Supplemental Materials Appendix B: Student Examples

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SUPPLEMENTAL MATERIALS APPENDIX B

STUDENT EXAMPLES

Appendix B1- pH Lab Example #1

pH Table Lab

We will be measuring some qualitative and quantitative properties of some common household items. When you get to your assigned lab station please write down any physical observations a *qualitative* property, a property that is measured using your senses, about each solution. You many use only two senses: sight and smell. Using your sense of sight write down anything you see including bubbles, color, *precipitate* (a solid that has formed within the liquid), etc. Using your sense of smell use the wafting technique and write down any odor you smell. **IT IS VERY IMPORTANT you do not smell or touch the solutions directly.** *pH* is a *quantitative* property, a property measured by using values, of solutions that measures the amount of Hydrogen ions there are within a solution. If a solution has a pH below 7 it is considered *acidic*, if a solution has a pH above 7 it is considered *basic* if a solution has a pH of 7 it is considered *neutral*. Once you have finished making physical observations we will be measuring the pH of these solutions using 2 methods: pH paper and litmus paper. Using the standard pH scale located at your lab stations match the color of the pH paper to the appropriate pH and record it in the table below. Litmus paper identifies if something is an acid, base or neutral solution. Red litmus paper stays red in the presence of an acid and turns blue in the presence of a base. Blue litmus paper turns red in the presence of an acid, and stays blue in the presence of a base. If both the red and blue litmus stay the same color the solution is neutral.

Enter your collected data into the following data table:

Solution	Physical Observations	pH value using pH paper	Color in Blue Litmus Paper	Color in Red Litmus Paper
Coke	black liquid, bubbily	~3	turned red	Stayed the Same
Milk	White liquid cloudy	6	Blue	Blue
Baking Soda	Clear liquid	8	Blue	red
Borax	A cloudy liquid	9	Stays the same	turns blue
Grapefruit Juice	Peach color	3	Stays the same	turns red
Lime Juice	Yellow	red 2	red	red
Egg Whites	Yellow liquid bubbly	9	blue	blue
Milk of Magnesia	looks like milk	~11	Stays the same	turns blue
Distilled Water	looks like water bubbl	5 All same		

Appendix B2-ph Example #2

pH Table Lab

We will be measuring some qualitative and quantitative properties of some common household items. When you get to your assigned lab station please write down any physical observations a [redacted], about each solution. You many use only two senses: sight and smell. Using your sense of sight write down anything you see including bubbles, color, [redacted]), etc. Using your sense of smell use the wafting technique and write down any odor you smell. **IT IS VERY IMPORTANT you do not smell or touch the solutions directly.** *pH* is a [redacted]. If a solution has a [redacted] if a [redacted] if a [redacted]
Once you have finished making physical observations we will be measuring the pH of these solutions using 2 methods: pH paper and litmus paper. Using the standard pH scale located at your lab stations match the color of the pH paper to the appropriate pH and record it in the table below. Litmus paper identifies if something is an acid, base or neutral solution. Red litmus paper stays red in the presence of an acid and turns blue in the presence of a base. Blue litmus paper turns red in the presence of an acid, and stays blue in the presence of a base. If both the red and blue litmus stay the same color the solution is neutral.

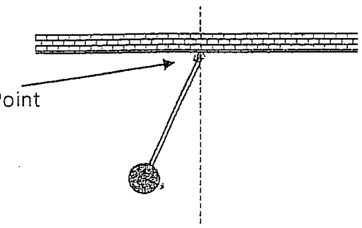
Enter your collected data into the following data table:

Solution	Physical Observations	pH value using pH paper	Color in Blue Litmus Paper	Color in Red Litmus Paper
Coke	brown smells sweet	2	Red	Red
Milk	white, thick	7	Red	blue
Baking Soda	cloudy	8	blue	blue
Borax	Clear/cloudy no smell	9	stays the same	blue
Grapefruit Juice	peachy and smells like fruit	3	Red	stays the same
Lime Juice	Acidic smell yellow murkey	2	Red	stays the same
Egg Whites	yellow translucent eggy	8	stays the same	blue
Milk of Magnesia	very white, thick, minty	11	stays the same	blue
Distilled Water	clear	5	blue	Red

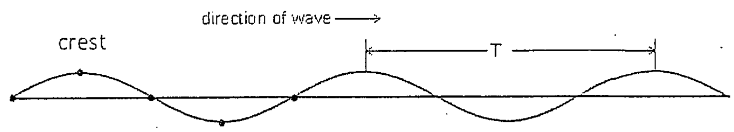
B3- Pendulum Lab Exemplar Example

Pendulum Lab

A *pendulum* is a weight suspended from a pivot so that it can swing freely. A picture of a pendulum is shown below:



You will be conducting an online pendulum simulation. You will look at some factors that may influence the *pendulum's period*. The time required for one complete vibration, for example, from one crest to the next crest, is called the *pendulum's period* and is measured in seconds.



To complete this simulation go to the following website:

http://phet.colorado.edu/sims/pendulum-lab/pendulum-lab_en.html

You will run two experiments with this simulation. In the first experiment you will only alter pendulum length. In the second experiment you will only alter the pendulum's weight. To record the period of each pendulum swing you must click on the photogate timer option and adjust the weight, length and pendulum angle for each set of data points. Hit play and then start the timer. Record your data in the table below. Make sure you run the simulation for each of the conditions listed below. (*Hint: It is very important that you double check your pendulum angle each trial that you do*). Write your results in the data tables below:

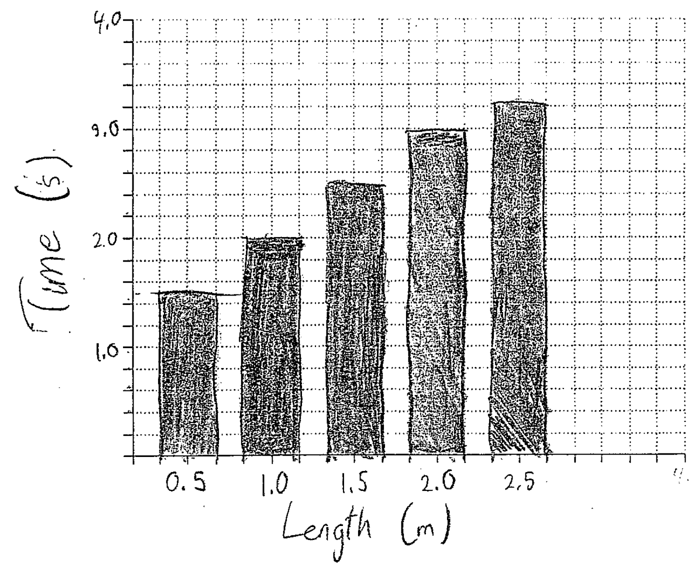
Experiment 1

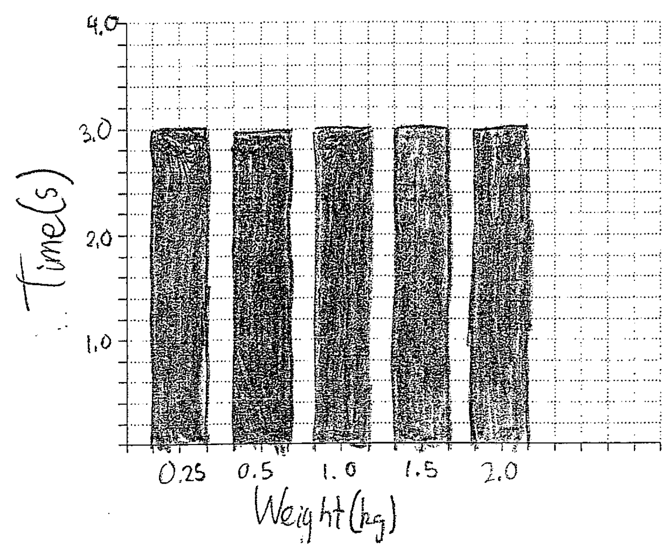
Pendulum Length (m)	Pendulum Angle (°)	Pendulum Weight (kg)	Period (s) (Rounded to the thousandths)
0.5	50	1.0	1.489 s
1.0	50	1.0	2.075 s
1.5	50	1.0	2.512 s
2.0	50	1.0	2.906 s
2.5	50	1.0	3.233 s

Experiment 2

Pendulum Length (m)	Pendulum Angle (°)	Pendulum Weight (kg)	Period (s) (Rounded to the thousandths)
2.0	50	0.25	2.978 s
2.0	50	0.5	2.977 s
2.0	50	1.0	2.978 s
2.0	50	1.5	2.978 s
2.0	50	2.0	2.977 s

Once you are finished complete two bar graphs: one with period (sec) on the y-axis and length (m) on the x-axis, the second with period (sec) on the y-axis and pendulum weight on the x-axis. Make sure to title both graphs.





Appendix B4- Bowling Ball Common Mistake Example

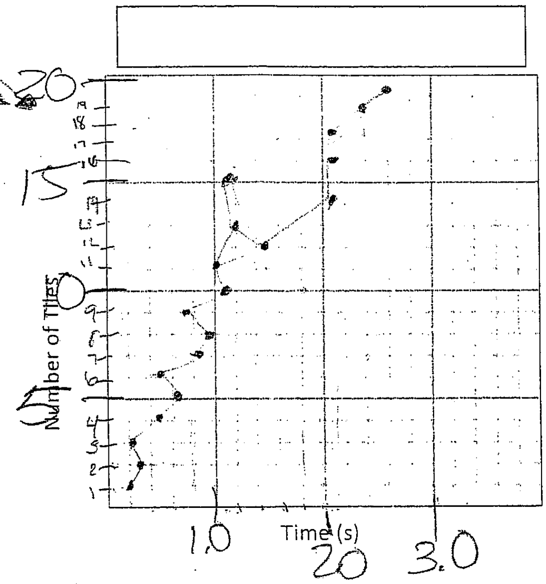
Bowling Ball Lab

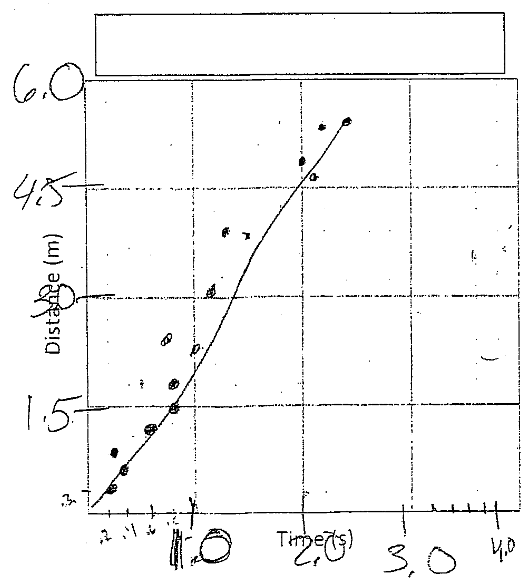
Today you will be collecting data on a bowling ball's *velocity*. *Velocity* is the rate of change of the position of an object; two equations you will utilize to calculate velocities are listed below:

$$\text{Velocity} = \frac{\text{distance(m)}}{\text{time(s)}} \qquad \text{velocity} = \frac{\text{\# of tiles}}{\text{time (s)}}$$

You will be assigned a timing station. You will stand at your timing station and hit stop on your stop watch when the bowling ball crosses the tile edge. Ms. Hamilton will walk down the line of timing stations and will record each time. Once Ms. Hamilton has collected all of the data return promptly to the classroom. Once you are back in the classroom record the class data in the data table below. Once you have copied all of the data down construct two line graphs. One line graph will compare tile # to time and the other will compare distance to time. Once you have finished your graphs answer the follow-up questions and turn in your assignment.

Tile #	Distance (m)	Time (s)
0	0	0
1	.305 ✓	.20
2	.610 ✓	.33
3	.915 ✓	.23
4	1.220 ✓	.50
5	1.425 ✓	.69
6	1.83 ✓	.44
7	2.135 ✓	.80
8	2.440 ✓	.90
9	2.745 ✓	.72
10	3.05 ✓	1.18
11	3.355 ✓	1.11
12	3.660 ✓	1.43
13	3.965 ✓	1.20
14	4.270	2.1
15	4.575	1.8
16	4.880	2.15
17	5.185	2.06
18	5.49	2.28
19	5.795	2.60
~~20~~		
~~21~~		
~~22~~		
~~24~~		
~~25~~		





Appendix B5- Bowling Ball Exemplar Example

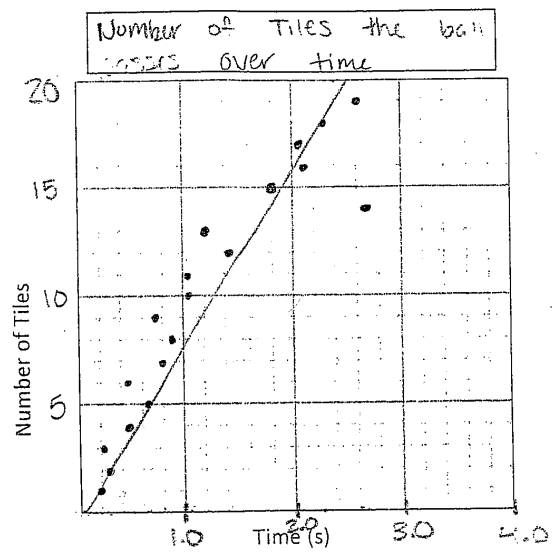
Bowling Ball Lab

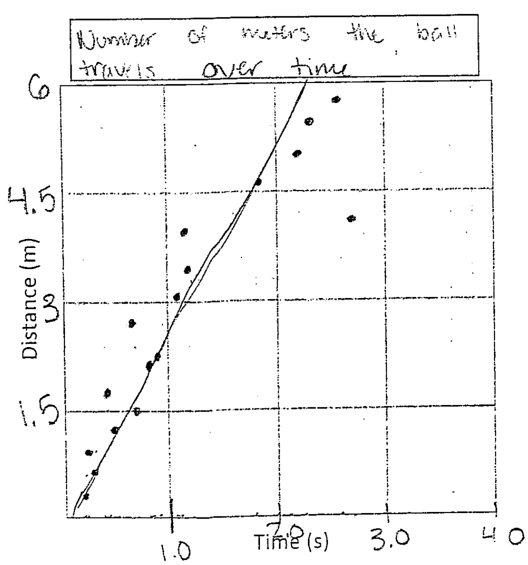
Today you will be collecting data on a bowling ball's *velocity*. *Velocity* is the rate of change of the position of an object; two equations you will utilize to calculate velocities are listed below:

$$\text{Velocity} = \frac{\text{distance(m)}}{\text{time(s)}} \qquad \text{velocity} = \frac{\text{\# of tiles}}{\text{time (s)}}$$

You will be assigned a timing station. You will stand at your timing station and hit stop on your stop watch when the bowling ball crosses the tile edge. Ms. Hamilton will walk down the line of timing stations and will record each time. Once Ms. Hamilton has collected all of the data return promptly to the classroom. Once you are back in the classroom record the class data in the data table below. Once you have copied all of the data down construct two line graphs. One line graph will compare tile # to time and the other will compare distance to time. Once you have finished your graphs answer the follow-up questions and turn in your assignment.

Tile #	Distance (m)	Time (s)
0	0	0
1	.305	.20
2	.610	.33
3	.915	.23
4	1.22	.50
5	1.525	.69
6	1.83	.44
7	2.135	.80
8	2.44	.90
9	2.745	.72
10	3.05	1.18
11	3.355	1.11
12	3.660	1.43
13	3.965	1.20
14	4.270	2.7
15	4.575	1.8
16	4.880	2.15
17	5.185	2.06
18	5.49	2.28
19	5.795	2.60
20		
21		
22		
24		
25		





Appendix B6- Bowling Ball with Student Written Formulas

$A^2-B^2=(A-B)(A+B)$

$(A+B)^2=A^2+2AB+B^2$ BK

Hour [redacted] Date [redacted] Name [redacted]

Bowling Ball Lab

$(A-B)^2=A^2-2AB+B^2$

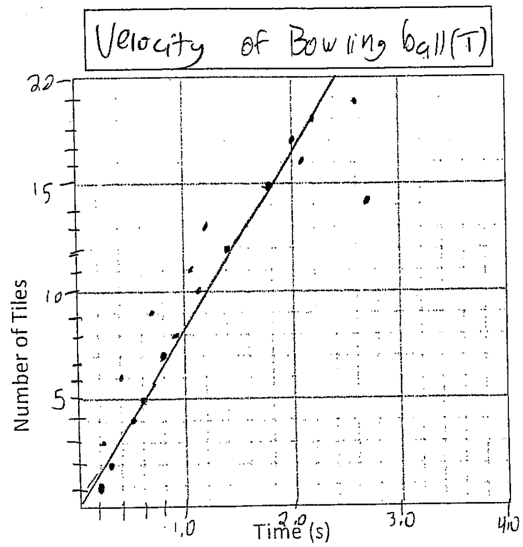
Today you will be collecting data on a bowling ball's *velocity*. *Velocity* is the rate of change of the position of an object; two equations you will utilize to calculate velocities are listed below:

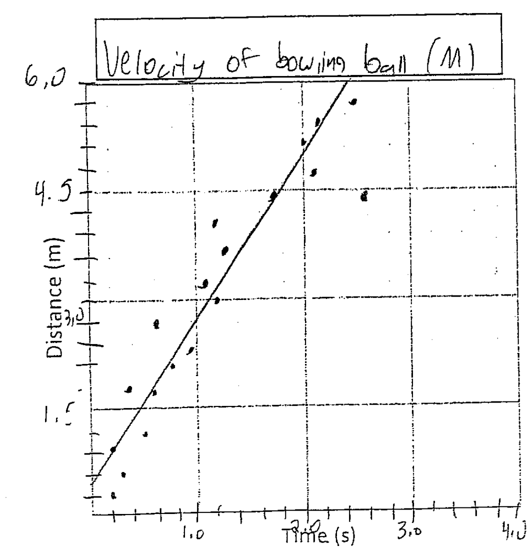
$$\text{Velocity} = \frac{\text{distance(m)}}{\text{time(s)}} \qquad \text{velocity} = \frac{\text{\# of tiles}}{\text{time (s)}}$$

You will be assigned a timing station. You will stand at your timing station and hit stop on your stop watch when the bowling ball crosses the tile edge. Ms. Hamilton will walk down the line of timing stations and will record each time. Once Ms. Hamilton has collected all of the data return promptly to the classroom. Once you are back in the classroom record the class data in the data table below. Once you have copied all of the data down construct two line graphs. One line graph will compare tile # to time and the other will compare distance to time. Once you have finished your graphs answer the follow-up questions and turn in your assignment.

Scatter Plot

Tile #	Distance (m)	Time (s)
0	0	0
1	.305	.20
2	.610	.33
3	.915	.23
4	1.120	.50
5	1.425	.69
6	1.73	.44
7	2.035	.80
8	2.34	.90
9	2.645	.72
10	2.95	1.18
11	3.255	1.11
12	3.56	1.43
13	3.865	1.20
14	4.17	2.7
15	4.475	1.8
16	4.78	2.15
17	5.085	2.06
18	5.39	2.28
19	5.695	2.60
20	6	
~~21~~		
~~22~~		
~~24~~		
~~25~~		





Appendix B7- Grow Toy Mistake Example

Grow Toy Lab

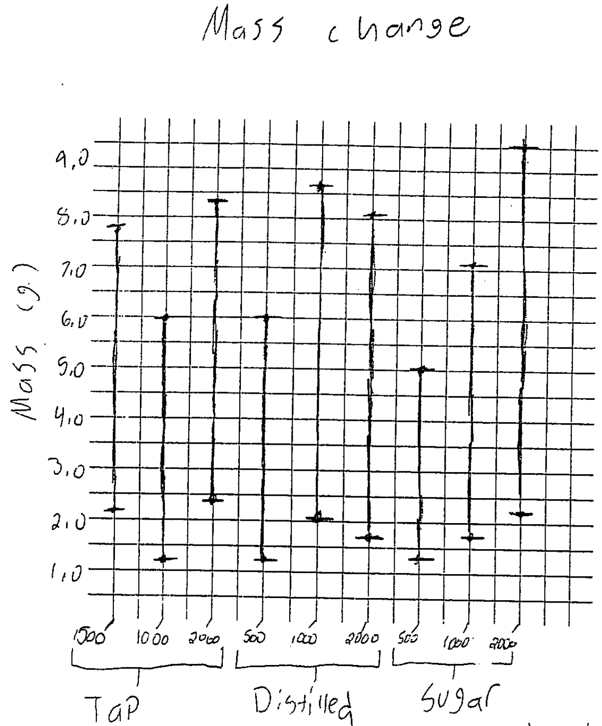
You will be collecting a series of data utilizing grow toys. Grow toys are toys made of a superabsorbent polymer. *Superabsorbent polymers* are large macromolecules that can absorb and retain extremely large amounts of liquid relative to their own mass. Some grow toys claim to grow up to 600% of their original size. You will be evaluating these claims of growth. You will record the mass in grams, length in centimeters, and width in centimeters before and after the grow toy is left in a particular liquid overnight. You will also measure the amount of milliliters left in the container after growth. You will be collecting data on three different solutions: tap water, distilled water and ~~salt~~ sugar water at various amounts: 500, 1000 and 2000 milliliters. Record your information in the tables below then graph the following data using the provided graphs. To calculate the % increase in mass, length, and width use the following equation:

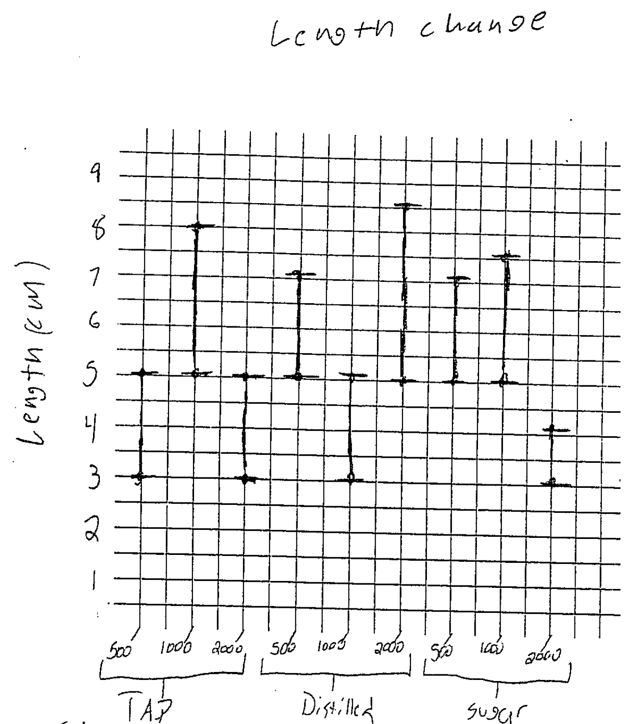
$$\frac{\text{Mass/Length/Width After} - \text{Mass/Length/Width Before}}{\text{Mass/Length/Width/Diameter Before}} \times 100 = \text{\% increase}$$

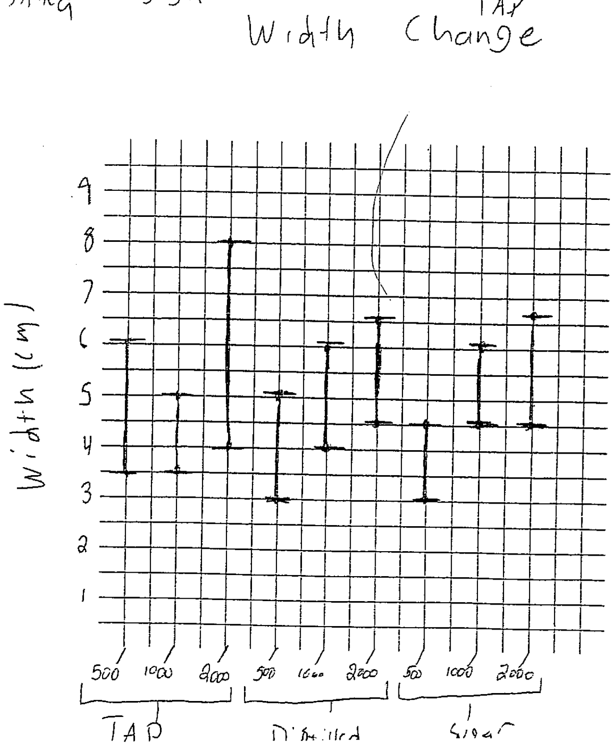
round to tenth

	Tap Water			Distilled water			Sugar ~~Salt~~ Water		
	500 (ml)	1,000 (ml)	2,000 (ml)	500 (ml)	1,000 (ml)	2,000 (ml)	500 (ml)	1,000 (ml)	2,000 (ml)
Mass Before (g)	2.20 g	1.35 g	2.37 g	1.34 g	2.18 g	1.76 g	1.34 g	1.77 g	2.27 g
Length from head to tail Before (cm)	3 cm	5 cm	3 cm	5 cm	3 cm	4.8 cm	5 cm	4.9 cm	3.1 cm
Width Before from top to bottom (cm)	3.5 cm	3.5 cm	4 cm	3 cm	3.8 cm	4.5 cm	3 cm	4.5 cm	4.3 cm
Mass After (g)	7.76 g	6.02 g	8.68 g	6.04 g	8.63 g	8.1 g	4.94 g	7.13 g	9.61 g
Length from head to tail After (cm)	5 cm	8 cm	5 cm	7 cm	5 cm	8.4 cm	7 cm	7.4 cm	4.2 cm
Width from top to bottom After (cm)	6 cm	5 cm	8 cm	5 cm	6 cm	6.5 cm	4.5 cm	6.0 cm	6.6 cm
Amount of H_2O remaining in container after (ml)	425 mL	900 mL	2000 mL	400 Ml	930 mL	1875 mL	425 mL	900 mL	1900 mL
Mass Increase (%)	252.7%	345.9%	282.4%	350.7%	295.9%	360.2%	268.7%	302.8%	323.3%
Length Increase (%)	66.7%	60%	66.7%	40%	66.7%	75%	40%	51%	35.5%
Width Increase (%)	71.4%	42.9%	100%	66.7%	57.9%	44.4%	50%	33%	53.5%

Use the following graphs to graph the mass, length, width and diameter % increase for each solution. Make sure to use appropriate axis labels, keys and titles when graphing all the information. You may want to check your axis with Ms. Hamilton before you begin graphing your data.







Appendix B8- Grow Toy Exemplar Example

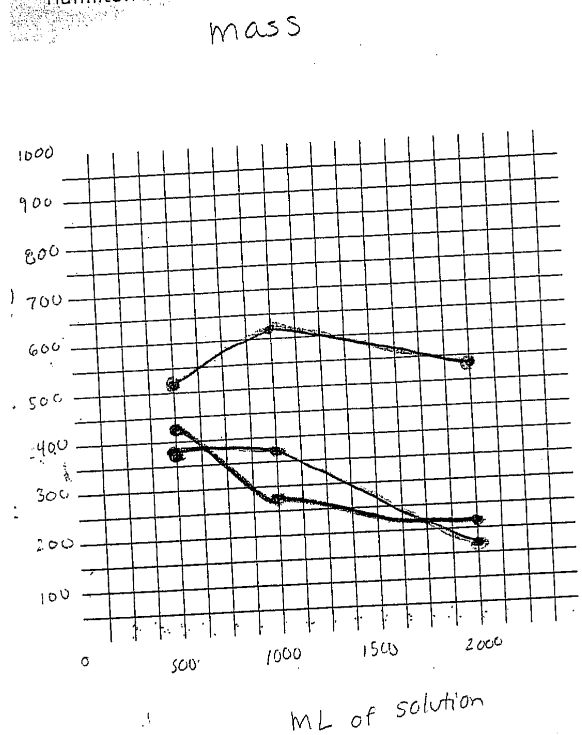
Grow Toy Lab

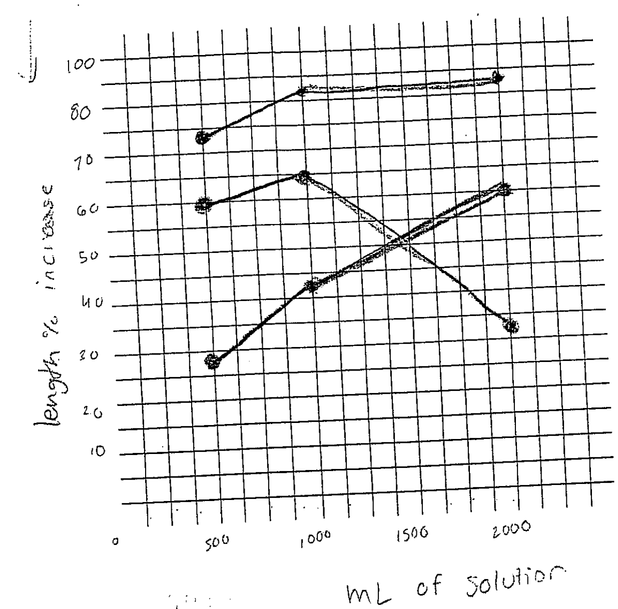
You will be collecting a series of data utilizing grow toys. Grow toys are toys made of a superabsorbent polymer. *Superabsorbent polymers* are large macromolecules that can absorb and retain extremely large amounts of liquid relative to their own mass. Some grow toys claim to grow up to 600% of their original size. You will be evaluating these claims of growth. You will record the mass in grams, length in centimeters, and width in centimeters before and after the grow toy is left in a particular liquid overnight. You will also measure the amount of milliliters left in the container after growth. You will be collecting data on three different solutions: tap water, distilled water and sugar water at various amounts: 500, 1000 and 2000 milliliters. Record your information in the tables below then graph the following data using the provided graphs. To calculate the % increase in mass, length, and width use the following equation:

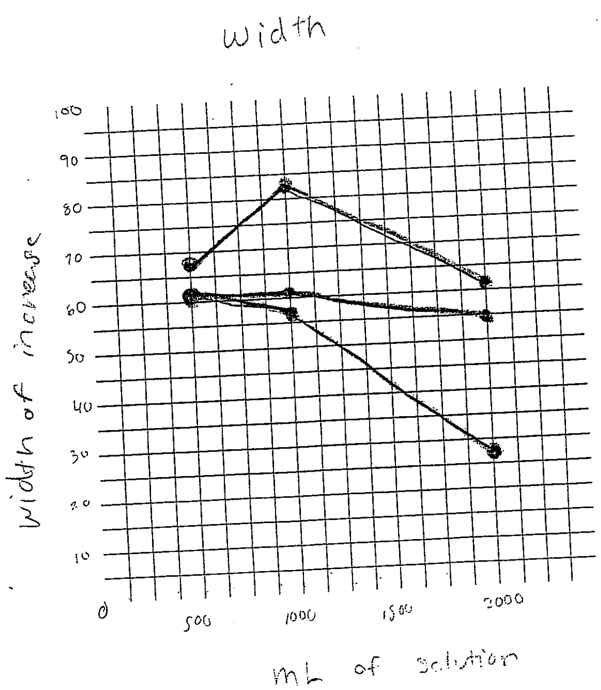
$$\frac{\text{Mass/Length/Width After} - \text{Mass/Length/Width Before}}{\text{Mass/Length/Width/Diameter Before}} \times 100 = \%\ \text{increase}$$

	Tap Water			Distilled water			Sugar Water		
	500 (ml)	1,000 (ml)	2,000 (ml)	500 (ml)	1,000 (ml)	2,000 (ml)	500 (ml)	1,000 (ml)	2,000 (ml)
Mass Before (g)	1.27g	1.27g	1.75g	1.73g	2.16g	2.13g	1.35g	2.17g	2.6g
Length from head to tail Before (cm)	4.7	4.9cm	5.0cm	4.7	31 mm	3 cm	5.0cm	3.1 cm	3.1cm
Width Before from top to bottom (cm)	3.1cm	3.1 cm	4.52cm	4.3cm	39 mm	4.5 cm	3.1cm	3.9cm	3.9cm
Mass After (g)	6.65g	4.66g	5.56g	10.47g	16.60g	13.78g	6.39	10.14	7.13g
Length from head to tail After (cm)	6.0cm	7.0cm	8.0cm	8.2cm	6 cm	5.5	8 cm	5.1 cm	4.5cm
Width from top to bottom After (cm)	5.0cm	5.0cm	7.0 cm	7.2cm	7 cm	7.3	5 cm	6.1 cm	5.0cm
Amount of H_2O remaining in container after (ml)	400 mL	650 mL	1700 mL	240 mL	700 mL	1700 mL	[illegible]20 mL	800 mL	1850 mL
Mass Increase (%)	424%	266%	218%	505%	669%	547%	373%	367%	174%
Length Increase (%)	28%	43%	60%	74%	81%	83%	60%	65%	33%
Width Increase (%)	61%	61%	55%	67%	82%	62%	61%	56%	28%

Use the following graphs to graph the mass, length, width and diameter % increase for each solution. Make sure to use appropriate axis labels, keys and titles when graphing all the information. You may want to check your axis with Ms. Hamilton before you begin graphing your data.

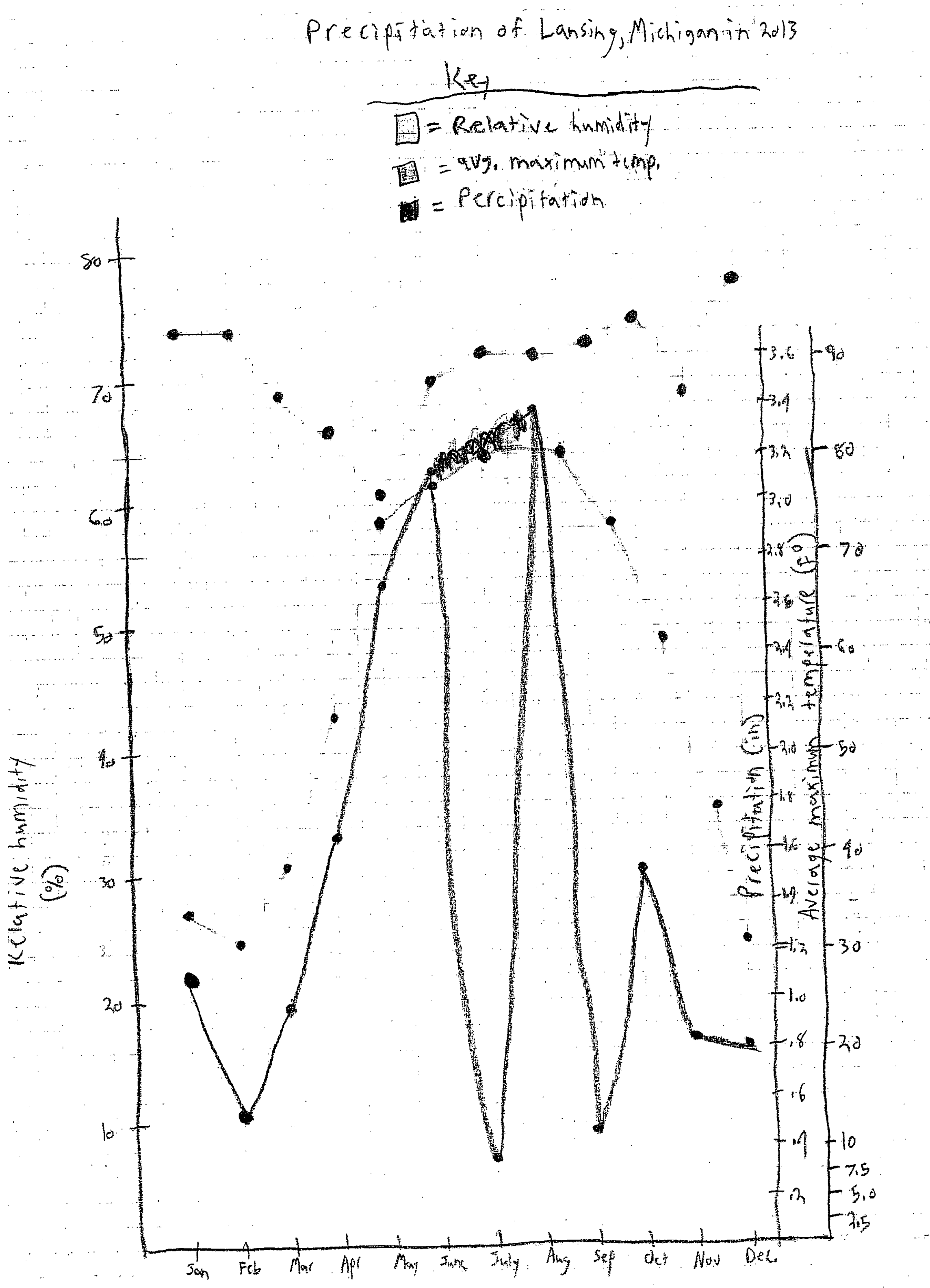






~~1st tap water~~
2nd ~~Stilled water~~
3rd Sugar water

Appendix B9- NOAA Weather Graphing Activity Common Mistake Example



Appendix B10- NOAA Weather Graphing Activity Exemplar Example