Bottle Sounds

Leading questions:

- What is the origin of all sounds we hear – what is the cause of sound?
- How does sound travel from one place to another? How do we hear it?

What to do:

1. Gently strike a tuning fork with a rubber hammer; try a second tuning fork different size.
   - Explain the differences do you see and hear.
2. Strike a tuning fork again and touch it to water
   - Explain what you think is happening.
3. The set of glass bottles each contain a different amount of water. Take a spoon and tap several of the bottles.
   - Describe any differences do you see and hear.
   - What do you think causes the differences in sound?
   - Explain where you think the sounds you hear are coming from.
4. Using the printed musical notes, see if you can play a recognizable melody.

Summary:

Energy is used to make sound. Plucking a string, blowing a horn, striking a drum and speaking all cause vibrations, which we hear as sound. The pitch or frequency of the sound in the bottles depends on the amount of water in the bottle. The more water, the slower the vibrations and the lower the pitch; less water, faster vibrations and the higher the pitch.

Bottle Sounds
(Guide)

Leading questions:

- What is the origin of all sounds we hear – what is the cause of sound?
  Listen: Let students express their ideas; they will learn by doing.
- How does sound travel from one place to another? How do we hear it?
  Listen: to students' ideas.

What to do:

1. Gently strike a tuning fork with a rubber hammer; try a second tuning fork different size.
   - Explain the differences do you see and hear.
     Explain: The forks are different size; they have different pitch (higher/lower); the sides are vibrating.
2. Strike a tuning fork again and touch it to water.
   - Explain what you think is happening.
     Explain: The vibrating fork makes the water vibrate, sending out waves.
3. The set of glass bottles each contain a different amount of water. Take a spoon and tap several of the bottles.
   - Describe any differences do you see and hear.
     Explain: The bottles make different sounds.
   - What do you think causes the differences in sound?
     Explain: The pitch or frequency of the sound depends on the amount of water in the bottle.
   - Explain where you think the sounds you hear are coming from.
     Explain: The spoon hits and transfers energy to the glass. The glass vibrates, making the water vibrate. The vibrating water makes the air vibrate. The vibrating air reaches our ears, transferring that energy to our ear drum.
4. Using the printed musical notes, see if you can play a recognizable melody.

Summary:

Energy is used to make sound. Plucking a string, blowing a horn, striking a drum and speaking all cause vibrations, which we hear as sound. The pitch or frequency of the sound in the bottles depends on the amount of water in the bottle. The more water, the slower the vibrations and the lower the pitch; less water, faster vibrations and the higher the pitch.

Bottle Recipes

#1 - Total Bottle Volume: 500 mL

Note	Fraction filled	mL water	
C	Filled	500	Red
D	8/9	444	Orange
E	4/5	400	Yellow
F	3/4	375	Lime
G	2/3	333	Green
A	3/5	300	Blue
B	8/15	267	Violet
C	1/2	250	Clear

#2 - We used 8, 8-oz. glasses and filled them in with measurements of 8 oz., 7 oz., 6 oz., 5 oz., 4 oz., 3 oz., 2 oz., and 1 oz.. Once the glasses were full, we began the color process. Everyone was able to mix their favorite color with a wooden skewer until we have a spectrum of eight colors.

#3 - 8 identical water glasses

Arrange the water glasses in a line and fill them up with varying amounts of water. Try to make the increments of water equal. For example, start with 1/8 cup of water in the first one, then fill each succeeding glass so that it has 1/8 cup of water more than the previous glass in line.

#4 - 3 identical large glass tumblers or mason jars for Mary Had a Little Lamb. Arrange the tumblers in a line and fill them up with the following amounts of water:

Tumbler 1: 1 3/4 cups

Tumbler 2: 1 1/2 cups

Tumbler 3: 1 1/4 cups

Label the tumblers 1, 2, and 3. Tap the glasses in the following order:

3-2-1-2-3-3-3; 2-2-2; 3-3-3; 3-2-1-2-3-3-3; 3-2-2-3-2-1

#5 - 3 identical large glass tumblers or mason jars for Mary Had a Little Lamb. Arrange the tumblers in a line and fill them up with the following amounts of water:

Fill the glasses in the following proportions by measuring cups:

14/8, 12/8, 10/8, 8/8, 6/8, 4/8. 2/8,

Musical Water Glasses

These melodious glasses are a fun way to integrate MUSIC, MATH, and SCIENCE.

Supplies:

You will need:

- 8 identical water glasses
- Water
- A set of measuring cups
- Red, yellow, and blue food coloring
- 1 plastic spoon
- 1 sheet of paper
- Tape
- A writing implement

1. Fill

- With your measuring cups, use the diagram below to fill each glass with the correct amount of water. From left to right, the glasses should have the following amounts:

  14/8 cups, 12/8 c, 10/8 c , 8/8 c, 6/8 c, 4/8 c, 2/8 c, 0/8 c

- For a twist, try substituting regular glasses with mason jars.
- Make some of your glasses turn red, yellow, and blue by adding one drop of food coloring to each. Create one or two green glasses by adding a drop of yellow and a drop of blue. Don't add any food coloring to the empty glass.

Math Challenge:

- Add all of the fractions together and then reduce the answer to its lowest terms.
- How much water was used to fill all 8 glasses?

2. Label

- Starting with the glass with the most water and working down to the glass with the least, label your jars from 1 to 8 using paper, tape, and a writing implement.
- Keep your glasses in the order of most to least water.

3. Play

- Using a plastic spoon, gently tap each glass and listen for the sound it makes.
- Which glasses produce a lower sound? A higher sound?
- **Why each glass makes a different sound:** When you tap one of the glasses, the spoon creates a sound wave that travels through the water inside. The pitch of the sound (high or low) depends on the rate of the sound wave's vibration. Lower-pitched sounds come from slower vibrations, while higher-pitched sounds come from faster vibrations. The more water a glass contains, the slower the sound of the wave's vibration.

The glass with the most water = SLOWEST sound wave vibrations = LOWEST PITCH

The glass with the least water = FASTEST sound wave vibrations = HIGHEST PITCH

- Once you've gotten comfortable tapping your glasses, try playing the songs below:

This Old Man (1st verse)

This old man, he played one,
5 3 5 5 3 5

He played knick-knack on my thumb
6 5 4 3 2 3 4

With a knick-knack pat-ty whack, give a dog a bone,
3 4 5 1 1 1 1 1 2 3 4 5

This old man came roll-ing home.
5 2 2 4 3 2 1

Happy Birthday

Hap-py birth-day to you
1 1 2 1 4 3

Hap-py birth-day to you
1 1 2 1 5 4

Hap-py birth-day dear (name)
1 1 8 6 4 3 2

Hap-py birth-day to you!
7 7 6 4 5 4

Musical Challenge:

- Create your own song!

CONNECTIONS ACADEMY

Basically the frequency of resonance is due to the Elasticity energy divided by the kinetic energy, when u add water or any liquid in the jar, the total mass of the system grows higher, and therefore the kinetic energy (0.5*m*v*v) (where m is the mass of the system, v the speed of the particles) grows higher, causing the frequency to go lower
And btw, air has nothing to do with it, if you put the same level of liquid (meaning the same « amount » of air left in the jar) but for example one is water and the other one is honey, u'll find a difference as well, it's the liquid inside the jar that makes adjusts the pitch not the air
https://www.youtube.com/watch?v=iFwtybB3R6Q

Alterations:
Have students add/pour water from a glass to see the effect of more or less water and draw a conclusion - more water, lower frequency
Also, blowing into bottles – the opposite effect. Now it's the air vibrating not the glass.