those bases that are soluble in water and produce OH^- ions in aqueous solution.

Examples of alkalies: NaOH , KOH , $\text{Ca}(\text{OH})_2$

Some bases like $\text{Cu}(\text{OH})_2$ or $\text{Fe}(\text{OH})_3$ are insoluble in water, hence they are not alkalies.

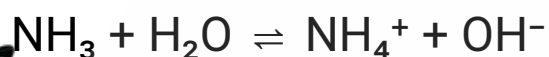
3. Define Bronsted-Lowry base and explain with an example that water is a Bronsted-Lowry base.

Definition:

According to Bronsted-Lowry concept, a base is a substance that accepts a proton (H^+).

Explanation with Example:

Reaction:



In this reaction:

- NH_3 acts as Bronsted-Lowry base (accepts H^+).
- H_2O donates H^+ , so it behaves as a Bronsted-Lowry acid.

 In another reaction, water can act as a base:



Here, H_2O accepts H^+ , acting as a Bronsted-Lowry base.

Hence, water is amphoteric, and can act as a base in this concept.

4. How can you justify that Bronsted-Lowry concept of acid and base is applicable to non-aqueous solutions?

Answer:

- The Arrhenius concept is limited to aqueous solutions only.
- But Bronsted-Lowry concept is based on proton transfer, not water presence.

Example in non-aqueous medium:

Reaction in gaseous state:



In this reaction:

- NH_3 accepts a proton \Rightarrow acts as a Bronsted-Lowry base
- HCl donates a proton \Rightarrow acts as a Bronsted-Lowry acid

✓ This shows the concept is valid outside water (non-aqueous systems) too.

5. Which kind of bond is formed between Lewis acid and a base?

Answer:

A coordinate covalent bond (also called dative bond) is formed between a Lewis acid and a Lewis base.

Explanation:

In this bond, both shared electrons are provided by the Lewis base.

- **Lewis acid:** electron pair acceptor
- **Lewis base:** electron pair donor

Example:



NH_3 donates a lone pair to BF_3 , forming a coordinate covalent bond.

6. Why H^+ ion acts as a Lewis acid?

Answer:

- H^+ ion (proton) has no electrons and can accept a lone pair of electrons from another substance.
 - According to Lewis concept, acids are electron pair acceptors.
- 👉 Hence, H^+ ion acts as a **Lewis acid** because it accepts electron pairs to form a coordinate bond.

Example Reaction:



(H^+ accepts lone pair from H_2O)

7. Name two acids used in the manufacture of fertilizers.



Answer:

Two important acids used in fertilizer production are:

1. Nitric Acid (HNO_3)
2. Phosphoric Acid (H_3PO_4)



Use:

- Nitric acid is used to make ammonium nitrate.
- Phosphoric acid is used to make superphosphate fertilizers.

8. Define pH. What is the pH of pure water?

Definition of pH:


pH is the negative logarithm of hydrogen ion concentration in a solution.




Formula:

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

✓ pH of pure water:

- 
- In pure water, $[\text{H}^+] = 1 \times 10^{-7}$ mol/L
 - So, $\text{pH} = 7$
 - ◆ This means pure water is neutral.

9. How many times a solution of pH 1 is stronger than a solution of pH 2?

Answer:

The pH scale is logarithmic, meaning:

Every 1 unit difference = 10 times difference in H^+ concentration.

Therefore:

A solution of pH 1 is 10 times more acidic (stronger) than a solution of pH 2.

10. Define the followings:



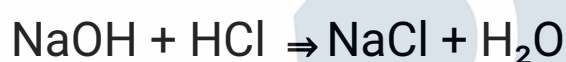


Answer:

(i) Normal Salt:

- A salt that is formed by the complete neutralization of a strong acid and a strong base.
- It contains no replaceable H^+ or OH^- ions.

Example:

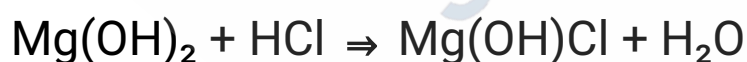


(Here, NaCl is a normal salt)

(ii) Basic Salt:

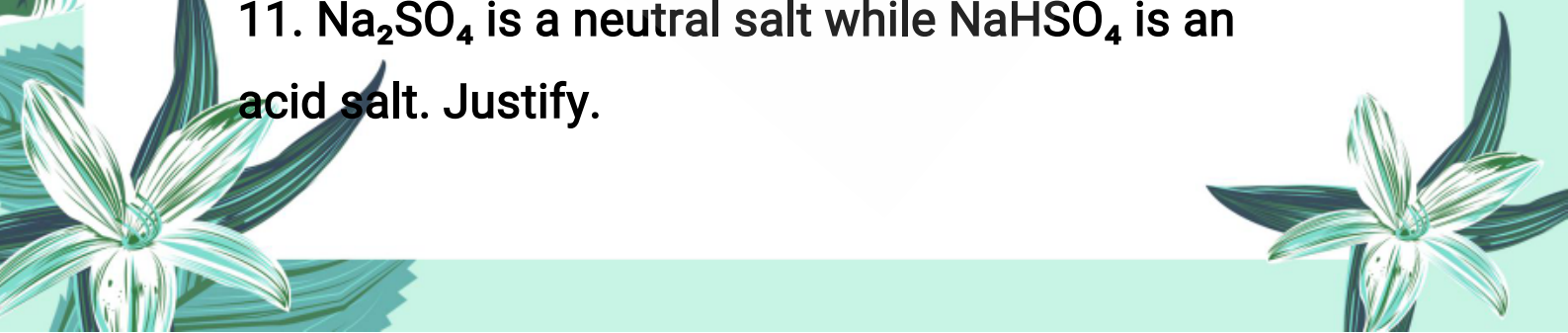
- A salt that is formed by the partial neutralization of a strong base and a weak acid.
- It contains extra OH^- ions, so it shows basic behavior.

Example:



(Mg(OH)Cl is a basic salt)

11. Na_2SO_4 is a neutral salt while $NaHSO_4$ is an acid salt. Justify.



Answer:

Na_2SO_4 (Sodium Sulphate) is formed by the complete neutralization of a strong acid (H_2SO_4) and a strong base (NaOH).

➤ Hence, it is a neutral salt and does not affect pH.

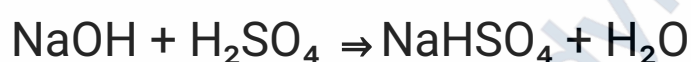
 **Reaction:**



NaHSO_4 (Sodium Bisulphate) is formed by the partial neutralization of H_2SO_4 by NaOH , so it still contains a replaceable H^+ ion.

➤ Hence, it behaves as an acid salt and shows acidic behavior.


 **Reaction:**

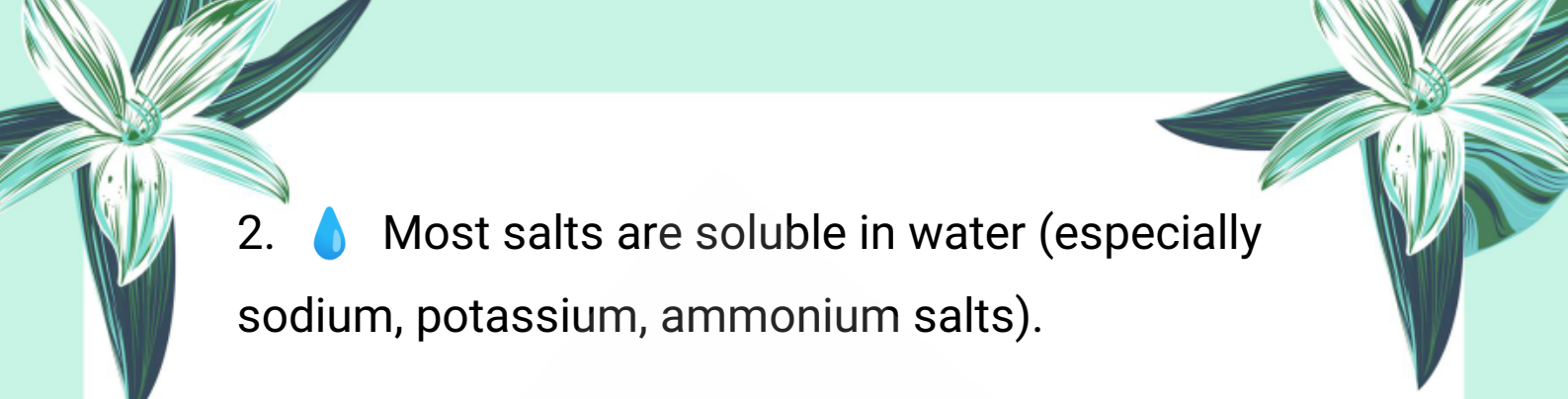


12. Give a few characteristic properties of salts.

Answer:


Some important properties of salts are:

1.  They are ionic compounds made up of cations and anions.



2. 💧 Most salts are soluble in water (especially sodium, potassium, ammonium salts).

3. ⚡ Their aqueous solutions conduct electricity (electrolytes).



4. 🌡 Many salts have high melting and boiling points.

5. 🎨 Some salts are colored (e.g., copper sulphate – blue).

6. 🔥 Some salts give characteristic colors in flame tests.

13. How are the soluble salts recovered from water?

Answer:

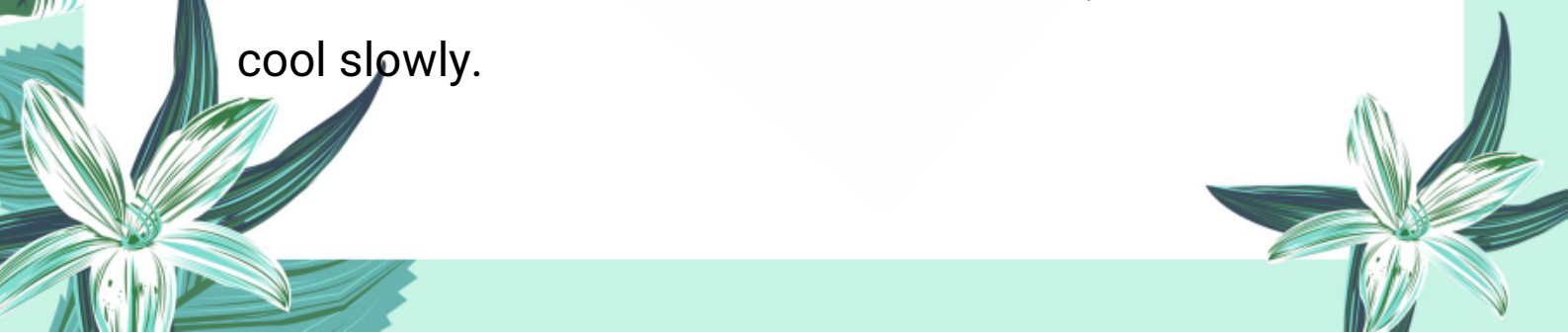
Soluble salts are recovered by the process of evaporation or crystallization:

📖 **Method:**

1. Prepare a solution of salt in water.

2. Heat the solution to evaporate water.

3. When the solution becomes saturated, allow it to cool slowly.



4. Crystals of salt form and can be collected.

Example: Sodium chloride (NaCl) from seawater.

14. How are the insoluble salts prepared?

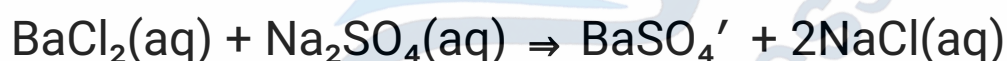
Answer:

Insoluble salts are prepared by the method of precipitation reaction.

 **Method:**

When two soluble salts react in aqueous solution to form an insoluble salt, it precipitates out.

Example:



(Barium sulphate is insoluble and forms a white precipitate.)

15. Why is a salt neutral? Explain with an example.

Answer:

A salt is neutral if it is formed by the complete reaction of a strong acid and a strong base.

➔ Such a salt has no replaceable H^+ or OH^- ions, so its solution is neutral in pH.



 **Example:**

- NaOH (strong base) + HCl (strong acid) \Rightarrow NaCl (neutral salt) + H_2O
- NaCl does not affect pH when dissolved in water.
- Therefore, NaCl is a neutral salt.

16. Name an acid used in the preservation of food.

Answer:

Benzoic Acid is commonly used in the preservation of food.

➔ It prevents the growth of bacteria and fungi in food products like pickles, juices, and jams.

17. Name the acids present in:

Substance Acid Present

(i) Vinegar Acetic acid (CH_3COOH)

(ii) Ant sting Formic acid (HCOOH)


(iii) Citrus fruit Citric acid

(iv) Sour milk Lactic acid



✓ **Explanation:**

- These are naturally occurring organic acids found in various everyday items.
- They are weak acids but have specific roles such as giving sour taste or causing irritation.



18. How can you justify that Pb(OH)NO_3 is a basic salt?

Answer:

Pb(OH)NO_3 (Lead Hydroxy Nitrate) is formed by the partial neutralization of a weak acid (HNO_3) by a strong base (Pb(OH)_2).

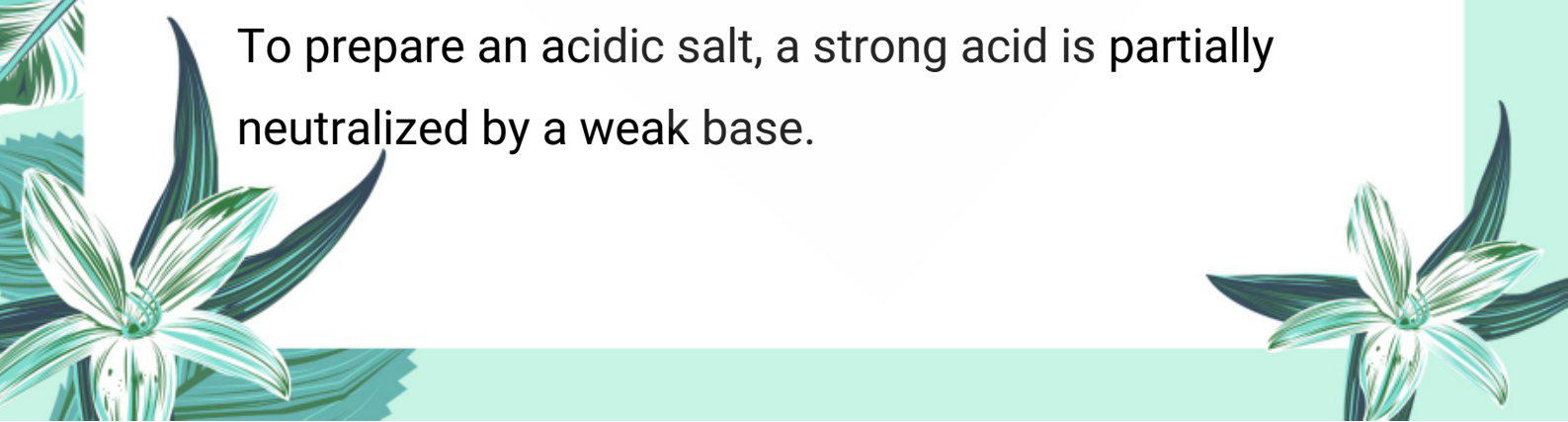
☑ Therefore, it contains replaceable OH^- ions, which make it behave as a basic salt.

➔ It shows basic properties in water.

19. You are in a need of an acidic salt. How can you prepare it?

Answer:

To prepare an acidic salt, a strong acid is partially neutralized by a weak base.



Example:

NaOH (base) + H_2SO_4 (strong acid) \rightarrow NaHSO_4
(acidic salt) + H_2O

➔ NaHSO_4 is acidic because it still has a replaceable hydrogen ion (H^+).

20. Which salt is used to prepare plaster of Paris?

Answer:

Gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) is used to prepare Plaster of Paris.

 **Chemical Reaction:**

$\text{CaSO}_4 \cdot 2\text{H}_2\text{O} \Rightarrow \text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O} + 1\frac{1}{2}\text{H}_2\text{O}$ (on heating)

➔ The product is Plaster of Paris (POP), used in casting, molds, and medical bandages.

Exercise Long Questions:

☀ Q1: Define an acid and a base according to Bronsted-Lowry concept and justify with examples that water is an amphoteric compound.

❖ Introduction:

Bronsted-Lowry theory is a widely accepted theory of acids and bases. This concept focuses on the transfer of protons (H^+ ions). It is more general than the Arrhenius concept and can be applied even in non-aqueous media.

📖 Bronsted-Lowry Concept:

✅ Definition of Acid:

> "An acid is a substance that donates a proton (H^+) to another substance."

📌 Example:

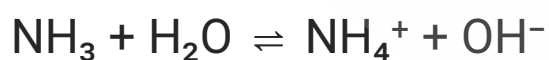


Here, HCl is donating a proton \Rightarrow Acid

✅ Definition of Base:

> "A base is a substance that accepts a proton (H^+) from another substance."

Example:



NH_3 is accepting a proton \Rightarrow Base

 **Water as an Amphoteric Compound:**

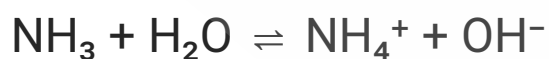
> A substance that can act both as an acid and a base is called amphoteric.

Water (H₂O) is amphoteric because it donates and accepts protons depending on the situation.

 **Justification with Examples:** **1. Water as a Bronsted-Lowry Base:** **Reaction:** **Explanation:**

HCl = Acid (donates H⁺)

H₂O = Base (accepts H⁺) ⇒ Forms H₃O⁺

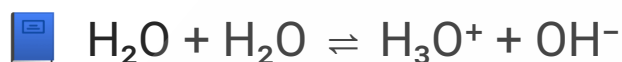
 Here, water is acting as a base. **2. Water as a Bronsted-Lowry Acid:** **Reaction:** **Explanation:**

NH₃ = Base (accepts H⁺)

$\text{H}_2\text{O} = \text{Acid (donates H}^+) \Rightarrow \text{Forms OH}^-$

✓ Here, water is acting as an acid.

↻ Self-Ionization of Water:



One molecule donates H^+ (acts as acid)

Other accepts H^+ (acts as base)

✓ This further proves the amphoteric nature of water.

☀ Q2: Explain the Lewis concept of acids and bases.

❖ Definition:

Lewis theory is a broad and general concept of acids and bases introduced by Gilbert N. Lewis in 1923. Unlike Arrhenius and Bronsted-Lowry theories, Lewis concept does not require the presence of hydrogen ions (H^+) or water. It explains acid-base reactions based on the transfer of electron pairs, and it is applicable in both aqueous and non-aqueous media.



Lewis Concept:

❖ Definition of Lewis Acid:

"A Lewis acid is a substance that accepts a pair of electrons to form a covalent bond."



Example:



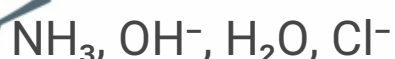
These are electron-deficient species, hence Lewis acids.

❖ Definition of Lewis Base:

> "A Lewis base is a substance that donates a pair of electrons to form a covalent bond."



Example:



These have lone pairs of electrons, hence Lewis bases.



Main Concept:

Lewis acid-base reaction involves:

- Electron pair donor (base)

- Electron pair acceptor (acid)

and they form a coordinate covalent bond resulting in a single product called an adduct.

Explanation with Example:

- ◆ Example 1: Reaction Between NH_3 and BF_3

 Equation:



 Explanation:

- NH_3 has a lone pair of electrons \Rightarrow Lewis base
- BF_3 is electron-deficient \Rightarrow Lewis acid
- NH_3 donates its electron pair to BF_3 forming an adduct.

 Hence, this is a Lewis acid-base reaction.

- ◆ Example 2: Formation of H_3O^+

Equation:



 Explanation:

- H^+ has no electrons \Rightarrow accepts pair \Rightarrow Lewis

acid

- H_2O donates lone pair \Rightarrow Lewis base

✓ A coordinate bond is formed \Rightarrow Lewis acid-base interaction.

C Nature of Bond in Lewis Acid-Base Reactions:

- Coordinate covalent bond is formed between the Lewis acid and base.
- This bond is formed when both electrons come from the base.

↻ Difference from Other Theories:

Theory Focus:

- Arrhenius H^+ and OH^- ions in water
- Bronsted-Lowry Proton transfer
- Lewis Electron pair transfer (more general)

☀ Q3: What is auto-ionization of water? How is it used to establish the pH of water?

◆ Introduction:

Water is a neutral compound, but under certain conditions, it undergoes a slight self-ionization. This

phenomenon helps in determining the pH of pure water.

✓ **Definition:**

> Auto-ionization of water is the process in which two water molecules react with each other to form hydronium ion (H_3O^+) and hydroxide ion (OH^-).

◆ **Chemical Equation:**



Or simply:



📘 **Ion Product of Water:**

$$K_w = [\text{H}^+] \times [\text{OH}^-] = 1 \times 10^{-14} \quad (\text{at } 25^\circ\text{C})$$

Since in pure water:

$$[\text{H}^+] = [\text{OH}^-] = 1 \times 10^{-7} \text{ mol/dm}^3$$



Determination of pH of Pure Water:

$$\text{pH} = -\log[H^+] = -\log(1 \times 10^{-7}) = 7$$

✓ Hence, pH of pure water is 7, which is neutral.

☀ Q4: Define a salt and give the characteristic properties of salts.

❖ Definition of Salt:

A salt is an ionic compound formed by the neutralization reaction between an acid and a base. It contains a positive metal ion (cation) and a negative non-metal ion (anion).

◆ General Reaction:



📖 Example:



Types of Salts:

Type	Description	Example
Normal Salt	Complete replacement of H^+ ions	$NaCl$
Acidic Salt	Partial neutralization of polybasic acid	$NaHSO_4$
Basic Salt	Partial neutralization of base	$Pb(OH)NO_3$

Characteristic Properties of Salts:

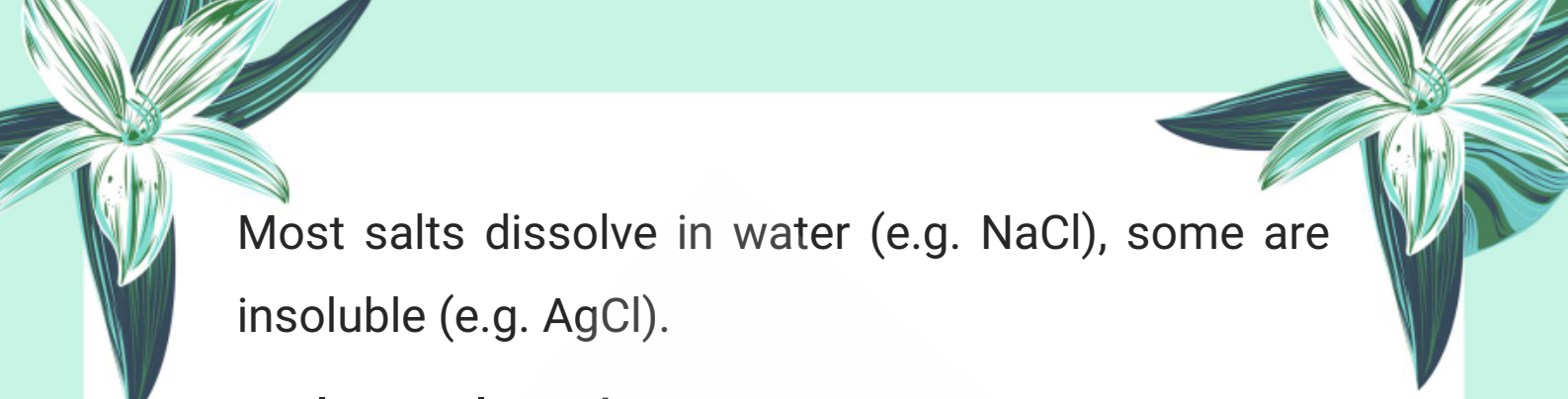
1. Ionic Nature:

Salts are composed of oppositely charged ions.

2. Crystalline Structure:

Salts usually form well-defined crystals.

3. Solubility in Water:



Most salts dissolve in water (e.g. NaCl), some are insoluble (e.g. AgCl).

4. Electrical Conductivity:

Aqueous salt solutions conduct electricity.



5. Taste:

Many salts (like NaCl) taste salty.

6. Effect on pH:

Neutral salts: $\text{NaCl} \Rightarrow \text{pH } 7$

Acidic salts: $\text{NaHSO}_4 \Rightarrow \text{pH} < 7$

Basic salts: $\text{CH}_3\text{COONa} \Rightarrow \text{pH} > 7$

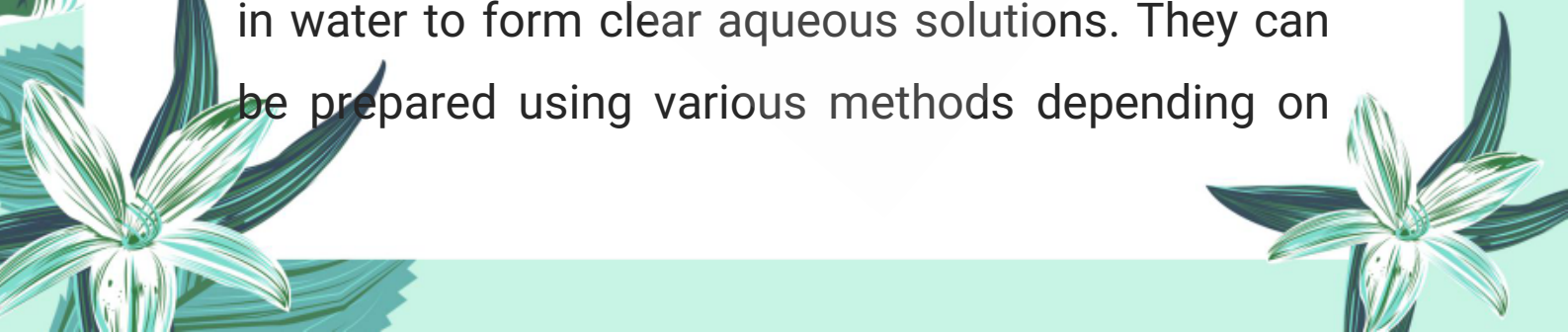
7. Formation in Neutralization:

All salts are formed by the neutralization of acids and bases.

☀ Q5: Explain with examples how are soluble salts prepared?

❖ **Definition:**

Soluble salts are the salts that completely dissolve in water to form clear aqueous solutions. They can be prepared using various methods depending on



the nature of reactants.

♦ Methods of Preparation (with explanation & examples):

☀ 1. Acid + Metal \Rightarrow Salt + Hydrogen Gas

✓ Explanation:

When a reactive metal is added to an acid, it displaces hydrogen and forms a soluble salt.

🧪 Example:



Here, Zinc sulfate is a soluble salt.

Hydrogen gas is released (seen as bubbles).

☀ 2. Acid + Metal Oxide \Rightarrow Salt + Water

Explanation:

Metal oxides are basic in nature. When they react with acids, they form salt and water.

🧪 Example:



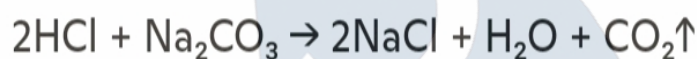
Copper(II) sulfate is a soluble blue salt used in labs.

☀️ **3. Acid + Metal Carbonate \Rightarrow Salt + Water + CO_2**

Explanation:

Carbonates react with acids and produce salt, water, and carbon dioxide gas.

🧪 **Example:**



- Sodium chloride (NaCl) is the common table salt.
- Effervescence (bubbles) shows CO_2 gas release.

☀️ **4. Acid + Alkali \Rightarrow Salt + Water**

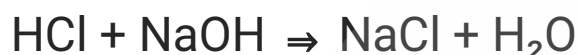
(This is a neutralization reaction.)

Explanation:

An acid reacts with an alkali (soluble base) to produce salt and water.



Example:



- This method gives neutral soluble salts.
- No gas is evolved, only water is formed.





Lab Method for Preparation of Soluble Salts (Steps):

1. Add acid into a beaker and warm it gently.
2. Add metal / oxide / carbonate in excess until no more reaction occurs.
3. Filter the solution to remove unreacted solid.
4. Heat the clear solution to evaporate water.
5. Allow to cool and form crystals of soluble salt.
6. Dry the crystals on a filter paper.

☀ Q6: Give the characteristics of an acidic salt.

❖ **Definition of Acidic Salt:**

An acidic salt is a type of salt that is formed when a polyprotic acid (like H_2SO_4 or H_3PO_4) is partially neutralized by a base.



It still contains replaceable hydrogen ions (H^+) and can show acidic behavior in water.

Formation of Acidic Salt:

Acidic salts are usually formed:

1. By partial neutralization of a diprotic or triprotic acid.
2. When strong acid reacts with a weak base.

Examples:



(Sodium bisulfate is an acidic salt)



(Monopotassium phosphate is also acidic)

Characteristics of Acidic Salts:

1. Contain Replaceable Hydrogen:

Acidic salts still contain hydrogen atoms that can be released as H^+ ions in solution.

2. Show Acidic Behavior in Water:

They turn blue litmus red, indicating acidic nature.

3. Conduct Electricity:

Like other salts, they dissociate into ions and conduct electricity in aqueous solution.

4. Formed from Strong Acid and Weak Base:

Often produced when a strong acid reacts with a weak base or during partial neutralization.

5. Do Not Fully Replace All H⁺ Ions:

In polyprotic acids, not all H⁺ ions are replaced, leaving the salt acidic.

Example of Acidic Salt Reaction:



NaHSO₄ (sodium bisulfate) is an acidic salt because it still contains one hydrogen ion from H₂SO₄.

 Q7: Give four uses of calcium oxide.

❖ Introduction:

Calcium oxide (CaO), also known as quicklime, is a white, caustic, alkaline chemical compound. It is an important industrial chemical with a wide range of



uses in construction, agriculture, and industry.

◆ Chemical Formula:

CaO

◆ Common Name:



Quicklime

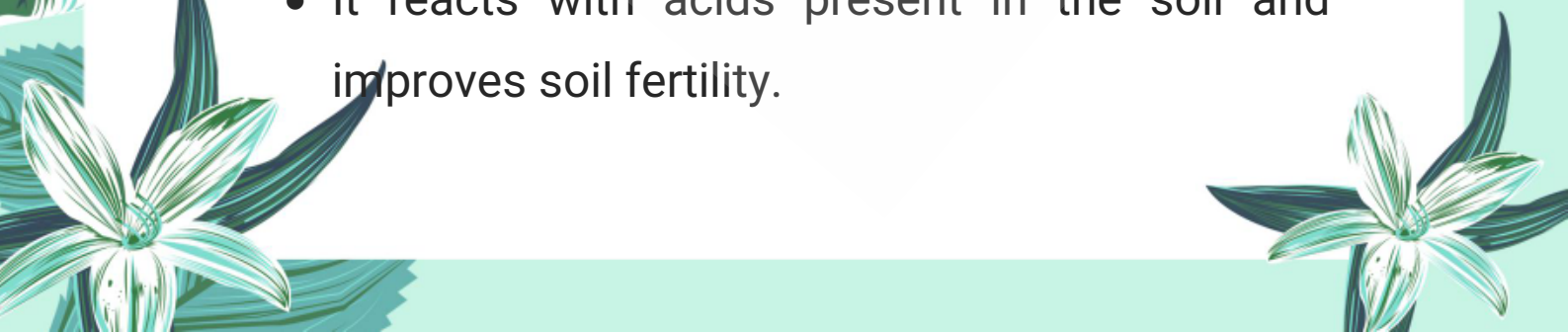


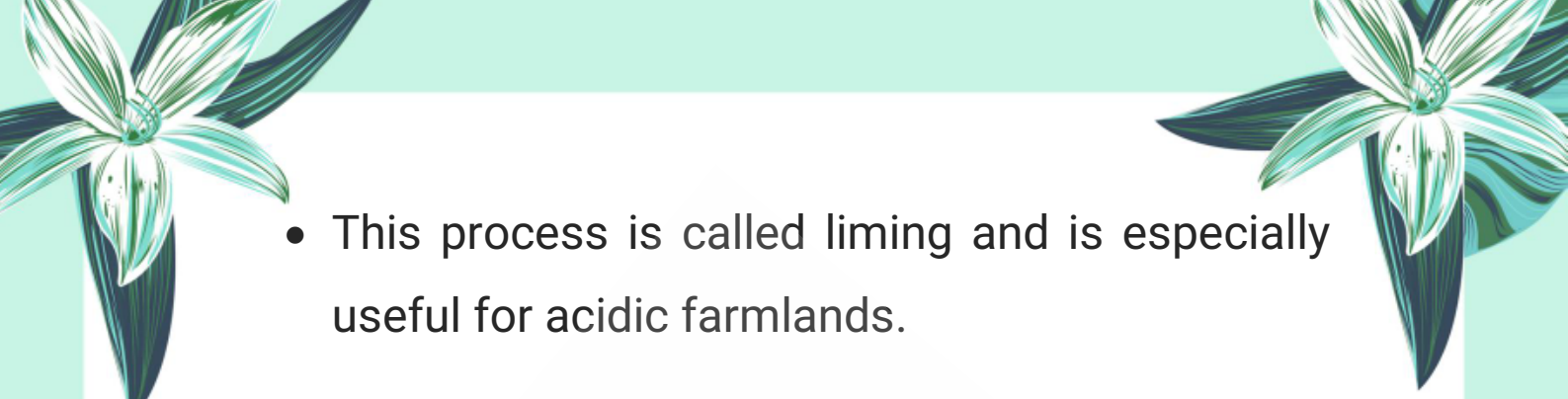
Four Major Uses of Calcium Oxide:

1. In the Manufacture of Cement:


- Calcium oxide is a key ingredient in cement production.
- It is mixed with silica (SiO_2), alumina (Al_2O_3), and other materials to form clinker, which is ground to produce cement.
- Cement is widely used in construction of buildings, bridges, and roads.

2. In the Neutralization of Acidic Soil:

- Calcium oxide is used to reduce the acidity of soil in agriculture.
 - It reacts with acids present in the soil and improves soil fertility.
- 

- 
- This process is called liming and is especially useful for acidic farmlands.

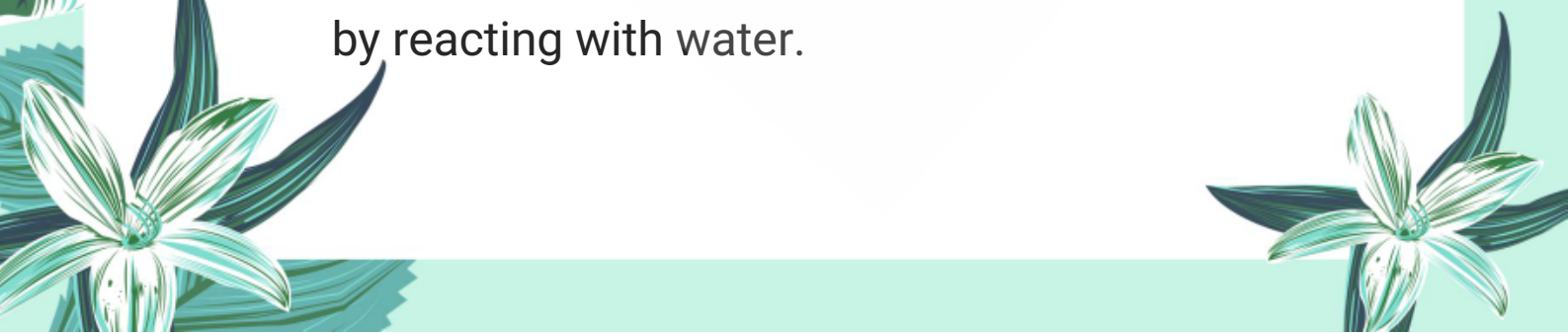
3. In Water Treatment:

- 
- It is used to treat wastewater and drinking water.
 - Calcium oxide helps to remove impurities and soften water by precipitating metal ions.
 - It also helps to raise the pH of acidic water.

4. In the Manufacture of Glass:

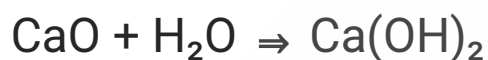
- Calcium oxide is added during glass production to increase durability and chemical resistance of glass.
- It helps improve the melting properties of the mixture during glass making.

Additional Uses (Optional for Extra Marks):


- Used in steel manufacturing to remove impurities.
 - Used in making calcium hydroxide (slaked lime) by reacting with water.
- 

- Used as a desiccant to absorb moisture.


Important Reaction:



(Quicklime + Water \Rightarrow Slaked Lime)

 Q8. You are having a strong acid (HNO_3) and strong base (NaOH), on mixing:

i. What type of salt will you have?

 When a strong acid (HNO_3) reacts with a strong base (NaOH), they neutralize each other to form a neutral salt.


◆ Reaction:



◆ Salt Formed:

Sodium Nitrate (NaNO_3) – a neutral salt because both the acid and base are strong.

ii. What type of reaction will it be?


 This is a neutralization reaction, in which an acid reacts with a base to form salt and water.



- ◆ **Definition:**

A reaction in which an acid and a base react to form salt and water is called neutralization.

iii. Will it be a soluble or insoluble salt?



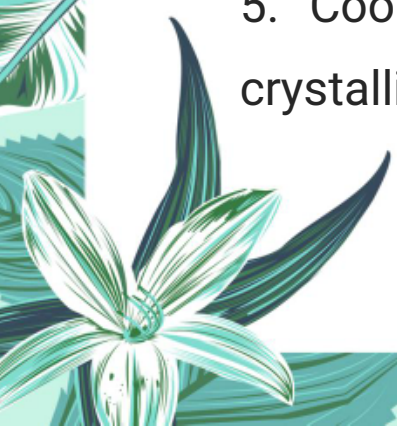
☞ The salt formed, Sodium Nitrate (NaNO_3), is soluble in water.

- ◆ Most salts of alkali metals (like Na^+) and nitrate ions (NO_3^-) are highly soluble in water.

iv. If it is soluble, how will it be recovered?

☞ Soluble salts like NaNO_3 are recovered using evaporation.

- ◆ **Method:**

1. Prepare the solution by mixing HNO_3 and NaOH .
 2. Allow the neutralization reaction to complete.
 3. Heat the solution gently to evaporate the water.
 4. On evaporation, crystals of NaNO_3 will appear.
 5. Cool and collect the crystals by filtration or crystallization.
- 



✓ **Summary Table:**

Step	Answer
Salt Formed	Neutral Salt (Sodium Nitrate - NaNO_3)
Type of Reaction	Neutralization
Solubility	Soluble
Recovery Method	Evaporation & Crystallization

✨ **Question Number 9:**

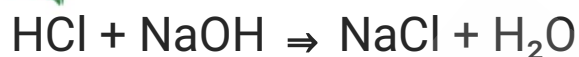
i. HCl forms only one series of salts

✓ **Explanation:**

HCl (Hydrochloric Acid) is a monobasic acid, meaning it contains only one replaceable hydrogen ion (H^+).

It donates only one proton per molecule during neutralization.

◆ **Reaction Example:**



👉 Since only one hydrogen ion is available for replacement, it can form only one type of salt – called a normal salt (e.g., NaCl).

◆ Therefore:

HCl forms only one series of salts – normal salts.

ii. H_2SO_4 forms two series of salts

✓ Explanation:

H_2SO_4 (Sulphuric Acid) is a dibasic acid, meaning it contains two replaceable hydrogen ions (H^+).

It can donate one or two protons, depending on the amount of base used.

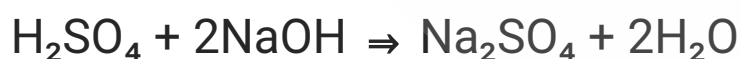
◆ Series of salts it can form:

1. Acid Salt (only one H^+ replaced):



(Sodium hydrogen sulfate)

2. Normal Salt (both H^+ replaced):



(Sodium sulfate)

◆ Therefore:

H_2SO_4 forms two series of salts – acid salts and normal salts.

iii. H_3PO_4 forms three series of salts

✓ Explanation:

H_3PO_4 (Phosphoric Acid) is a tribasic acid, meaning it contains three replaceable hydrogen ions (H^+).

It can donate one, two, or all three protons, forming different types of salts.

◆ Series of salts it can form:

1. First Replacement \Rightarrow Acid Salt:



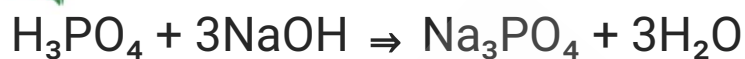
(Sodium dihydrogen phosphate)

2. Second Replacement \Rightarrow Acid Salt:




(Disodium hydrogen phosphate)

3. Third Replacement \Rightarrow Normal Salt:



(Trisodium phosphate)

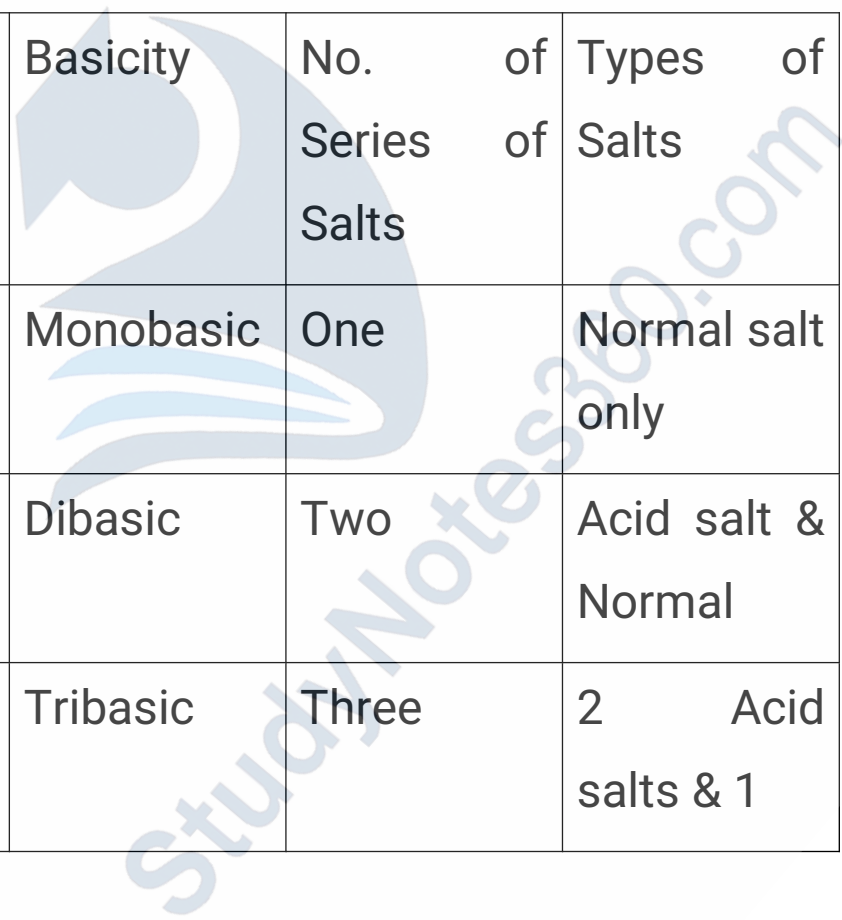
◆ Therefore:



H_3PO_4 forms three series of salts – two acid salts and one normal salt.

✓ Summary Table:

Acid	Basicity	No. of Series Salts	of Types of Salts
HCl	Monobasic	One	Normal salt only
H_2SO_4	Dibasic	Two	Acid salt & Normal
H_3PO_4	Tribasic	Three	2 Acid salts & 1





Note:

This chapter is designed to provide a solid foundation of knowledge, with the goal of deepening understanding and encouraging further exploration of the subject. The content has been carefully selected to support effective learning and inspire students to engage with the topic more deeply.

Author: Muhammad Asghar

Purpose: To contribute to education by offering insightful, valuable content that enhances learning and understanding.

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