Chemistry 204

Experiment 3

Titration-Technique
Preparation of a Primary and Secondary standards

Names:

Unknown number: 3

Purpose:
1. To learn Acid-Base titration technique.
2. To learn how to prepare a primary standard.
3. To learn how to standardize a secondary standard.
4. To find the concentration of an unknown acid solution by titrating it with a standardized base solution.

Theory:
The titration reaction involves equivalent amounts of reactants that combine with each in case of acid-base reaction:

 *equivalent acid = equivalent base

equivalent acid = mol acid/ number of protons donated per 1 mol of acid
equivalent base= mol base/ number of protons accepted per 1 mol base

as mol acid or base = weight of acid or base/ molecular weight acid or base
 equivalent acid or base = weight acid or base/ equivalent acid or base

Equivalent weight (acid or base)
 = molecular weight acid or base / number or protons donated or acc per mol

Molarity acid or base (M) = mol/ volume of solution liters*
*Normality* *acid or base (N) = equivalent/ volume of solution liters

mol acid or base = Molarity x volume liters

Equivalent acid or base = Normality x Volume liters

At equivalent-point or end-point:
N acid x V acid solution = N base x V base solution*Procedure:
1. Preparation of primary standard acid solution:
- Weight roughly about 5 grams of KHP transfer to weighting bottle that is accurately weighted on the analytical balance.
- Reweight again to know accurately the weight of KHP.
- Transfer the acid, through a funnel, into a clean 250 ml volumetric flask.
- Dissolve in distilled water any acid remaining in the bottle( add this to the volumetric flask).
-Fill the flask to about one-half full with distilled water and swirl it until dissolution is completed.
-Water carefully from with the wash bottle until the meniscus comes to the graduation mark.

Then:
*Normality of KHP = (Weight of KHP/ 204.4) x ( 1/0.250 L)*
Data Table:

|  |  |
| --- | --- |
| 19.88 g | Weight of weighing bottle empty |
| 24.45 g | Weight of weighing bottle with KHP |

*Method of calculation:*
*Weight of KHP = Weight of weighing bottle with KHP – weight of weighing bottle empty = 24.24 – 19.88= 4.57g
Normality of KHP = (4.57/204.4)x(1/0.25)
 = 0.0894mol/l*

2. Standardization of NaOH Solution:
- Clean your buret and the rinse twice with 5 mL of NaOH solution.
-Fill the buret with NaOH solution and drain enough liquid so the entire tip of the buret is free of air bubbles.
- Ajust the upper level of the solution so that the meniscus rests on the zero mark.

- Using a pipet transfer 25 mL of the standard acid KHP solution into a clean 250 mL Erlenmeyer flask.
- Add 2 drops of *phenolphthalein* indicator.

Preliminary Titration:
- Allow one to two mL at a time of NaOH solution to drain into the Erlenmeyer flask, swirling the flask after each addition.
- A pink color appears locally in the solution and disappears on swirling.
- When the pink color persists after swirling, RECORD THE BURET READING.
Then, Discard the contents of the Erlenmeyer flask and rinse several times with distilled water.

Accurate Titration ( in Duplicate):
-Pipet 25 mL of standard KHP into the Erlenmeyer flask.
-Record the initial buret reading.
-Allow NaOH solution to drain into the Erlenmeyer flask at a moderately slow rate until about 2 mL within reach of end-point.
-Swirl the flask, any pink color that may have formed should at this point disappear.
- Continue the titration carefully slowing down the drop by drop addition with swirling.
- The end point is taken after the addition of the first drop of NaOH solution which produces a permanent faint pink color.
- Record the final buret reading.
- Repeat the same procedure another time.
- If the two trails are in difference of more than 0.5 mL of NaOH volume repeat again.

Data Table:

Preliminary titration:

|  |  |
| --- | --- |
|  0 mL | Initial Buret reading |
| 24 mL | Final buret reading |
| 24 mL | Volume of NaOH |

First titration:

|  |  |
| --- | --- |
|  24 mL | Initial Buret reading |
| 48 mL | Final buret reading |
| 24 mL | Volume of NaOH |

*No need for second titration.*

*Method of calculation:

At equivalent-point or end-point:
N acid x V acid solution = N base x V base solution*
*0.0894 x 25ml = N base x 24ml
N base = 0.093125 mol/l*

3. Determination of the concentration of an unknown HCl solution:
- Follow the same procedure as in part (2) except pipet 10 mL of the unknown acid solution into 125 mL Erlenmeyer flask.
- Add 2 drops to 3 drops of phenolphthalein indicator and titrate with the standard NaOH solution until a faint pink color persists over 15 seconds while the solution is being stirred.

Data Table:

Preliminary titration:

|  |  |
| --- | --- |
| 0 mL | Initial Buret reading |
| 13.5 mL | Final buret reading |
| 13.5 mL | Volume of NaOH |

First titration:

|  |  |
| --- | --- |
| 0 mL | Initial Buret reading |
| 27 mL | Final buret reading |
| 13.5 mL | Volume of NaOH |

No need for second titration
 *Method of calculation:

At equivalent-point or end-point:

N acid x V acid solution = N base x V base solution
N acid x 10 = 0.093125 x 13.5
N acid = 0.1257 mol/l*