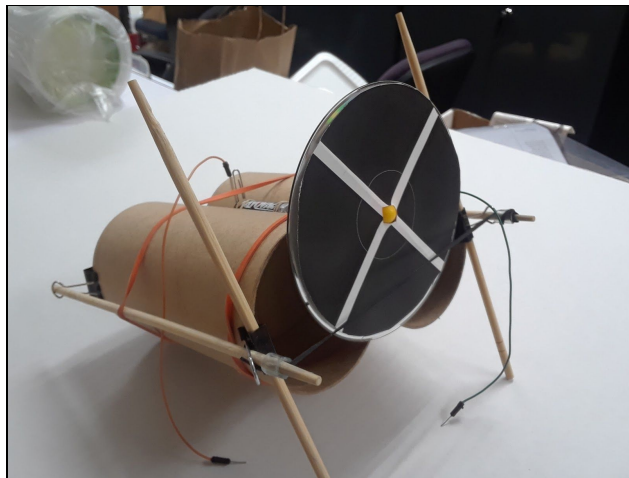


Wave Explorer

Assemble a device that allows you to see waves! The Wave Explorer uses a strobe-like effect to visualize sound waves. By juxtaposing a black rubber band against a rotating black disk with four white stripes, the rubber band is only visible when a white stripe is behind it. As the disk rotates, you see a series of snapshots of different parts of the rubber band as the white stripes rotate behind it, revealing the shape of soundwaves.



Topics:

- Properties of waves
- Science & engineering practices

Subject(s):

- Engineering
- Physical Science

Grades: 4-12

NGSS:

Sound, Wave Properties, Energy

[4-PS4-1](#) | [MS-PS3-2](#) | [MS-PS4-1](#) | [MS-PS4-2](#) | [HS-PS4-1](#)

Designing Possible Solutions, Optimizing the Design Solution

[3-5-ETS1-3](#)

Materials

WARNING: CHOKING HAZARD - Small parts not suitable for children under 3 yrs. Rubber bands contain natural latex which may cause allergic reactions.

1. Rubber bands, 7" x 1/8" (2), 2. Rubber band, 2" x 3/16", 3. Rubber bands, 1 1/8" x 1/32" (2), 4. Rubber band, black, 8.5 cm x 4 mm, 5. Cardboard tubes, ~6.5" x 3" (2), 6. Chopsticks, 9" with grooves (4), 7. Velcro adhesive strips with hooks, 1" x 3/4" (2), 8. Velcro adhesive dots with loops, 1/2" diameter (2), 9. DC hobby motor, 1.5 V, 10. Tubing, silicone or vinyl, 4.5 mm OD, 2 mm ID, 5 mm long (2), 11. Tubing, stretchy, 2.5 mm OD, 1 mm ID, 1/4" long (3), 12. Tubing, viny, 1/4" long x 3/16" ID (2), 13. Binder clips, small (6), 14. Paper clips, 1 1/4" (5), 15. Jumper wires with pins, 10" long (2), 16. Propeller, plastic with 3 blades, 1 9/16", hole fits motor shaft, 17. Compact Disc, 18. Strobe pattern printed on paper, plus adhesive dots & tape 19. Nichrome wire, 10" long, 20. AA battery

Explore (Click links to view related science content and phenomena)

<http://bit.ly/WaveExplorerScience> (teacher resource)

bit.ly/WaveonString (interactive simulation) (student resource)

Engineer It

1. Access this link for assembly instructions (slideshow) - <http://bit.ly/WaveExplorerAssembly> (student resource)
2. Use components to build 3 sub assemblies: 1) Reverb housing, 2) Motor and Battery, 3) Strobe disc (see pictures below)
3. Complete assembly of device following steps shown in videos embedded in slideshow.



Predict. Experiment. Play!

1. When the Wave Explorer is fully assembled, connect the wire from the (-) terminal of the battery to one end of nichrome wire.
2. Connect the wire going from the paper clip slider on the nichrome wire to the motor.
3. Connect the wire going from the motor to the (+) battery terminal. The strobe disc should start spinning.
4. Face the spinning strobe disc and pluck the black rubber band.
5. Record your observations in a science notebook, journal, or other document. You may draw as well as write out your observations.
6. Adjust the paperclip on the wire (rheostat) and see how slowly you can make the disc turn. Do the same to see how fast you can make it spin.
7. Try adjusting the tension on the rubber band to get a higher and lower note when plucked.
8. Set a slow speed for the spinning disc. Pluck the rubber band and record your observations.
9. Increase the speed and compare and record what you see. Increase the speed more, make more comparisons and record your observations. Repeat 3 or 4 times.
10. Pick any speed for the spinning disc. Pluck the rubber band and record what you see. Change the tension on the rubber band, compare and record. Repeat 2 or 3 times.
11. By adjusting speed and tension, try to make the wave appear stationary. See if you can make the waves appear to move left and/or right.

To show what you learned

In a science journal or otherwise, write your response to each of the questions:

- ☐ Describe what you noticed when you first plucked the rubber band?
- ☐ What changed when you increased the tension in the rubber band?
- ☐ What happened when you increased the speed of the spinner? Decreased speed?
- ☐ Did you notice any connection between the size of the wave and the sound of the rubber band when plucked?
- ☐ What if any improvements would you make to the Wave Explorer?

Extensions

- Allow students to draw the wave patterns for different conditions based on their learning using the Wave Explorer. For example, they can show a comparison between the waves caused by plucking the rubber band softly and then with more strength.
- Show students two different wave patterns and have them identify the pattern with higher amplitude, frequency, and/or wavelength
- Students can create a poster illustrating how sound travels through air

Additional Resources

Visit <https://raft.net/resources-2/> to view these related RAFT ideas:

- Back in the Groove
- Buzz Off!
- Glove-A-Phone
- Making Waves
- Sound String

Please provide your feedback

Any information you provide regarding the science content, instructions, and/or facilitation is greatly appreciated!

bit.ly/survey4kits