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| **Acetic Acid in Water** | Name: |  |
| Hand-In, Chem 210L | Partner: |  |

See the attached rubric for more detailed information about grading.

1. (3 points) Write a balanced chemical equation for the acid dissociation reaction of acetic acid with water. Then write a correct equilibrium constant expression, *K*a, for this reaction and list the known *K*a value (cite the source from which you obtained the value).

**{Type answer here.}**

***The following questions refer to Part 1 of this experiment in which you diluted a stock acetic acid solution with water.***

2. (3 points) How did the pH change and why did the pH change in the way it did as you diluted the acetic acid solution? Describe the change and explain why it occurs.

**{Type answer here.}**

3. (3 points) How did the percent ionization change as you diluted the acetic acid solution? Show a sample calculation of % ionization for one of your solutions. As always, first write the general equation, then write the equation with your numbers included and then solve.   
Include an explanation of each of the steps in your calculation, making it clear what all the values are that you are plugging in to your calculation and why you are using those steps and values.

**{Insert sample calculation here.}**

**{Insert explanation here.}**

4. (4 points) Based upon your data for Part 1, calculate the *K*a of acetic acid. Average the values of *K*a for all four solutions and report the average with the associated error. How does your calculated *K*a value compare to the known value of *K*a that you cited in question 1 above? You should include a % difference as part of your comparison of your average *K*a value to the reported value.

**{Insert a sample calculation of *K*a here.}**

**{Insert % difference from the reported value and discussion here.}**

***The following questions refer to Part 2 of this experiment in which you added sodium acetate to an acetic acid solution.***

5. (3 points) How did the pH change and why did the pH change in the way it did when you added sodium acetate? Describe the change and explain why it happens.

**{Type answer here.}**

6. (2 points) Based on the change in pH you noted when sodium acetate was added, predict how the percent ionization changed for the acetic acid with addition of sodium acetate?   
Explain using Le Châtelier’s Principle.

**{Type answer here.}**

7. (2 points) After adding sodium acetate to the acetic acid solution, do you expect that the *K*a value will be the same as it was in part 1 of this experiment? Why or why not?

**{Type answer here.}**

See the attached rubric on the next page for more detailed information about grading.

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|  | **Unsatisfactory** | **Borderline** | **Satisfactory** | **Excellent** | **Score** |
| **Q #1**  **Rxn. & K**a | Incorrect formulas in equation and no *K*a expression nor  *K*a value.  **0 points** | Two of three parts of the answer not included.  **1 point** | One of the three parts of the answer not included or incorrect charges or state labels or no source for value of *K*a.  **2 points** | Correct equation for acid dissociation with proper charges and state labels  **(1 pt).**  *K*a expression included and correct **(1 pt)**  Value and source of *K*a given **(1 pt).** | **3 pts**. |
| **Q #2**  **pH change** | Trend is not properly described and explanation is not given.  **0 points** | Trend is not properly described or explanation is not given.  **1 point** | Explanation is not clear.  **2 points** | Clear, correct description **(1 pt)** and explanation of pH trend **(2 pts)** | **3 pts**. |
| **Q #3**  **% ioniz. trend** | No sample calculation of % ionization or Microsoft Equation not used.  **0 points** | **1 point** | **2 points** | Clear, correct sample calculation of % ionization **(1 pt)** and identification of trend in % ionization **(1 pt)** and explanation of the trend **(1 pt)** . | **3 pts**. |
| **Q #4**  ***K*a** **Calc.** | No sample calculations or Microsoft Equation not used.  **0 points** | No determination of error or error not calculated correctly and no comparison to known  *K*a value.  **1-2 points** | No determination of error or no comparison to known *K*a value.  **3 points** | Clear, correct sample calculation of *K*a **(2 pts)** with determination of error **(1 pt)** and qualitative **(0.5 pt)** and quantitative **(0.5 pt)** comparison to known *K*a value. | **4 pts.** |
| **Q #5**  **pH change** | Change in pH not listed and no explanation given.  **0 points** | **1 point** | Explanation given but not clear.  **2 points** | Correct identification of trend **(1 pt)** and clear, valid explanation for change in pH on addition of sodium acetate in Part 2 **(2 pts)**. | **3 pts**. |
| **Q #6**  **% ioniz. Part 2** | Correct % ionization identified but no explanation given.  **0 points** |  | Explanation not clear.  **1 point** | Clear, correct explanation of % ionization change in going from Part 1 to Part 2 based on Le Châtelier’s Principle. **2 points** | **2 pts**. |
| **Q #7**  ***K*a?** | Incorrect prediction and no reason given.  **0 points** |  | Prediction not clear.  **1 point** | Clear, correct prediction of the impact of sodium acetate addition on *K*a with reason given.  **2 points** | **2 pts**. |
| **Total** |  |  |  |  | **20 pts** |