4.3 Exercise 1 - Bronsted-Lowry theory

1. State whether the following species can behave as an acid, as a base, or both:

a) NH_4^+
b) NH_3
c) H_3O^+
d) $HClO_4$
e) CO_3^{2-}
f) NO_3^-
g) CH_3CH_2OH
h) CH_3COOH
i) HSO_4^-
j) HNO_3
k) HCl

2. In each of the following reactants, one of the reactants acts as an acid. Identify it:

a) $H_2O(l) + NH_3(aq) == NH_4^+(aq) + OH^-(aq)$
b) $CH_3COOH(aq) + HClO_4(aq) == CH_3COOH_2^+(aq) + ClO_4^-(aq)$
c) $HCO_3^-(aq) + HSO_4^-(aq) == H_2O(l) + CO_2(g) + SO_4^{2-}(aq)$
d) $H_3O^+(aq) + OH^-(aq) == 2H_2O(l)$

3. Identify the acid-base conjugate pairs in the following reactions:

a) $HCO_3^-(aq) + H_2O(l) == CO_3^{2-}(aq) + H_3O^+(aq)$
b) $HCO_3^-(aq) + H_3O^+(aq) == CO_2(g) + H_2O(l) + H_2O(l)$
c) $H_2SO_4(aq) + HNO_3(aq) == HSO_4^-(aq) + NO_2^+(aq) + H_2O(l)$
d) $HSO_4^-(aq) + OH^-(aq) == SO_4^{2-}(aq) + H_2O(l)$