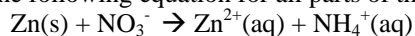


AP Chemistry Problem Set #4

1. Answer each of the following regarding neutralization.

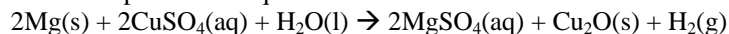
- Calculate the volume of 0.150 M Ba(OH)₂ needed to neutralize 75.0 mL of 0.150 M HOCl.
- Calculate the volume of 0.0736 M Ba(OH)₂ needed to neutralize 87.0 mL of 0.0500 M H₂SO₄.
- Calculate the volume of 0.0800 M NaOH needed to neutralize 123.0 mL of 0.750 M H₃PO₄.
- Calculate the volume of 0.0200 M Ba(OH)₂ needed to neutralize 15.00 mL of 3.0 M H₃PO₄.
- Calculate the volume of 0.300 M NaOH needed to neutralize 1.65 L of 0.0750 M H₂SO₄.

2. Use the following equation for all parts of this question.



- Write the complete balanced half-reaction for the oxidation in an acidic solution.
- Write the complete balanced half-reaction for the reduction in an acidic solution.
- Identify the oxidizing agent and the reducing agent.
- Write the complete balanced reduction oxidation equation in an acidic solution
- Write the complete balanced reduction oxidation equation in a basic solution

3. Use the following equation for all parts of this question.

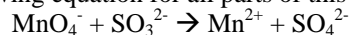


- If 2.46 grams of Mg(s) are added to 500. mL of a 0.300 M solution of CuSO₄, what is the maximum molar yield of H₂(g)?
- What is the limiting reagent?
- When all of the limiting reagent has been consumed in (a), how many moles of the other reactant (not water) remain?
- Assuming that the volume of the solution does not change, calculate the concentration of Mg²⁺ in solution.
- If a student declares that her percent yield of copper(I) oxide is 87.9%, how many grams of copper(I) oxide did she actually produce?

4. Sodium hydroxide reacts with iron(III) nitrate to produce sodium nitrate and iron(III) hydroxide

- Write a complete balanced equation for this reaction.
- Write the net ionic equation for this reaction.
- If you have 450.0 mL of a 0.750 M sodium hydroxide solution and 0.850 L of a 0.250 M iron(III) nitrate solution, what is greatest mass of your precipitate that you could produce?
- If only 7.73 grams of precipitate are collected when the experiment is carried out, what is your percent yield?

5. Use the following equation for all parts of this question.



- Write the complete balanced half-reaction for the oxidation in an acidic solution.
- Write the complete balanced half-reaction for the reduction in an acidic solution.
- Which substance is oxidized? Which substance is reduced?
- Write the complete balanced reduction oxidation equation in an acidic solution.
- Write the complete balanced reduction oxidation equation in a basic solution.

AP Chemistry Problem Set #4

- Answer each of the following regarding neutralization.
 - Calculate the volume of 0.150 M Ba(OH)₂ needed to neutralize 75.0 mL of 0.150 M HOCl. **0.0375 L**
 - Calculate the volume of 0.0736 M Ba(OH)₂ needed to neutralize 87.0 mL of 0.0500 M H₂SO₄. **0.0591 L**
 - Calculate the volume of 0.0800 M NaOH needed to neutralize 123.0 mL of 0.750 M H₃PO₄. **3.46 L**
 - Calculate the volume of 0.0200 M Ba(OH)₂ needed to neutralize 15.00 mL of 3.0 M H₃PO₄. **3.38 L**
 - Calculate the volume of 0.300 M NaOH needed to neutralize 1.65 L of 0.0750 M H₂SO₄. **0.825 L**
- Use the following equation for all parts of this question.
$$\text{Zn(s)} + \text{NO}_3^- \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{NH}_4^+(\text{aq})$$
 - Write the complete balanced half-reaction for the oxidation in an acidic solution. **Zn → Zn²⁺ + 2e⁻**
 - Write the complete balanced half-reaction for the reduction in an acidic solution.
10H⁺ + NO₃⁻ + 8e⁻ → NH₄⁺ + 3H₂O
 - Identify the oxidizing agent and the reducing agent. **OA: NO₃⁻ RA: Zn**
 - Write the complete balanced reduction oxidation equation in an acidic solution.
10H⁺ + NO₃⁻ + 4Zn → 4Zn²⁺ + NH₄⁺ + 3H₂O
 - Write the complete balanced reduction oxidation equation in a basic solution.
7H₂O + NO₃⁻ + 4Zn → 4Zn²⁺ + NH₄⁺ + 10OH⁻
- Use the following equation for all parts of this question.
$$2\text{Mg(s)} + 2\text{CuSO}_4(\text{aq}) + \text{H}_2\text{O(l)} \rightarrow 2\text{MgSO}_4(\text{aq}) + \text{Cu}_2\text{O(s)} + \text{H}_2(\text{g})$$
 - If 2.46 grams of Mg(s) are added to 500. mL of a 0.300 M solution of CuSO₄, what is the maximum molar yield of H₂(g)? **0.0506 moles H₂**
 - What is the limiting reagent? **Mg**
 - When all of the limiting reagent has been consumed in (a), how many moles of the other reactant (not water) remain? **0.049 moles**
 - Assuming that the volume of the solution does not change, calculate the concentration of Mg²⁺ in solution. **0.202 M**
 - If a student declares that her percent yield of copper(I) oxide is 87.9%, how many grams of copper(I) oxide did she actually produce? **6.36 g**
- Sodium hydroxide reacts with iron(III) nitrate to produce sodium nitrate and iron(III) hydroxide
 - Write a complete balanced equation for this reaction. **3NaOH + Fe(NO₃)₃ → Fe(OH)₃ + 3NaNO₃**
 - Write the net ionic equation for this reaction. **3OH⁻ + Fe³⁺ → Fe(OH)₃**
 - If you have 450.0 mL of a 0.750 M sodium hydroxide solution and 0.850 L of a 0.250 M iron(III) nitrate solution, what is greatest mass of your precipitate that you could produce? **12.0 g**
 - If only 7.73 grams of precipitate are collected when the experiment is carried out, what is your percent yield? **64.4%**
- Use the following equation for all parts of this question.
$$\text{MnO}_4^- + \text{SO}_3^{2-} \rightarrow \text{Mn}^{2+} + \text{SO}_4^{2-}$$
 - Write the complete balanced half-reaction for the oxidation in an acidic solution.
H₂O + SO₃²⁻ → SO₄²⁻ + 2H⁺ + 2e⁻
 - Write the complete balanced half-reaction for the reduction in an acidic solution.
5e⁻ + 8H⁺ + MnO₄⁻ → Mn²⁺ + 4H₂O
 - Which substance is oxidized? Which substance is reduced? **Ox: SO₃²⁻ Red: MnO₄⁻**
 - Write the complete balanced reduction oxidation equation in an acidic solution.
6H⁺ + 2MnO₄⁻ + 5SO₃²⁻ → 2Mn²⁺ + 5SO₄²⁻ + 3H₂O
 - Write the complete balanced reduction oxidation equation in a basic solution.
3H₂O + 2MnO₄⁻ + 5SO₃²⁻ → 2Mn²⁺ + 5SO₄²⁻ + 6OH⁻