Reactions in Aqueous Solution, Solution Stoichiometry and Analysis

SCH3UE_2010 - 2011

1. a. Write balanced molecular equations for the following potential precipitation reactions. Indicate the states of reactants and products [$_{(aq)}$ or $_{(s)}$].
   b. In those cases where a precipitate forms, write the **total dissociated equation** and the **net ionic equation**. If there is no reaction, state 'no reaction'. State the **spectator ions**.

i. $MgCl_{2(aq)} + Pb(NO_3)_{2\,(aq)} \longrightarrow$
ii. $CuCl_{2\,(aq)} + Na_3PO_{4(aq)} \longrightarrow$
iii. $Ba(ClO_4)_{2\,(aq)} + K_2CO_{3\,(aq)} \longrightarrow$
iv. $(CH_3COO)_2Mg_{(aq)} + KOH_{(aq)} \longrightarrow$
iv. $(NH_4)_2SO_{4(aq)} + Ca(NO_3)_2 \longrightarrow$
v. $Pb(NO_3)_{2\,(aq)} + Na_2S_{(aq)} \longrightarrow$

2. If 2.2828 g of $Ni(ClO_4)_{2\,(s)}$ is dissolved in enough water to make 25.00 dm^3 of solution. (The molar mass of $Ni(ClO_4)_{2\,(s)}$ = 257.594 g mol^{-1}.)
   a. Name $Ni(ClO_4)_2$
   b. What is the concentration of the $Ni(ClO_4)_{2\,(aq)}$ solution?
   c. Write the dissociation equation for an aqueous solution of $Ni(ClO_4)_{2\,(aq)}$
   d. What is the concentration of the nickel (II) cation?
   e. What is the concentration of the perchlorate anion?
   f. What volume of the above prepared solution would be required to make 100 cm^3 of a 0.225 mol dm^{-3} dilute solution of $Ni(ClO_4)_{2\,(aq)}$.

3. Sulphuric acid when purchased has a concentration of 17.8 M, however 2.50 L of 1.25 M sulphuric acid is required for experimentation. What volume, in mL, of the concentrated acid is required for dilution in order to obtain 2.50 L of 1.25 M sulphuric acid.

4. a. Write the balanced chemical equation for the reaction of hydrochloric acid and zinc metal to produce hydrogen gas and aqueous zinc chloride.
   b. When 200.0 mL of 0.40 mol L^{-1} hydrochloric acid is added to excess zinc metal, calculate the mass of the zinc chloride that is produced.
   c. Write the total dissociated equation and the net ionic equation.

5. a. Write the balanced chemical equation for the reaction of silver nitrate solution and sodium chromate solution to produce silver chromate and sodium nitrate.
   b. State the name and the formula of the precipitate, giving reasons. Name the spectator ions.
   c. What volume of 0.350 mol L^{-1} of sodium chromate is required to completely react with 125 mL of 0.145 mol L^{-1} silver nitrate solution?
   d. Write the total dissociated equation and the net ionic equation.

6. a. Write the balanced chemical equation for the reaction of aqueous solutions of potassium sulphate and barium bromide.
   b. State the name and the formula of the precipitate, giving reasons. Name the spectator ions.
   c. What concentration of barium bromide is needed to produce 1.25 g of the precipitate if 50.0 mL of barium bromide is reacted with excess potassium sulphate solution?
   d. Write the total dissociated equation and the net ionic equation.

7. 10.0 g of calcium carbonate, $CaCO_{3(s)}$, reacts with excess hydrochloric acid, $HCl_{(aq)}$, to form an aqueous solution of calcium chloride, carbon dioxide gas, and water. Write a balanced chemical equation, a total dissociated ionic equation, a net ionic equation. Determine the mass of calcium chloride that is formed in the reaction.

8. 1.65 g of aluminium metal reacts with 50.0 mL of 2.00 mol dm^{-3} hydrochloric acid to form hydrogen gas. The hydrogen gas is collected at 25.0 ^{O}C and 96.9 kPa. What is the volume of hydrogen gas collected?