1. (4 points) Consider each of the reactions below. Circle the Brønsted-Lowry acid on the reactant side and put a square around the Brønsted-Lowry base on the reactant side.

\[
\text{HCl (aq)} + \text{KOH (aq)} \rightarrow \text{HOH (l)} + \text{KCl (aq)}
\]
\[
\text{NH}_4^+ (aq) + \text{HOH (l)} \rightarrow \text{NH}_3 (aq) + \text{H}_2\text{O}^+ (aq)
\]

2. (4 points) Write the formula for the conjugate base of each of the following.
   a. HF
   b. HNO_3
   c. NH_4^+
   d. OH^-

3. (2 points) If the pH of a solution is 5.48, its hydrogen concentration is closest to:
   a. 3 x 10^{-6} M   b. 5 x 10^{-8} M   c. 4 x 10^{-5} M   d. 5 x 10^{-5} M   e. 5 x 10^{-4} M

4. (2 points) The pH of a solution that has a hydrogen concentration of 4 x 10^{-8} M is about:
   a. 8.4   b. 4.8   c. 9.3   d. 7.3   e. 5.4

5. (4 points) Identify each of the following as an acidic or basic oxide.
   a. BaO
   b. P_2O_5
   c. NO_2
   d. CsO
6. (3 points) Describe the three approaches we have used to identify substances that are oxidized and reduced. In each case, clearly state how the approach is used to identify a species that is oxidized.

OXYGEN: GAIN OF OXYGEN → OXIDATION
LOSS OF OXYGEN → REDUCTION

NITROGEN: GAIN OF NITRIDE → REDUCTION
LOSS OF NITROGEN → OXIDATION

ELECTRON: GAIN OF ELECTRONS → REDUCTION
LOSS OF ELECTRONS → OXIDATION

7. (4 points) Balance and combine the following reactions.

a. \[(e^- + Ag^+ → Ag) \times 2\]
\[Zn → Zn^{2+} + 2e^-\]
\[2e^- + 2Ag^+ + Zn → 2Ag + Zn^{2+} + 2e^-\]
\[2Ag^+ + Zn → 2Ag + Zn^{2+}\]

b. \[(Al → Al^{3+} + 3e^-) \times 3\]
\[2e^- + I_2 → 2I^-\]
\[2Al → 2Al^{3+} + 6e^-\]
\[6e^- + 3I_2 → 6I^-\]
\[2Al + 6e^- + 3I_2 → 2Al^{3+} + 6e^- + 6I^-\]
\[2Al + 3I_2 → 2Al^{3+} + 6I^-\]