Faster Plop, Plop, Fizz, Fizz: A Scientific Method Investigation
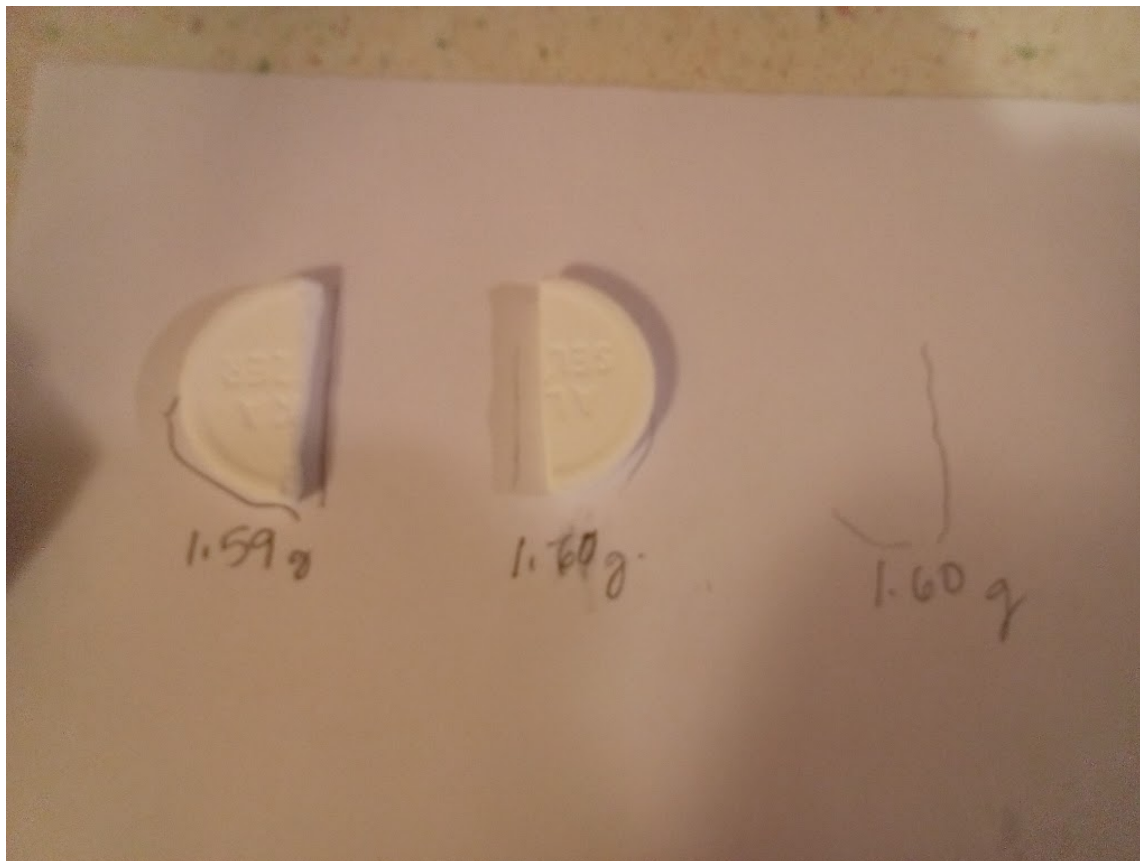
Activity 1

1. State a hypothesis for Activity 1 using an "if/then" statement. Remember to create a statement that is able to be tested empirically.

If the temperature is increased, the Alka-Seltzer tablet will dissolve more rapidly.
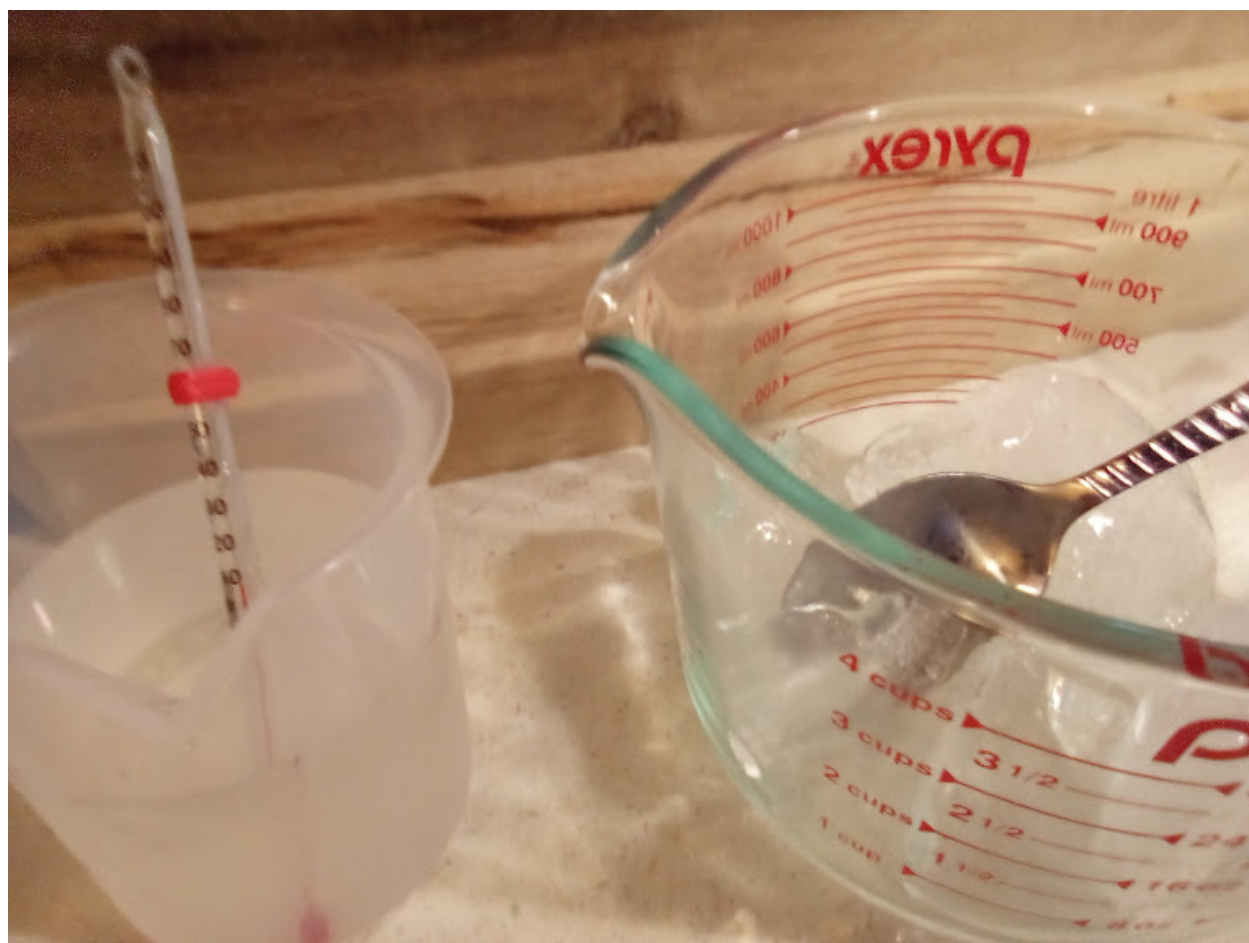
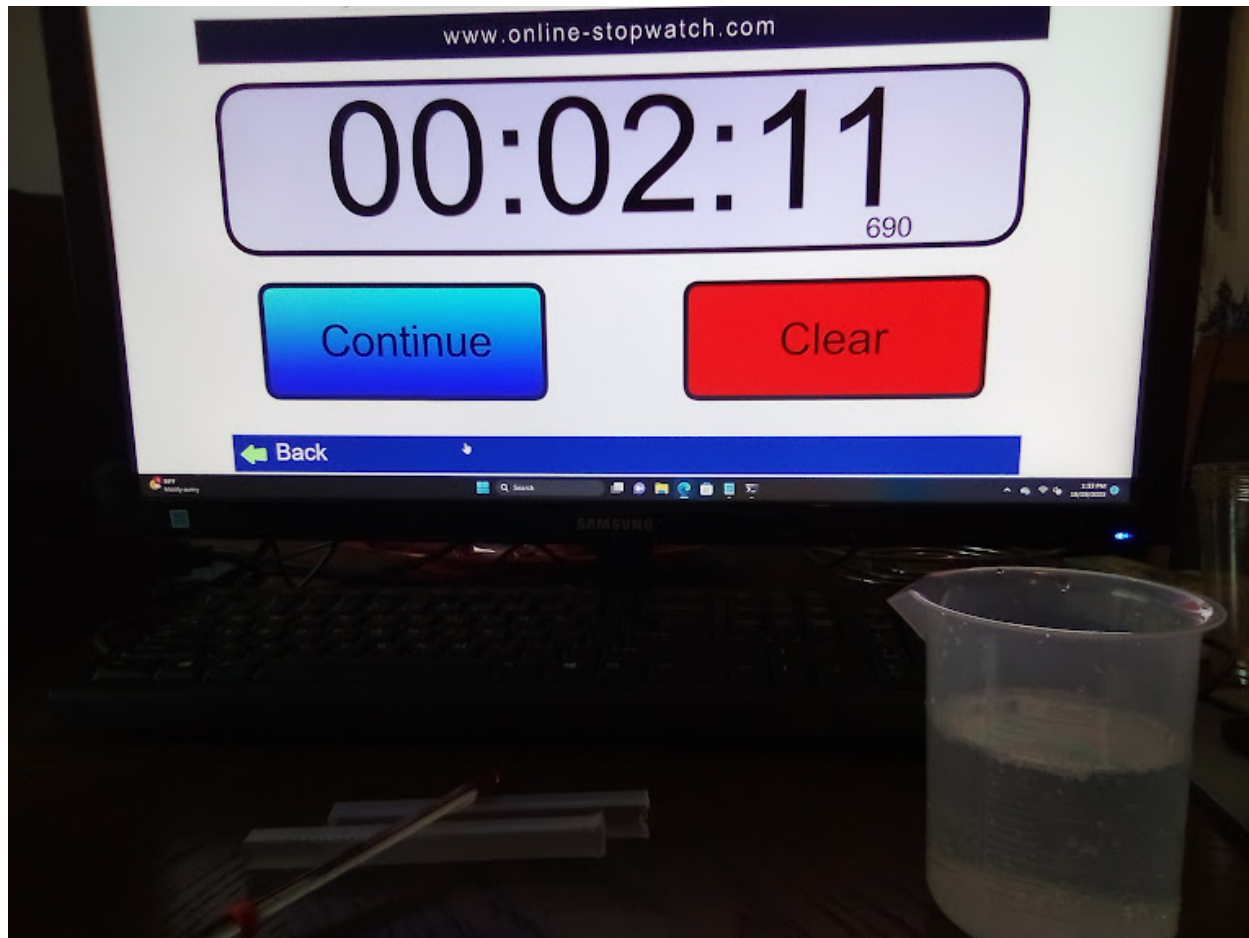**Each experiment trial was conducted with a 1.60 g half-tablet in 200 mL of water**

1.59 g   1.69 g   1.60 g

Data Table 1

Run No.	Cup	Temp. (˚C)	Time (sec.)	Observations
1	C	8	2:40	The 1.60g half-tablet fizzed gently. Few fragments at the end of the reaction started to float slightly.
1	RT	20C (68F)	0:53	Music jam helps smooth prep routine, make samples more uniform. Rolf Royce. Tosca
1	H	80	12	Vigorous fizz on the surface of the water
2	C	8	2:45	Judging the end of the reaction is a bit subjective: When do they disappear? The last small fragments seem to bubble more slowly.
2	RT	22	0:56	Farka Toure.
2	H	80	10	Very fast reaction. Mound of bubbles on the surface of the water.
3	C	8	2:48	Vigorous bubbling, beaking surface, musical fizz, pill flipping, dancing

Run No.	Cup	Temp. (˚C)	Time (sec.)	Observations
3	RT	22	0:54	Vigorous bubbles. Hissing fizz. Last remnant of tablet rises to top at the end of the reaction. Arno Elias. Kundalini Chillout-Liquid Mantras
3	H	80	13	Rapid reaction
Avg.	C	8	165.3	
Avg.	RT	22	54	
Avg.	H	80	11.7	

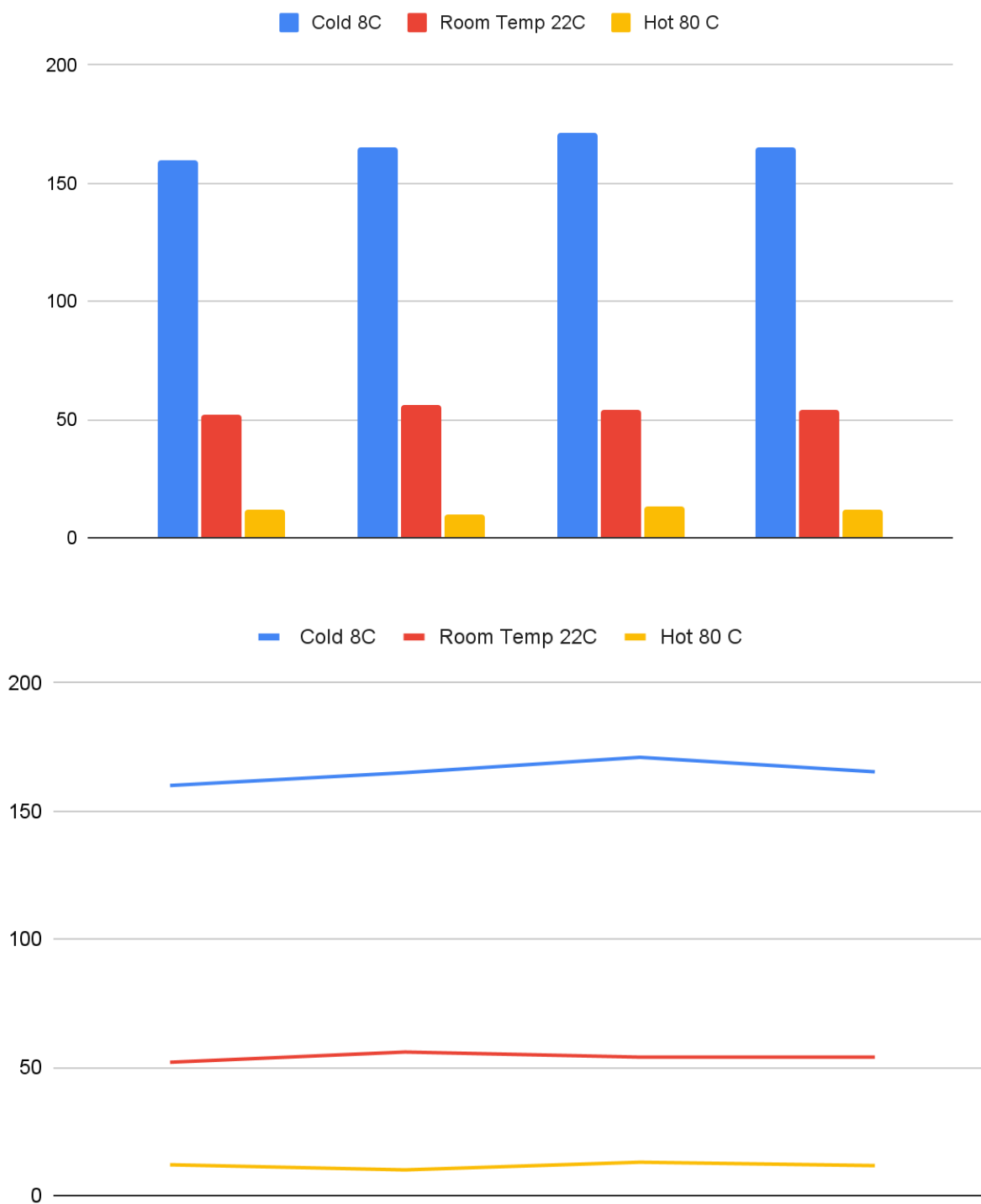2. Take a picture of Activity 1 and paste it here.

Alka-Seltzer reaction fizzes as it dissolves at room temperature

3. Using graphing software such as Google Sheets, graph the results of Activity
    1. [How to Create a Graph in Google Sheets](#) (use a line graph)

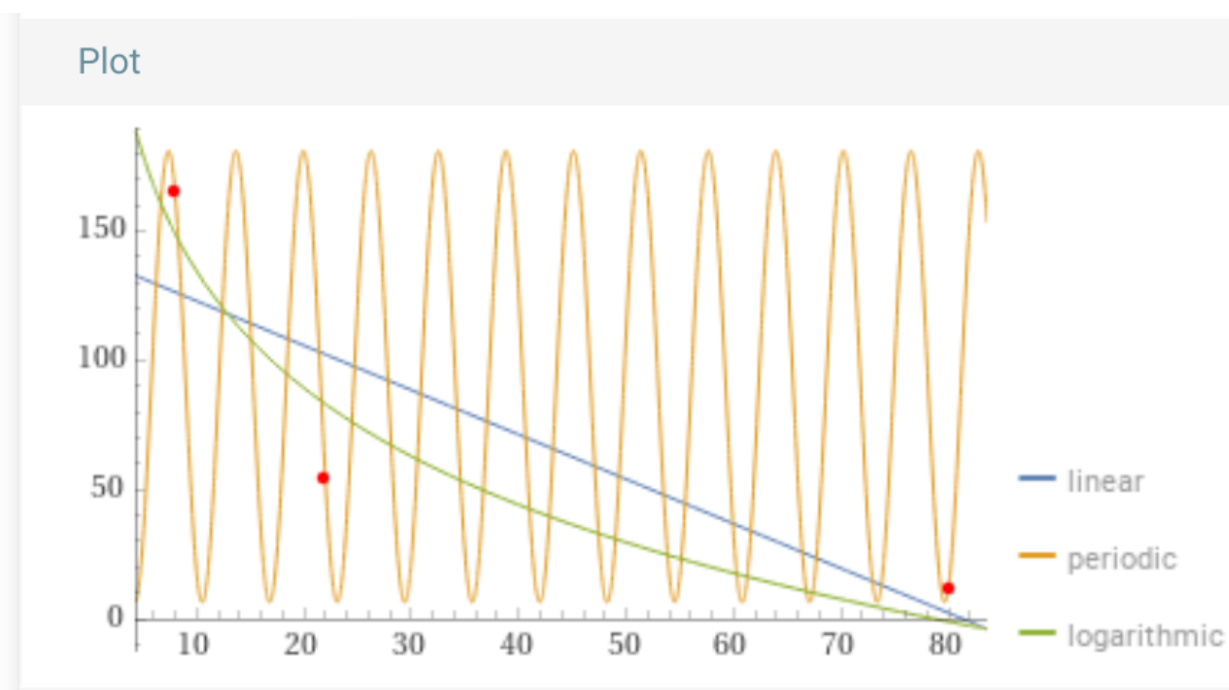# Reaction Time (s) vs. Water Temperature

4. What are the two variables that you graphed?

Reaction time vs water temperature

5. Which is the independent variable? Should it be on the X- or Y-axis? Why?
Independent variable that I change is the water temperature. It goes on the x-axis.

6. Which is the dependent variable? Should it be on the X- or Y-axis? Why?
The dependent responding variable that I measure is the reaction time. It goes on the y-axis.

7. Estimate how many seconds it will take to dissolve an Alka-Seltzer® tablet in 200 mL of water at the following temperatures.

Wolfram Alpha best fit estimates based on experimental average reaction time. The logarithmic scale seems to fit the data the best. Y-axis: Reaction time in seconds. X-axis: Water temperature in degrees Celsius.

a. 35°C   1 minute, 60 seconds

b. 60°C   Estimate: 30 seconds   Experimentally verified 36 seconds. The non-linear graph is fairly accurate in curvature, but low on the high side of

the temperature scale, so the estimate for 60C was increased from that green line estimate.

c. 80°C 160 seconds (experimental)

Activity 2

8. List three questions about the rate at which Alka-Seltzer® tablets dissolve if the temperature was held constant and one of the controlled variables was changed.
    a. Is the reaction speed dependent on the reaction vessel shape or material? Cylinder vs narrow base wide mouth.
    b. Is the reaction speed dependent on the pH of the water?
    c. Is reaction speed dependent on the total amount of water?
    d. Is reaction speed dependent on the amount of Alka-Seltzer?

9. Develop a new hypothesis based on one of the questions. Remember that a hypothesis must be testable with empirical or measurable data.

Hypothesis: If the amount of vinegar in the water is increased, the reaction speed will increase.

Activity 2 Table

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State the hypothesis.	If the amount of vinegar in the water is increased, the reaction speed will increase and the reaction time will decrease.
Identify the independent variable.	Amount of vinegar in the water.
Identify the dependent variable.	The dependent variable is reaction time.
List the controlled variables.	Amount of water is 200 ml in each sample. Water temperature is 22C for each sample.
How will the dependent variable be measured?	Reaction time is measured as the time that the last fragment of tablet floats and dissolves.
If the hypothesis is true, what results are expected?	If the hypothesis is true, as the amount and percent of vinegar in the solution is increased, the time to dissolve all the Alka-Seltzer will decrease.

Data Table 2

Run No.	Manipulated Variable	Time (sec.)	Observations
1	0 ml vinegar 200 ml water	23	**7.2 pH neutral. Orange pH strip.**
1			
1			
2	50 ml vinegar 150 ml water	30	strong acidic pH (off range). Yellow pH strip.
2			
2			
3	100 ml vinegar 100 ml water	41	strong acidic pH (off range). yellow pH strip.
3			
3	**200 ml vinegar**	60	Fragment floated at 37. Reaction time 61
Avg.			
Avg.			
Avg.			

10. Take a picture of Activity 2 and paste it here.
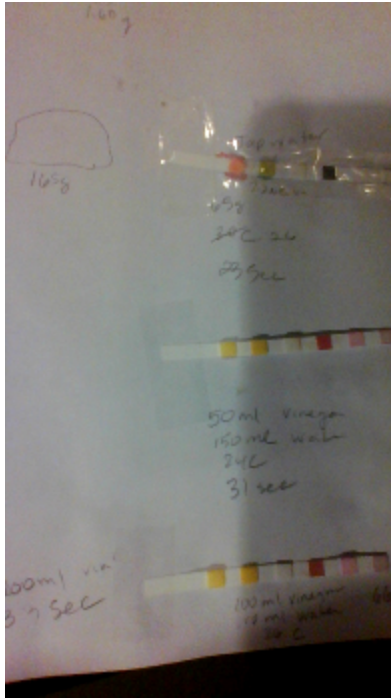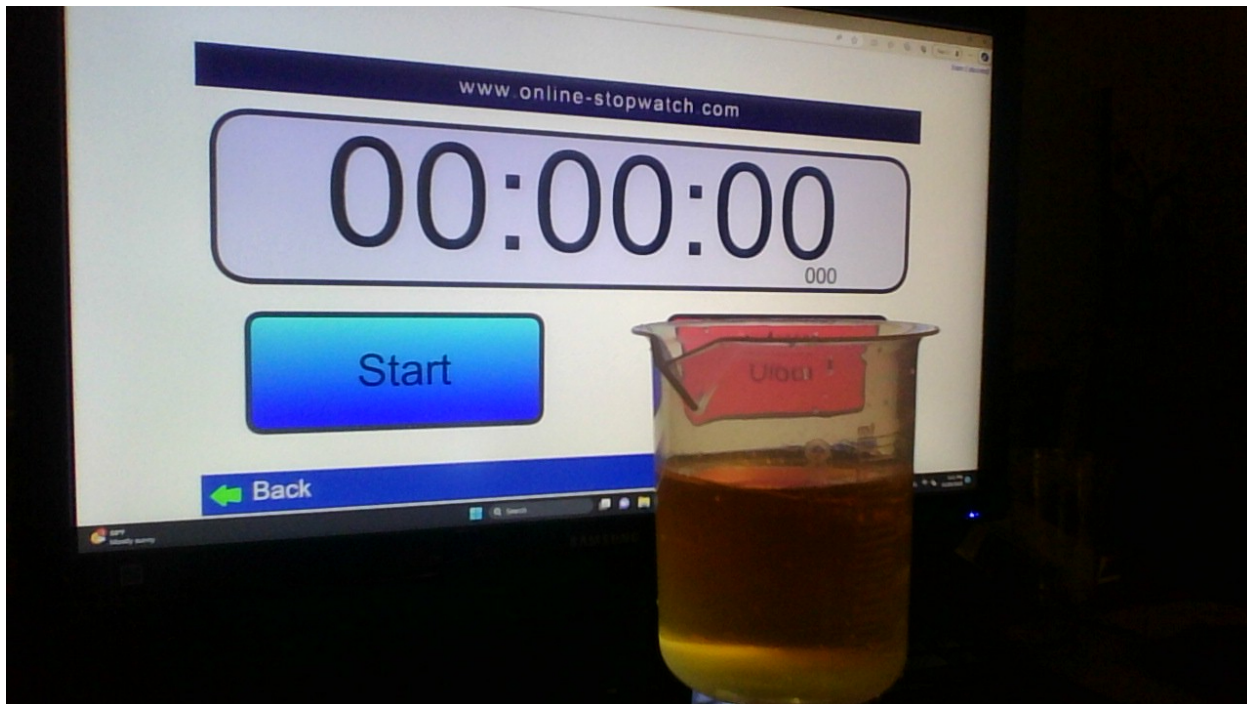
11. Was your hypothesis for Activity 2 supported by the data? Provide evidence to support your answer.

> My hypothesis was not supported. I expected that a higher vinegar concentration would reduce reaction time. In the experiment, the higher concentration of vinegar had a longer reaction time. I learned a lot about performing an experiment. The dip test strips for fish tanks were a useful indication, but I would like to get a digital pH meter for more accurate results in the future. I need more research and learning to understand this reaction.

Reaction Time vs. Vinegar Content (ml)
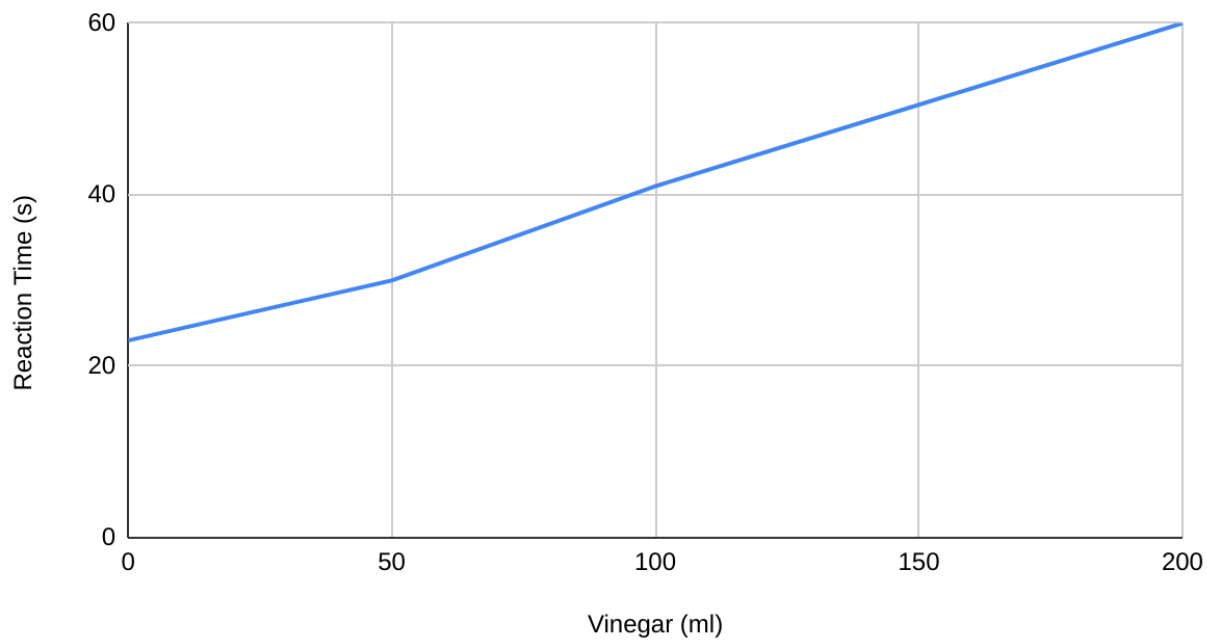
Experimental results: Time to dissolve 65 grams of Alka-Seltzer vs amount of vinegar in a 200 ml solution.