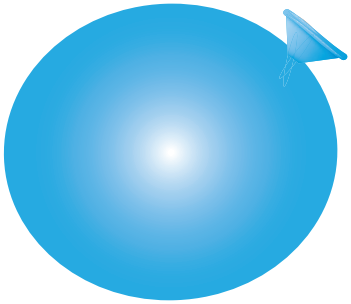
Laminar Flow

What You'll Need

- Bowl
- Balloons
- Water
- Pin
- Tape (any type)
- Scissors (if needed to cut the tape)
- Funnel (optional)
- Pen or pencil for tracking observations



What You'll Do

1. Fill your balloon with water and secure it with a knot. A funnel can help with this step if you have one.
2. Put tape on your balloon in the shape of a hashtag, leaving an exposed part of the balloon in the middle between the pieces of tape. Place your balloon in the bowl so it doesn't roll away.

For the next portion, we suggest you go outside. You'll thank us later!

3. In the chart provided on the next page, make a prediction about what you think will happen if you poke the balloon in the middle of the hashtag. Now stick the pin into the balloon in the middle of the hashtag.
4. What happened? Was your prediction correct?
5. Fill up another balloon with water, and place it securely in the bowl.
6. Write your prediction in the chart about what you think will happen if you poke a hole in the balloon without tape. Now poke it with the pin!
7. Was your prediction correct?
8. Try it again with the tape. Make observations about the water flow, paying particular attention to what the stream of water looks like.
   - Is it really smooth, bumpy or both?
   - Does it look glassy or cloudy?
   - Does it look like it is frozen in time, or does it look like it's moving?
   - Does the whole stream look the same, or does it change?
   - Does the flow pattern change when there is less water in the balloon?
9. Try it again with extra tape, and see if you can make more than one stream of water. Does each stream of water look the same? Does the size of the poked hole change the flow pattern?
10. Try making the size of the balloon different. Does that affect laminar flow?

♥ We'd love to see your efforts!

Take pictures and videos of your experiments, post them on social and tag the Science Museum of Virginia so we can see your results.

Science Museum of Virginia

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Laminar Flow

What's Happening

Laminar flow is when a fluid moves in a very smooth, straight way. Parallel layers of laminar flow don't disturb each other. Turbulent flow is more chaotic and rough.

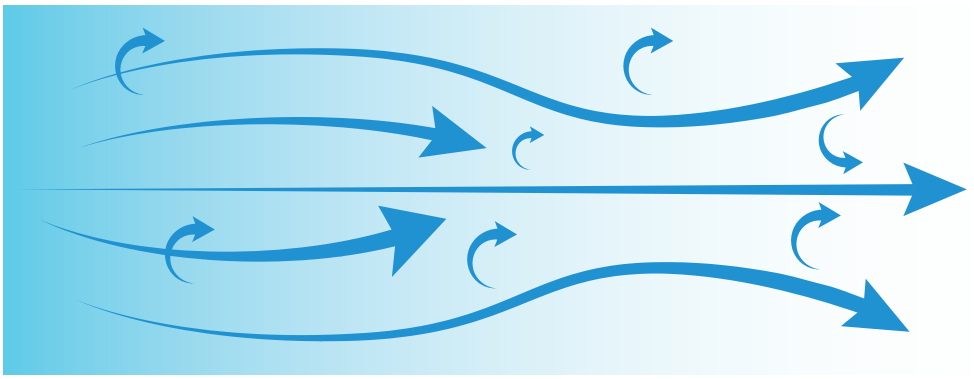
A flow pattern can be predicted based on the viscosity (relative thickness), velocity (speed) and density (how much mass per given volume) of a fluid combined with the dimensions of the object the fluid is flowing through.

This relationship is called the Reynolds number, and the formula looks like this: $R=\rho\nu R/\eta$

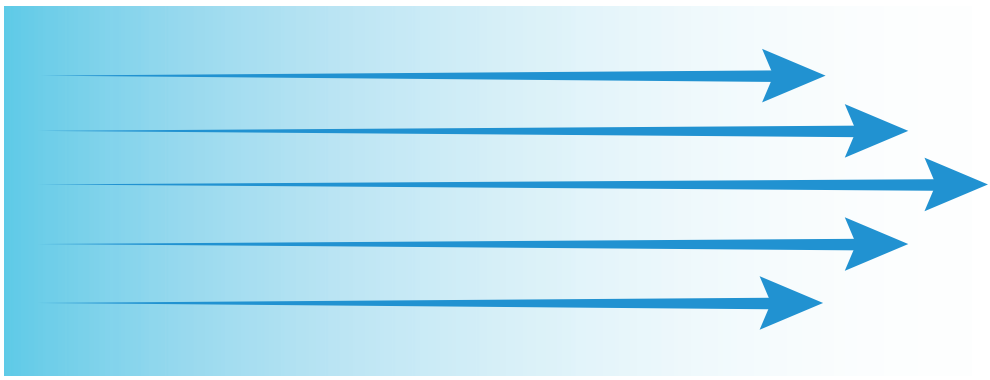
ν= velocity
R= size of the flow (sometimes used for diameter)
ρ= density
η= viscosity

In this particular case, the water is forced out of the hole by the air pressure on the balloon which determines the velocity of the water. You'll notice as the stream of water gets further away from the balloon, it gets more turbulent.

Turbulent Flow



Laminar Flow



Laminar Flow

What to Remember

You've likely seen laminar flow in action without even realizing it. One example is at a drinking fountain. When you drink from a water fountain, you want the stream to be in a nice laminar flow, otherwise you might end up with water all over you!

You also might see it on parts of a river where it's straight without anything like curves or rocks to affect the flow. Other parts of that same river might be really rocky, which could produce more rapids, and therefore create turbulent flow.

Trial	Prediction	Observations
Tape with one hole		
No tape		
Tape with two holes		
Different balloon size		