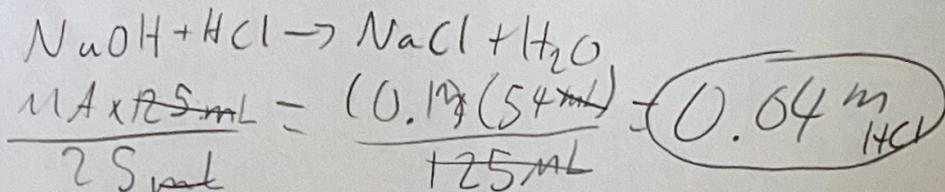


Titration Practice Worksheet

Find the requested quantities in the following problems:

- 1) If it takes 54 mL of 0.1 M NaOH to neutralize 125 mL of an HCl solution, what is the concentration of the HCl?

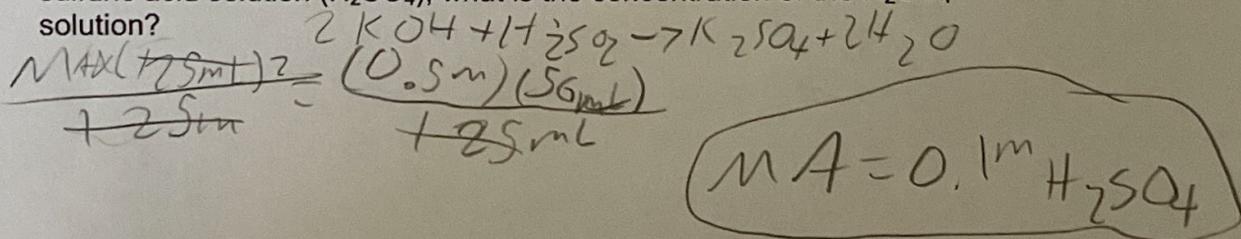


- 2) If it takes 25 mL of 0.05 M HCl to neutralize 345 mL of NaOH solution, what is the concentration of the NaOH solution?

$$M_B \times 345 \text{ mL} = (0.05 \text{ M})(25 \text{ mL}) = 0.003 \text{ M NaOH}$$

$$\frac{345 \text{ mL}}{345 \text{ mL}}$$

- 3) If it takes 50 mL of 0.5 M KOH solution to completely neutralize 125 mL of sulfuric acid solution (H_2SO_4), what is the concentration of the H_2SO_4 solution?



- 4) Can I titrate a solution of unknown concentration with another solution of unknown concentration and still get a meaningful answer? Explain your answer in a few sentences.

No because you can only have 1 unknown per equation.

- 5) Explain the difference between an endpoint and equivalence point in a titration.

end point = stop b/c colors change in indicator. and the equivalence point = no color change b/c acid and base cancel each other out.

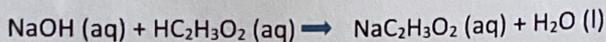
Lab Title: Acid-Base Titration

Research Question:

What can we determine from a titration?

Introduction:

In this experiment, we will use a standardize solution of NaOH (sodium hydroxide) with a concentration of 0.50 (M) to find the concentration of HC₂H₃O₂ (acetic acid) in vinegar. This is an organic acid. The reaction with sodium hydroxide and vinegar is an acid-base reaction; the balanced chemical equation for this reaction is:



H₂O can also be thought of as H-O-H to better understand that the first H is donated to the base, thereby forming water because this base has the OH⁻¹ ion. The product is water and a salt, which is the combination of sodium (Na) and the acetate ion (C₂H₃O₂).

We will be using the following formulas in our calculations:

$$\text{NaOH}_{\text{final}} - \text{NaOH}_{\text{initial}} = \text{NaOH}_{\text{used}}$$

$$M_A \times V_A = M_B \times V_B$$

$$\text{Sum}/\# \text{ items} = \text{Average}$$

$$[(\text{Experimental Value} - \text{Accepted Value})/\text{Accepted Value}] \times 100 = \% \text{ Error}$$

Procedure:

Place the NaOH in the biuret using a funnel and the vinegar into the Erlenmeyer flask with distilled water so that there is 20 mL in the flask. Then, add a few drops of phenolphthalein for the indicator. Use the stop cock to adjust the flow of NaOH from the biuret into the flask of vinegar. Swirl and rinse inside of flask with distilled water as the NaOH is being dripped into it. When the pink coloration appears and does not fade, turn the stop cock on the biuret to stop the flow of NaOH. Use a white piece of paper to read the biuret. Record the final amount onto the table for the NaOH. Repeat this procedure twice, recording the results for each of these trials as well in the table. After all three trials are completed, perform the calculations necessary to obtain the volume of NaOH used, the molarity (M) of acetic acid in the vinegar, and the % error for our experiment.

Data/Observations

	TRIAL 1	TRIAL 2	TRIAL 3
Volume of Vinegar	20.00 mL	20.00 mL	20.00 mL
Volume of NaOH (initial)	0.60 mL	0.85 mL	0.45 mL
Volume of NaOH (final)	35.45 mL	34.30 mL	33.80 mL
Volume of NaOH (used)	34.85 mL	33.45 mL	33.35 mL
Molarity of Vinegar	0.87 M	0.84 M	0.83 M

Molarity (M) -

the concentration of a solution

Indicator -

A Pointer or index.