Salts

Multiple Choice Questions (5-7)

1. **What are salts?**
   a) Covalent compounds formed from non-metals.
   b) Ionic compounds formed from the combination of cations and anions.
   c) Mixtures of acids and bases.
   d) Neutral compounds formed only from metals.

   Answer: b) Ionic compounds formed from the combination of cations and anions.

2. **In the formation of a salt, the positive ions (cations) are typically supplied by the:**
   a) Acid
   b) Base
   c) Water
   d) Indicator
   Answer: b) Base
3. **In the formation of a salt, the negative ions (anions) are typically supplied by the:**
   a) Acid
   b) Base
   c) Water
   d) Salt itself
   Answer: a) Acid
4. **The force that holds the positive and negative ions together in a salt is:**

a) Covalent bonding
b) Magnetic attraction
c) Electrostatic attraction
d) Hydrogen bonding
Answer: c) Electrostatic attraction

5. **In the reaction $HCl + NaOH \rightarrow NaCl + H_2O$, which of the following is the salt formed?**
   a) HCl
   b) NaOH
   c) NaCl
   d) H_2O
   Answer: c) NaCl

Short Questions (4-6)

1. **Define a salt and explain its formation from an acid and a base.**
   Salts are ionic compounds formed through the electrostatic attraction between oppositely charged ions known as cations and anions. In a typical acid-base reaction, the base provides the positive cations, while the acid provides the negative anions. These ions, originating from the acid and base, combine to form a neutral ionic compound, which is the salt. For example, in the reaction between NaOH and HCl, Na^+ from the base and Cl^- from the acid combine to form the salt NaCl.
2. **Using the example of sodium chloride formation, identify the source of its ions.**
   Sodium chloride (NaCl) is formed from the reaction between hydrochloric acid (HCl) and sodium hydroxide (NaOH). The sodium ion (Na^+) is the cation supplied by the base, sodium hydroxide. The chloride ion (Cl^-) is the anion supplied by the acid,

hydrochloric acid. These ions are held together by strong electrostatic forces of attraction to form the neutral salt, NaCl.

3. **Why is the principle of ionic bonding crucial in understanding salts?**
   The principle of ionic bonding is crucial because it explains the formation, structure, and many physical properties of salts. It describes how the electrostatic attraction between oppositely charged ions leads to the formation of a stable, neutral compound. This bonding is responsible for the characteristic crystal lattice structure, high melting points, and electrical conductivity in molten or aqueous states observed in salts.

Physical Properties of Salts

Multiple Choice Questions

1. **What is the physical state of most salts at Standard Temperature and Pressure (STP)?**
   a) Liquid
   b) Gas
   c) Solid
   d) Plasma
   Answer: c) Solid
2. **The high melting points of ionic compounds are primarily due to:**
   a) The presence of free electrons.
   b) Weak intermolecular forces.
   c) Strong electrostatic forces in the lattice.
   d) Low atomic masses of the ions.
   Answer: c) Strong electrostatic forces in the lattice.

3. **Why do solid salts not conduct electricity?**
   a) They have no ions.
   b) Their ions are not free to move.
   c) They have free electrons.
   d) They are covalently bonded.
   Answer: b) Their ions are not free to move.
4. **In which of the following states can a salt like NaCl conduct electricity?**
   a) Solid only
   b) Solid and aqueous solution
   c) Molten and aqueous solution
   d) It never conducts electricity.
   Answer: c) Molten and aqueous solution
5. **The brittleness of ionic compounds is caused by:**
   a) The ductility of the metal ions.
   b) The shifting of ion layers leading to repulsion between like charges.
   c) The presence of water molecules.
   d) Weak ionic bonds breaking easily.
   Answer: b) The shifting of ion layers leading to repulsion between like charges.
6. **What is the name of the repeating three-dimensional pattern in which ions are arranged in a solid salt?**
   a) Atomic cloud
   b) Molecular cluster
   c) Crystal lattice
   d) Ionic gel
   Answer: c) Crystal lattice

Short Questions

1. **Explain why salts are solid at room temperature and have high melting points.**
   Salts are solid at room temperature due to the strong electrostatic forces of attraction between the oppositely charged ions that form a rigid, tightly bound crystal lattice structure. A significant amount of energy, in the form of heat, is required to overcome these powerful forces to break the lattice and melt the solid. This high energy requirement is the reason why ionic compounds have high melting points.
2. **Describe the electrical conductivity of a salt in its solid, molten, and aqueous states.**
   In its solid state, a salt does not conduct electricity because its ions are fixed in place within the crystal lattice and cannot move. In the molten state, the lattice breaks down, freeing the ions to move and carry electrical charge. Similarly, when dissolved in water (aqueous state), the salt dissociates into free-moving ions, allowing the solution to conduct electricity.
3. **How does the crystal lattice structure contribute to the stability of an ionic compound?**
   The crystal lattice is a highly ordered, repeating three-dimensional arrangement of cations and anions. This specific arrangement maximizes the electrostatic attractions between oppositely charged ions while simultaneously minimizing the repulsions between ions of the same charge. This balance of attractive and repulsive forces results in a very stable and strong structure with low potential energy.
4. **Why are ionic compounds hard yet brittle?**
   Ionic compounds are hard because of the strength and rigidity of their crystal lattice structure, which strongly resists being

deformed. However, they are brittle because when a force is applied, it can shift layers of the lattice. This shift may bring ions of the same charge (like-charged ions) face-to-face, causing a strong repulsive force that splits the crystal, making it shatter.

Preparation of Soluble Salts

Multiple Choice Questions

1. **Which method is used to prepare a salt when both the acid and the base are soluble?**
   a) Preparation with Excess Metal
   b) Preparation with Excess Insoluble Carbonate
   c) Titration
   d) Filtration
   Answer: c) Titration
2. **In the preparation of Zinc Sulphate, why is excess zinc metal added to the sulphuric acid?**
   a) To make the reaction faster.
   b) To ensure all the acid is reacted.
   c) To make the salt insoluble.
   d) To act as a catalyst.
   Answer: b) To ensure all the acid is reacted.
3. **What is the observable sign that the reaction between an acid and a carbonate is complete?**
   a) A colour change.
   b) A temperature drop.
   c) The formation of a precipitate.
   d) The cessation of effervescence.
   Answer: d) The cessation of effervescence.

4. **In the titration method for preparing NaCl, what indicates the neutralization endpoint?**
   a) The production of a gas.
   b) A change in the indicator's colour.
   c) The formation of a precipitate.
   d) A change in temperature.
   Answer: b) A change in the indicator's colour.
5. **After the reaction is complete in the 'excess metal' method, the next step to obtain pure crystals is:**
   a) Evaporation to dryness
   b) Filtration to remove excess reactant
   c) Adding more water
   d) Distillation
   Answer: b) Filtration to remove excess reactant
6. **The gas produced when an acid reacts with a metal carbonate is:**
   a) Hydrogen
   b) Oxygen
   c) Nitrogen
   d) Carbon Dioxide
   Answer: d) Carbon Dioxide

Short Questions

1. **Describe the titration method for preparing a soluble salt like sodium chloride.**
   Titration is used when both the acid and base are soluble. A measured volume of an acid (e.g., HCl) is placed in a flask with an indicator. A base (e.g., NaOH) is slowly added from a burette until the indicator changes colour, signaling neutralization. The exact volume of base used is noted. The resulting salt solution is then

gently evaporated to saturation and allowed to cool and crystallize. The crystals are then filtered out.

2. **Explain why an excess of an insoluble reactant (like a metal or carbonate) is used in some salt preparation methods.**
   An excess of the insoluble reactant is used to ensure that all of the soluble acid completely reacts. Since the excess solid is insoluble, it remains in the beaker after the reaction is finished. This makes it easy to separate the unreacted solid from the desired salt solution by simple filtration, ensuring no acid remains in the final product and the yield is maximized.
3. **Outline the steps involved in preparing copper(II) sulphate using copper(II) oxide and sulphuric acid.**
   First, an excess of solid copper(II) oxide is added to a measured volume of dilute sulphuric acid and heated. The addition continues until no more solid dissolves, indicating all acid has reacted. The mixture is then filtered hot to remove the unreacted excess copper(II) oxide. The filtrate (copper(II) sulphate solution) is evaporated to obtain a saturated solution, which is then cooled to crystallize. The blue crystals of $CuSO_4$ are finally collected by filtration.
4. **What is the purpose of the crystallization step in salt preparation?**
   The purpose of crystallization is to obtain pure, solid crystals of the salt from its solution. Gently evaporating some water creates a concentrated, saturated solution. Upon cooling, the solubility of the salt decreases, causing it to come out of the solution in the form of well-defined crystals. This process helps to separate the pure salt from any soluble impurities and yields a product with a regular crystalline structure.

Solubility of Salts

Multiple Choice Questions

1. **According to the solubility rules, which of the following salts is always soluble?**
   a) Calcium Carbonate
   b) Silver Chloride
   c) Potassium Nitrate
   d) Lead(II) Sulphate
   Answer: c) Potassium Nitrate
2. **Which of the following carbonates is soluble in water?**
   a) Calcium Carbonate ($CaCO_3$)
   b) Magnesium Carbonate ($MgCO_3$)
   c) Sodium Carbonate (Na_2CO_3)
   d) All of the above
   Answer: c) Sodium Carbonate (Na_2CO_3)
3. **Which ion, when present in a salt, makes the salt soluble regardless of the counter-ion?**
   a) Chloride (Cl^-)
   b) Carbonate (CO_3^{2-})
   c) Ammonium (NH_4^+)
   d) Sulphate (SO_4^{2-})
   Answer: c) Ammonium (NH_4^+)
4. **Which pair of salts are both insoluble in water?**
   a) NaCl and KBr
   b) AgCl and $PbSO_4$
   c) KNO_3 and NH_4Cl
   d) Na_2SO_4 and $MgCO_3$
   Answer: b) AgCl and $PbSO_4$

5. **What is the solubility of most sulphate salts?**
   a) Mostly insoluble
   b) Always insoluble
   c) Mostly soluble
   d) Soluble only when heated
   Answer: c) Mostly soluble

Short Questions (

1. **State the general solubility rule for nitrate salts and sodium salts.**
   According to the general solubility rules, all salts containing nitrate ions (NO_3^-) are soluble in water. Examples include potassium nitrate (KNO_3) and calcium nitrate ($Ca(NO_3)_2$). Similarly, all salts containing sodium ions (Na^+) are also soluble in water, such as sodium chloride (NaCl) and sodium sulphate (Na_2SO_4).
2. **Identify two common chloride salts that are insoluble in water.**
   Two common chloride salts that are exceptions to the general rule and are insoluble in water are silver chloride (AgCl) and lead(II) chloride ($PbCl_2$). While most chlorides are soluble, these two specific compounds form precipitates in aqueous solutions.
3. **Explain the solubility of carbonate salts, mentioning any exceptions.**
   Most carbonate salts are insoluble in water. Common examples of insoluble carbonates include calcium carbonate ($CaCO_3$) and magnesium carbonate ($MgCO_3$). The key exceptions to this rule are the carbonates of sodium, potassium, and ammonium, which are soluble. For instance, sodium carbonate (Na_2CO_3) dissolves readily in water.
4. **Why is knowledge of solubility rules important in chemistry?**
   Knowledge of solubility rules is fundamental for predicting the

outcomes of chemical reactions in solution, particularly precipitation reactions. It allows chemists to determine whether a reaction will form a solid precipitate.