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| **Lowell HS AP Chemistry** | **Name(s):** |
| **Acid- Lab** | **Date:** |
| **Group Name / Data Set #:** | **Block:** |  |

**Introduction:**

**Refer to the** [**Titration of a Weak Acid Lab Protocol**](https://drive.google.com/file/d/1dcYikGjuqtCCJEfk9gkwFvRytntvtPO2/view?usp=sharing)**.**

1. Write a paragraph in your own words about the purpose/objectives in this lab.

2. Make a list of all of the equations that will help you with the calculations in this lab.

1.
2.
3.
4.

**Experimental Procedures:**

Using the lab video as a guide but following the procedure in the lab protocol, fill in this T-table with the experimental procedure in the left column and any corresponding qualitative observations and/or quantitative data in the right column. Use your own words when summarizing or paraphrasing the procedure. Format the table as you see appropriate.

|  |  |
| --- | --- |
| **Procedure** | **Data/Observations** |
| 1. |  |
| 2.  |  |
| 3.  |  |
| 4.  |  |
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|  |  |
|  |  |
| (add more rows as needed) |  |

**Data Tables and Observations:**

Include experimental data and observations here for both trials in titled data tables. Include relevant data that will help you with the graphs in the next section.

**Graphs:**

Include the titration graphs from Trials 1 and 2. Label the equivalence point and half-equivalence point of each graph. Graphing using a computer or online program is acceptable.

**Calculations:**

Answers/calculations may be typed or handwritten for this part of the lab. Type answers/calculations or Insert picture(s) of your POST-LAB calculations. If handwritten, pics **MUST** have the **FULL NAME of the person working on that part** in the image in **INK** or your answers/calculations will not receive any credit. Insert into corresponding areas below:

|  |  |
| --- | --- |
| **Calculations** | **Your answers** |
| 1. Write the net ionic equation for the reaction that occured between the acetic acid and NaOH. (Include physical states.) | [Answer here] |
| 2. Determine the moles of OH from NaOH added to reach equivalence and the moles of acetic acid that were in your 10.0 mL vinegar sample. | [Answer here] |
| 3. Determine the concentration, in mol/L, of acetic acid in vinegar. | [Answer here] |
| 4. Determine the % by mass of acetic acid in vinegar. Assume the density of vinegar is 1.0g/mL. | [Answer here] |
| 5. Determine the Ka of acetic acid. Hint: what part of the ICE table does the pH tell you? Double hint: This is the same type of problem as Ch 14 pg 675 #67. | [Answer here] |
| 6. Determine the pKa of acetic acid from the Ka you just got. | [Answer here] |
| 7. Write out the Henderson-Hasselbalch equation for acetic acid. | [Answer here] |
| 8. Write the Henderson-Hasselbalch equation for what it looks like at the half-equivalence point. |  |
| 9. From your pH curve at the half-equivalence point, determine the pKa of acetic acid. | [Answer here] |
| 10. From this pKa, calculate the Ka of acetic acid. | [Answer here] |
| 11. In the data table, list your values for each trial next to these accepted values and include the % difference. | [Insert data table here.] |

**Data Analysis:**

A diagram with the answers must be generated by your group on a computer or handwritten for this part of the lab. Insert picture(s) of your POST-LAB calculations. Both handwritten or computer-generated diagrams **MUST** have the **FULL NAME of the person working on that part** in the image in **INK (or typed on the computer diagram)** or your answers/calculations will not receive any credit. No copying of images from the internet. Insert into corresponding area below:

|  |
| --- |
| On your titration curve for Trial #2, draw 4 beakers which have inside them particulate representations showing what species are present in the solution at the following points in the titration:1. no NaOH added2. half-equivalence point3. equivalence point4. half-way past the equivalence point where excess NaOH has been added (You may need to add this data point and estimate the pH at this data point if your experimental data does not contain this information.)Draw arrows to indicate which part of the titration curve each beaker represents. For beaker #1 (no NaOH yet added), assume you start with 8 molecules of weak acid HA. Hint: Choose from among these species for your particulate representations: HA, H3O+, A-, OH-, H2O (only water molecules produced during reaction need to be shown). |
| [Insert pic or computer-generated diagram here] |

**Discussion Questions:**

Answers/calculations MUST BE TYPED for this part of the lab. Type answers/calculations into corresponding areas below:

|  |  |
| --- | --- |
| **Discussion Questions** | **Your answers** |
| 1. Why might it be important to rinse the buret so thoroughly in Step #1? | [Answer here] |
| 2. Describe how much your concentration of acetic acid in vinegar would be off if you didn’t realize you had added too much NaOH and had gone past the endpoint of the titration and recorded that volume of NaOH as the amount required to neutralize the acetic acid? | [Answer here] |
| 3. Why won’t the equivalence point change when 25 mL of water was added to your 10.0 mL of vinegar in Step #3? | [Answer here] |
| 4. The density of vinegar is not exactly 1 g/L. But based on your % by mass of acetic acid in vinegar, why might it be a good approximation to use the density of vinegar as 1.0 g/mL in Calculations step #4? | [Answer here] |
| 5. What possible sources of error might have contributed to your numbers being off in the direction they are? For each proposed source of error, explain how it affected your data in that particular direction. | [Answer here] |
| 6. Using your data, explain the difference between the endpoint determined by your pH indicator and the equivalence point determined using the pH probe. | [Answer here] |

**Conclusion:**

* Write a summary of your results and findings from this lab as it relates to the purpose/objectives.
* Discuss two experimental sources of error (or than misreading instruments or instrument/glassware malfunction) that could have occurred during this lab. Explain the effect of the source of error on the lab data and results. Be specific as to describe the direction of the change in data.
* Explain how this lab could be applied to everyday life. Be specific and clearly explain with chemistry.