

Forces, Fluids, and Density

What do you think a **fluid** is?

Fluid: any matter that has no fixed shape but that takes the shape of its container.

-includes liquids AND gases.

-example: the air in a bicycle tire takes the shape of a tire and the water in a bottle takes the shape of the bottle.

Matter...does anyone remember the Particle Theory of Matter?

1. All matter is made up of tiny particles.
2. Particles are always moving.
3. Particles have spaces between them.
4. Particles are attracted/bonded to each other.

Draw the arrangement of particles for the following:

Solid:

Liquid:

Gas:

We are going to discuss the properties of fluids.

Our first property is **viscosity**. What does this mean?

How fluids flow is determined by viscosity.

Viscosity is a liquid's internal resistance or friction that keeps it from flowing. Fluids with a high viscosity do not flow as easily as fluids with a low viscosity.



Which is easier to pour, orange juice or ketchup?

Which has the higher viscosity?

Think about what would happen if these fluids did not flow the way they usually do. For example, what if soda pop was like a thick syrup and what if ketchup was like water?

How do we determine viscosity?

1. Bubble Test: you time how long it takes an air bubble to rise through a tube of fluid.

Longer time=_____ viscosity.

2. Ramp Method: you time how long it takes a fluid to flow down a ramp.

Longer time=_____ viscosity.

With a person sitting close to you:

1. Create a list of 3 fluids you would want to have a different viscosity. Would you want it higher or lower and why?
2. Create a list of 3 fluids you would not want to have a different viscosity. Why? What would happen if the viscosity of these fluids was higher or lower?

For example: I would not want the viscosity of yogurt to change because I don't like watery yogurt and I don't want it too thick either.

I wouldn't mind if hair conditioner had a lower viscosity so it would be easier to get out of the bottle.

Can you actually change the viscosity of a fluid?

Can you actually change the viscosity of a fluid?

Think about when you're cooking.

What do you do if your gravy is too watery?

What do you do if your brownie batter is too thick?

What do you think differs in the particles of fluids that are low in viscosity versus the particles in fluids that are high in viscosity.

What do you think differs in the particles of fluids that are low in viscosity versus the particles in fluids that are high in viscosity.

Even though all fluids flow, the greater the attraction between particles, the higher the viscosity. This attraction is related to their size and shape. Smaller particles can move past each other more easily, resulting in a lower viscosity.

Higher Viscosity

Lower Viscosity

more attraction
bigger size

How does an increase in temperature affect the particles in matter?

Using that logic, how would temperature affect the fluid's viscosity?

As temperature increases, the viscosity decreases.

As temperature decreases, the viscosity increases.

You are given three samples of the same shampoo at three different temperatures

25 degrees Celsius, 50 degrees Celsius and 75 degrees Celsius.

Which sample would have the highest viscosity?

Create Your Own Experiment!

We will be creating our own experiments to test the viscosity of different substances.

First, we need to brainstorm what an experiment needs. All of this information will be included in a lab report.

What do you think we need to think of when we create an experiment?

Every lab report must have a title. Your title can be as creative as you like, as long as it's accurate.

Underneath your title, you should also include:

On your page, your title should be centered. Your page should look like:

Title

Experimenter Names: _____

Experiment Date: _____

Please write these down, or type it out, as you will be producing a lab report for your experiment.
(It might be helpful to type it so you can just insert your information as you do the experiment.)

Lesson 1-Fluids and Viscosity

1. Purpose:

What is the purpose of our experiment?

Lesson 1-Fluids and Viscosity

1. Purpose:

What is the purpose of our experiment?

To compare the viscosity of _____(at least 3) different substances and rank them in order from lowest viscosity to highest viscosity.

2. Hypothesis:

What do you think is going to happen?

For example, I think ketchup will flow the slowest and water will flow the fastest so from lowest viscosity to highest, the order will be water, hair gel, ketchup.

3. Materials:

What materials are you going to use to do your experiment?

This will depend on your experiment. You need to include:

- the amounts of each substance you're going to use.
- any containers you're going to use
- anything you'll use to test it.

For example, if you're making a ramp to pour the substances, down, you're going to include "ramp" on your materials.

*All materials must be found at school or brought from home. Materials cannot be purchased for this experiment.

4. Procedure:

What steps are you going to follow to test your hypothesis?

For example:

1. Set up the ramp on a flat surface.
2. Take the ketchup and pour it onto the ramp. Start the timer when you do so.
4. When the ketchup reaches the bottom of the ramp, stop your timer.
5. Record your time in the chart in the Data/Observations section.
6. Clean the ramp and repeat steps 2-5 with the other two substances.
7. Use your data and observations table to calculate the speed each substance travelled down the ramp.
8. Determine the highest and lowest viscosity by ranking the substances from fastest speed to lowest speed.

5. Data/Observations

This is where you record your data from the experiment. You might want to create a chart in this section to organize your data. Any calculations you perform (to calculate velocity which is distance/time) should be in this section as well.

You will also be creating a graph of your data. (This is why you want numerical answers and not just visual observations.)

You can choose to create a line graph or bar graph.

6. Conclusion

Your conclusion is a summary of what you did in the experiment. It should follow this format.

The purpose of this experiment was to

_____.

My hypothesis was _____.

According to the data we collected, my hypothesis _____ correct. (was or was not.)

The data showed that _____ had a velocity of _____, and _____ had a velocity of _____, and _____ had a velocity of _____. Therefore, from lowest viscosity to highest viscosity, the order of substances would be

_____.

From this experiment, I learned

_____.

This information is useful in real-life situations because

_____.

Lesson 1-Fluids and Viscosity

Once your data collection is done, you can complete your lab report. Remember that each person needs to complete their own lab report **independently**. The only things that should be the same between group members' lab reports are:

Purpose (we did this together)

Materials

Procedure

The data.

Title

Experimenter Names: _____

Experiment Date: _____

1. Purpose

2. Hypothesis

3. Materials

4. Procedure

5. Data and Observations

-includes your data (you may have a chart)

-includes your calculations

-includes a bar graph displaying your data (can be made by hand or on the computer.)

What should this bar graph look like? What do all graphs need to include?

6. Conclusion: