

Water Bottle Xylophone

Grade level: 4

Subject areas: Science and Music

Materials needed: Water; metal spoons; measuring cups and spoons; 5 clean, unlabeled glass bottles (3 12 oz. IBC Root Beer bottles and 2 8 oz. Coke bottles) per group; black markers; lab worksheets; towels

*For classrooms without sinks, provide students with bottles or pitchers of water and small basins or Tupperware to pour water over when measuring.

Standards:

Science:

- 4.2.2. Conduct simple investigations to answer questions based on observations
- 4.2.3. Use scientific tools (i.e., thermometers, rulers, balances) during simple investigations
- 4.3.6. Explain how the pitch of a sound is related to the rate of vibrations.

Music:

- 4.2.1 Perform independently on an instrument.
- 4.3.1 Improvise simple melodies, rhythmic and melodic variations, and accompaniments.
- 4.5.2 Know how to use a system to read simple pitch notation.

Objectives:

- TLW observe and analyze how water levels effect pitch of sound in glass bottles using the scientific method.
- TLW play a simple melody using pitch notation.

Learning activity:

1. Review the concepts of sound and how is created through vibration, as well as the differences between loud/soft (volume) and high/low (pitch).
2. Introduce the experiment:
 - a. Explain that they will be creating a 5-scale xylophone using glass bottles and water. During the experiment, they will be testing to see if and how water levels influence pitch.

- b. Separate students into groups of three or four. (Giving each student in the group a particular role, such as recorder, measurer, or player, may help the experiment move more quickly and smoothly).
 - c. Provide each group with the materials needed and hand each member a copy of the lab handout, though only one copy will be turned in to the teacher.
 - d. Review proper lab procedures before allowing students to begin.
3. Lab:
 - a. Students will then begin following the steps in the lab handout, answering questions and writing down observations.
 - b. Finished groups can practice the included music and/or improvise a melody.
4. As a group, review the experiment and discuss what the students discovered.
5. (Optional) Provide each group with a familiar children's song to have one or more of them perform in front of the class without providing the title to see if any of the other students can identify it.

Assessment:

- Teacher will observe students during discussion and throughout the experiment to check that all students are participating and that they understand the concepts and directions (formative).
- Teacher will use the group lab handout to again check student understanding of the experiment.

Reflection:

Name(s): _____

Date: _____

Water Bottle Xylophone Lab

Purpose: To determine if increasing or decreasing water in a glass bottle changes the pitch when gently tapping it with a metal spoon.

Research: *Volume vs. Pitch*

Sounds or sound waves are created by movement or vibration in the air. Sounds can be described by volume (loud/soft) and by pitch (high/low). Volume is the energy used in creating the sound while pitch is the speed of the vibration. A loud sound is created by lots of energy and a soft sound is created with little energy. A high pitch is created with fast vibrations and a low pitch is created with slow vibrations.

1. Can a sound be both high (pitch) and soft (volume)? If yes, give an example.

2. Can a sound be both low and loud? If yes, give an example.

Hypothesis: *Making Predictions*

3. What do you *predict* the pitch will be from tapping a spoon against a glass bottle filled with a lot of water?
4. What do you *predict* will happen to the pitch if only a little bit of water is added to an empty glass bottle?

Test:

Step One: With a permanent marker, write the number 1 on a BROWN glass bottle. Take your measuring cup and spoons, and measure 258mL (milliliters) of water, then pour into the bottle. Try to be as exact as possible. You may have to measure and pour small amounts into the bottle at a time. If so, make notes of the amount of water you pour each time so that you do not get confused.

5. Gently tap the side of your spoon against the side of the bottle, towards the bottom. Is the pitch high or low?
6. Does the pitch/sound change if you tap on the top or middle of the bottle? If yes, write down your observations.
7. Does the pitch/sound change if you use the full part of the spoon to gently tap the bottle?

Step Two: With a permanent marker, write the number 2 on a BROWN glass bottle. Measure 194mL of water and then pour into the bottle.

8. Use the side of your spoon to gently tap the side of bottle #2 towards the bottom. How does the pitch compare to the first bottle—is it higher or lower?

Step Three: With a permanent marker, write the number 3 on a BROWN glass bottle. Measure 153mL of water and then pour into the bottle.

9. Again, gently tap the side of your spoon against the side of bottle #3. How does bottle #3 compare in pitch to the first two?

10. From your observations so far, are you able to make any connections about the pitch and water level in the bottles?

Step Four: With a permanent marker, write the number 5 on a CLEAR glass bottle. Measure 150mL of water and then pour into the bottle.

11. Gently tap bottle #5 on the side, towards the bottom, with the side of your spoon. Is the pitch high or low?

12. Bottle #5 has almost the exact same amount of water (150mL) as bottle #3 (153mL). Is there a difference in the pitch? If yes, explain why that might be.

Step Five: With a permanent marker, write the number 6 on a CLEAR glass bottle. Measure 83mL of water and then pour into the bottle. Move all your bottles into a semi-circle ordered from #1-#6 and evenly spaced apart.

13. Gently tap the side of your spoon against the sides of bottles #1 and #6. Is there a difference in the pitch? If yes, how much?

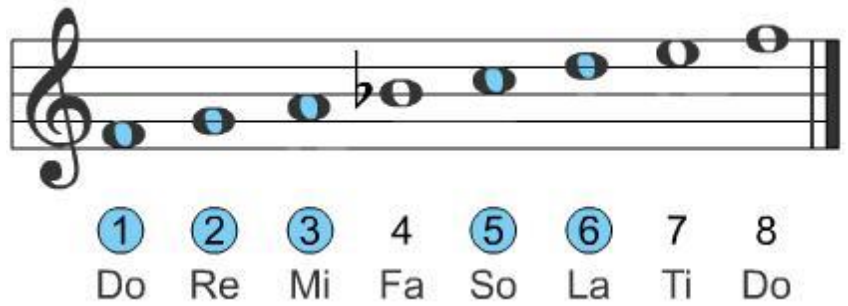
Data Analysis and Conclusion:

14. Based on your observations of pitch and water levels, are you able to make any conclusions?

15. Were your predictions in questions 3 and 4 correct? Why or why not?

Play:

Your group has now created a five scale Water Bottle Xylophone!
The numbers on the bottle match up with notes on a musical scale, as seen in the picture:



Name that Tune:

Experiment with playing any of these melodies by tapping the side of your spoon against the side of the bottom part of the bottle, matching the corresponding notes! See if you can guess which popular children's song it is the beginning of!

A 1 3 5 5 6 5 3 1 2 3 3 2 1 2

B 5 3 5 5 3 5 5 3 6 5 5 3

C 5 5 3 5 6 5 3 3 2 3 2

D 3 2 1 2 3 3 3 2 2 2 3

5 5 5 5 3 5 6 5 3 2 3 2 1

Can you make up any of your own?

