

1. A solution contains 0.0134 mol/L of calcium hydroxide. a) What concentration of ions are in solution? b) Using your answer from a, what is the pH of this solution?

#### Double Displacement Reactions:

2. Which of the following compounds are insoluble AgI, Na<sub>2</sub>SO<sub>4</sub>, KNO<sub>3</sub>, NaOH, HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub> in water?
3. Write the ionic equation, net ionic equation and identify the spectator ions in the following reactions:
- a)  $\text{KCl}_{(aq)} + \text{Pb}(\text{NO}_3)_2_{(aq)} \rightarrow \text{PbCl}_2_{(s)} + \text{KNO}_3_{(aq)}$  (unbalanced)      c)  $\text{KOH}_{(aq)} + \text{HNO}_3_{(aq)} \rightarrow$
- b)  $\text{HCl}_{(aq)} + \text{Na}_2\text{S}_{(aq)} \rightarrow \text{H}_2\text{S} + \text{NaCl}$  (unbalanced, missing states)      d)  $\text{Pb}(\text{NO}_3)_2_{(aq)} + \text{Na}_2\text{SO}_4_{(aq)} \rightarrow$
4. When Pb(NO<sub>3</sub>)<sub>2</sub> (aq) and KI (aq) solutions are mixed, what is the precipitate and which species are spectator ions?

#### Making Solutions:

5. Your first task as a lab technician is to prepare five 1000 mL volumetric flasks, each containing 1.00 L of 0.100 M HCl. You have a solution of concentrated HCl, which is 11.6 M. What volume of concentrated acid will you add to each flask?
6. An experiment calls for 200 mL of 2.0 M HCl. If you had a 9.0 M stock solution of HCl on hand, how many mL of this solution would be required? What lab steps would you take to make this solution?
7. A lab requires 250 mL of a 0.8 mol/L solution of sodium hydroxide. What lab steps would you take (include any calculations that you would need) to make this solution. Sodium hydroxide is a solid.

#### Stoichiometry in Solution Chemistry:

8. Over the years, the thermite reaction has been used for welding railroad rails, in incendiary bombs, and to ignite solid-fuel rocket motors. The reaction is:  $\text{Fe}_2\text{O}_3_{(s)} + 2\text{Al}_{(s)} \rightarrow 2\text{Fe}_{(l)} + \text{Al}_2\text{O}_3_{(s)}$  What masses of iron(III) oxide and aluminum must be used to produce 15.0 g of iron?
9. Calculate the mass of precipitate formed when 45.00 mL of 0.200 M NaOH and 22.50 mL of 0.150 M Cr(NO<sub>3</sub>)<sub>3</sub> are mixed.  $\text{Cr}(\text{NO}_3)_3_{(aq)} + 3\text{NaOH}_{(aq)} \rightarrow \text{Cr}(\text{OH})_3_{(s)} + 3\text{NaNO}_3_{(aq)}$
10. A solution containing 3.44 g of AgNO<sub>3</sub> is mixed with a solution containing 4.22 g of K<sub>3</sub>PO<sub>4</sub>. A precipitate of Ag<sub>3</sub>PO<sub>4</sub> forms. What mass of Ag<sub>3</sub>PO<sub>4</sub> is produced?
11. 100.0 mL of 0.200 M aqueous potassium hydroxide is mixed with 100.0 mL of 0.200 M aqueous magnesium nitrate. What mass of magnesium hydroxide is formed? Challenge: What is/are the concentration of any ions remaining in solution?

#### Acid-Base Reactions:

12. Calculate the molarity of a sodium hydroxide solution if 10.42 mL of this solution are needed to neutralize 25.00 mL of 0.2042 M oxalic acid.  $\text{H}_2\text{C}_2\text{O}_4_{(aq)} + 2\text{NaOH}_{(aq)} \rightarrow$
13. a) 10.0 mL of a 3.0 M KOH (aq) is transferred to a 250 mL volumetric flask and diluted to the mark. Calculate the concentration.
- b) It was found that 38.5 mL of this diluted solution (part a) was needed to reach the equivalence point in a titration of 10.0 mL of a H<sub>3</sub>PO<sub>4</sub> solution according to the reaction:  $\text{KOH}_{(aq)} + \text{H}_3\text{PO}_4_{(aq)} \rightarrow$   
What is the molar concentration of the H<sub>3</sub>PO<sub>4</sub> in solution?