Excellent setting out.

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Plan Draft

Title: Sweet vibrations

Aim: To investigate the effect of glass volume on resonant frequency, as well as water fill level on resonant frequency.

Variables:

Dependant
- resonant frequency

Independant
- Volume of wine glass
- level of water fill of glass

Controlled
- Material of glass
- Atmospheric conditions
- Glass shape
- Method of inducing resonance (finger)
- ~~Distance of microphone from glass~~

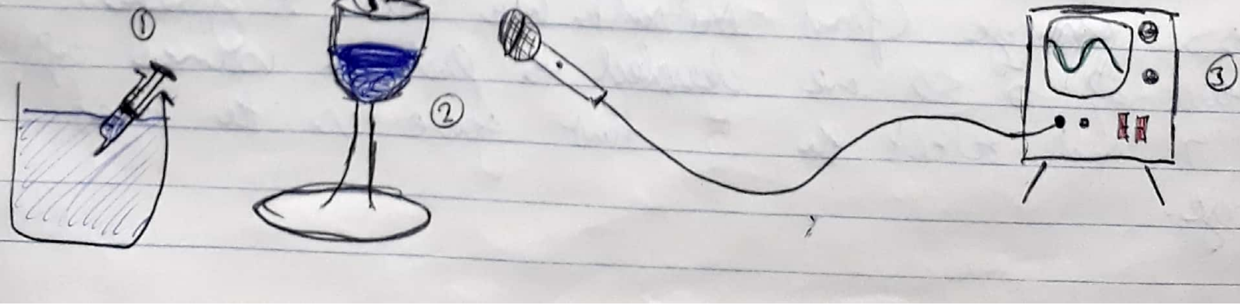
Materials:
- 5x wine glasses of different volume
- CRO with microphone
- Graduated syringe
- Distilled water

Apparatus:

1 - Syringe with distilled water for filling glasses

2 - Glass full of distilled water to produce resonant frequency

3 - CRO and microphone for recording resonant frequency.



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Procedure

1. Dampen finger and run around the rim of the wine glass until a note is produced.
2. Record frequency of note using CRO and microphone.
3. Fill glass with 25mL of distilled water and repeat steps 1-2.
4. Repeat step 4 until glass is full.
5. Repeat steps 1-4 with all 5 wine glasses.

Summary:
Plan drafted, ready to sign.
Next lesson, test equipment and prepare to record data.

@N/L
4/9/17.

Determining Volume

To properly run our experiment we need to determine the total volume of our wine glasses (Independent variable). Seeing as we are using water we can use scales to do this, where 1g = 1mL. To determine volume we can record the initial mass of the glass the mass of the glass full of water, then calculate the total volume from the mass change (final - initial). We had 7 glasses instead of 5 so we decided to find the volumes of all 7 and select the 5 that gave us the best range.

Glass #	initial mass (g)	final mass (g)	Δ mass (g)	Volume (mL)
1	174.7	571.8	397.1	397.1
2	157.7	453.1	295.4	295.4
3	141.4	337.6	196.2	196.2
4	185.0	446.2	261.2	261.2
5	175.2	363.7	188.5	188.5
6	157.7	360.5	202.8	202.8
7	216.5	552.1	335.6	335.6

Volumes in order: 188.5, ~~196.2~~, ~~202.8~~, 261.2, 295.4
335.6, 397.1

Having ordered the volumes we decided to get rid of glass 3 and 6, as they were very close to each other and the remaining volumes gave the most favourable spread. Having attained our final range, we renamed our glasses (for ease of notation) in order of increasing volume, as below.

New glass #	VOLUME (mL)
1	188.5
2	261.2
3	295.4
4	335.6
5	397.1
weeps	N/A

Uncertainty
Due to sig figs on scales, all volume measurements are subject to uncertainty of ±0.05 mL

Measurement of Frequency

After extensive testing with the CRO, a signal generator and a microphone we were not able to find a reliable way of measuring frequency. We've switched to an app used for tuning violins but as we are unsure of its accuracy we will compare its readings against the known frequencies of tuning forks to determine uncertainty.

Tuning fork expected frequency (Hz)	App recorded frequency (Hz)	difference
512	529	17
480	479	1
427	420	7
384	386	2
341	335	6
320	319	1
288	287	1
256	256	0
	Average Difference	4.375 Hz

Having conducted calibration we ~~are~~ were concerned that the tuning forks we were using might have been damaged or be otherwise untrue to their expected frequency (stamped on each). To get around this and attain a more accurate uncertainty value, we youtubed some frequency samples and repeated the same calibration experiment using a range of them.

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Known Frequency (Hz)	Recorded Frequency (Hz)	Difference
396	396	0
417	417	0
444	444	0
528	528	0
639	639	0
741	741	0
852	852	0
	Average Diff	0

Uncertainty: due to sig figs on app, all measurements of frequency are subject ~~to~~ uncertainty of ±0.5 Hz

Wowzers! Sorry we doubted you little phone. Having callibrated the phone we can conclude that measurements can be taken with an uncertainty of ±0.5 Hz

Adaptions

measurement equipment:
As discussed above, the microphone, ~~CRO and signal~~ and CRO have been replaced by ~~an app~~ a smartphone app accurate to ~~within~~ ±0.5 Hz.

addition of water:
Adding water to glasses using the syringe (as suggested) would probably incur a level of unnecessary uncertainty. To counter this we have decided to use digital scales to monitor the amount of water added (limit = 1g)

Step one:
Less of an adaption and more of a clarification; it is important that the finger is dampened on a source that is external to the glass to keep things consistent.

Plan (draft #2)

Title: Good Vibrations (Bup Bup)

Aim: To investigate the effect of glass volume on resonant frequency, as well as water fill level on resonant frequency.

Variables:

Dependant:
- resonant frequency.

Independent
- Volume of wine-glass (mL)
- Level of water fill of wine-glass

Controlled
- ~~Material of glass~~
- Atmospheric conditions
- Glass shape
- Method of inducing resonance (finger)
- ~~Distance of recorder~~

Materials:

- 1x wine-glass (188.5 mL)
- 1x wine-glass (261.2 mL)
- 1x wine-glass (295.4 mL)
- 1x wine-glass (385.6 mL)
- 1x wine-glass (397.1 mL)
- Smartphone with "Master Violin Tuner" application
- Graduated syringe
- Measuring cylinder (250 mL)
- Digital scales accurate to one decimal place.
- Dish for wetting finger