

## Investigating How Music is Made

Name: Solution

Learning Goals: Students will be able to:

- describe how sounds are produced with vibrations.
- describe how tones can be varied by changing the length of the resonant cavity.
- describe how string instruments require a source of vibration, a way to change pitch and use sympathetic vibration to amplify sound.
- define frequency and vibration in terms of a sound wave and what we hear.
- generalize the ideas of vocalizing and making music. Both require a source of sound (vibrations), a way to change pitch (resonance) and a way to amplify sound (resonance or sympathetic vibration).

*Predictions section – graded for completeness not correctness:*

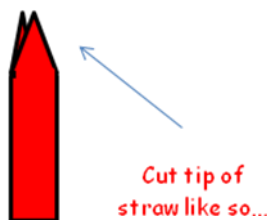
1. What instruments, if any, have you ever played?
2. Please describe with as much detail as you can, how an instrument makes sound. Pick at least two examples to describe.
3. Please describe with as much detail as you can, how different tones are made with these instruments.
4. Pull out your straw instrument from the previous class or make a new one.

You will need:

- Straws
- Scissors

Here's what you do:

- Take the straw and the scissors, and cut off the tip of the straw to a point, like so. (Try to get both sides to be the same.)



- Now, *gently* chew on the straw to soften the tip, and to get the edges to be smooshed together. You would like the two tips to be *almost* touching each other.
- Now, put the pointy end in your mouth, and *blow really hard*. If you do it right (it might take some practice), you will get a very loud sound from the straw instrument!

5. How do you make the lowest possible pitch with your “straw trombone” (that’s when you slide a second straw over the initial straw)

*Make it as long as possible*

6. How do you make the highest possible pitch with your “straw trombone”?

*Make it as short as possible*

Make a new straw instrument with one long straw.

7. Test out how your straw instrument sounds after you cut about an inch off.

*The pitch is a little higher*

8. Keep cutting sections off, and compare how the sound changes.

*The pitch gets a little higher each time and the really short straw instrument is really high pitched!*

9. Think about *natural frequency* of something or the frequency it likes to vibrate at. What do you think determines the natural frequency of your straw instrument? *Hint: What determines its pitch?*

*The natural frequency is determined by the length of the straw since the straw’s length determines its pitch*

10. Now use the water bottle. Blow over the top of the water bottle until you have a tone. Would you describe it as a low pitch or a high pitch?

*Low*

11. What kind of instrument does the bottle remind you of?

*A flute*

12. Figure out how to make a new tone with the same water bottle. Describe what you did to vary the tone.

*Added water to the bottle and now the tone is higher*

13. What determines the *natural frequency* of the water bottle instrument?

*The air inside the bottle. When there is water added, there is less air so a higher pitch is heard.*

14. Would the straw instrument and the bottle instrument be woodwinds, strings or brass?

Look at [www.dsokids.com](http://www.dsokids.com) for information. Look under “Listen” – “By Instrument.”

Woodwinds

How did you decide this?

I looked and found out that a clarinet or an oboe are both woodwinds and so is a flute!

### **Your Voice**

Hold your fingers against the front of your throat and say *Aaaaah*. Notice the vibration against your fingers.

15. Change the sound to an *Ooooooh*. What do you notice with your fingers as you listen? How about your mouth?

Vibrations feel about the same but the shape of my mouth had to change to make the different vowel sound.

16. Change the sound to *Eeeeeee*. What do you notice with your fingers as you listen? How about your mouth?

Again, I still feel vibrations but the new shape of my mouth made the new vowel sound.

17. Would you say the different vowels are made differently by your throat or your mouth?

My mouth determines the different vowel sounds

18. Now try *Sssss*, not *Esssss*. Does your throat vibrate? What is vibrating?

My throat doesn't vibrate, not using my vocal chords but my tongue is vibrating very quickly next to the roof of my mouth.

19. How about *Ffffff*? What is vibrating?

My lip with my teeth.

Hold your hand to your throat while speaking. Pitch varies with the emphasis given to different words. The last words of a question, for example is at a higher pitch.

20. Tie a 3 foot piece of string to a table leg. Pull it tight and pluck it. Does it make a sound?

Would you say it is a musical sound? What does it sound like to you?

It makes a sound but I'm not sure I'd call it musical.

21. What if you slide the string between your thumb and index finger? Does it make a sound?

Is it quiet or loud? How would you describe the sound?

A swooshing sound or if I really pinch it hard, a squeaky sound. Pretty quite

### **Cup Instrument:**

You will need:

- Plastic cup
- String
- Paper clip

Take the cup and poke a hole in the bottom. Put the loose end of your string through the hole from the bottom, tie the end of the string that is inside the cup to the paper clip and then pull all the extra string out of the cup so the paper clip is on the bottom of the cup.



22. Hold the cup so the string is loose and slide the string between your thumb and index finger. How does the sound compare to what you heard with just the string and no cup?

*Much louder!*

23. Does this change in volume remind you of the *sympathetic vibration* of the table top when you placed a vibrating tuning fork on it?

*Yes*

24. Now attach the string of your cup instrument to a table leg. Pull the cup so that the string pulls very tightly against the table leg. Pluck the string. Can you get a musical (ish) sound from it?

*Yes, it sounds like a banjo*

25. Have your partner hold the string at different lengths from the cup while you pluck it (still tied to the table leg!) How does the sound change?

*The shorter the string is between the cup and her fingers, the higher the pitch.*

26. How can you make it louder?

*Yes, pluck harder*

27. What instrument does this remind you of?

*Banjo*

28. Can you summarize three important features of your cup instrument that makes it play sound, makes it loud and changes the pitch?

*When I pluck the string, I make the sound – the string vibrates.*

*It's loud because the cup. The string makes the cup vibrate and the cup moves lots of air.*

*The length of the string determines the pitch.*

29. How about your straw instrument? What were the three important features to make it play sound, make it loud and change pitch?

*When I blow in it, the tips (cut like a v) vibrate against each other*

*It's loud because the entire straw vibrates and moves a lot of air*

*The pitch changes only if I change the straw. I have to make it longer or shorter.*

30. Get a wet paper towel and pinch the string *very* tightly as you slide the towel down it. If you do it right, you'll get a *very loud* sound. What instrument does this remind you of?

*Not much – it's pretty obnoxious*

**31. What is creating the vibration in this case?**

*The paper towel sticking and then slipping and sticking and then slipping on the string.*

**32. Did you hear any animal sounds? What sounded like what? Try to make a chicken (quick short slides), or a whale sound (long smooth slide) with the cup instrument.**

*All sorts of sound effects are possible with this. A squeaky door is a good one.*

### **Electric vs. Acoustic Guitars**

**33. Compare the two types of guitars. Pluck a string on each one and compare the sounds.**

*The Acoustic Guitar is a fuller more musical sound and it's louder.*

**34. Why is the acoustic guitar so much louder? What is the difference between the two that causes the acoustic guitar to be loud?**

*The acoustic guitar has the hollow wooden box, or body, that can vibrate easily and moves a lot of air.*

**35. What happens if you press your finger on the string on one of the frets along the neck of the guitar? What happens if you hold the string down closer to the body (basically shortening the length of the string that can vibrate)?**

*I can change the pitch if I shorten a string by pressing on a fret. The pitch I hear is higher the shorter I make the string.*

**36. Name three string instruments that are "plucked" and three that use slip stick vibrations.**

*There are many but here are a few examples: Plucked: Guitar, Banjo, Violin (can be plucked), harp*

*Slip Stick: Violin (bowed), Viola, cello, fiddle*

### **Compare cup instruments**

**37. Find at least two other groups that have different cups than you used but the same string.**

**How do their cup sounds compare to yours. What seems to be the cause of the differences, if any?**

*Bigger cups are louder. You might also hear some pitch differences but that could easily just be because the string lengths are different.*

**38. Find one other group that has the same cup but used different string than you did. How do their cup sounds compare to yours? What seems to be the cause of the differences, if any?**

*The string doesn't make much difference to the plucking sounds but it makes a big difference to the slip stick sounds. The shiny nylon string is not very loud at all. It seems to be too slippery.*