Appendix E - Titration Analysis of ASA - "Is the concentration of ASA on the package correct?"

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Purpose: To perform an investigation to accurately determine the ASA content of an over-the counter pain reliever and to compare the result with the quantity claimed on the label.

Prediction: Based on the manufacturer's claim on the label of the bottle of ASA, I predict that the quantity of ASA will be 325 mg.

Materials:

- eye protection
- 4 - 125 ml flasks
- 4 samples of potassium hydrogen phthalate (KHP)
- distilled water
- Phenolphthalein
- $NaOH_{(s)}$
- 500 ml volumetric flask
- Burette
- Burette clamp
- Pipette
- Stirring Rod
- Ring Stand
- Mortar
- Pestle
- ASA tablets
- ethanol
- analytical balance

Safety:

Chemical	Hazard	Symptoms	Prevention/Safety
KHP	Irritant	Inhalation – cough, sneezing Skin – irritation Eyes – irritation Ingestion – burning	Breathing protection. Wear protective gloves and clothing. Wear goggles. Don't eat or drink in a lab.
Ethanol	Flammable	Inhalation- cough, drowsiness, headache, fatigue Skin – dry skin Eyes – redness, pain, burning Ingestion – burning sensation, dizziness, confusion, headache, unconsciousness	Have ventilation systems. Breathing protection. Wear protective gloves and clothing. Wear goggles. Don't eat or drink in a lab.
Phenolphthalein Indicator	Irritant	Inhalation – coughing, sneezing Skin – itching skin rash Eyes – slight irritation Ingestion – purging, collapse, fall in blood pressure	Breathing protection. Wear protective gloves and clothing. Wear goggles. Don't eat or drink in a lab.
Sodium Hydroxide	Corrosive	Inhalation – burning sensation, cough, difficulty breathing Skin – redness, serious skin burns, pain	Breathing protection. Wear protective gloves and clothing. Wear goggles. Don't eat or drink in a lab.

Procedure: Standardizing the Base

1. Clean four 125 ml flasks. They do not need to be dried. Label them.
2. Mass out 4 samples of reagent-grade KHP, of about 1.2 grams each.
3. Place one sample in each flask. Dissolve each of the four KHP samples in 25 ml of distilled water.
4. Add three drops of phenolphthalein to each flask. The solution will remain colourless.
5. Prepare 500 ml of a 1.5 M NaOH solution.
6. Prepare your burette for titration by filling it with your $NaOH_{(aq)}$ solution.
7. Titrate one of your KHP samples fairly quickly to determine the approximate endpoint.
8. Titrate the remaining three KHP samples carefully and slowly, adding $NaOH_{(aq)}$ in I.0mL increments. Record the exact volume of $NaOH_{(aq)}$ needed to reach endpoint.
9. Calculate the exact concentration of your NaOH solution using the final 3 samples.

Titration of an ASA tablet with the standardized base.

1. Obtain 1 ASA tablet (not coated).
2. Obtain the mass of the ASA tablet.
3. Using a mortar and pestle, grind the tablet into a fine powder.
4. Dissolve the ASA tablet in 50 ml of alcohol.
5. Obtain the standardized $NaOH_{(aq)}$ in a clean, dry, labeled 100 ml beaker.
6. Set up the burette with the standardized $NaOH_{(aq)}$.
7. Pipet 10 ml of the diluted ASA into a clean Erlenmeyer flask.
8. Add 1 or 2 drops of phenolphthalein indicator.
9. Record the initial burette reading in your observation chart.
10. Titrate the sample with $NaOH_{(aq)}$ until a single drop produces a permanent change from colourless to faint pink.
11. Swirl the sample for 1 minute to make sure the colour does not disappear.
12. Record the final burette reading to the nearest 0.1ml.
13. Repeat steps 6 – 12 until three consistent results are obtained.

Analysis:
1. Calculate the amount of ASA (active ingredient) in a commercial ASA tablet using the titration formulas and the data obtained.
2. What are some sources of error which may have affected your results?
3. Name some possible changes in the lab procedure that may have improved your results.

Laboratory Report Rubric

	Level 1	Level 2	Level 3	Level 4
A. Initiate and Plan				
A clear understanding of the procedure that allows for the control of the variables as designed	Major errors in the logic of the steps followed or procedure does not allow for the control of variables Safety rules are not followed	Some errors in the logic of steps or does not control all variables well Same safety rules are missing	Procedure is logical and allows for the control of variables Safety is addressed	Procedure is of excellent technical quality and controls variables as well Safety is addressed
B. Perform and Record				
Table is designed to record raw data appropriately, including units and uncertainties where necessary	Data is recorded poorly There are some major omissions in the data	Data is recorded in the table is not clearly summarized There are minor omissions in the data	Data recorded in the table is clearly summarized Most of the pertinent data is recorded	Data is recorded in a highly original table All pertinent data is recorded
Raw data is presented clearly allowing for easy interpretation	There are numerous errors in the data with respect to presentation of the data, units, uncertainties, and significant figures	There are some errors in the data with respect to presentation of the data, units, uncertainties, and significant figures	There are very few errors in the data with respect to presentation of the data, units, uncertainties, and significant figures	All the data is presented clearly, uses correct units, includes uncertainties and significant figures
C. Analyze and Interpret				
The raw data is processed correctly to produce results that help interpretation; where appropriate error analysis is included	There are numerous errors in the calculations and/or analysis of results	There are some minor errors in the calculations and/or analysis of results	There are very few errors in the calculations and/or analysis of results	There are no errors in the calculations and/or analysis of results
Data/results are presented appropriately and effectively, where relevant, errors and uncertainties are taken into account	The analysis is not presented clearly. There are numerous errors in the data with respect to units and significant figures	The analysis is presented somewhat clearly. There are some errors in the data with respect to units and significant figures	Most of the analysis is presented clearly. There are very few errors in the data with respect to units and significant figures	The analysis is presented clearly, uses correct units and significant figures
D. Conclude and Evaluate				
A valid conclusion based on the correct interpretations of the results, with an explanation, is given, where appropriate, results are compared with literature values (label value)	Demonstrates limited ability to identify major findings, theory, and supporting details	Demonstrates some ability to identify major findings, theory, and supporting details	States major findings, that demonstrates a good understanding of the experiment and theory	Offers a clear conclusion that demonstrates a strong understanding of the experiment and theory
The procedure (apparatus/materials and method) including limitations, weaknesses or errors in manipulation is evaluated. Effects on results are clearly explained	Sources of error are irrelevant and the effects of the results are not explained	Describes few sources of error or irrelevant sources of error and weakly explains effects on results	Describes some sources of error and explains their effect on results	Describes all sources of error and clearly explains their effects on results
Suggestions to improve the investigation following the identification of weaknesses are stated	No suggestions for improvement are given	Weak suggestions for improvements are described	Some suggestions for improvements are described	Suggestions for improvements are thoroughly described