Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Student Activity- Titrations**

**Learning Objective SAP-9.C** Explain the relationship among p H, p O H and concentrations of all species in a solution of a monoprotic weak acid or weak base. **SAP-9.E** Explain results from the titration of a mono- or polyprotic acid or

 base solution, in relation to the properties of the solution and its components.

**Science Practice s: 5.D** Identify information presented graphically to solve a problem .

 **6.C** Support a claim with evidence from representations or models at the particulate level, such as the structure of atoms and/or molecules.

 **2.D** Make observations or collect data from representations of laboratory setups or results, while attending to precision where appropriate .

 **5.F** Calculate, estimate, or predict an unknown quantity from known quantities by selecting and following a logical computational pathway and attending to precision.

**QUESTION:** What factors can be determined about the amount of base needed to neutralize an acid?

Instructions: You will be working with a computer simulation that covers acid/base titrations; please discuss each question with your lab partners and write down your best answer.

Web Site address for the computer simulation:

<http://faculty.concordia.ca/bird/javascript/titration/titration-js.html>

**PROCEDURE: (PART I)**

1. Under **Acid\***, select **Hydrochloric acid** and in Molarity Box type in **0.1** for Molarity.

2. Under **Base\***, select **Sodium Hydroxide** and in Molarity Box type in **0.25** for Molarity.

3. Under **Indicator**, select **Phenolphthalein**.

4. Under **Buret contains:\***, select **Base**.

5. Click the box next to **Show the equivalence point**.

6. Click the box that says, **Add solutions to the buret and flask**.

7. Click on the buret tap to start, continue, or pause the titration.

Calculate the volume of the base needed to reach the equivalence point using the titration

equation **M*a*V*a*=M*b*V*b***. Does it match the volume from your graph?

 Why did the mixture of HCl and NaOH turn pink at the equivalence point?

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How many moles of HCl were in the flask at the start of the experiment? (Show calculation).

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How many moles of NaOH were used to titrate the HCl ? How do you know this?

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Explain why the graph plotted was in the shape of an S-curve.

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What was the pH of this titration at the equivalence point? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Write out the net ionic reaction for the reaction between HCl and NaOH.

**PROCEDURE: (PART II)**

8. Repeat the entire experiment, but this time use **Acetic acid** instead of Hydrochloric acid.

Keep everything else the same.

Calculate the volume of the base needed to reach the equivalence point using the titration

equation **M*a*V*a*=M*b*V*b***. Does it match the volume from your graph?

Was the volume the same as in the previous experiment? Explain why or why not.

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What was the approximate pH of this titration at the equivalence point? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Write out the net ionic reaction for the reaction between NaOH and HC2H3O2.

(Remember Acetic acid is a weak acid).

What is the difference between the strength of an acid and the concentration of an acid?

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In determining the moles of base needed to titrate an acid to its endpoint, does the **strength** of the acid or the base matter? Explain.

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Why was the pH of this titration at the equivalence point was not the same as that of the previous experiment? Explain in detail.

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At half way to the equivalence point, the pH of this titration is equal to the pK*a* of the acid is which is 4.74. Explain why this is true.

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