

COWBELL CONCERTS

Teaching Guidelines

Subject: Mathematics

Topics: Algebra

Grades: 7-12

Concepts:

- Function

Knowledge and Skills:

- Can investigate and describe the relationships among variables in a real-world scenario.

Procedure:

This activity is best done in teams of two.

You will need access to a piano or keyboard (a toy keyboard will work well).

What is most important in this activity is that students identify the variables involved (the various dimensions of the cans and the frequencies of the ones produced), and then see that there is a relationship between those dimensions.

In investigating those relationships, it may be helpful to combine data from all students, and then look for patterns. For example, look at the data from all the cans with the same height and radius. How does the frequency vary with the ratio of long width to short width?

With more advanced students, you may wish to ask them to try to find the algebraic functions that represent the relationships they discover. With less advanced students, ask them to look for “increasing” and “decreasing” patterns. With all students, it is a good idea to ask them to make a prediction for a can size that they haven’t yet tried out, and test that prediction.

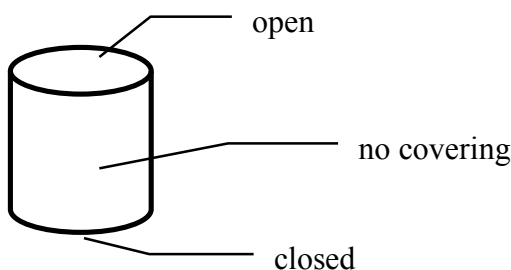
Cowbell Concerts

To: Research Team

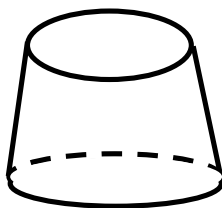
From: Research Director

As you know, it's an important part of our program to get young people interested in music, but it is often difficult to find instruments for them. I would like you to investigate the use of food cans for this purpose, as follows:

1. Gather a collection of food cans of various sizes. They should be empty and cleaned, with all paper removed, one end open and the other closed:



2. Choose one can and squeeze the open end on two sides so as to form an elliptical opening.

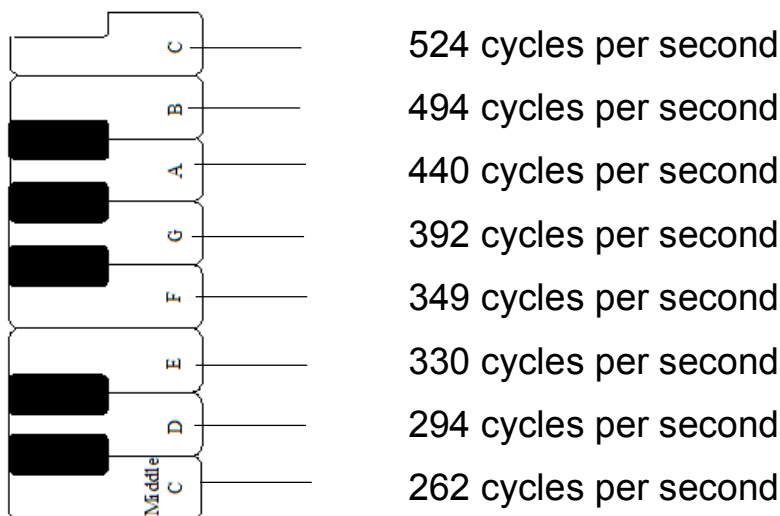


3. Holding the can lightly at the closed end, tap on the open end with a spoon or fork. You should hear a distinct tone, like the sound produced by a cowbell.
4. Bend the open end of the can so that it is slightly more closed. Tap again, and notice that the tone is a little lower.

5. Your task is to use 5 cans in this fashion to make five different tones, which match tones produced by keys on the piano. Then make measurements as needed to fill out this chart:

Can #	radius of closed end	height of can	ratio of height to radius	long width of open end	short width of open end	ratio of long width to short width	frequency of tone produced
1							
2							
3							
4							
5							

To determine the frequency, use the information provided in this diagram, plus the fact that when you go down an octave on a piano, you halve the frequency of the tone:



6. Study your data. What is the relationship, if any, between the measurements of the cans and the frequencies produced?