

NOTES

CLASS 7

SCIENCE

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ACIDS, BASES AND SALT

Acids:

Acids are compound in which one of the elements that makes up the acid molecule is always the hydrogen element. For example, hydrochloric acid (HCl).

Substances that contain acids are known as acidic substances. The word acid comes from the Latin word '*acere*' meaning sour.

Types of acids:

Based on the sources they are obtained from, acids are of two types:

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Organic acids: Acids that are naturally obtained from plants and animal sources are called organic acids.

Name of Acid	Source
Lactic acid	Curd, milk
Oxalic acid	Spinach tomatoes
Citric acid	Oranges and lemons
Malic acid	Apple
Tartaric acid	Unripe mangoes, grapes
Formic acid	Ant's sting
Acetic acid	Vinegar
Ascorbic acid	Amla



Mineral acids: Acid that are derived from an inorganic material or source are called mineral acids. For example, nitric acid, hydrochloric acid and sulphuric acid.

Depending upon the amount of water present in acids, they are categorized into concentrated and dilute acids.

Concentrated acids: Acids that contain only a small quantity of water are called concentrated acids.

Dilute acids: Acids that contain more water than the concentrated acid are called dilute acids. They can be obtained by adding water to a concentrated acid.

Properties of acids:

Acids are sour to taste.

- Acids turn blue Litmus to red.
- Acids can corrode metals like aluminium and iron due to their corrosive nature. That is why acids are stored in glass containers and not in metal containers.
- Acids are soluble in water.

- Acids react with metal to form a salt and hydrogen gas.
 $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$
 Magnesium + Hydrochloric acid $\rightarrow$ Magnesium chloride + hydrogen Gas
 Magnesium + Hydrochloric acid $\rightarrow$ Magnesium chloride + hydrogen Gas
- Acids react with bases to form a salt and water.
 $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
 Sodium hydroxide + Hydrochloric acid $\rightarrow$ Sodium chloride + water
 Sodium hydroxide + Hydrochloric acid $\rightarrow$ Sodium chloride + water
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- Acids react with carbonates to form a salt and carbon dioxide gas.
 $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
 Calcium Carbonate + Hydrochloric acid $\rightarrow$ Calcium chloride + water + Carbon dioxide
 Calcium Carbonate + Hydrochloric acid $\rightarrow$ Calcium chloride + water + Carbon dioxide

Strong acids	Weak acids
Hydrochloric acid sulphuric acid, nitric acid, phosphoric acid	citric acid, lactic acid, Acetic Acid, carbonic acid

Uses of acids:

Acids are widely used in industries and present in everyday products. Hydrochloric acid which is present in our stomach, help to digest our food. Uses of some acids are given in the following table;

Acids	Uses
Hydrochloric acid	used to remove rust from metals
Sulphuric acid	used in automobile batteries, fertilizers, paints plastic and dyes
Nitric acid	used in fertilizers, plastics, photographic films, explosive and dyes
Acetic acid	used in food supplements as a raw material and used as solvent

Bases:

Bases are compounds which contain oxygen or oxygen along with hydrogen. A base that contain oxygen is called an oxide while a base that contains oxygen along with hydrogen is called the Hydroxide. Substances that contain bases are called basic substances.

Types of Bases:

Based on how they take part in a reaction, bases are of two types: strong bases and weak bases.

Strong bases: Some of the bases are corrosive in nature and may result in skin burns. Such bases are called strong bases. For example, Sodium hydroxide, calcium hydroxide and potassium hydroxide.

Weak bases: Some of the bases are not corrosive in nature. Such bases are called weak bases.



For example, Magnesium hydroxide, Ammonium hydroxide, copper hydroxide.

Properties of bases:

- Bases are bitter to taste.
- Bases turn red litmus to blue.
- Some of the bases are soluble in water they are called alkalis (potassium hydroxide and sodium hydroxide).
- Bases react with acids to form a salt and water.
 $\text{NH}_4\text{OH} + \text{HCl} \rightarrow \text{NH}_4\text{Cl} + \text{H}_2\text{O}$
Ammonium Hydroxide + Hydrochloric acid $\rightarrow$ Ammonium chloride + water
Ammonium Hydroxide + Hydrochloric acid $\rightarrow$ Ammonium chloride + water
- Bases react with metals to form salt and hydrogen gas
 $2\text{NaOH} + \text{Zn} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2$
Sodium hydroxide + Zinc $\rightarrow$ Sodium Zincate + H_2
Sodium hydroxide + Zinc $\rightarrow$ Sodium Zincate + H_2

Uses of bases:

Sodium Hydroxide is a strong base and it is used to drain cleaners. Strong bases dissolve grease and help in removing dirt.

Uses of some bases are given in the following table:

Bases	Uses
Sodium hydroxide	used in the manufacture of paper soaps and detergent
Potassium hydroxide	used in the manufacture of soaps and batteries
Calcium hydroxide	used in the manufacture of mortar and plaster
Magnesium hydroxide (milk of magnesia)	used as an antacid to neutralize acidity in the stomach
Ammonium hydroxide	used in cleansing agent and manufacture of fertilizers



Salts

A salt is formed when an acid and a base react.

The reaction in which acids react with bases resulting in the formation of salt and water are called neutralization reactions.

Types of salts:

A salt can be acidic basic or neutral.

Acidic salts: Acidic salt are formed when strong acids react with weak bases. These salts have a pH value of less than 7. For example, ammonium chloride (NH_4Cl), aluminium chloride (AlCl_3).

Basic salts: Basic salts are formed when strong bases react with weak acids. These salts have a pH value of more than 7. For example, sodium carbonate (Na_2CO_3), Sodium acetate (CH_3COONa).

Neutral salts: Neutral salts are formed when strong acids react with strong bases. These salts

have a pH value of 7. For example, sodium chloride (NaCl), Potassium Nitrate (KNO₃).

Properties of Salts:

- Most of the salts are soluble in water.
- Solution of salts in water acts as good conductor of electricity.
- Some salts are white crystal whereas some are coloured. For example, copper sulphate is blue in colour and ferrous sulphate is green.
- Some salts contain water molecules trapped inside them, this is referred to as water of crystallization. The salts that contain water of crystallization are referred to as hydrated salts. For example, Blue vitriol (CuSO₄.5H₂O).
- Two or more salts that crystallize to form a single substance are referred to as mixed salts. For example, Alum K₂SO₄. Al₂(SO₄)₃.24H₂O.
- **Uses of salts**

Name of the salt	Common name	Uses
Sodium chloride (NaCl)	Common salt	Used for seasoning and preserving food, essential in life processes
Sodium carbonate (Na ₂ CO ₃)	Washing soda	Used as a detergent
Sodium Bicarbonate (NaHCO ₃)	Baking soda	Used in baking powder and manufacture of glass and in fire extinguisher
Potassium Nitrate (KNO ₃)	Nitre	Used in Fireworks and in the manufacture of fertilizers
Sodium nitrate (NaNO ₃)	Chile saltpetre	Used as a fertilizer and in the manufacture of gunpowder
Calcium carbonate (CaCO ₃)	Limestone	Used in construction of building, purification of iron
Calcium sulphate (CaSO ₄)	plaster of Paris (hydrated)	Used in the cement industry and in the synthesis of sulphuric acid
Calcium phosphate (Ca ₃ (PO ₄) ₂)	Bone mineral	Used in the manufacture of fertilizer and in medicine
Potassium Aluminium Sulphate (K ₂ SO ₄ .Al ₂ (SO ₄) ₃ .24H ₂ O)	Alum	Used in purification of water and in textile industry
Ammonium chloride (NH ₄ Cl)	Sal ammoniac	Used in soldering and in dry cell
Copper sulphate hydrated (CuSO ₄ .5H ₂ O)	Blue vitriol	used as fungicide and in textile industry

Neutralization reaction: When the bases react with acid to produce salt and water. This is a neutralization reaction. In a neutralization reaction, the acid loses its acidity and the base its alkalinity. As a result, a neutral solution is obtained.

Uses of neutralization reactions:

Following are some neutralization reaction that we observe in our everyday life.



In the treatment of ant sting: Some people are highly allergic to ant sting as it releases formic acid. It is neutralized by rubbing moist baking soda (sodium bicarbonate) or Calamine solution, which contains zinc carbonate on the affected area.

In the treatment of indigestion: Hydrochloric acid secreted in the stomach helps in the digestion of food. However, its excess secretion could lead to acidity and indigestion. Milk of magnesia is used to neutralize the acid.

In the treatment of soil: When the soil is too acidic, it is treated with slaked lime or quicklime, which is a base. If the soil is too basic, it is treated with organic matter such as fertilizers that are obtained from vegetables or fruits as they are acidic in nature.

In the treatment of sewage waste: several Industries produce acids as waste. If they are allowed to flow into water bodies, these wastages would affect aquatic organisms. Slaked lime (Calcium Hydroxide) is often used to neutralize this acidic waste let out from the factories.

Protecting teeth: One of the best common applications of neutralization of acids is the toothpaste. Toothpastes contain an alkali that neutralizes the weak acid produced by bacteria and prevent tooth damage.

Indicators: Substance that assist in determining whether a given substance is acidic or basic, with the help of a colour change are called indicators.

Natural indicators:

Litmus: Litmus is the most commonly used natural indicator extracted from lichen. Two types of Litmus are available: in the form of a solution, referred to as Litmus solution and a strip of paper called Litmus Paper. Acid turns blue Litmus red. Bases turn red litmus blue.

Turmeric: In acidic and neutral substances the turmeric solution remains yellow in colour, while in basic substance it turns brick red in colour.

China rose: China rose (Hibiscus) juice obtained from the petals is used as a natural indicator. if acidic substance are added, it turns dark pink (Magenta) in colour, while adding basic substances make the juice green.

Other commonly used acid base indicators-

Indicators	Colour in acid	Colour in base
Methyl orange	Red orange	Orange
Phenolphthalein	Colourless	Pink

Universal indicator:

Universal indicators are mixture of dyes or compounds that show a gradual change in colour to indicate the acidity or basicity for pH values from 1 to 14.

pH:

pH scale is a numerical representation of the acidity or basicity of substances. It varies from 1 to 14. Solution with a pH value of less than 7 are referred to as 'acids'; the ones with the pH value of more than 7 are referred to as 'bases' and those with a pH value of 7 are referred to as 'neutral'.



SOME IMPORTANT QUESTIONS-

1. Name the process in which a solid directly changes into gas on heating.

Answer: Sublimation

2. What is the range of a clinical thermometer?

Answer: 35°C to 42°C

3. What is acid rain?

Answer: The rain containing excess of acids is called an acid rain.

4. Which acid naturally present in our stomach?

Answer: Hydrochloric acid (HCl)

5. What is the role of hydrochloric acid in the stomach?

Answer: Hydrochloric acid (HCl) helps us to digest food.

6. Which acid is present in an ant sting?

Answer: Formic acid is present in an ant sting.

7. What is the nature of soap solution?

Answer: Soap solution is basic in nature.

8. What is the nature of distilled water?

Answer: The Distilled water is neutral.

9. State the nature of baking soda.

Answer: Baking soda is basic in nature.

10. Where does the word acid come from?

Answer: The word acid comes from the Latin word *acere* which means sour.

11. Why curd, lemon juice, orange juice and vinegar taste sour?

Answer: These substances taste sour because they contain acids.

12. Which is the most commonly used natural indicator?

Answer: The most commonly used natural indicator is litmus.

13. Tom rubs a solution between fingers and feels soapy, what is the nature of that solution?

Answer: Basic

14. Name the acid which is present in each cell of our body.

Answer: Each cell in our body contains an acid, the deoxyribonucleic acid or DNA.

15. When red litmus paper is dipped in a solution; it remains red, what is the nature of the solution?

Answer: Neutral

Short Extra Questions

1. What are the effects of acid rain?

Answer: Acid rain can cause damage to buildings, historical monuments, plants and animals.

2. What does organic matter do in soil?

Answer: If the soil is basic, organic matter is added to it. Organic matter releases acids which neutralises the basic nature of the soil.

3. Why solid baking soda does not change colour of dry litmus paper?



Answer: The solid baking soda does not change colour of dry litmus paper because in solid states ions are not free to move.

4. How acidic soil can be treated?

Answer: When the soil is too acidic, it is treated with bases like quick lime (calcium oxide) or slaked lime (calcium hydroxide).

5. What are salts? Give example.

Answer: In neutralisation reaction a new substance is formed. This is called salt. Salt may be acidic, basic or neutral in nature. Example: Sodium chloride.

6. What is the role of DNA in the cell of the human body?

Answer: It controls every feature of the body such as our looks, colour of our eyes, our height etc.

7. Give examples of some acids and bases.

Answer: Acids – Curd, lemon juice, vinegar, orange juice etc.

Base – baking soda, lime water etc.

8. What are indicators?

Answer: Solutions of substances that show different colour in acidic, basic and neutral solutions are called indicators.

9. What is the effect of the China rose indicator on acidic and basic solutions?

Answer: China rose indicator turns acidic solutions to dark pink (magenta) and basic solutions to green.

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

Answer: Ammonia is basic in nature as it turns the red litmus blue.

11. Why a turmeric stain on my white shirt is turned to red when it is washed with soap.

Answer: A turmeric stain on my white shirt is turned to red when it is washed with soap because the soap solution is basic in nature.

12. How to prepare lime water?

Answer: To prepare limewater, dissolve some lime (chuna) in water in a bottle. Stir the solution and keep it for some time. Pour a little from the top. This is lime water.

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

Answer: The solution could be a base or neutral solution because blue litmus paper doesn't change its colour in the neutral as well as in basic solution.

14. What do you mean by neutral solution? Give examples.

Answer: The solutions which do not change the colour of either red or blue litmus are known as neutral solutions. Examples- sugar solution, distilled water, salt etc.

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

Answer: Distilled water is neutral in nature. This can be verified by using red and blue litmus papers. Neither will show change in colour with distilled water. This proves that distilled water is neutral.



16. How does rain become acidic?

Answer: The rain becomes acidic because carbon dioxide, sulphur dioxide and nitrogen dioxide (which are released into the air as pollutants) dissolve in rain drops to form carbonic acid, sulphuric acid and nitric acid respectively.

Long Extra Questions

1. Why factory waste is neutralised before disposing it into the water bodies?

Answer: 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.

2. Calamine solution is applied on the skin when an ant bites. Give reason.

Answer: When an ant bites, it injects the acidic liquid (formic acid) into the skin. The effect of the acid can be neutralised by rubbing moist baking soda (sodium hydrogen carbonate) or calamine solution, which contains zinc carbonate.

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

Answer: Litmus solution is extracted from lichens. It is most commonly used natural indicator. It has a mauve (purple) colour in distilled water. When added to an acidic solution, it turns red and when added to a basic solution, it turns blue.

4. Why we take an antacid tablet when we suffer from acidity?

Answer: Our stomach contains hydrochloric acid. It helps us to digest food. But too much of acid in the stomach causes indigestion. Sometimes indigestion is painful. To relieve indigestion, we take an antacid such as milk of magnesia, which contains magnesium hydroxide. It neutralises the effect of excessive acid.

5. Explain the process of neutralisation with the help of an example.

Answer: 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.

Acid + Base $\rightarrow$ Salt + Water

(Heat is evolved)

The following reaction is an example:

Hydrochloric Acid + Sodium Hydroxide $\rightarrow$ Sodium Chloride + Water

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?

Answer: Dorji can use red and blue litmus paper in order to test the drink.

- The drink which does not change the colour of either red or blue litmus is the neutral drink.
- The drink which turns red litmus blue is the basic drink.
- The drink which turns blue litmus red is the acidic drink.



7. Complete the following table.

Answer:

Found in	Name of acid
Vinegar	Acetic acid
Ant's sting	Formic acid
Citrus fruits such as oranges, lemons, etc.	Citric acid
Curd	Lactic acid
Spinach	Oxalic acid
Amla, Citrus fruits	Ascorbic acid (Vitamin C)
Tamarind, grapes, unripe mangoes, etc.	Tartaric acid



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.

Answer: Put a drop of each of the three liquids i.e., hydrochloric acid, sodium hydroxide and sugar solution on the turmeric indicator, the liquid which changes the colour of turmeric indicator to red is basic in nature, that is, sodium hydroxide.

Now, put a drop of sodium hydroxide on a drop of each of the other two liquids separately i.e. hydrochloric acid and sugar solution. After that, put the drops of these mixtures on turmeric indicator. The drop which will change colour of the turmeric indicator to red contains sugar solution. This is because the mixture of basic and neutral solution is basic in nature. On the other hand, the drop will not change the colour of turmeric indicator contains hydrochloric acid. This is because hydrochloric acid reacts with sodium hydroxide to form a neutral solution.



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