Lab 3: Vitamin C Lab

Report:
You have been hired as a consultant on a manned trip to Mars. Because of its high fiber content, vitamin C content, and energy (sugar) content, it is determined that there should be a large amount of fresh fruit available. However, there is only so much room on a space shuttle so you want to maximize juice and vitamin C and minimize the space the fruit takes. You are to use the data from your lab to write a report telling the astronauts which fruit they should take on the trip. Consider not only the amount of vitamin C, but the amount of juice, and the size of the fruit in making your report. Include how many pieces of each must be eaten to get 100% of the daily recommended vitamin C.

The people in charge of the mission would also like to include fruit juice on the shuttle. Include in your report a discussion of the amount of vitamin C present in store-bought juice, how it compares to the labels, and if there is any change over time to the vitamin C content of the juice.

Procedure:
Part One: Testing the Standard Vitamin C (Ascorbic Acid) Solution
1. Place 25.0 mL of the ascorbic acid solution (which is 1 mg/mL) in a 125-mL flask.
2. Add 2 mL of 6 M acetic acid and 3 mL of 1% starch solution to the ascorbic acid solution.
3. Rinse your buret out with a small amount of iodine solution. Pour the iodine solution into the specified waste container located at the central station in the lab.
4. Fill the buret with more iodine solution.
5. Titrate the ascorbic acid/starch solution to a blue endpoint with the iodine solution. Perform this titration twice. Use the first titration as a “ballmark” estimate of the iodine needed to reach the endpoint. Use the second titration to determine the exact volume of iodine needed to reach the endpoint. Record this exact volume.
6. You can pour the titrated solution in the flask down the sink.

Part Two: Testing Fruit Juice for Vitamin C
1. Place 25.0 mL of new white grapefruit juice in a 125-mL flask.
2. Add 2 mL of 6 M acetic acid and 3 mL of 1% starch solution to the juice solution.
3. Fill a buret with the iodine solution.
4. Titrate the juice/starch solution to a blue endpoint with the iodine solution. Perform this titration twice. Use the first titration as a “ballmark” estimate of the iodine needed to reach the endpoint. Use the second titration to determine the exact volume of iodine needed to reach the endpoint. Record this exact volume.
5. You can pour the titrated solution in the flask down the sink.
6. Repeat with the previously opened white grapefruit juice (the juice was opened 2 weeks ago). Perform this titration twice, using the same procedures as above.
Part Three: Testing Fruits for Vitamin C
1. Select a type of fruit and cut it in half with a knife. Measure the diameter of the fruit.
2. Squeeze all of the juice from the fruit into a beaker.
3. Record the volume of juice obtained from one whole piece of fruit.
4. Place 25.0 mL of the juice in a 125-mL flask.
2. Add 2 mL of 6 M acetic acid and 3 mL of 1% starch solution to the juice solution.
3. Fill a buret with the iodine solution.
4. Titrate the juice/starch solution to a blue endpoint with the iodine solution. Perform this titration twice. Use the first titration as a “ballmark” estimate of the iodine needed to reach the endpoint. Use the second titration to determine the exact volume of iodine needed to reach the endpoint. Record this exact volume.
5. You can pour the titrated solution in the flask down the sink.
6. Repeat with one other type of fruit.
7. Make sure you have the data for the other types of fruit you did not test. Get this information from other students in the class.
8. Pour any unused iodine solution from your buret into the specified waste container located at the central station in the lab.

Part Four: Gathering Information from the Label
1. Look at the label on the fruit juice bottle, record the vitamin C content and the amount of one serving.

Data and Calculations: (Show all work!)
1. The USRDA recommended dosage of vitamin C is 60 mg (this is considered to be 100%). What volume of iodine solution is required to react with 60 mg of ascorbic acid?
2. Determine the vitamin C content in one cup (240 mL) of the newly opened juice and compare this value to the label.
3. Determine the vitamin C content in one cup (240 mL) of the previously opened juice and compare this value to the label.
4. Compare the vitamin C content in one cup (240 mL) of newly opened juice to one cup of freshly squeezed juice from each of the fruits.
5. Provide a table that includes volume of each piece of fruit, total volume of juice for each piece of fruit, complete vitamin C content, and percentage of recommended vitamin C for each type of fruit. To determine the volume of each piece of fruit, use the following equation: \[ V = 4.19 \times r^3 \] (where \( r \) = the radius of the fruit). Show all of your work for at least one of the types of fruit.

Paper Idea III:
Write a paper on the importance of vitamin C in the body. Address at least the following questions:

Why is vitamin C important in the body? How does the body use it? Is there a limit to the amount of vitamin C that a human should ingest and why? Why does the amount of vitamin C in juice change over time?

Note: Do not merely answer these questions in order, but write a coherent paper that addresses the above issues. The paper must be typed, should not be longer than 5 pages (double spaced, reasonable margins), and must include at least 2 references (web references are fine). The work must be your own.