WKS
Brønsted Acids and Bases

Name ______________________________
Period ____ Date _______________

1) The Arrhenius definitions of acids and bases are somewhat limited because they can only describe acids and bases that have been dissolved in water. Thus, sometimes the Brønsted acid/base definitions are more useful because they can be used when acids and bases are in other liquids. Complete the Brønsted definitions below:
   a) A Brønsted acid **(donates, accepts)** a proton (H^+).
   b) A Brønsted base **(donates, accepts)** a proton (H^+).

2) Write the conjugate base for each of the following acids. [Remember, the an acid *loses one* H^+]

   a) HNO_3
   b) HS^-
   c) HPO_4^{2-}
   d) $HC_3H_5O_2$
   e) H_2SO_3
   f) C_6H_5COOH

3) Write the conjugate acid for each of the following bases. [Remember, the a base *gains one* H^+]

   a) HPO_4^{2-}
   b) NO_2^-
   c) NH_3
   d) HS^-
   e) S^{2-}
   f) C_5H_4N

4) For the following reactions:
   – draw an arrow showing the transfer of the H^+ <u>between reactants</u> (Look at the products—which way does the H^+ go?).
   – Label the acid (A), the base (B), the conjugate acid (CA), and the conjugate base (CB).

   a) HNO_3 (aq) + OH^- (aq) $\rightleftharpoons$ NO_3^- (aq) + H_2O (*l*)

   b) HCO_3^- (aq) + HCl (aq) $\rightleftharpoons$ H_2CO_3 (aq) + Cl^- (aq)

   c) NH_3 (aq) + $H_2PO_4^-$ (aq) $\rightleftharpoons$ NH_4^+ (aq) + HPO_4^{2-} (aq)

   d) HCOOH (aq) + H_2O (*l*) $\rightleftharpoons$ $HCOO^-$ (aq) + H_3O^+ (aq)

5) For the following reactions:
   - show the arrow for the transfer of H^+ <u>between reactants</u> *(Remember-- the acid always gives its H^+ to the base.)*
   - determine the products of each reactions (Watch your charges!! *Losing/gaining H^+ only)*
   - Label the conjugate acid (CA) and the conjugate base (CB)

   a) NH_2^- (aq) + H_2O (*l*) $\rightleftharpoons$
      base *acid*

   b) H_2S (aq) + NH_3 (aq) $\rightleftharpoons$
      acid *base*

   c) HSO_4^- (aq) + OH^- (aq) $\rightleftharpoons$
      acid *base*

   d) CO_3^{2-} (aq) + NH_4^+ (aq) $\rightleftharpoons$
      base *acid*

6) Methylamine (CH_3NH_2, Lewis structure below) forms hydroxide in water the same way that ammonia, NH_3, does. Draw the transfer of H^+ from water (H–OH) and explain why methylamine is a Brønsted-Lowry base but not an Arrhenius base. [Hint: in the products, the N is tetrahedral with one additional H and a + charge, like NH_3 becoming NH_4^+.]