Lab: Standardization of NaOH Solution

Procedure !:

1. Prepare the NaOH solution by dissolving approximately 4g of solid NaOH in 200mL of water in a 250mL beaker. Calculate the approximate NaOH concentration:
2. Convert grams of NaOH to moles of NaOH

(MW = 40.00, moles = g/MW)

1. Calculate Concentration of NaOH (Molarity = moles/liter) Record this amount.
2. To prepare the primary standard, first calculate and record the expected mass of benzoic acid required to react in stoichiometric proportion with 20mL of the NaOH solution:
3. From the balanced acid-base reaction,

C7H6O2 + NaOH => NaC7H5O2 + H2O, you know that the acid to base ratio is 1:1.

1. Find moles of NaOH (moles = Molarity x Volume (L))
2. Convert moles of NaOH to moles of C7H6O2 using a ratio of 1:1
3. Convert moles of C7H6O2 to grams of C7H6O2. (grams = moles x Molecular Weight, MW = 122.12)

Record mass.

1. Add calculated mass of benzoic acid to a clean flask and dissolve in 50mL of water. Add 2 drops of phenolphthalein.
2. Fill a 50mL burette with NaOH and record initial volume.
3. Connect the flask containing the benzoic acid solution to the base of the burette stand. Open the Data window and click the Pushpin icon to keep the data display set to the flask.
4. Titrate the benzoic acid solution by adding NaOH solution in large increments at first and then smaller increments. Open the properties window and click on the burette. Enter the amount of titrate to add, and click either the flow buttons to deliver the desired amounts.
5. Once the solution in the flask turns pink, you have reached the endpoint of the titration.
6. Repeat the analysis with another flask of benzoic acid solution prepared Exactly as before. Refill the burette with NaOH solution. This time, add NaOH in large increments until you get near the endpoint by previous trial.
7. Change to adding drops instead of mL, and add NaOH solution until the endpoint is reached as exactly as possible. You should be able to determine the endpoint to within 0.02mL.
8. With the total volume of NaOH solution used to titrate the benzoic acid primary standard, calculate the concentration of the NaOH solution.
9. Repeat the precise titration twice more and compare the 3NaOH concentrations. They should be within 1% of each other.
10. The rest of the NaOH solution can now be used in further lab work as a secondary standard with reliably known concentration equal to the average of the 3 titrations.

Procedure 2:

Acetic Acid of Unknown Concentration

1. In a flask, add 25mL of acetic acid of unknown concentration and 2 drops of phenolphthalein indicator.
2. Refill the burette with the NaOH solution (standardized in Procedure 1) and recoed the initial volume.
3. Titrate the acetic acid sample to the phenolphthalein’s color change endpoint. Record the final volume of the NaOH in the burette. Calculate the concentration of the acid.
4. Repeat the titration 2 more times and calculate the acid concentration of each trial.
5. Give the final acid concentration as the average of the 3 results.

Procedure 1:

Approximate concentration of NaOH solution: 4g/40g/moles = 0.1 moles

 0.1moles/(200mL/1000L) = 0.5 moles/L

Molecular weight of benzoic acid: 122.12g/moles

Mass of benzoic acid used: 0.50 x 0.02 = 0.01moles

* 1. x 122.12= 1.2212g

Titration of NaOH and benzoic acid:

 Trial 1(rough) Trial 2 (Fine) Trial 3 (Fine)

Initial Volune (NaOH)(mL) 50.00mL 50.00mL 25.00mL

Final Volume (NaOH)(mL) 29.75mL 29.75mL 4.75mL

Procedure 2:

Volume of acetic acid (mL): 25mL

Titration of NaOH and acidic acid:

 Trial 1 (Rough) Trial 2 (Fine) Trial 3 (Fine)

Initial Volume (NaOH)(mL) 33.00mL 33.00mL 30.00mL

Final Volume (NaOH)(mL) 31.15mL 31.15mL 28.15mL

Calculations/Interpretations (Show all work, labels)Use significant figures!

Procedure 1: NaOH titrated with benzoic acid

1. Moles of benzoic acid:
2. Moles of NaOH:

 Trial 2 Trial 3

Volume of NaOH used(mL): 50.00mL-29.75mL=20.25mL 25.00mL-4.75mL=20.25mL

 Average of 2&3

 20.25mL + 20.25mL/2= 20.25mL

1. Volume of NaOH (L):
2. Molarity of NaOH:

Procedure 2: NaOH titrated with Acetic Acid.

 Trial 2 Trial 3

Volume of NaOH used (mL): 33.00mL- 31.15mL=2.18mL 30.00mL-28.15mL = 1.85mL

 Average 2&3

 2.18mL + 1.85mL /2= 2.015mL

1. Volume of NaOH (L)
2. Moles of NaOH (molarity x volume):
3. Moles of Acetic Acid:
4. Volume of Acetic Acid (L):
5. Molarity Acetic Acid:
6. Conclusion: