

Part 1 Comparing the Viscosity of Different Liquids

Background: If you have ever tried to pour honey from a bottle, you know that it flows very slowly compared to a liquid like water. The resistance to flow is called a liquid’s **viscosity**. Honey and ketchup have a high viscosity, while water and milk have a low viscosity. Liquids that flow easily could be described as being very **fluid**, while liquids that flow slowly are **viscous**. Fluidity and viscosity are the opposite properties of a liquid.

Procedure for Part 1

1. Fill the beakers, jars, or glasses two-thirds full with the liquids provided.
2. Place them on the tray or protective paper.
3. Blow bubbles into each using straws.
4. Based upon the way in which bubbles flowed through the liquids, predict the viscosity of the 5 liquids, ranging from the least viscous (most fluid) to the most viscous.

Data Table 1A

Viscosity	Fluid
least	
most	

Part 2: Measuring viscosity

Background: If you drop a marble into honey, it will fall very slowly, and if you drop a marble into water, it will fall quickly. This effect of viscosity can be used to compare the viscosity of different liquids. By determining the distance that a marble falls through a column of liquid and the time it takes for it to fall, we can determine the velocity of the marble by using the formula: $velocity = distance/time$. We want to start determining the velocity, not when the marble starts falling, but when it has reached its maximum speed, called its **terminal velocity**.

Procedure for Part 2

1. Transfer each of the five liquids from the beakers used in Part 1 into five separate graduated cylinders.
2. Using a water soluble pen, make a line about 2 cm below the surface of the liquid. This will allow the marble to reach terminal velocity before you start making measurements.
3. Make another line about 5 cm from the bottom of the graduated cylinder. This will allow you to measure the end of the marble’s fall without the complication of the bottom of the column interfering with the velocity. If there are already marbles in the bottom of the container, make your mark 5 cm from the top of the layer of marbles.

4. Measure the distance between the two lines, and record in your data table. Your measurement will be in centimeters.
5. Drop the first marble. Start the stopwatch when the bottom of the marble hits the top line, and stop the stopwatch when it hits the bottom line.
6. Repeat the process 3 times for each liquid.
7. To clean up, pour the liquids carefully into a bowl. Use a spoon to retrieve the marbles. Wash the marbles, and return the liquids to the cylinders or original containers.

Data Table 2

Liquid	Distance (cm)	Trial 1 (sec)	Trial 2 (sec)	Trial 3 (sec)	Average time (sec)	Average velocity (cm/sec)

Based upon your measurements of velocity, fill in the chart about the viscosity again.

Data Table 1B

Viscosity	Fluid
least	
most	

Conclusion Questions for Part 2

1. What is the relationship between the viscosity of a liquid and the velocity a marble falling through a liquid?
2. Which of the liquids allowed gases to escape the most easily? _____
3. Which of the liquids caused the most pressure to build up before the gases could escape?
4. If the air coming through the straw is compared to lava erupting out of a volcano, would you describe the bubbling of air from the liquid with the highest viscosity as a gentle eruption or an explosive eruption?