What are Qualitative Analysis Tests?

Worksheet

Qualitative tests detect the presence (not amount) of ions/compounds by observing colors, precipitates, or gases. Examples: sodium ions produce yellow flame; silver ions form white AgCl precipitate; sulfide ions produce black PbS. Each ion has a characteristic 'signature.'

Questions

1. In a flame test, a lilac (violet) color indicates

A) Sodium Na
B) Potassium K
C) Calcium Ca
D) Copper Cu

2. When AgNO is added to a Cl solution, a white precipitate forms. If you add NH and the precipitate dissolves, you confirm

A) Ag only
B) Cl only
C) Ag (the dissolving behavior is diagnostic)
D) Both Ag and Cl

3. A solution gives a reddish-brown precipitate when NaOH is added. This is likely

A) Fe
B) Fe
C) Cu
D) Pb

4. When HS gas is bubbled through an acidic solution, a yellow precipitate forms. What is likely present?

A) Pb (black PbS)
B) Cd (yellow CdS)
C) Cu (black CuS)
D) Fe (not typically precipitated by HS)

5. A white precipitate forms when NaCl solution is added to a mystery solution. The precipitate dissolves in ammonia. What ion was present?

6. When a solution is acidified and HS gas is bubbled through, a black precipitate forms. What is likely present?

7. A solution gives a bright yellow flame test and a white precipitate with sulfuric acid. Identify the metal ion.

8. Define: What is qualitative analysis?

9. Define: What is a flame test and what does it detect?

10. Define: What makes AgCl special in qualitative analysis?

Answer Key

1. B) Potassium K - Lilac/violet flame is diagnostic for potassium ions. Sodium = yellow, calcium = brick-red, copper = blue-green.

2. C) Ag (the dissolving behavior is diagnostic) - The white precipitate is AgCl. Its dissolution in ammonia is diagnostic for Ag - it forms the soluble [Ag(NH)] complex, confirming Ag.

3. B) Fe - Fe + 3OH Fe(OH), reddish-brown precipitate. Fe gives greenish Fe(OH); Cu gives blue Cu(OH); Pb gives white Pb(OH).

4. B) Cd (yellow CdS) - CdS (cadmium sulfide) is yellow. PbS is black; CuS is black/brown. Yellow sulfide precipitate = Cd.

5. White precipitate + solubility in ammonia suggests AgCl (silver chloride). This is the classic AgCl test: Ag (aq) + Cl (aq) AgCl (s) white A key feature: AgCl is insoluble in water but dissolves in excess NH [Ag(NH)] complex. Conclusion: The mystery solution contained Ag (silver ion).

6. Black precipitate from HS suggests a heavy metal sulfide (FeS, CuS, PbS, or ZnS). The black color is characteristic of PbS (lead sulfide). Reaction: Pb (aq) + HS (aq) PbS (s) black HS is a common reagent in qualitative analysis for detecting Pb, Cu, Bi, and other metal cations.

7. Bright yellow flame sodium (Na) - this is distinctive and diagnostic. White precipitate with HSO NaSO is soluble, so this test doesn't confirm a specific ion. Conclusion: Na is present (confirmed by flame test; sulfate test is non-diagnostic here).

8. Chemical identification of ions/compounds by observing visible changes (colors, precipitates, gases), without measuring concentrations. A rapid, inexpensive diagnostic tool.

9. A metal salt is heated in a flame; the characteristic color of the flame identifies the metal. Example: Na = yellow, K = lilac, Cu = green-blue.

10. It forms a white precipitate with Ag and Cl. Unlike most salts, AgCl dissolves in excess ammonia, forming [Ag(NH)] complex, confirming Ag is present.