

AP Chemistry – Buffers, Titration, Solubility – 61

Name _____ Per ____

1. Calculate the pH of a buffer that is 0.100 M NaHCO_3 , $K_a = 5.6 \times 10^{-11}$, and 0.125 M Na_2CO_3 .

2. Calculate the pH of a solution formed by mixing 55 mL of 0.20 M NaHCO_3 with 65 mL of 0.15 M Na_2CO_3 .

3. How many grams of sodium lactate, $\text{NaC}_3\text{H}_5\text{O}_3$ should be added to 1.00 L of 0.150 M lactic acid, $\text{HC}_3\text{H}_5\text{O}_3$, $K_a = 1.4 \times 10^{-4}$, to form a buffer solution with pH 2.90? Assume that no volume change occurs when the sodium lactate is added.

4. How many milliliters of 0.105 M HCl are needed to titrate each of the following solutions to the equivalence point:
 - (a) 55.0 mL of 0.0950 M NaOH

 - (b) 23.5 mL of 0.117 M KOH

 - (c) 125.0 mL of a solution that contains 1.35 g of NaOH per liter

5. Consider the titration of 30.0 mL of 0.030 M $\text{NH}_3(\text{aq})$, $K_b = 1.8 \times 10^{-5}$, with 0.025 M HCl. (a) Calculate the pH of the NH_3 before titration.

(b) Calculate the pH after 10.0 mL of HCl has been added.

6. The molar solubility of PbBr_2 at 25°C is 1.0×10^{-2} moles/L. Calculate K_{sp} .

7. If 0.0490 g of AgIO_3 dissolves per liter of solution, what would be the value of K_{sp} ?

8. Calculate the solubility of LaF_3 in g/L in pure water. The K_{sp} of $\text{LaF}_3 = 2 \times 10^{-19}$.

9. Consider the reaction of ozone with nitrogen monoxide: $\text{O}_3(\text{g}) + \text{NO}(\text{g}) \rightarrow \text{O}_2(\text{g}) + \text{NO}_2(\text{g})$. (a) Calculate the standard enthalpy change.

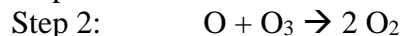
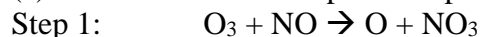
(b) Based on the reaction alone, make a prediction of the standard entropy change. Explain.

(c) Based on your answers from parts (a) and (b) what do you think the sign of the standard free-energy change will be? Explain.

(d) Using the information in the table below, write the rate-law for the reaction. Explain how you determined the rate-law.

Experiment	Initial $[\text{O}_3]$ M	Initial $[\text{NO}]$ M	Initial Rate M/s
1	0.0010	0.0010	0.163
2	0.0010	0.0020	0.326
3	0.0020	0.0010	0.326
4	0.0020	0.0020	0.652

(e) Here are the three steps of the proposed mechanism for the reaction:



Which step is the rate determining step which is consistent with the rate law from part (d)? Explain.