

Wine Glass Resonance

Estimated Time: 45 minutes

SUMMARY: In another STEM @ Home activity, you had the opportunity to make musical instruments out of recycled material. For this activity, you can become the maestro of the kitchen using wine glasses and water. Learn a little about sound waves and resonance as you try and match frequency and create music!

WHAT YOU'LL LEARN

- Resonance and frequency as it relates to sound waves
- Observation of sound waves traveling through water and air as mediums

Materials Used

- Liquid measuring cup (2 cup preferred)
- Water
- Paper towel or reusable cloth towel
- Spoon
- 2-4 9 oz or larger wine glasses (crystal gives your better sound but glass will work, bigger bowls work better)
- Smartphone, tablet, or computer
- Sound meter that measures frequency or sound meter app that measures frequency
- Paper
- Pen or pencil

WHAT TO DO

1. Set your wine glasses on a clean countertop or table.
2. Carefully hold the stem of one glass and gently tap the bowl. Observe your sound meter or sound meter app and record the frequency (Hz) of tapping the empty wine glass.
3. Set the glass back on the table. Pour a small amount of water into the glass, filling it about halfway and making note of how much water you added.
4. Now hold the stem of the glass and tap the bowl. Observe your sound meter and record the frequency. Is it higher or lower frequency? You should notice that adding water changes the mass and the increase in mass means a decrease in natural frequency.
5. Wine glasses are a great way to observe standing waves which are physical oscillations in the glass. For the next demonstration you will use friction to provide matching energy to the standing wave energy in the glass. This will create resonance and you should be able to hear the sound.
6. Dip one finger into the water and rub the rim of the glass. Gently hold the stem with one hand and run your finger along the edge of the wine glass. This takes some practice to find the right amount of friction to match the standing wave energy.
7. Once you get a tone from your glass, measure it with the sound frequency meter. Record it on your paper. How does it compare to the frequency measured when you tap the glass?
8. Set another wine glass next to your first one. Pour the same amount of water in the second glass as in the first glass. Use your finger on the rim of the glass to create resonance. Looking at the sound meter, is it registering the same frequency as the first glass?

9. If the frequencies are not the same, add or reduce the amount of liquid in the glass by using your spoon.
10. Once you match the resonance, look at the water levels in the glasses and compare. If there are differences in the water levels what other factors could be impacting the oscillation of the glass?
11. If you have additional glasses, vary the levels and see if you can form a series of notes. Can you play the wine glass instruments?

TIPS

- Use a wine glass without decorations and with thin walls
- Try different shapes of wine glasses. What factors impact the natural frequency of the glass (bowl size, height, shape, etc.)?