Acid-Base Theory

1. Identify the acid, base, conjugate acid, and conjugate base in the following reactions.
   a) $HCN + SO_4^{2-} \leftrightarrows HSO_4^- + CN^-$
   b) $CH_3COO^- + H_2S \leftrightarrows CH_3COOH + HS^-$
   c) $NH4^+ + OH^- \leftrightarrows NH_3 + H_2O$
   d) $HSO_4^- + H_2O \leftrightarrows SO_4^{2-} + H_3O^+$
   e) $HSO_4^- + H_2O \leftrightarrows H_2SO_4 + OH^-$

2. Write the conjugate acid for the following.
   a) NO_2^-
   b) HPO_4^{2-}
   c) H_2SO_4
   d) HCO_3^-
   e) OH^-
   f) CH_3NH_2

3. Write the conjugate base for each of the following.
   a) HF
   b) NH_3
   c) HPO_4^{2-}
   d) HCO_3^-
   e) $N_2H_5^+$
   f) $(CH_3)_2NH_2^+$

4. Name the following acids.
   a) HCl
   b) HNO_3
   c) H_2SO_4
   d) H_3PO_4
   e) $HClO_3$
   f) CH_3COOH
   g) HNO_2
   h) HClO
   i) H_2SO_3
   j) H_2CO_3
   k) $HClO_2$
   l) $HClO_4$

5. Write the formulas for the following acids.
   a) boric acid
   b) benzoic acid
   c) arsenous acid
   d) chromous acid
   e) oxalic acid
   f) periodic acid
   g) hypoiodous acid
   h) hyposulfurous acid
   i) bromous acid
   j) formic acid
   k) permanganic acid
   l) phosphorous acid

6. Predict the acidic or basic nature of the following anhydrides.
   a) MnO_2
   b) SO_3
   c) CO_2
   d) Cl_2O
   e) BaO
   f) Fe_2O_3

7. Write the balanced neutralization reaction for each of the following.
   a) phosphoric acid + magnesium hydroxide →
   b) iron(II) hydroxide + perchloric acid →
   c) ammonium hydroxide + sulfurous acid →
   d) cobalt(II) hydroxide + nitrous acid →
   e) arsenic acid + barium hydroxide →
   f) perbromic acid + zinc hydroxide →

8. Write the balanced hydrolysis reactions for the following salts. Predict the acidic, basic or neutral character of the resulting solutions.
   a) $NaClO_3$
   b) $Fe(ClO_4)_2$
   c) $Mg(IO_3)_2$
   d) MnI_2
   e) $Ba(NO_3)_2$
   f) $PbCl_2$
   g) $ZnSO_4$
   h) $Ca(ClO)_2$
   i) $Sr_3(PO_4)_2$