Coke and Diet Coke Lab Report

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94

Introduction --

This lab is about finding the density of Coke and Diet through a variety different measurements. Through careful measuring and observation the first experiment was done by measuring the mass and finding the volume of Coke and Diet Coke. We then found the density by dividing mass and volume. After all data was calculated we placed all our measurements on a computer made graph for Coke and Diet Coke and then made another graph by hand for Coke and Diet Coke. The next procedure we used Coke and Diet Coke cans, one empty and one full Coke can and one empty and one full Diet Coke can. With a triple beam balance we were able to find the mass of all four cans, and with the volume we found the density. In the last procedure we observed the buoyancy of Coke and Diet Coke in water.

Procedure --

Part A:

In the first procedure we found the density of Coke and Diet Coke by a triple beam balance, eye dropper, graduated cylinder and a beaker. We first added about 30mL of regular Coke into a 50 mL beaker. We then placed two 10 mL cylinders on a scale and measured their mass. Leaving both graduated cylinders on the scale, we used an eye dropper to add about 2mL of soda to one of the cylinders. The volume and mass were attentively recorded and checked. Next, we recorded volume and mass every 2 mL until we had 20 mL of Coke in our graduated cylinders. After we finished measuring the Coke we did the same exact procedure for Diet Coke. We made sure to empty all the old Coke and have clean glassware for the Diet Coke. Again, we recorded volume and mass every 2mL of Diet Coke in the graduated cylinders until we had 20mL of Diet Coke.

Part B:

For the second process we used one full and one empty Coke can then one full and one empty Diet Coke can. The volume of Coke and Diet Coke was printed on the cans

and we recorded this value. First, we measured the mass of an empty Coke can and then the mass of a full Coke can. After recording both measurements we then found the mass of an empty Diet Coke can and the mass of a full Diet Coke can. Again all measurements were carefully and correctly recorded and calculated.

Part C:

The last experiment we put a full can of Coke and a full can of Diet Coke in a bucket of water. We recorded our observation of the levitation of the Coke and Diet Coke cans.

Data/Results --

Part A:

Regular Coke:

All data recorded on spreadsheet (page 7)

Density of Coke = D=M*/V *Mass of soda without cylinder

All calculations of density on spreadsheet (page 7)

Graphs:

Hand made graph (pages 10&11)

Point 1:

$X_1 = 4.09mL$

$Y_1 = 4.2g$

Point 2:

$X_2 = 18.10mL$

$Y_2 = 18.4g$

Density = Slope = $\frac{Y_2 - Y_1}{X_2 - X_1} = \frac{18.4g - 4.2g}{18.10mL - 4.09mL}$

$= 1.01356174g/mL$

Rounded to ---> 1.0g/mL

Computer made graph (pages 8&9)

f(x) = A + B*X

B = 1.02g/mL

Density = Slope = B = 1.02g/mL

Diet Coke:

All data recorded on spreadsheet (page 7)

Density of Diet Coke = D=M*/V *Mass of soda without cylinder

All calculations of density on spreadsheet (p.)

Graphs:

Hand made graph (pages 10&11)

Point 1:

$X_1 = 1.99mL$

$Y_1 = 1.9g$

Point 2:

$X_2 = 3.98mL$

$Y_2 = 3.8g$

Density = Slope = $\frac{Y_2 - Y_1}{X_2 - X_1} = \frac{3.8g - 1.9g}{3.98mL - 1.99mL}$

$= 0.9547738693g/mL$

Rounded to ---> 0.95g/mL

Computer made graph (pages 8&9)

$f(x) = A + B*X$

$B = 0.982g/mL$

Density=Slope = B = 0.982g/mL

Part B:

Regular Coke:

Volume of Coke Can = 355mL

Mass of empty Coke Can (EC) = 13.1g

Mass of full Coke Can (FC) = 387g

Mass of Coke (MC) = FC - EC = 387g - 13.1g = 373.9g

Density of Coke Can = MC/V = 373.9g/355mL = 1.053239437g/mL

Rounded to ---> 1.05g/mL

Diet Coke:

Volume of Diet Coke Can = 355mL

Mass of empty Diet Coke Can (EDC) = 14.0g

Mass of full Diet Coke Can (FDC) = 369g

Mass of Diet Coke (MDC) = FDC - EDC = 369g - 14.0g = 355g

Density of Diet Coke Can = MDC/V = 355g/355mL = 1.00g/mL

Rounded to ---> 1.00g/mL

Part C:

Regular Coke:

Sunk to bottom of bucket

Diet Coke:

Floated on top of water

Summary Table of Density

	Coke	Diet Coke
Spreadsheet	1.0g/mL	0.97g/mL
Hand made Graph	1.0g/mL	0.95g/mL
Computer made Graph	1.02g/mL	0.982g/mL
Full/Empty Can Method	1.05g/mL	1.00g/mL
Float Method	Sunk	Float

Discussion --

In this lab the data seemed to be consistently accurate. All four methods came out with a similar answer. The measurement of mass for all the methods in this experiment is not as precise as we could have gotten it. While all mass measurements are only to the tenth decimal we could have gotten an even more precise answer if we had measured the mass to the hundredth decimal. Therefore we have to rely more on consistency of our answers than our direct information.

One part of the data that seemed interesting was that for the Regular Coke Density in the first procedure, Part A, the measurement slightly increased from the first measurement, 0.95g/mL to the fifth measurement, 1.05g/mL. With all the other measurements no more than a tenth away from each other, this seemed rather strange. This could be due simply to human error but it also could have been because some of the soda became stuck to the top of the graduated cylinder therefore the mass was recorded completely but the volume was not.

The pro of the method on the spreadsheet in Part A is that the measurements are nearly exact because of the strenuous and careful measuring. If there was any strange change that occurred during the procedure it would have been recognized immediately because so many measurements were made. The problem with this procedure is that there could be a mistake when observing the measurement on the graduated cylinder. Just looking at the graphs made, there were many points that were slightly off the diagonal density line. The liquid could

have also become stuck on the top of the graduated cylinder, therefore the mass would have been recorded but the volume would not be correct.

The pro of the Full Can method , Part B, was that this procedure was most likely the most accurate. The volume had to be correct because it was recorded on the can and the mass was easily found through calculating the measurements. This was the easiest and most reliable method. If we had put down the hundredth decimal place for mass in our measurements we would have gotten an even more accurate and precise answer. The only problem with this method is that there is a slim chance that an empty can could have been a different weight than the full can. We are also trusting that the volume on the can is true. Both these problems would be unusual but could have happened and made a glitch in the final measurement of density.

The good thing about the Float method, Part C, is that it was the most obvious. You did not need faith that your measurements for Coke probed that it was denser than Diet Coke. The proof was right in front of you. The flaw with this is that there could have been something wrong with one or both of the bottles. One soda could have been older that the other or it might have been damaged when being manufactured.

The pro of the computer made graph is that it is the least amount of work and the easiest to recognize the correct points. It is nearly impossible for any error to occur in the final calculations because the points are set perfectly. But as good as this may seem, this could also be a con. If the points were written in for the graph incorrectly the graph would be incorrect. If there were not enough or too many significant digits the final answer for density would be wrong. Also, the line across the points could also be effected by a point that is off the slope. All this could throw off the final answers.

The good thing about the Hand made Graph is that the line of your slope can be just about perfect. If the points are set correctly it is easy to recognize which points are the most accurate and which are a little off the slope. The problem with this method is that it is difficult to set the point perfectly on the graph. Even if the graph is a tenth off where it should be, the final answer would be incorrect.

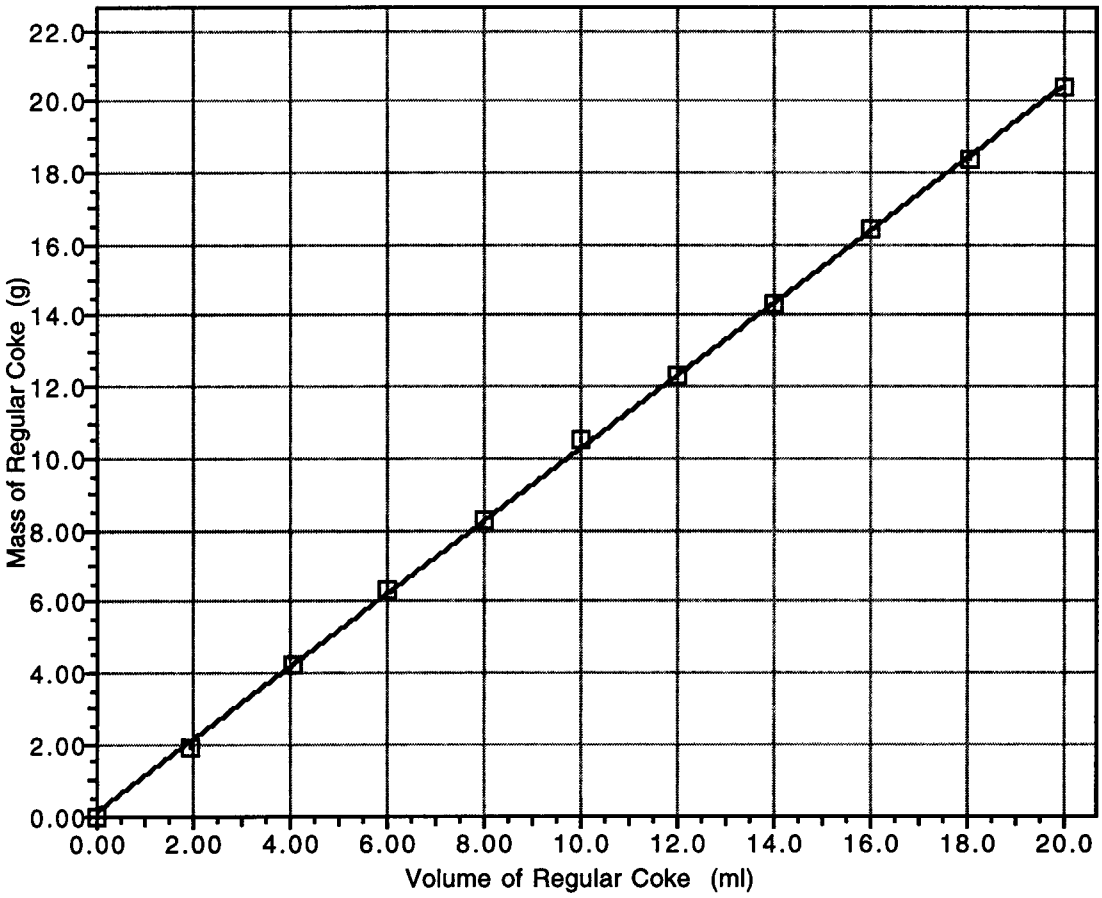
Even though all procedures could have flaws to them the outcomes that Coke is denser than Diet Coke is most likely correct because all the procedures came out with that as their final answer. The Floating method was an absolute method to find out which soda was denser. With the most full proof method with accurate numbers, that would most likely be, the full/empty can method and the computer made graph method. But in this lab the computer made graph method is the best method because there was not enough precision in the full/empty can method to come out with the best answer.

Conclusion--

Therefore, by the computer made graph method Coke that has a density of 1.02g/mL is more dense than Diet Coke with a density of 0.982g/mL.

	A	B	C	D	E	F	G	H	I	J
1	regular coke									
2	volume of soda(ml)		mass of cylinders and soda (g)		mass of soda(g)	grams	density			
3	0.00	ml	49.4	grams	0.0	grams		grams/ml		
4	1.99	ml	51.3	grams	1.9	grams	0.95	grams/ml		
5	4.09	ml	53.6	grams	4.2	grams	1.0	grams/ml		
6	6.00	ml	55.7	grams	6.3	grams	1.1	grams/ml		
7	8.00	ml	57.7	grams	8.3	grams	1.0	grams/ml		
8	10.00	ml	59.9	grams	10.5	grams	1.05	grams/ml		
9	12.00	ml	61.7	grams	12.3	grams	1.03	grams/ml		
10	14.00	ml	63.7	grams	14.3	grams	1.02	grams/ml		
11	16.00	ml	65.8	grams	16.4	grams	1.02	grams/ml		
12	18.10	ml	67.8	grams	18.4	grams	1.02	grams/ml		
13	20.00	ml	69.8	grams	20.4	grams	1.02	grams/ml		
14						average density =	1.0	grams/ml	*g4 omitted from average	
15	diet coke									
16	volume of soda(ml)		mass of cylinders and soda(g)		mass of soda(g)		density			
17	0.00	ml	49.5	grams	0.0	grams		grams/ml		
18	1.99	ml	51.4	grams	1.9	grams	0.95	grams/ml		
19	3.98	ml	53.3	grams	3.8	grams	0.95	grams/ml		
20	6.07	ml	55.3	grams	5.8	grams	0.96	grams/ml		
21	8.00	ml	57.2	grams	7.7	grams	0.96	grams/ml		
22	9.99	ml	59.2	grams	9.7	grams	0.97	grams/ml		
23	12.10	ml	61.2	grams	11.7	grams	0.967	grams/ml		
24	14.00	ml	63.3	grams	13.8	grams	0.986	grams/ml		
25	16.00	ml	65.1	grams	15.6	grams	0.975	grams/ml		
26	18.00	ml	67.1	grams	17.6	grams	0.978	grams/ml		
27	20.00	ml	69.1	grams	19.6	grams	0.980	grams/ml		
28						average density =	0.97	grams/ml		

A Graph Showing Mass vs. Volume for Regular Coke



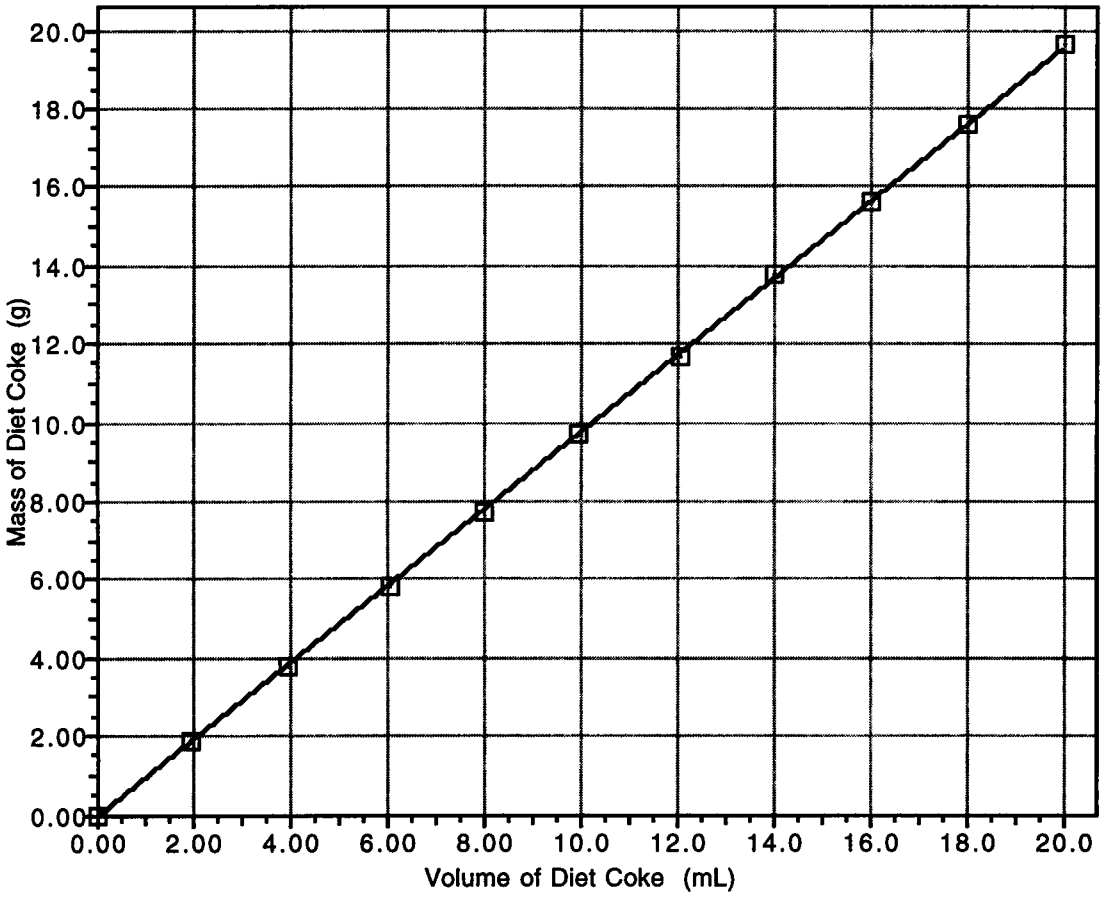
Automatic Curve Fit:

f(x)= A + B*x

A= 0.0551 B= 1.02

Mean Square Error: 0.0127

Mass and Density of Diet Coke



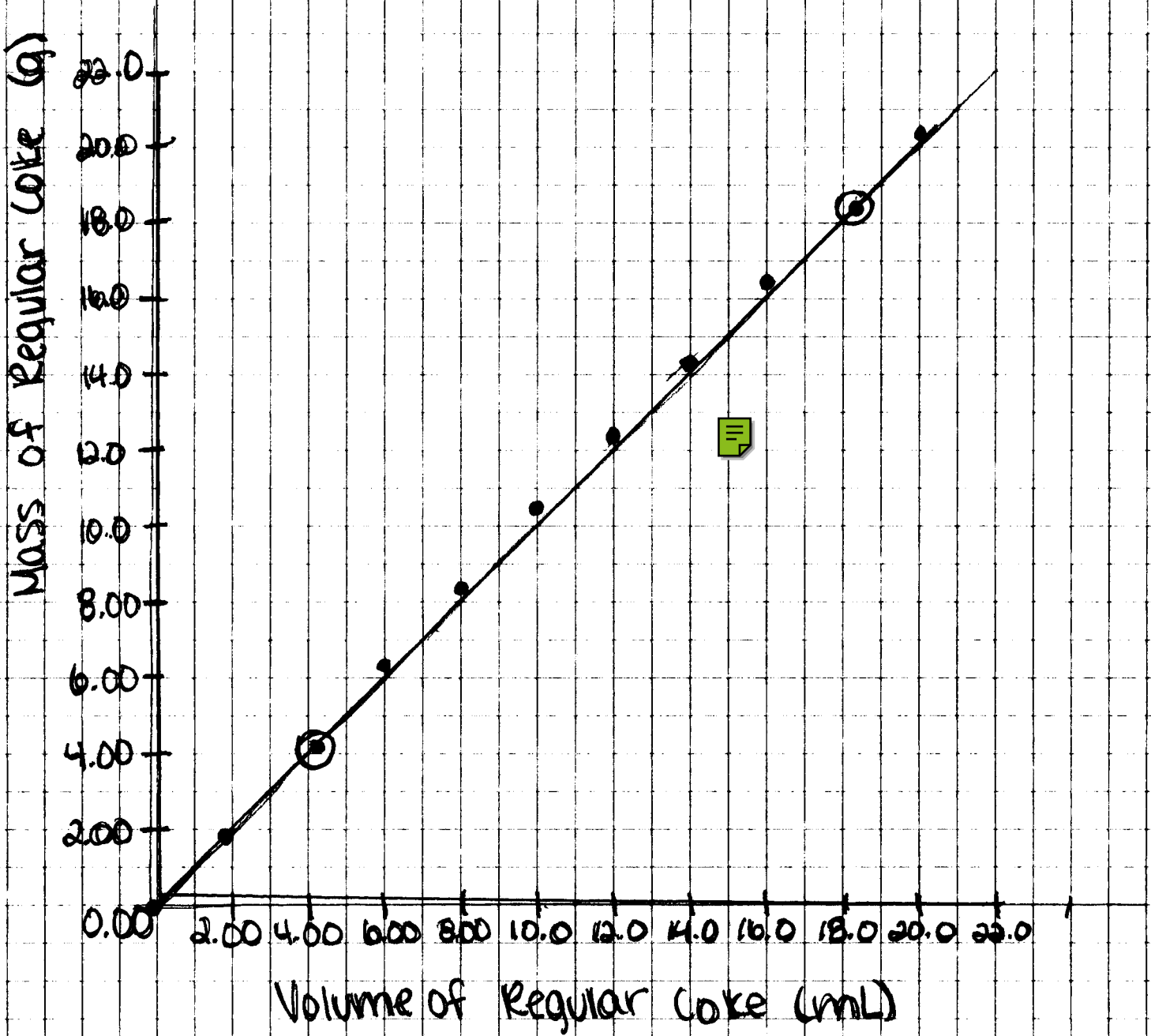
Automatic Curve Fit:

f(x)= A + B*x

A= -0.0904 B= 0.982

Mean Square Error: 0.00464

A Graph Showing Mass vs. Volume for Regular Coke



A Graph Showing Mass vs. Volume of Diet Coke