2/22/16

ppt = precipitate = Solid formed during a reaction (key: Reactants are both aqueous)

Determine ppt by checking both products on Solubility table — insoluble = ppt

Practice:

1. $HgNO_3 + KCl \rightarrow Hg_2Cl_2 + KNO_3$ ppt = Hg_2Cl

2. $3KMnO_4 + AlPO_4 \rightarrow K_3PO_4 + Al(MnO_4)_3$ none

3. $Pb(ClO_3)_2 + Na_2SO_4 \rightarrow PbSO_4 + NaClO_3$ ppt = $PbSO_4$

1. $Ca(NO_3)_2 + Na_2(SO_4) \rightarrow Ca(SO_4)$ (ppt) $+ 2NaNO_3$

full ionic equation

$Ca^{2+} + 2NO_3^{1-} + 2Na^{1+} + SO_4^{2-} \rightarrow CaSO_4(ppt) + 2Na^{1+} + 2NO_3^{1-}$

Net ionic equation

$Ca^{2+} + SO_4^{2-} \rightarrow CaSO_4(ppt)$

2. $BaCl_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(ppt) + 2NaCl(aq)$

full ionic eq.

$Ba^{2+} + 2Cl^{1-} + 2Na^{1+} + SO_4^{2-} \rightarrow BaSO_4(ppt) + 2Na^{1+} + 2Cl^{1-}$

net ionic eq.

$Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4(ppt)$

3. $Pb(NO_3)_2(aq) + H_2SO_4(aq) \rightarrow PbSO_4(s)$ (ppt) $+ 2HNO_3(aq)$

full ionic eq.

$Pb^{2+} + 2NO_3^{1-} + 2H^{1+} + SO_4^{2-} \rightarrow PbSO_4(ppt) + 2H^{1+} + 2NO_3^{1-}$

net ionic eq.

$Pb^{2+} + SO_4^{2-} \rightarrow PbSO_4(ppt)$

Redox

Reduction - Oxidation

Leo - Ger

Lose e^- oxidation

Gain e^- reduction

$$\overset{0}{Mg(s)} + 2\overset{+1\ -1}{HCl(aq)} \longrightarrow \overset{0}{H_2(g)} + \overset{+2\ -2}{MgCl_2}$$

$Mg = \emptyset$ $H = +1$ $Cl = -1$ $H = \emptyset$ $Mg = +2$ $Cl = -1$

$Mg^0 \longrightarrow Mg^{2+} + 2e^-$ oxidation

$2H^+ + 2e^- \longrightarrow 2H^0$ reduction

Practice:

D 1.

A/C 2.

B 3.

E 4

A/C 5.

1. ppt = Hg_2Cl_2
2. ppt = none
3. ppt = $PbSO_4$

Hints:

Oxidation-Reduction

DC (syn) & SR

Combustion

$+ O_2(g)$

Ionic has charges

Acid-Base

products = salt + H_2O

Precipitation

DR only & produces a solid

PPt Practice

1. No ppt – No Rxn

2. ionic equation

$Ba^{2+} + 2Cl^{1-} + 2Na^{1+} + SO_4^{2-} \longrightarrow BaSO_4(ppt) + 2Na^{1+} + 2Cl^{1-}$

net ionic equation

$Ba^{2+} + SO_4^{2-} \longrightarrow BaSO_4(ppt)$

3. ionic equation

$Pb^{2+} + 2NO_3^{1-} + 2H^{1+} + SO_4^{2-} \longrightarrow PbSO_4(ppt) + 2H^{1+} + 2NO_3^{1-}$

net ionic equation

$Pb^{2+} + SO_4^{2-} \longrightarrow PbSO_4(ppt)$

Redox Practice:

1. $2Fe(s) + 3S(s) \rightarrow Fe_2S_3(s)$

+6 -6

$Fe = \emptyset \quad S = \emptyset \quad Fe = +3 \quad S = -2$

$2Fe^{\circ} \longrightarrow 2Fe^{3+} + 6e^-$ oxidation

$3S^{\circ} + 6e^- \longrightarrow 3S^{-2}$ reduction

2. $4K(s) + C(s) \rightarrow K_4C(s)$

$4K = \emptyset \quad C = \emptyset \quad 4K = +1 \quad C = -4$

$4K^{\circ} \rightarrow 4K^{1+} + 4e^-$ oxidation

$C^{\circ} + 4e^- \rightarrow C^{-4}$ reduction

3. $2Al(s) + Fe_2O_3(s) \longrightarrow 2Fe(s) + Al_2O_3(s)$

$2Al = \emptyset \quad 2Fe = +3 \quad 3O = -2 \quad 2Fe = \emptyset \quad 2Al = +3 \quad 3O = -2$

$2Al^{\circ} \rightarrow 2Al^{3+} + 6e^-$

$2Fe^{3+} + 6e^- \rightarrow 2Fe^{\circ}$

$KClO_3$ $\quad \frac{+5 + -6}{ClO_3} = -1$

potassium chlorate $\xrightarrow{\Delta}$ potassium chloride + oxygen gas

$2\,KClO_3(s) \xrightarrow{\Delta} 2\,KCl + 3\,O_2(g)$

Redox:

$2K = +1 \quad 2Cl = +5 \quad 6O = -2 \quad \therefore \quad 2K = +1 \quad 2Cl = -1 \quad 6O = \emptyset$

$2Cl^{+5} + 12e^- \longrightarrow 2Cl^{1-}$ reduction

$6O^{2-} \longrightarrow 6O^{\circ} + 12e^-$ oxidation

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Precipitation Reactions

Rxn where two aqueous compounds combine (DR) → 2 new compounds
1 of which is insoluble in H_2O (ppt)

Evaluate both products using the Solubility Table

if no ppt → no rxn

Practice

1. Hg_2Cl_2 or KNO_3 ppt Hg_2Cl_2
2. K_3PO_4 or $Al(MnO_4)$ ppt No Rxn
3. $PbSO_4$ or $NaClO_3$ ppt $PbSO_4$

1. No Rxn
2. $BaCl_2(aq) + Na_2SO_4(aq) \longrightarrow BaSO_4(ppt) + 2NaCl(aq)$

full ionic equation

$Ba^{2+} + 2Cl^{1-} + 2Na^{1+} + SO_4^{2-} \longrightarrow BaSO_4(ppt) + 2Na^{1+} + 2Cl^{1-}$

net ionic equation

$Ba^{2+} + SO_4^{2-} \longrightarrow BaSO_4(ppt)$

3. $Pb(NO_3)_2(aq) + H_2SO_4(aq) \longrightarrow PbSO_4(ppt) + 2HNO_3(aq)$

full ionic equation

$Pb^{2+} + 2NO_3^{1-} + 2H^{1+} + SO_4^{2-} \longrightarrow PbSO_4(ppt) + 2H^{1+} + 2NO_3^{1-}$

net ionic equation

$Pb^{2+} + SO_4^{2-} \longrightarrow PbSO_4(ppt)$

Reduction - Oxidation Reactions (Redox)

electrons are exchanged between elements causing oxidation # to change between reactants + products.

OIL RIG

Leo Ger

$$2\,Fe(s) + 3\,S(s) \longrightarrow Fe_2S_3(s)$$

(+6 −6)

Fe = ∅ S = ∅ Fe = +3 S = −2

$2Fe^{\circ} \longrightarrow 2Fe^{3+} + \boxed{6e^-}$ oxidation

$3S^{\circ} + \boxed{6e^-} \longrightarrow 3S^{2-}$ reduction

2. $4\,K(s) + C(s) \longrightarrow K_4C(s)$

K = ∅ C = ∅ K = +1 C = −4

$4K^{\circ} \longrightarrow 4K^{+1} + 4e^-$ oxidation

$C^{\circ} + 4e^- \longrightarrow C^{-4}$ reduction

3. $\overset{\emptyset}{2Al}(s) + \overset{+3\ -2}{Fe_2O_3}(s) \longrightarrow 2\overset{\emptyset}{Fe}(s) + \overset{+3\ -2}{Al_2O_3}(s)$

$2Al^{\circ} \longrightarrow 2Al^{3+} + 6e^-$ oxidation

$2Fe^{+3} + 6e^- \longrightarrow 2Fe^{\circ}$ reduction

$$2KClO_3 \xrightarrow{\Delta} 2KCl + 3O_2(g)$$

Decomposition

- binary
- Chlorates
- hydroxides
- Carbonates

Homework:

Complete odd # prediction problems.