Precipitation Equations and Reactions

Precipitation = ppt Solution = soln

Reaction = rxn

Definition

A precipitation rxn occurs when two solutions are combined that contain dissolved ionic compounds. When the solns are mixed, the cation from one compound can combine with the anion from the other compound to form a neutral ionic compound that forms a solid. The solid is a precipitate.

Precipitation Equation: Is a balanced chemical equation that shows the combination of a cation with an anion to form a neutral ionic compound that has formed a solid. The precipitation equation is the opposite of

Qualitative Analysis

1. Test for Silver (Ag^+): is the addition of chloride (Cl^-) to form $AgCl(s)$ - a white ppt. Test is: 2 drops unknown soln plus two drops Cl^- test soln.

2. Test for chloride (Cl^-): is the addition of silver ion (Ag^+ from $AgNO_3$) to form $AgCl(s)$ - white ppt. Test: 2 drops unknown soln. 2 drops $AgNO_3$.

3. Test for barium (Ba^{+2}): is the addition of sulfate soln (Na_2SO_4) to produce $BaSO_4$ - white ppt. Test: 2 drops unknown soln. 2 drops sulfate soln.

4. Test for sulfate (SO_4^{-2}): is the addition of barium ion ($Ba(NO_3)_2$) to produce $BaSO_4$ - white ppt. Test: 2 drops unknown soln. 2 drops $Ba(NO_3)_2$

5. Test for lead (Pb^{+2}): is the addition of iodide (KI) to form PbI_2 - yellow ppt. Bright yellow! Test: 2 drops unknown soln. 2 drops KI soln.

6. Test for iodide (I^-): is the addition of lead ion ($Pb(NO_3)_2$) to form PbI_2 - yellow ppt. Test. 2 drops unknown soln. 2 drops $Pb(NO_3)_2$

Qualitative Analysis

7. Carbonate (CO_3^{-2}) test: Two methods:

(a) Solid compound: place a small amount of the solid in a test tube. Add 2-4 drops of HCl or HNO_3. If bubbles are observed, then the compound has CO_3^{-2} in it. (b) Liquids: Place 6 drops of the liquid in a test tube. Add 2-4 drops of HCl or HNO_3. If bubbles are observed then the compound contains CO_3^{-2}.

8. Hydrate Test: Place a small amount of the solid in a dry test tube. Heat the tube gently over a bunsen burner. Watch for the formation of droplets of liquid and condenstation on the walls of the tube. If liquid is present then the compound is a hydrate.

9. Test for Nitrate (NO_3^-): Add 20 drops of unknown compound to test tube. Add a small amount of Al powder. Add 20-40 drops of NaOH (1M) solution. Pre-wet a piece of red litmus paper. Gently heat the mixture over a bunsen flame until the reaction starts. Once good vapor is rising from the strong, bubbling, exothermic reaction, expose the wet litmus to the vapor. If the red litmus turns blue, the compound contains a nitrate.

Ag, CO_3=Br, SO_4=, O_2=I CO_3

5. Tests for the following cations are all the same: Al^{+3}, Ca^{+2}, Cu^{+2}, Fe^{+2}, Fe^{+3}, Zn^{+2}.

a. Add 2 drops of soln to be tested to a clean tube.

b. Add 1 drop of a NaOH soln. Mix. Observe. If ppt: write down color.

c. Now add sequential drops of NaOH soln one at a time. Mix. Observe. write down observation. use the cheat sheet to identify the cation.

d. Repeat a, b, c using the NH_4OH soln.

e. Combine all data to identify the cation.

cation	*effect of aqueous sodium hydroxide*	*effect of aqueous ammonia*
aluminium (Al^{3+})	white ppt., soluble in excess giving a colourless solution	white ppt., insoluble in excess
ammonium (NH_4^+)	ammonia produced on warming	–
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt., or very slight white ppt.
copper (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess giving a dark blue solution
iron(II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) (Fe^{3+})	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess giving a colourless solution

Test for gases

gas	*test and test results*
ammonia (NH_3)	turns damp red litmus paper blue
carbon dioxide (CO_2)	turns limewater milky
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	'pops' with a lighted splint
oxygen (O_2)	relights a glowing splint