Engineering

Does the viscosity [1] of liquids affect the shape of droplets?

(Project found at http://www.all-science-fair-projects.com/)

Purpose

Observe the different forms of drops of liquids with varying viscosities.

Materials

- ☑ Water
- ☑ Glycerin
- ☑ 10W-40 motor oil
- ☑ 10W-30 motor oil
- ☑ 88% glycerin and water mixture
- ☑ 90% glycerin and water mixture
- ☑ Ethyl alcohol
- ☑ Graduated cylinder
- ☑ Metal ball
- ☑ Magnet
- ☑ Stopwatch
- ☑ Burette
- ☑ Graph paper
- ☑ Video camera

Safety Concerns: Chemicals; oil. Students will wear gloves and goggles when doing this activity.

Procedure

1. Test each liquid for viscosity. Mark a ten-inch range in a graduated cylinder, and fill the tube with the liquid about an inch above the line marked.

2. Drop a metal ball into the graduate cylinder. Use the magnet to hold the ball above the top line.

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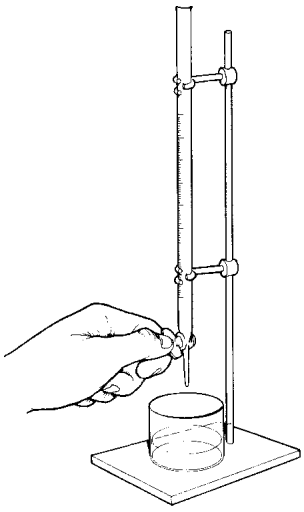
[1] Thickness of a liquid; high viscosity means the liquid is thick and flows slowly (molasses); low viscosity means the liquid is thin and flows rapidly (water).

3. Using the stopwatch, move the magnet away from the ball and time the ball's fall from the top to the bottom. Repeat the process five times and average the results. (The longer it took the ball to fall, the higher the viscosity of that liquid.)



4. Place each liquid into a burette and let it drip out at a slow rate. Place graph paper behind the dropper. Film the drops.

5. Measure the length of the drops using the graph paper as a background.

Which Bridge Design is Stronger?

(Project found at http://www.all-science-fair-projects.com/)

Purpose

Determine see which type of bridge is the strongest out of three types of bridges.

Materials

- ☑ Box of 7" Popsicle™ sticks
- ☑ Micrometer
- ☑ 3 Bridges constructed of Popsicle™ sticks
- ☑ Stand constructed of Lego's™
- ☑ 10 1 kg weights

Procedure

1. Construct a stand for the bridges using Lego's™.

2. Construct a spanning bridge, made of Popsicle™ sticks, half a meter long using hot glue to fasten.

3. Construct a truss bridge, it looks like triangles between the two platforms, the platform is underneath the triangles.

4. Construct an arch bridge, looks like a platform with an arch above it

5. Place a 45kg weight on the span bridge.

6. Measure the amount it flexes using a micrometer.

7. Record data.

8. Switch bridges to the truss bridge

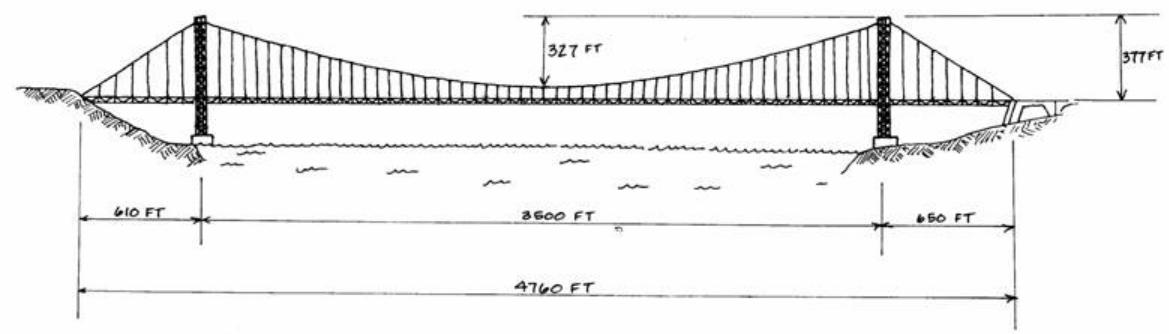
9. Place weights on new bridge.

10. Measure flex using a micrometer.
11. Record data.

12. Place weights on the arch bridge.

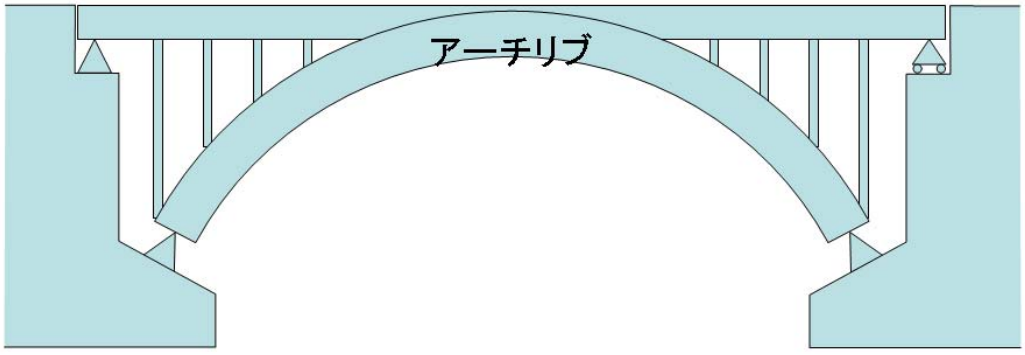
13. Measure the flex using a micrometer.

14. Record data.



Span Bridge

Truss Bridge



Arch Bridge

Which Windmill Blade Angle is Most Efficient?

(from All Science Fair Projects/ http://www.all-science-fair-projects.com/project715_57.html)

Purpose

The purpose of this experiment was to find out which blade size and angle is most efficient.

Experimental Design

The constants in this study were:

- Same windmill
- Same fan (wind generator)
- Same DC ampmeter
- Same electricity generator
- Same wind speed
- Same fan distance (1 meter) from the blades

The manipulated variables were the angle and the length (blade area) of the blade.

The responding variable was the electrical output of generator attached to the windmill.

To measure the responding variable, I am going to hook an ampmeter to the motor and record the electrical current output.

Materials

QUANTITY	ITEM DESCRIPTION
2	Electrical wires
1	Rubber band (pulley)
1	Fan (wind source)
1	Tape measure
1	Windmill (Homemade from Tinker-Toys and Erector Set)
1	Ampmeter (Measured current output)
1	Protractor (Measuring blade angle)
1	Electrical generator

8	5cm x 1cm blades
8	10cm x 1cm blades
8	15cm x 1cm blades
8	20cm x 1cm blades

Procedures

1. Build the windmill out of Tinker-Toys and Erector Set.

2. Cut out four of each of these; 1 inch, 2 inch, 3 inch, 4 inch, and 5 inch long blades out of Venetian blind blades.

3. Place fan approximately 1 meter away from windmill.

4. Attach all of one size to the propeller holder.

5. Measure the degree of the blade with a protractor.

6. Make sure the blades are at 0 degrees (parallel with other blades).

7. Attach ampmeter wires to the motor.

8. Turn the fan on and take notes on DC current.

9. Read the voltmeter to tell how much electricity has been produced.

10. Repeat the above but change the angle of the blade to 15, 30, 45, 60, 75, and 90 degrees.

11. Repeat the above with the 5-inch long blades set at 0 degrees.

12. Repeat the above with the 10-inch long blade set at 0 degrees.

13. Repeat the above with the 15-inch long blade set at 0 degrees.

14. Repeat the above with the 5-inch long blade set at 0 degrees.

15. Collect the data and make graphs of current output vs. blade area and angle.