Top 10 Advanced Questions

Acids, Bases and Salts

1. Why does distilled water conduct electricity very poorly, but when you add a small amount of acid or base, conductivity increases significantly? Explain with ionic theory.

> Distilled water is almost pure H_2O with very few ions, so it conducts electricity poorly because electricity flows via ions. When acid (like HCl) or base (like NaOH) is added, they dissociate into ions (`H⁺, Cl⁻, Na⁺, OH⁻`). These ions move and carry charge, so conductivity increases drastically.

2. If you mix equal volumes of 0.1 M HCl and 0.1 M NaOH solutions, what will be the pH of the resulting solution? What happens if you mix 0.1 M HCl and 0.05 M NaOH?

> - Equal volumes & concentrations of strong acid and base neutralize each other completely → pH = 7 (neutral).
> - If 0.1 M HCl is mixed with 0.05 M NaOH (less base), acid remains in excess → solution acidic → pH < 7.

3. Explain why baking soda ($NaHCO_3$) is used to neutralize acid spills but not bases. What is the chemical reaction

involved?

Baking soda is a weak base and reacts with acids to form salt, water, and CO_2 gas which helps neutralize acid spills:

$NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO_2\uparrow$

With bases, it does not neutralize but may increase alkalinity, so not used.

4. Why is ammonium hydroxide (NH_4OH) considered a weak base, even though it releases OH^- ions? Explain with equilibrium concept.

NH_4OH partially dissociates:

$NH_4OH \rightleftharpoons NH_4^+ + OH^-$

Since dissociation is incomplete, few OH^- ions are produced → weak base. Strong bases fully dissociate.

5. When a strong acid reacts with a weak base, the resulting solution is acidic. Explain why, with an example.

Strong acid (HCl) fully dissociates, weak base (NH_4OH) partially. After neutralization, NH_4^+ ion (from NH_4OH) can hydrolyze, releasing H^+ ions → solution acidic:

$NH_4Cl + H_2O \rightarrow NH_4^+ + Cl^-$

$NH_4^+ + H_2O \rightleftharpoons NH_3 + H_3O^+$ (acidic)

6. Explain the effect of dilution on the strength and concentration of an acid. Can dilution turn a strong acid into a weak acid? Why or why not?

Dilution decreases concentration but **does not change strength**. Strength depends on dissociation degree, concentration on number of moles per litre. Strong acid still dissociates fully even when diluted, so strength remains.

7. Why does an aqueous solution of CH_3COOH (acetic acid) conduct electricity poorly compared to HCl of the same concentration?

CH_3COOH is a weak acid; it partially dissociates → fewer ions → low conductivity. HCl is strong acid; fully dissociates → more ions → high conductivity.

8. Why does universal indicator paper show different colors for the same salt solution if the salt is hydrated versus anhydrous? Explain the role of water of crystallization.

Hydrated salt releases water of crystallization which can hydrolyze, changing pH (e.g., acidic/basic), affecting indicator color. Anhydrous salt lacks this water → different pH effect.

9. Explain why milk of magnesia ($Mg(OH)_2$ suspension) is used as an antacid, despite its low solubility in water.

Milk of magnesia is slightly soluble, releasing OH^- ions slowly. It neutralizes stomach acid gently without irritation, making it effective antacid.

10. How does the salt formed in the neutralization of a strong acid and weak base behave in water? Does it affect the pH of the solution? Give an example.

Salt from strong acid + weak base (e.g., NH_4Cl) hydrolyzes in water to produce acidic solution because NH_4^+ ion reacts with water to form NH_3 and H_3O^+ ions, lowering pH.