Logbook

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Timeline

09/17/2024 - Science fair info. meeting at school.
09/24/2024 - Submit question. (school)
09/27/2024 - Start research (school)
09/29/2024 - Start hypothesis and question
10/06/2024 - Get materials.
10/20/2024 - Finish materials and procedure and variables. (school)
10/21/2024 - 11/01/2024 - Conduct the experiment (school)
10/30/2024 - Upload project info. (School)
11/02/2024 - 11/05/2024 Complete observations. (school)
11/06/2024 - 11/09/2024 Complete Analysis (school)
11/19/2024 - Buy trifold (School)
11/20/2024 - 11/24/2024 - Think of applications. (school)
11/26/2024 - Write sources of error (school).

12/10/2024 - 12/15/2024 - Write conclusions (school).

12/25/2024 - 12/26/2024 - Write Sources and Acknowledgements (school).

1/01/2025 - Finish applications (school)

1/02/2025 - 1/16/2025 - Decorate trifold (school).

1/16/2025 - 1/21/2025 - Fine-tune everything.

1/21/2025 - School Science Fair.

1/30/2025 - Submit Ethics due care 2A (CYSF)

3/21/2025 - Projects due (CYSF).

3/22/2025 - 4/07/2025 - Type and print info.

4/08/2025 - Create trifold, practice presenting.

4/10/2025 - Project setup at olympic oval.

4/11/2025 - Presentation day.

4/12/2025 - Awards Ceremony.

09/24/2024

Question Ideas:

1. Do diffent liquids affect plant growth?
2. Does music affect plant growth?
3. Does temperature affect magnet strength?
4. Does music affect memory?
5. Can sound waves move items?

09/23/2024

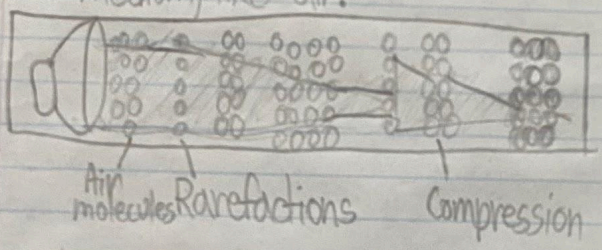
Question:	Thoughts	Decision
1	They do, but plants need weeks to show noticeable growth changes.	Takes too long.
2	Would also take too long to show noticeable growth changes.	Also takes too long.
3	This would require special tools to measure magnet strength, which I didn't have.	No access to special tools.
4	This is very interesting, but this idea was already taken by a fellow classmate.	Idea was already took.
5	Scientists manadged to achieve acoustic levitation. I figured that I could do a variation. I had all the materials within reach, so I did this.	Interesting and easy to conduct. Can sound waves move items?

* Selected project

09/27/2024 Research

What are sound waves, how do they form?:

A sound wave is a wave of compression (high pressure regions within the wave) and rarefactions (low pressure regions within the wave). They form when something vibrates, creating a pressure wave that travels through a medium, like air.



What are localized pressure differences?:

-Tiny variations in air pressure that occur in specific areas when a sound wave traves through a medium.

Do sound waves exert force?:

Sound waves do exert force. The strength of this force can move tiny particles, like seeds.

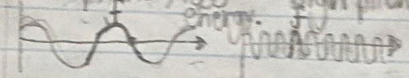
09/27/2024

Research* continued

The 5 main properties of a sound wave.

1. **Frequency**

Low frequency
- Low pitched, less energy.

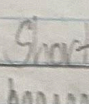


High frequency
- High pitched, more energy.

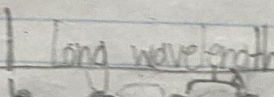
- The number of wave cycles that pass a given point on a sound wave. Measured in Hertz (Hz).

2. **Wavelength**

Short wavelength
- High pitched, less energy.



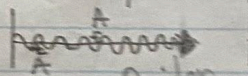
Long wavelength
- Low pitched less energy.



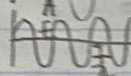
- The distance from one crest (top) or trough (bottom) of a sound wave to the next. Measured in meters (m).

3. **Amplitude**

Low amplitude
- Quiter, softer sounds.



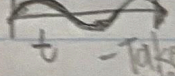
High amplitude
- Sharper, loud sounds.



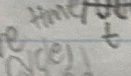
- The maximum displacement of a crest or trough on a sound wave from its equilibrium (mid-line) position. Measured in meters (m).

4. **Time period**

Long time period
- Take more time to complete a cycle (ie) low pitched.



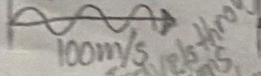
Short time period
- Take less time to complete a cycle, high pitched.



- Amount of time taken for a sound wave to complete one cycle. Measured in seconds (s).

5. **Velocity**

High velocity
- 100m/s
- Travels through mediums faster.



Low velocity
- 5m/s
- Travels through mediums slower.

- How fast a sound wave propagates through a medium. Measured in meters per second (m/s).

09/29/2024 **Question**

Is it possible to move items with sound waves?

Hypothesis

I believe that sound waves can move items, because if sound waves emit vibrations and exert force on tiny particles, then the items I will test with will move, because the sound waves will transfer their vibrations to the vibrating surface, their exerted force onto the items, and the localized pressure differences formed by the travelling sound waves should push or pull on the items. To check if my hypothesis I will be conducting an experiment to check and see if sound waves can move items.

10/20/2024 **Materials**

- Plastic wrap
- Tape
- A container
- A sound source
- Light-weight items

Procedure

1. Tape plastic wrap over the top of the container, ensuring that there are no wrinkles.
2. Sprinkle a small amount of items on top of the plastic wrap.
3. Use a sound source and position the speaker part(s) directly above or gently touching the plastic wrap.

Procedure *continued

4. Play sounds at different frequencies.

5. Record your results for each trials of frequencies.

11/06/24

Variables

-Responding Variable:
- The movement, shaking, rotation, oscillation, and/or attraction to the sound source of the items when exposed to sound waves.

-Manipulated Variables:
- The type of items placed on the plastic wrap.
- The frequency of the sound waves.

-Controlled variables:
- The plastic wrap and its tension.
- The amount of plastic wrap and tape used.
- The sound source and volume of the sound played.
- The environment where the experiment takes place.

11/06/2024

Analysis

Carom seeds:
Minimal movement at very high and low frequencies. Most movement and attraction occurred at 1000 Hz.

Flower Petal:
Slight movement, shaking, and oscillation at very high & low frequencies. The strongest response was at 2500 Hz.

Date
Page

Analysis *continued

Almond:
Little to no movement at very high & low frequencies. Peak movement, shaking, rotation, and oscillation occurred at 1000 Hz.

Rice:
Moderate movement at low frequencies, minimal at high frequencies. Strongest response at 1000 Hz.

11/07/2024

Analysis *continued

Overall Analysis 11/07/2024
Peak action mainly occurred at 1000 & 2500 Hz, with items exhibiting the most movement, shaking, rotation, oscillation, and/or attraction to the sound source. Very high & low frequencies, mainly resulted in little to no movement, shaking, rotation, oscillation, and/or attraction to the sound source. A sudden burst of movement in the flower petal suggested that lower frequencies had more energy in them, but may have been due to an accidental press on the plastic wrap.

11/08/2024
Why did this happen?
Since the tested items were lightweight, sound waves exerted enough force to move them. Vibrations from my phone's speaker caused pressure variations in the air, pushing objects towards the sound source. Sound waves consist of compressions and rarefactions, which tug on objects, causing movement, shaking, rotation, or oscillation.

11/09/2024
Why do different frequencies cause different results?
Objects vibrate at their natural frequencies. When a sound wave matches this frequency, resonance amplifies movement. Lighter objects move more easily, while heavier objects need higher-energy waves.

Analysis *continued

Were my results reliable?
They were mainly reliable, because I mainly got consistent results through out every trials of freqvencies. Likely due to minor inconsistencies, there may have been significant variations in my results. My controlled variables remained the same to ensure consistency.

11/26/2024 Possible sources of error:

- Limited trials.
- Accidental pressure on plastic wrap.
- Volume issues.
- Tension of plastic wrap.
- Minor inconsistencies.

12/10/2024 Conclusion

I tested whether sound waves can move objects using plastic wrap, a container, tape, a sound source, and lightweight items. I observed how different freqvencies affected movement, and identified trends and patterns. Objects showed the most movement, shaking, rotation, oscillation, and attraction to the sound source at 1000 & 2500 Hz, while very low and high freqvencies often resulted in little to no movement.

12/11/2024, Conclusion *continued

My hypothesis was partially correct - sound waves moved items but also caused shaking, rotation,

oscillation, and attraction to the sound source. Lightweight objects were easily affected by vibrations and pressure changes, which pushed them toward the sound source.

12/13/2024 Different frequencies affected objects uniquely because each has a natural frequency. When a sound wave matches it, resonance amplifies vibrations, increasing movement.

12/15/2024 Some sources of errors may have affected my results, causing some variations. Overall, my results were mainly consistent.

Some suggestions for improvement:
- Testing with more items.
- Conducting more trials.
- Testing with other materials, other than plastic wrap.
- Getting a larger sound source.

Applications

01/1/2025 This experiment helps us understand how sound waves interact with materials. Applications include soundproofing, levitation and transport, and instrument design.