AP Chemistry Exam Review

Free Response Practice #8

2017 #3, shortened, 5 points

Nitrogen monoxide, NO(g), can undergo reactions to produce acids such as HNO_2, a weak acid with a K_a of 4.0×10^{-4} and a pK_a of 3.40.

a. A student is asked to make a buffer solution with a pH of 3.40 by using 0.100 M HNO_2(aq) and 0.100 M NaOH(aq).

   i. Explain why the addition of 0.100 M NaOH(aq) to 0.100 M HNO_2(aq) can result in the formation of a buffer solution. Include the net ionic equation for the reaction that occurs when the student adds the NaOH(aq) to the HNO_2(aq).

   ii. Determine the volume, in mL, of 0.100 M NaOH(aq) the student should add to 100. mL of 0.100 M HNO_2(aq). to make a buffer solution with a pH of 3.40. Justify your answer.

b. A second student makes a buffer by dissolving 0.100 mol of $NaNO_2$(s) in 100. mL of 1.00 M HNO_2(aq). Which is more resistant to changes in pH when a strong acid or a strong base is added, the buffer made by the second student or the buffer made by the first student in part (c)? Justify your answer.