Percent of Petroleum in Candles

Problem Statement:

To determine the percent mass of petroleum by-products in a birthday candle.

Hypothesis:

Cite if you are using a value taken from a source

Develop a hypothesis for the experiment. This is where you use prior knowledge, observations and research to tell us what you think should happen.

Materials: (Place materials in a single-spaced list either one or two columns)

(2) 50 ml Beaker
50.0 ml Shampoo, pH 2
50.0 ml Shampoo, pH 4
1.0 mm Dropper

(5) Weighing Dishes
125 ml Distilled Water
Analytical Scale (0.001 precision)
5 M, Hydrochloric Acid, HCL

Concentration of chemical, name, and formula

Tools used for measuring must have precision noted

Data Measured:

Two or three sentences explicitly stating what the independent and dependent variables are in the experiment and what units they are measured in.

Procedures:

1. You will type in third person (as in a textbook) the list of steps taken to duplicate your experiment. Each step should be detailed and clear so that anyone could read and duplicate this experiment. Imagine a freshman with only the listed materials, trying to duplicate your experiment.

2. Do not begin any step of the procedure with “Next” or “Then.”

3. Single space procedures with a double space between each step. Or double space the whole everything if you only have a few steps.

4. Inanimate objects are not capable of acting so a beaker cannot be “sitting”, but it can be “set aside” for a period of time.

5. Tare (“zero”) weighing dish #1 on the electronic balance.

6. Add about one-fifth of the metal shot to the dish. Record the mass of sample 1 in the data table.

7. Obtain a clean, 25-ml graduated cylinder and add 10 ml of water to the cylinder.

Diagram:

Include a diagram if one is required by your science instructor. Label all important aspects.

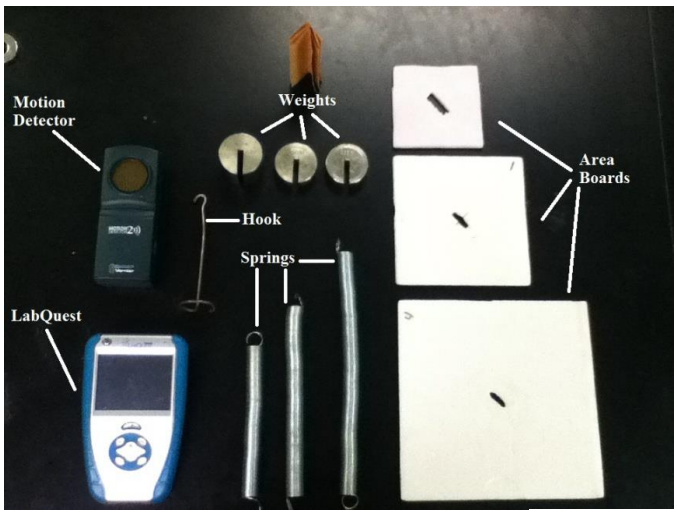


Figure 1. Materials Hilliard (2018)

Figure 1 above shows all the materials used in this lab. Five different sized springs, three square boards with different areas, a hook and three masses along with a motion detector and LabQuest were used to measure coefficient of friction.

Data and Observations:

Remember to use significant figures

Table 1
Popcorn Lab Measurements

Kernel	Mass Before (g)	Mass After (g)	ΔMass (Mass Lost) (g)	Percent ΔMass
1	10	8	2	20
2				
3				
Sum Σ				
Average ($\bar{x}$)				

Table 1 is the data gathered during the experiment. First, the mass of each sample was measured, then…

The percentage of water in all of the kernels that popped was calculated using the equation shown if figure 2 below. The mass of kernels before being popped, $Massbefore$, minus the mass of popped kernels after being popped, $Massafter$, divided by the mass of the un-popped kernels before being heated, $Massbefore$ then multiplied by 100 shows the percentage of mass lost.

$$\Delta Mass = Massbefore - Massafter$$

$$\%\Delta Mass = \frac{\Delta Mass}{Massbefore} x100 \qquad \frac{1.6}{30.1} x100 = 5.3\%$$

Figure 2. Formula and Sample Calculation for Percent Change in Mass

Also shown in figure 2 is a sample calculation for the percent change in mass of the popcorn. Here is where you show how you calculated the percent of water for the kernels of popcorn using the formula above. Also, don't forget to tell us which trial you are using.

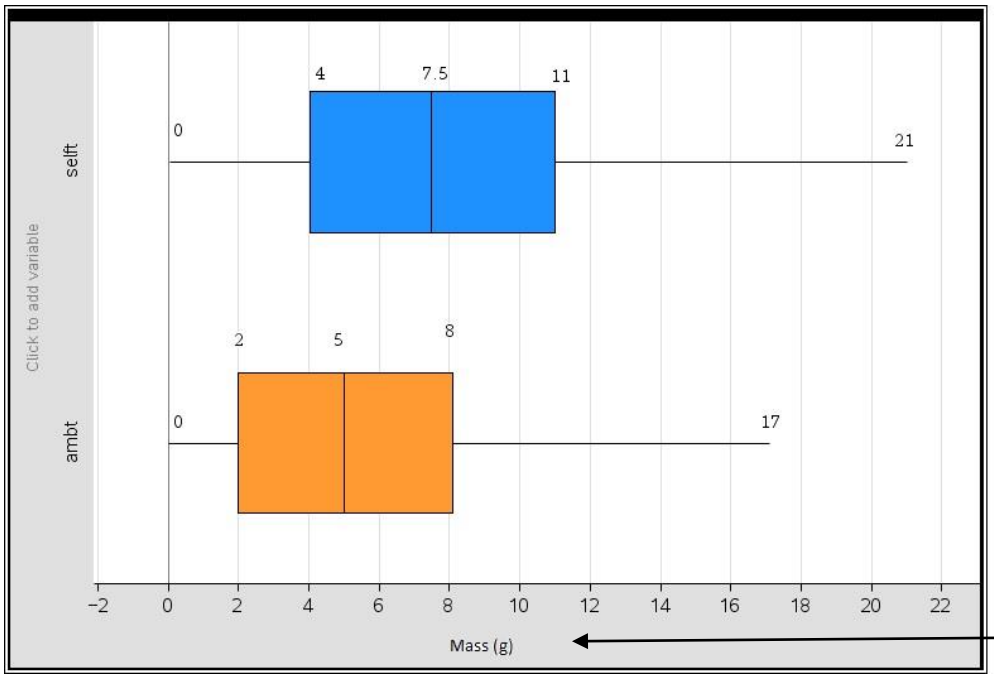
Table 2
Observation of Each Popcorn Trial

Trial	Observations Made During Trial
1	Kernel was average size and took about 2 miniutes to pop.
2	

Table 2 notes the observations taken during each trial. Mrs. Hilliard would like observations made for each trial.

Data Analysis and Interpretation:

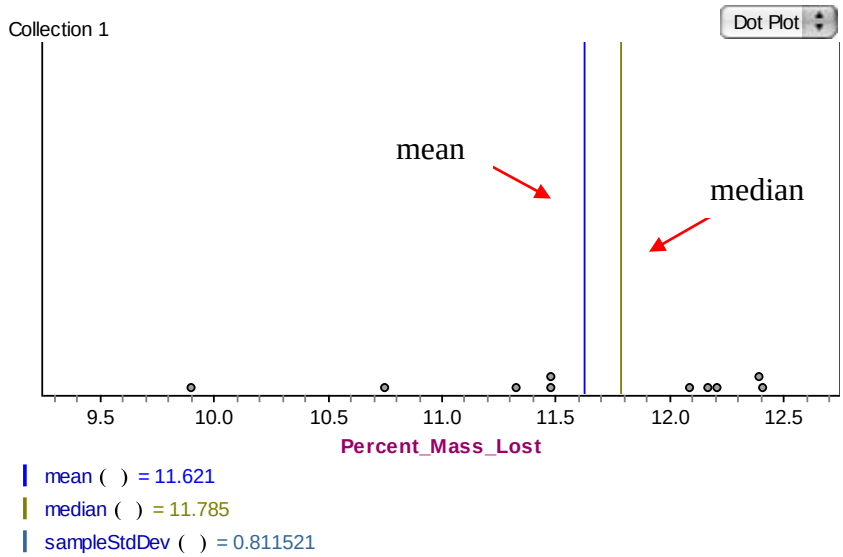
Start this section with a short paragraph on the type of data you collected. What is your response variable and is it quantitative or categorical, discrete or continuous? Were the units/subjects selected randomly? Tell us how you selected them.



Remember to label the x-axis correctly

Figure 3. Mass of Popcorn Before Being Heated and After

The difference in mass before and after heating the kernel is shown is figure 3 above. Compare and discuss shape, centers, spread and overlap of both graphs and relate to the problem of your experiment, talk about the mass of popcorn.



Use Fathom for dot plots and show mean, median lines and label them. Also give the standard deviation

Figure 4. Percentage of Mass Lost or Percentage of Water in a Kernel of Popcorn

Figure 4 above shows the distribution of the percentage of water found in popcorn gathered from this experiment. From this graph it is shown that …(discuss measures of shape, center and spread. Spread is the amount of variability in the data. What does that tell you about your experiment?

Using the table method, calculate the standard deviation of the percent of water in the popcorn. Include the table you used with the three columns labeled, x (% mass lost or % mass of water), (x - $\bar{x}$), (deviation of %mass of water), (x – $\bar{x}$)^2, (deviation of %mass of water squared), explain in the anchor what each column heading means. Show the equation for standard deviation, define each variable and show the actual calculation. In the anchor also explain what your standard deviation tells you about the data and about the experiment.

Table 3
Standard Deviation Chart

Trial	%Mass Loss (x)	Deviation from the mean (x- $\bar{x}$)	Deviation Squared (x- $\bar{x}$)^2
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
	$\bar{x}$ =		∑(x- $\bar{x}$)^2 =

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} \qquad s = \sqrt{\frac{1479}{9}} = 12.82\%$$

Always use equation editor to type up equations.

Figure 5. Formula and Calculation for Standard Deviation

Figure 5 shows the formula for standard deviation. The symbol x represents…define all variables. Also state whether this standard deviation is large or small in relation to your experiment and what it tells you about the validity of your results.

It is important to also calculate the Percent Error for the percent of mass lost (or the percent of water in a kernel). This can be done by using the following equation:

$$PercentError = \left| \frac{ExperimentalValue - TheoreticalValue}{TheoreticalValue} \right| \times 100$$

$$PercentError = \left| \frac{15 - 18}{18} \right| \times 100 = 16.7\%$$

Figure 6. Formula and Sample Calculation for Percent Error of Mass Lost

In figure 6 the formula for percent error is given. According to this calculation, it is found that there is a 16.7% difference between the experimental mass of water found and what is accepted to be the average percent of water found in a kernel of corn.

Conclusion:

The conclusion should sum up what happened in the experiment, whether the hypothesis was accepted or rejected, and the scientific explanation of the outcome. This section of the paper draws final conclusions based on the evidence from your data analysis as well as a critique of the quality of the data you collected. Never cover up or fudge your data, take responsibility for your results, good or bad, and explain the science behind them. State and discuss your percent error and standard deviation and what each tells you about your results. Refer us to graphs or tables if it helps support your claim.

A good conclusion should have 3 or 4 paragraphs: 1. Restate original hypothesis and give your results supported with statistical evidence. 2. Explain the results with scientific concepts, reasoning and/or laws. 3. Discuss errors and explain their effect on the outcome. 4. If you were to do the experiment again what would you do differently to improve it?