Glass Harp

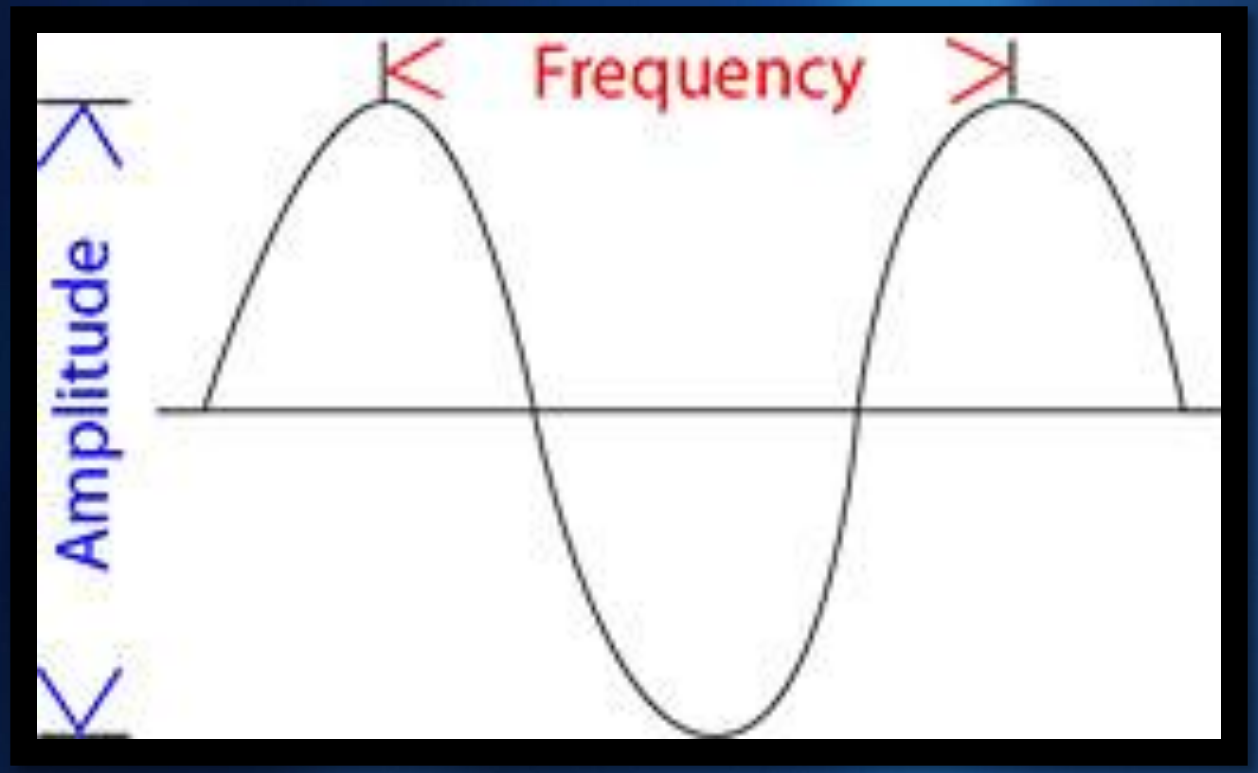
How the density and the amount of liquid effect the sound of a vibrating glass

Introduction

This science fair project is on sound, specifically the sound of the glass harp, also known as the musical glasses, or vérillon. This experiment will help us learn about how sound is made and how it changes in different scenarios.

G2 (glass harp makers)

Sound



Sound is like a tsunami. The earthquake is the source of the sound, and the wave is the noise. Sound is made of waves in the air. The length of the wave or the number of waves per second is the frequency, or how high or low the sound is. The height of the wave is the amplitude or how loud it is. Our ear drum vibrates with pressure changes and transfers this to another part of your ear that transfers that to your brain.

Arizona State University

The glass harp

The glass harp, as I will be referring to it, is when you rub a wet finger on a wine glass and after a few seconds, it will make noise. This is because of the friction of your wet finger on the glass. This form of music came from Asia. It became what we know it as today when they started using glass cups in Europe. The more automated glass harp is an instrument called the glass harmonica or glass armonica that Benjamin Franklin invented. The glass harmonica is made of a lot of spinning bowls. Both Beethoven and Mozart composed music for the glass harmonica.

G2 (glass harp makers)

Question & Hypothesis

Question:

How does the amount and type of liquid effect the frequency of the glass harp?

Hypothesis:

According to my research, increasing the liquid in the glass lowers the frequency and so I think the thicker the liquid, the lower the frequency will be.

Material & Procedure

Materials

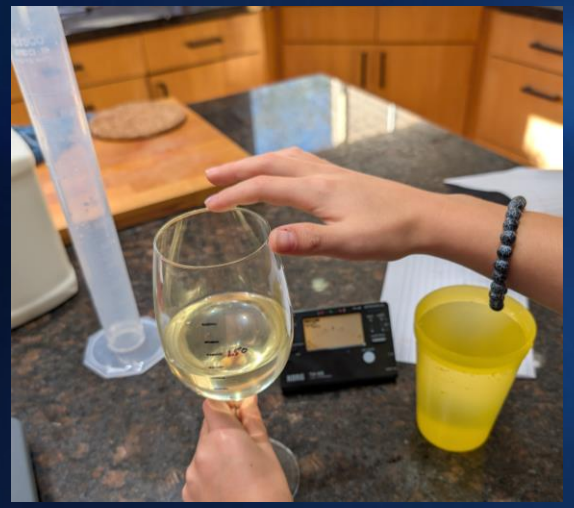
- Stemmed wine glass
- Graduated cylinder
- Scale
- Water
- Elmer's glue
- Canola oil
- Isopropyl alcohol
- Tuner
- Safety glasses

Procedures

1. Using graduated cylinder, weigh 100mL of each liquid. Record the weight (grams).
2. Calculate density of each liquid (g/mL).
3. Add 50mL of water to the glass.
4. Play glass with wet finger. Record frequency of the glass with tuner.
5. Repeat steps 3 and 4 for volumes 100mL, 150mL, 200mL, 250mL, 300mL and 350mL.
6. Repeat steps 3-5 replacing water with glue, then oil and then isopropyl alcohol.

Data Collection

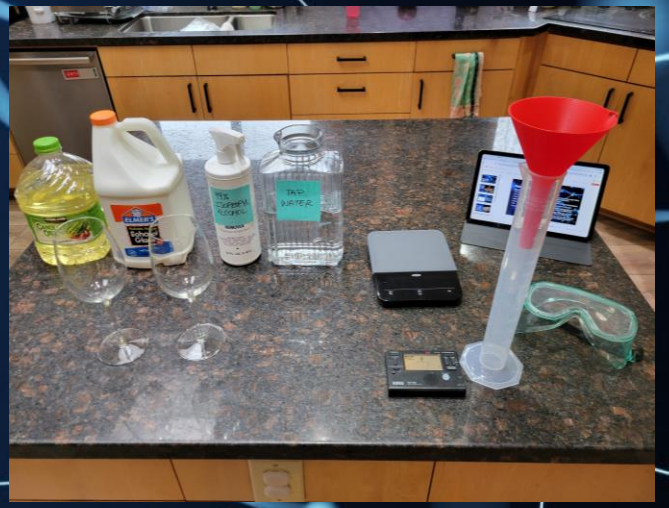
Measuring the frequency of Canola Oil using tuner.



Measuring the frequency of water.

Calculating the density of Elmer's School Glue.

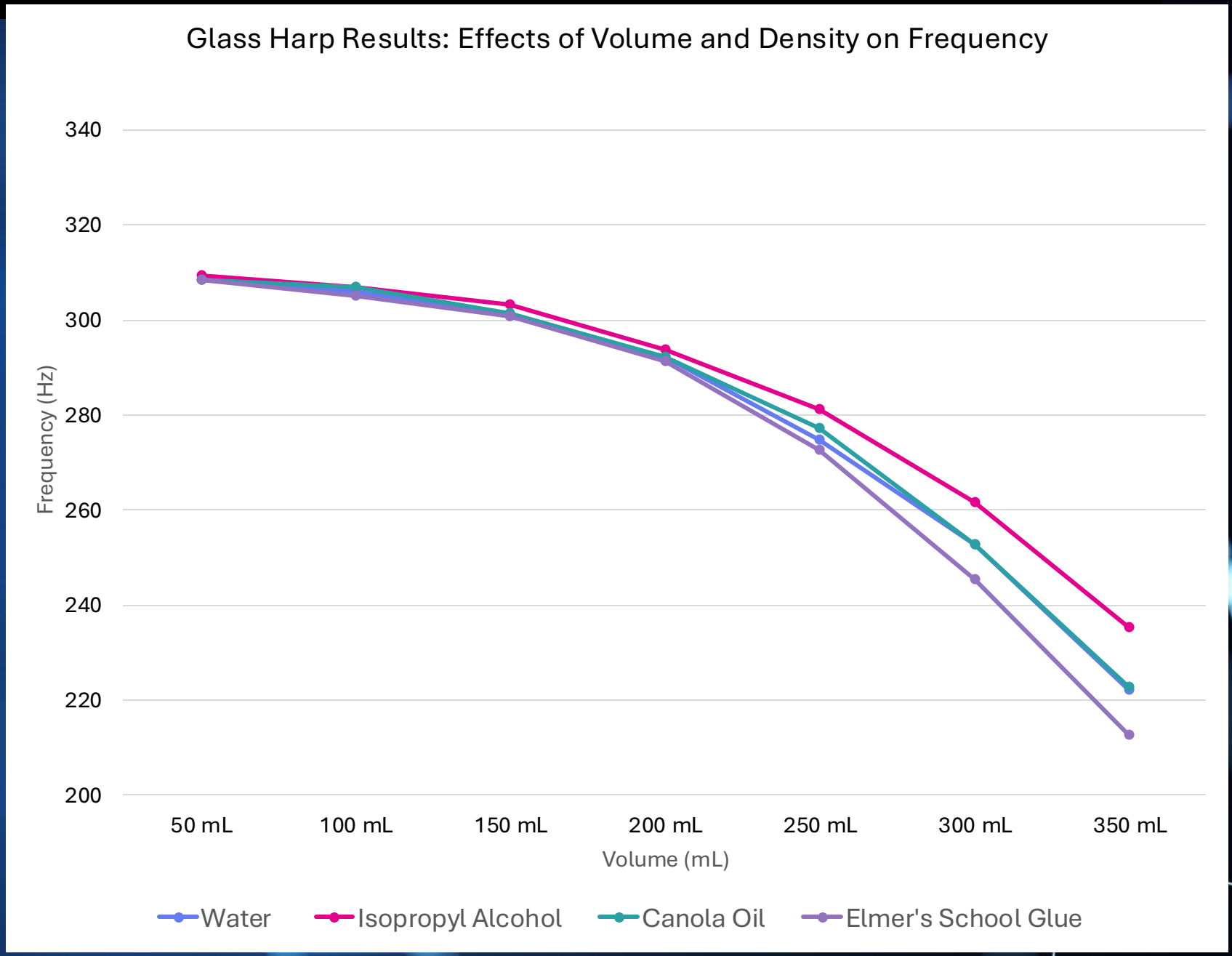
Set up of materials and equipment for data collection.



Data

	Frequency (Hz)			
Volume of Liquid	Water	Isopropyl Alcohol	Canola Oil	Elmer's School Glue
50 mL	308.5	309.4	308.5	308.5
100 mL	305.9	306.8	306.8	305
150 mL	300.7	303.3	301.5	300.7
200 mL	292.1	293.7	292.1	291.2
250 mL	274.9	281.3	277.2	272.5
300 mL	252.8	261.6	252.8	245.5
350 mL	222	235.2	222.6	212.6

Densities	
Liquid	Density [grams/mL
Water	0.988 g/mL
Isopropyl Alcohol	0.773 g/mL
Canola Oil	0.906 g/mL
Elmer's School Glue	1.054 g/mL



Interpretation & Discussion

Effect of Volume on Frequency:

- The more liquid added, the lower the frequency.
- When the glass got full it got harder to play them, especially with Elmer's School Glue.

Effect of density on frequency:

- The denser the liquid the lower the frequency.
- The more liquid in the glass the more the density impacted the frequency.
- All the frequencies started about the same.
- Oil and water are very similar in density and had similar frequencies.

Interpretation & Discussion continued

One of the problems I faced during, and after, testing is the fact that are tuner used cents, a musical measurement that divides the space in between notes into 100 pieces, so I had to convert the cents into Hz. I first had to look up the frequency of the notes, then I found the distance in between the notes. After that I divided the distance in between the notes into 100, then then multiply that by the cent-value I read on the tuner.

Implications & Ideas for Future Research

Implications

One implications is that the type of liquid does not make a very big difference in the frequency, so if you want to make your own glass harp, just use water!

Ideas for Future Research

For future testing it would be interesting to test different sizes and shapes of glasses to find a glass that can play a whole octave.

References

- Britannica "glass harmonica" and "musical sound"
- Wikipedia "Piano key frequencies", https://en.wikipedia.org/wiki/Piano_key_frequencies
- G2 (photos), https://glassharp.eu/en/
- Arizona State University (diagram), https://askabiologist.asu.edu/defining-sound