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The Siphontific Method

Student Handout

In the following handout, students will be required to:

- Record data from the activity
- Present their data in a graph

Provided in this document are sample answers (pages 2-5) and a blank handout (pages 6-11). The blank handout should be made available to each group prior to the activity.

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The Siphontific Method - Handout Answers

WOW Lab data and questions with solutions for the demonstration:

Siphon	Inside Diameter (cm)	Time 1 (sec)	Time 2 (sec)	Time 3 (sec)	Average Time = (T1+T2+T3)/3 (sec)
1	12	12	10	12.5	11.5
2	9	23.2	24	22	23.0
3	4	130	112.5	117.0	119.8

After viewing the demonstration, discuss and answer the following questions:

Why would you perform the experiment three times? Why do you take an average time?

Performing an experiment multiple times improves the accuracy and precision of your measurements. By taking an average of the three results, you minimize the error of each individual experiment.

What are you testing in the experiment?

The siphon demonstration tests the effect of changing the diameter of the tubing.

What do you measure to observe this change?

By measuring the time it takes to empty a constant volume, you can observe the effect of changing the diameter of the tube.

In the scientific community, things that can be changed or manipulated during an experiment are called variables. Variables can be independent (the part of the experiment that you change) or dependent (what you measure in the experiment to observe this change).

In the demonstration, what was the dependent variable? (hint: what did you measure?)

The time is the dependent variable.

What was the independent variable?

The diameter of the tube is the independent variable.

Are there other things that you could change in the experiment? Are there more independent variables that were not tested? How could you test these?

Many other variables could be tested. The height difference between the bottle and the bucket, the room temperature, the fluid used (eg salt water, oil, honey), the length of tube, etc.

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The Siphontific Method - Handout Answers

WOW Lab data for the student activity

The following results were obtained by the WOW Lab experiment team. Different results will be obtained by using different tubing, various lengths, etc.

Variable: Tube Length		
Tube Type	Time to empty (sec)	Tube Length (cm)
Long	14.3	200
Medium	12.6	150
Short	13	90

Variable: Tube Width		
Tube Type	Time to empty (sec)	Inside Diameter (cm)
Wide	4.1	1.3
Medium	12.3	0.6
Thin	74.8	0.3

Variable: Height Difference		
Tube Type	Time to empty (sec)	Height Difference (cm)
High	9.1	53.5
Medium	12.2	36.0
Low	27.8	19.5

Once the data is obtained, the infomation can be plotted in various ways to demonstrate the benefits of visually inspecting data.

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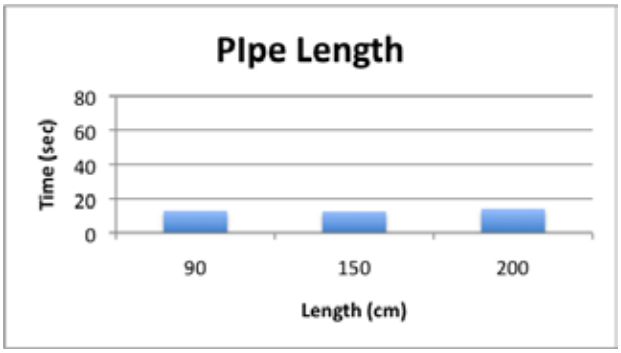
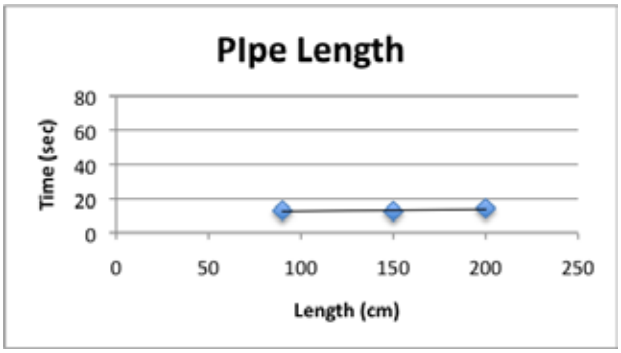
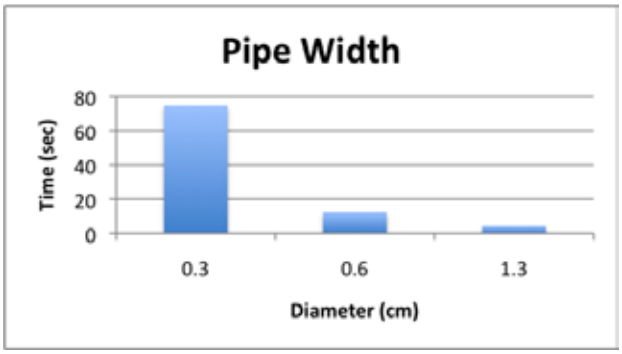
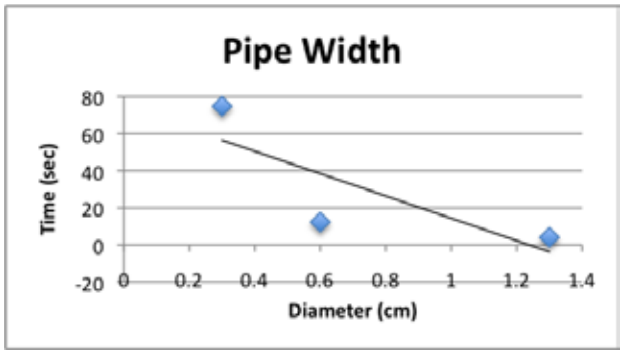
The Siphontific Method - Handout Answers

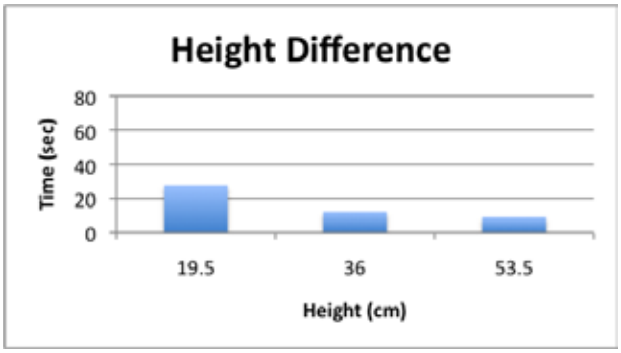
WOW Lab graphs for the Student Activity

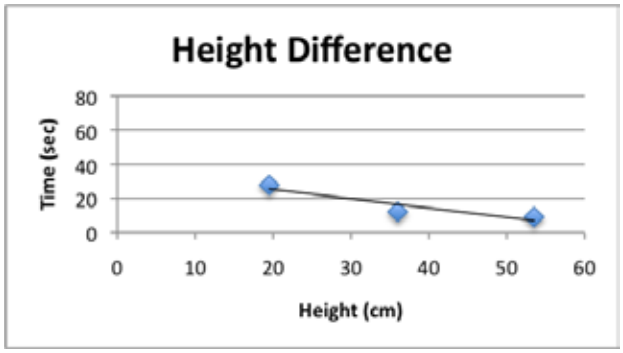












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The Siphontific Method - Handout Answers

Now that you have gathered this data, it is time to present your results. Often data is graphed in various ways, for example bar graphs, line graphs or pie charts. What would be some suitable graphs for the data you have collected?

The WOW Lab graphed the data as a bar graph and a line graph.

What are the important features of a scientific graph?

Scientific graphs must always have a meaningful title, labelled axes and appropriate units. They should also be neat and accurate.

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The Siphontific Method - Student Handout

Student Handout

This *Student Handout* contains:

- a table for students to complete while observing the demonstration
- discussion questions to complete after viewing the demonstration
- instructions for the student activity
- tables for recording the data collected in the individual activity
- questions to discuss following the activity

If performing the demonstration alone, the student will only need the first page of this document. Otherwise the entire document is suitable.

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The Siphontific Method - Student Handout

Class Demonstration

During the class demonstration, fill out the following table. Your teacher will provide you with the inside diameters of the tubes.

Siphon	Inside Diameter (cm)	Time 1	Time 2	Time 3	Average Time = (T1+T2+T3)/3
1					
2					
3					

After viewing the experiment, discuss and answer the following questions:

Why would you perform the experiment three times? Why do you take an average time?

_____

What are you testing in the experiment?

_____

What do you measure to observe this change?

_____

In the demonstration you just observed, what was the dependent variable? (hint: what did you measure?)

_____

What was the independent variable?

_____

Are there other things that you could change in the experiment? Are there more independent variables that were not tested? How could you test these?

_____

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The Siphontific Method - Student Handout

Student Activity

Now that you have seen the siphon in action, you can make your own. Perhaps you have an independent variable that you want to test, or your teacher may assign you one of the options below.

Materials

Items	Quantity
Empty squeezable ketchup bottle	1
beakers or glasses	2
masking tape	1
stopwatch	1
ruler	1
plastic tubing, various properties depending on chosen variables (see below)	3

Variables

Variable: Length of tube

Perform the activity above using 3 tubes of different lengths – short, medium and long.

Variable: Width of tube

Perform the activity above, using 3 tubes of different widths – wide, medium and narrow. (Note: ensure that the tubes can still be easily plugged by a thumb)

Variable: Height difference

Repeat activity above with one tube. For each test, change the height of the top beaker. Call the three different heights - high, medium and low.

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The Siphontific Method - Student Handout

Activity Instructions

Step 1

Use the masking tape to mark two horizontal lines on one of the beakers, approximately 10 cm apart. Fill the beaker with water until the water is above the upper tape line.

Step 2

Place the empty beaker on a desk. Place the full beaker on a surface about 30 cm above the desk, such as a pile of books or a sturdy box (**Figure 1**).

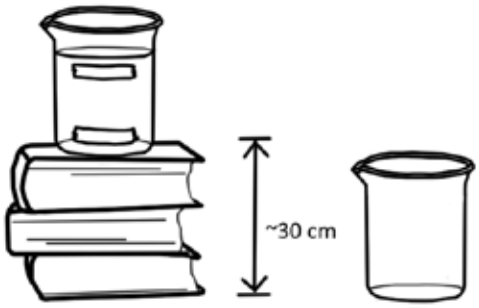

Figure 1

Figure 2

Step 3

Fill the ketchup bottle with water. Take a length of tubing and plug one end with your thumb (**Figure 2**). Carefully insert the ketchup bottle tip into the opposite end of the tube and gently squeeze the bottle to fill the tube with water. Remove the tip and plug this end with your other thumb. It will be easier with two people. This step creates the siphon effect observed in the main experiment.

Step 4

Submerge one end of the tube into the full beaker, ensuring that the end is below the lower tape line. Keeping the other end plugged, lower it carefully to the bottom of the empty beaker.

Step 5

Prepare to begin timing. The siphon should start when the thumb is removed from the lower tube. Start the stopwatch when the water level passes the top of the upper tape line. Stop when the water level passes the top of the lower tape line. Record this time in the appropriate table on the next page.

Step 6

Repeat the entire activity twice. If testing the variables 'tube length' or 'width of tube', replace the tube with the appropriate alternative tube. If testing the 'height difference', alter the height of the full beaker, for example by adding more books to the pile or using a larger box.

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The Siphontific Method - Student Handout

Fill in the appropriate table for your experiment.

Variable: Tube Length		
Tube Type	Time to empty (sec)	Tube Length (cm)
Long		
Medium		
Short		

Variable: Tube Width		
Tube Type	Time to empty (sec)	Inside Diameter (cm)
Wide		
Medium		
Thin		

Variable: Height Difference		
Tube Type	Time to empty (sec)	Height Difference (cm)
High		
Medium		
Low		

Now that you have gathered this data, it is time to present your results. Often data is graphed in various ways, for example bar graphs, line graphs or pie charts. What would be some suitable graphs for the data you have collected?

_____

What are the important features of a scientific graph?

_____

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For your chosen experiment, graph your data on the graph paper provided. Graph your data as a bar graph and a line graph. Scientists always graph the dependent variable on the vertical axis and the independent variable on the horizontal axis. This allows us to visually examine the relationship between the variables.

Inspect your own graph. Compare your graph with other groups. Can you identify a trend or pattern? Can you make a general prediction about different lengths/diameters/heights because you have graphed your data? Discuss with your teacher.

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