Determining How Much Apple Juice is in Cran-Apple Juice

Materials

- Spectrophotomer
- 100% Apple and Cran-Apple Juices
- 4 Volumetric flasks 25 mL
- 5 mL measuring burets
- 6 Cuvets
- Pipets
- Plastic Cups

Procedure

A) Apple Juice Absorption Spectrum

1) Make a 60% apple juice solution by putting 15 mL apple juice in the 25 mL volumetric flask with the 5 mL measuring buret and filling to the line with deionoized water. Put the yellow cap on the flask and invert a few times to ensure even mixing. Note: the yellow base of the cap need not touch the glass at the top of the flask. This will make it too tight to be pulled off.
2) Using the measuring buret or a pipet, fill a clean cuvet about ¾ full with this solution. Be careful to handle only the lid or frosted sides of the cuvet so as to not affect absorbance readings. If possible, wipe the sides of the cuvet off with a lint-free wipe before placing into the spectrophotometer each time.
3) Fill another cuvet ¾ with deionoized water. This will function as the blank for calibrating the spectrophotometer.
4) Put the blank in the third slot in the spectrophotometer, set the wavelength to 340 nm, and adjust the absorbance meter to read 0 (The spectrophotometer should be on setting "Absorbance 0-1").
5) In order to determine the wavelength at which apple juice absorbs maximally, an absorption spectrum for apple juice will be made. Starting at 340 nm and going up to 400 nm, measure the absorbance every 10 nm. Be sure to recalibrate the spectrophotometer at each new wavelength. Note: You may need to switch the setting on the spectrophotometer to "Absorbance 1-2" for some of these measurements because the apple juice absorbs very strongly. You will need to do this if when set on "Absorbance 0-1", the meter reads greater than 1.
6) Construct a graph (scatter with smooth lines and markers) of absorbance vs. wavelength and use the point with the highest absorbance as the maximum absorbance, λ_{max}. This is the wavelength that will be used to make your calibration curve in part B.
7) Print this off to turn in with your lab report.

B) Apple Juice Calibration Curve

1) Using a measuring buret, transfer 20 mL of apple juice into a new 25 mL volumetric flask then fill to the line with deionized water. This is your 80% apple juice solution. Cap the flask and invert it as done in part A.

2) Fill a cuvet ¾ full with this solution, and place it near your existing 60% solution, being careful not to mix them up.
3) Pour the rest of your 80% solution into a plastic cup.
4) Using the measuring buret, transfer 12.5 mL of the 80% solution into another volumetric flask. Dilute up to the line again, and this will be your 40% apple juice solution. Cap and invert a few times like before.
5) Fill a third cuvet ¾ with this solution and place with the others.
6) Pour the rest of the 40% solution into another plastic cup.
7) Transfer 12.5 mL of the 40% solution into a new volumetric flask with the measuring buret. Dilute this solution to the line to create your 20% dilution. Cap and invert as before.
8) Measure and record the absorbances of your 20%, 40%, 60%, and 80% apple juice solutions at your λ_{max} from part A. Note: You do not need to recalibrate the spectrophotometer between each of these readings because the same wavelength will be used for all of them.
9) Construct a graph (scatter with only markers) of absorbance vs. concentration using these four data points from step 8.
10) Add a linear trendline to your graph. Note: the trendline may not go through zero because there are so few data points; this is fine.
11) Print the graph off to turn in with your report.

C) Absorbance of Cran-Apple Juice

1) Using a pipet or measuring buret, fill a clean cuvet ¾ full with 100% cran-apple juice.
2) Calibrate the spectrophotometer using the blank as before at the λ_{max}.
3) Place the 100% cran-apple juice cuvet in the spectrophotometer and measure its absorbance at λ_{max}. Record this value in the data section.
4) Using the calibration curve from part B, calculate the percent of apple juice that makes up cran-apple. Show all of your work.
5) Clean up your work area, and empty and rinse all cuvets, burets, and flasks used.

Data

A)

Wavelength (nm)	Absorbance
340	
350	
360	
370	
380	
390	
400	

λ_{max}: _____

B)

% Apple Juice	Absorbance
20	
40	
60	
80	

Best-Fit Line Equation: _____

C)
Cran-Apple Absorbance at λ_{max}: _____

Calculations:

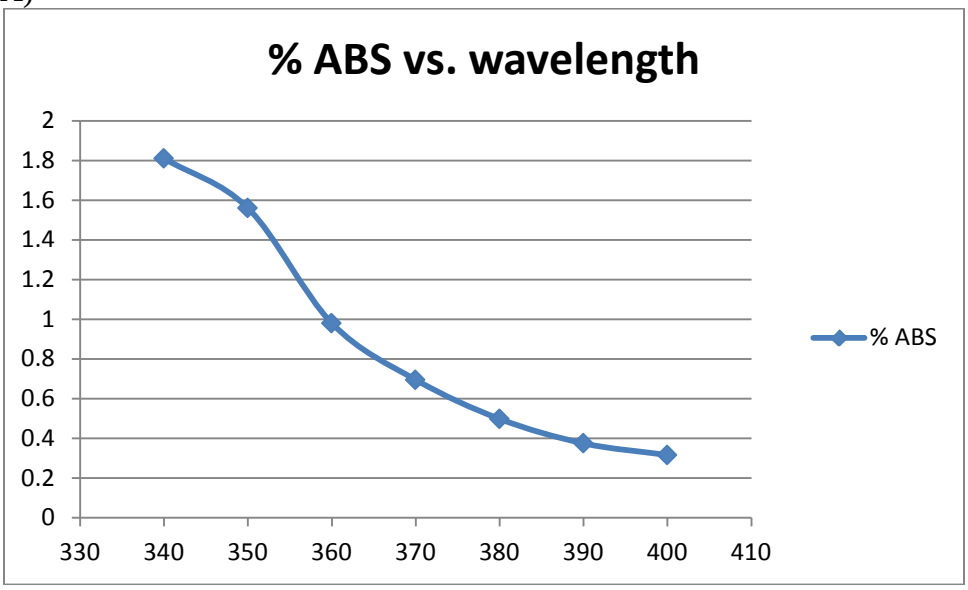
This experiment was adapted from:
Etinosa Edionwe, John R. Villarreal, and K. Christopher Smith. *How Much Cranberry Juice Is in Cranberry_Apple Juice? A General Chemistry Spectrophotometric Experiment*
Department of Chemistry, University of Texas-Pan American, Edinburg, Texas 78539-2999, United States

Determining How Much Apple Juice is in Cran-Apple Juice (supplement)

Here is the data from when I initially ran the experiment:

1)

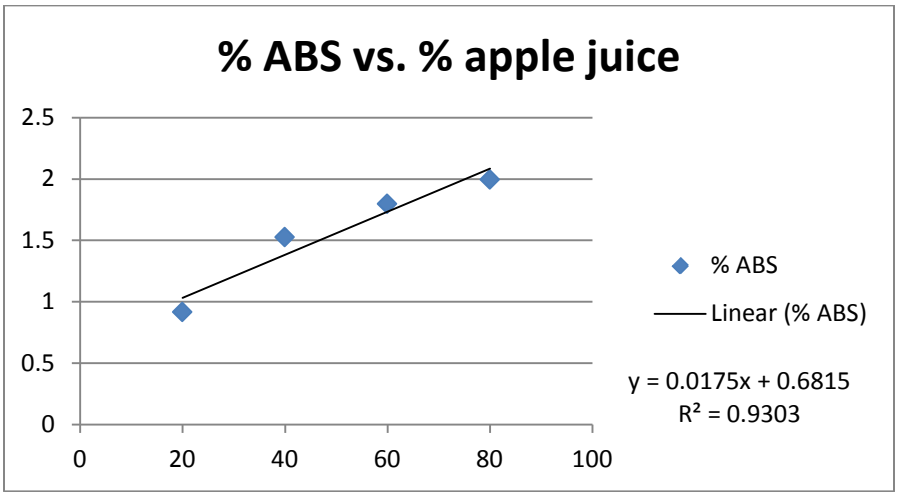
A)



λ_{max}: 340 nm

wavelength	% ABS
340	1.81
350	1.56
360	0.98
370	0.695
380	0.498
390	0.375
400	0.316

B)



solution	% apple	% ABS
1	80	1.995
2	60	1.798
3	40	1.526
4	20	0.916

2) Measuring Buret Directions:

- Stick the pointed end into the desired solution, and place the red bulb at the other end.
- Squeeze the bulb and allow it to return to normal size while drawing up the liquid such that the meniscus is above the top line and does not get drawn up into the bulb.
- Quickly remove the bulb and cap it with your finger.
- Move your finger on and off to allow the liquid to lower until the meniscus is at the top line.
- Empty desired amount into your cuvet.
- When there is excess, red bulb can be used to expel it.
- When changing between solutions of different concentration, draw water into the buret, turn it sideways and roll, and then use the bulb to expel the solution.

Acknolwedgements:
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VWR Product Part Numbers

Package 3 (Cranberry):

25 mL volumetric flasks	89041-926
Measuring pipets	89003-516
Bulb pipet fillers	82024-574
Semi-micro cuvettes	97000-586
Pasteur pipets	14672-380
Rubber bulbs	82024-554

Package 6 (Papain):

10 mL graduated cylinders	65000-000
13x100 mm test tubes	47729-572
PTFE stir rods	89026-280