Let's Make Music Lab #19

Pre-Lab Discussion

We have learned in class that most musical instruments produce _____ waves. Some instruments use a string and some use a column of air to produces these waves.

Research Question

How will water in the bottom of a bottle change the pitch of the sound generated in the bottle by resonance?

Hypothesis

As more water is added to a bottle the length of the column of air in the bottle will become _____. The longer the column of air in the bottle, the _____ the pitch of the resonant sound produced should be. In the space below, define resonance.

_____

_____

Theory

For strings, the standing wave must have nodes _____. For woodwinds like our bottles, the water in the bottom will cause a(n) _____ and the open end of the bottle will require a(n) _____. In a standing wave, from one node to the next node measures _____ of a wavelength and from a node to the first antinode measures _____ of a wavelength.

Materials

bottles ruler water

Method

1. Measure the height of the bottles.
2. Leave one bottle, A, empty, fill one bottle, B, ¼ full, a third bottle, C, ½ full, and the last bottle, D, ¾ full.
3. Record the length of the column of air in each of the bottles in the Data section.
4. Blowing across the top of a bottle should produce a resonance frequency in the bottle. Before you test each bottle, write your prediction about what will happen to the pitch and wavelength each bottle will produce as the length of the air column is reduced. Be sure to explain your predictions. Blowing across the mouth of a bottle with a shorter air column will produce a sound with _____

   _____

   _____

   Dropping the bottle with a shorter air column will produce a sound with _____

   _____

   _____

5. Blow across the mouth of each bottle and record the pitch it produces in the Data section.
6. Drop each bottle and record the pitch it produces on your Data section.

Data Collection and Processing

1. Height of the air column for each bottle:

   Bottle A: _____ cm Bottle B: _____ cm

   Bottle C: _____ cm Bottle D: _____ cm

2. Pitch produced by blowing across the mouth of each bottle:

   Bottle A: _____ Bottle B: _____

   Bottle C: _____ Bottle D: _____

3. Pitch produced by dropping each bottle:

   Bottle A: _____ Bottle B: _____

   Bottle C: _____ Bottle D: _____

Conclusions

1. Describe how sound is produced in Step 5. Which bottle produced the highest pitch? Which bottle produced the lowest pitch?

   _____

   _____

2. What caused the change in pitch from bottle to bottle due to blown air?

   _____

   _____

3. Describe how sound is produced in Step 6. Which bottle produced the highest pitch? Which bottle produced the lowest pitch?

   _____

   _____

4. What caused the change in pitch from bottle to bottle due to dropping the bottle?

   _____

   _____

5. Why is the pitch the same whether you drop the bottle or blow across the bottle?

   _____

   _____

6. Explain the relationship between the length of the air column in a bottle and the pitch produced by the bottle.

   _____

   _____