1. **Calculate the concentration of the HCl(aq) solution**

( 25mL of .1M unstandardized HCl solution, 2 drops of phenolphthalein indicator used. Titrated with 15.2mL of sodium hydroxide solution)

1. **Calculate the concentration of the Na2B4O7 solution two ways**
2. From the HCl titration of the Na2B4O7 solution

( 10mL of ~0.07M unstandardized Na2B4O7 solution, 50mL de-ionized water, and 3 drops of methyl red indicator. Titrated with 12.2mL of standardized hydrochloric acid)

1. From the titration with NaOH

* the reaction for the titration of sodium tetraborate with hydrochloric acid solution is: Na2B4O7(aq) + 2HCl(aq) + 5H2O(l) 🡪 4H3BO3(aq) + 2NaCl(aq)

(To the solution remaining from (a), added 5 sccops of sugar mannitol, 2 drops of phenolphthalein indicator. Titrated this solution with 15.1mL of standardized NaOH solution.)

1. **Determine the theoretical and percent yields and purities for boric acid and sodium perborate.**
2. 10.028 g of borax, 5mL of HCl, and 40mL water used. I got 5.155g of boric acid.

(Na2[B4O5(OH)4]\*8H2O(s) + 2HCl(aq) 🡪 4H3BO3(s) + 2NaCl(aq) )

1. 20.08g of borax, 4.0488g of sodium hydroxide, 165mL of 3% H2O2, and 40mL water used. I got 29.252g of sodium perborate.

( Na2B4O7\*10H2O(aq) + 4H2O2(aq) + 2NaOH(aq) + H2O(l) 🡪 2Na2[B2(O2)2(OH)4]\*6H2O(s) )

1. **Determine the average concentration of each solution titrated.**
2. 25mL of 0.1M unstandardized HCl solution, 2drops of phenolphthalein indicator used. Titrated this solution with 15.2mL of standardized sodium hydroxide solution to the stoichiometric end point, a pink color.

[double titration]

1. 10mL of ~0.07M unstandardized Na2B4O7 solution, 50mL of de-ionized water, and 3 drops of methyl red indicator. Titrated with 12.2mL of standardized hydrochloric acid.

* the reaction for the titration of sodium tetraborate with hydrochloric acid solution is: Na2B4O7(aq) + 2HCl(aq) + 5H2O(l) 🡪 4H3BO3(aq) + 2NaCl(aq)

1. To the solution remaining from (b), added 5 sccops of sugar mannitol, 2 drops of phenolphthalein indicator. Titrated this solution with 15.1mL of standardized NaOH solution.
2. **Determine the percent yield and percent purity of the boric acid and sodium perborate.**
3. 0.2 g of boric acid, 5.051g of mannitol, and 50mL of water used. Titrated with 28mL of 0.1M NaOH.
4. 0.25g of Na2[B2(O2)2(OH)4]\*6H2O (307.6g/mol) and 30mL of 4M H2SO4 used. Titrated with 7.5 mL of ~0.07M KMnO4.
5. **Determine the number of moles and percent by weight of sodium perborate and sodium carbonate in a given sample of Purex.**

* sodium carbonate, one of the important industrial chemicals, is the salt of a strong base and a weak acid. Its solution in water is distinctly basic:

CO32-(aq) + H2O(l) 🡪 HCO3-(aq) + OH-(aq)

* sodium perborate can also be titrated with acid:

[B2(O2)2(OH)4]2- + 2H+ +2H2O 🡪 2H3BO3 + 2H2O2

* the hydrogen peroxide released can subsequently be titrated with a standard solution of potassium permanganate:

5H2O2 + 2MnO4- + 6H+ 🡪 2Mn2+ + 8H2O + 5O2

1. .921g of Purex, 100mL de-ionized water, 2drops Antifoam C, 5 drops of methyl orange indicator used. Titrated with 8.6 mL of ~0.08M HCl.
2. Added 10 mL of 4M H2SO4 to (a). titrated with 22mL of ~0.015M of KMnO4.