1. Define **acid** and **base**. What happens when they are mixed?

2. What **volume** of 0.0500 M Ba(OH)$_2$ is required to **neutralize** exactly 22.00 mL of 0.113 M H$_3$PO$_3$?

3. Write the **balanced molecular**, **complete ionic** and **net ionic** equations for the reaction of hydrochloric acid and barium hydroxide.

4. If 0.47 g of barium hydroxide are added to 100.0 mL of 0.040 M hydrochloric acid, what are the **concentrations** of each ion remaining in solution? Is the solution **acidic**, **basic** or **neutral**? (use the above reaction)
5. Assign oxidation states to each atom in the following:

a. NH$_4^+$

b. Na$_2$C$_2$O$_4$

c. PbSO$_3$

6. For each of the following, indicate whether it is a redox reaction. If it is, identify the substance oxidized and reduced, the oxidizing and reducing agents and the number of electrons transferred.

a. NaHCO$_3$ (aq) + HBr (aq) $\rightarrow$ H$_2$O (l) + CO$_2$ (g) + NaBr (aq)

b. CH$_4$ (g) + 2O$_2$ (g) $\rightarrow$ CO$_2$ (g) + 2H$_2$O (l)

7. Balance the following redox reactions:

a. MnO$_4^-$ + Fe$^{2+}$ $\rightarrow$ Mn$^{2+}$ + Fe$^{3+}$ (Acidic)

b. CrI$_3$ + Cl$_2$ $\rightarrow$ CrO$_4^{2-}$ + IO$_4^-$ + Cl$^-$ (basic)