Chapter = 02

Acid, Base, Salt

Q 1. Discus the properties of acid and base

PROPERTIES OF ACID

1. Acids have sour taste.
2. They change the colour of blue litmus to red.
3. Aqueous solution of acids conducts electricity.
4. When react with base, they from salt and water.

PROPERTIES OF BASE

1. Bases have bitter taste.
2. Bases are slippery to touch.
3. They changed the colures of red litmus to blue.
4. Aqueous solution of bases, conduct electricity.
5. They react with acids to form salt and water.

Q 2. Elaborate the Arrhenius concept of acid and base with suitable example

ARRHENIUS THEORY OF ACIDS

The acids are those substances that produce Hydrogen (H^+) ions when dissolved in water are called acids

EXAMPLE:

HCl, HNO_3, CH_3COOH, HCN)

ARRHENIUS THEORY OF BASE

Bases are those substances that produce hydroxide ion (OH^-) when dissolved in water

EXAMPLE:

NaOH, KOH, NH_4OH, $Ca(OH)_2$).

Q 3. What is the limitation of Arrhenius theory?

LIMITATIONS OF ARRHENIUS THEORY

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

Q 4. What is Bronsted-Lowry acid- base theory?

BRONSTED-LOWRY THEORY OF ACID AND BASES

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.

$$HCl + H_2O \rightleftharpoons H_3O^+ + Cl^-$$

Thus, HCl is a Bronsted acid and H_2O is Bronsted base. H_3O^+ is Conjugated acid and Cl^- is a Conjugated base.

Q 5. What is the limitation of Bronsted-Lowry theory?

LIMITATIONS OF BRONSTED-LOWRY CONCEPT

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

Q 6. Discus the Lewis concept of acid and base.

LEWIS'S THEORY OF ACID

An acid is a substance that is capable of accepting an electron pair. a Lewis acid is an electron pair acceptor

LEWIS'S THEORY OF BASE

Base is a substance that is capable of donating an electron pair. Thus, and a Lewis base is an electron pair donor

Q 7. **What is the limitation of Lewis theory?**

LIMITATIONS OF LEWIS ACID AND BASE CONCEPT

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

Q 8. **What is P_H and P_{OH}?**

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

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

Q 9. **What is salt? Give some examples of salt**

SALTS

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

Examples: $NaCl$, $CuCl_2$, etc.

Q 10. **Write chemical preparation of salts**

$$CaO + H_2SO_4 \rightarrow CaSO_4 + H_2O$$

(Calcium oxide) (Calcium sulphate)

$$KOH + HNO_3 \rightarrow KNO_3 + H_2O$$

(Potassium hydroxide) (Potassium nitrate)

$$BaCO_3 + 2HCl \rightarrow BaCl_2 + CO_2 + H_2O$$

(Barium carbonate) (Barium chloride)

$$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_20$$

(Sodium sulphate)

Q 11. Discus the types of salts

TYPES OF SALTS

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, $Ca(NO_3)$, $NaHSO_4$, NaH_2PO_4, Such salts solution have pH less than 7.

BASIC SALT:

Basic salts are those salts which are distinctly basic in nature they produce alkaline solution when dissolved in water

FOR EXAMPLE

CH_3COONo, K_2CO_3, Na_2CO_3, KCN.

Such salts solution has pH more than 7.

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.

Q 12. Give uses of salt

USES OF SOME SALTS

1. Salts play an important role in our daily life.
2. Most of the chemical fertilizers used in agriculture by farmers are salts.

3. Certain salts are used as pesticides to kill or destroy insects, pests, weeds and fungi.
4. In medical field hydrated calcium sulphate, is found in plaster of Paris. It is used to make plaster casts for supporting broken bones.
5. Patients suffering from anemia use iron (11) sulphate heptahydrate is an ingredient in 'iron Pills as food supplement.
6. Sodium hydrogen carbonate is ap ingredient in anti-acids. This salt can neutralize the excess acid secreted by the stomach.
7. 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
8. Potassium permanganate (VII) can kill bacteria and hence is suitable for use as a disinfectant

Q 13. Discus the P_H in our food.

- The pH of acidic food is 0 to7
- The neutral food has exact pH 7
- The alkaline food is from pH 7 to 14.

A healthy human body required a controlled pH level in the serum up to 7.4, which is slightly alkaline.

Q 14. What are the effect of acid rain

HARMFUL EFFECTS OF ACID RAIN

1. It affects both animals and humans' respiratory systems.
2. Acid rain has an impact on the aquatic ecology when it falls and runs into rivers and ponds.
3. 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.
4. Acid rain also causes water pipelines to corrode, resulting in heavy metals such as iron, lead, and copper seeping into drinking water.
5. It causes damage to stone and metal structures and monuments.

Q 15. Write short note on stomach acidity

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.

Q 16. Define the following terms;

(a) Indicator (b) Neutralization (c) Titration

(a) Indicator

Indicators are weak organic acid or base which change their color over small range of pH.

(b) Neutralization

Neutralization is a reaction between acid and base to produce salt and water

(c) Titration

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 toa known quantity of the analyte (the unknown solution) until the reaction is complete.

Q 17. Define buffers. What is the composition of buffers? Discuss its importance in our daily life.

BUFFER SOLUTION

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

COMPOSITION OF 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 toa buffer or allowing water to evaporate will not change the pH of a buffer.

IMPORTANT

1. Bicarbonate buffer maintains the pH of the blood.
2. Phosphate buffer maintains the internal environment of cells.
3. Hemoglobin has buffering capacity.
4. Proteins have a zwitterionic structure that enables them to resist pH change.

Q 18. **Classify the following solutions as acidic, basic or neutral.**

A solution that has $[H^+]=1x10^{-4}$ mol. dm^3

A solution that has $[H^+]=1x10^{-11}$ mol. dm^3

A solution that has $[OH^-]=lx10^{-9}$ mol. dm^3

A solution that has $[OH^-]= 1x10^{-3}$ mol. dm^3

NUMERICAL

Book Example. 1

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

Book Example.2

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

Book Numerical

1. Calculate pH of 5M solution of NaOH.
1. A solution of H_2SO_4 has pH of 1.05 calculate its pOH and [H']
2. The hydrogen ion concentration of a solution is $1x10^{-8}$ mol. dm'. what is pH of the solution?