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.

\[ \text{HCl (aq)} + \text{KOH (aq)} \rightarrow \text{HOH (ℓ)} + \text{KCl (aq)} \]

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

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. \( 3 \times 10^{-6} \text{ M} \)  b. \( 5 \times 10^{-8} \text{ M} \)  c. \( 4 \times 10^5 \text{ M} \)  d. \( 5 \times 10^{-5} \text{ M} \)  e. \( 5 \times 10^{-4} \text{ M} \)

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

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

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

   b. \( \text{Al} \rightarrow \text{Al}^{3+} + 3\text{e}^- \)
      \[ 2\text{e}^- + \text{I}_2 \rightarrow 2\text{I}^- \]