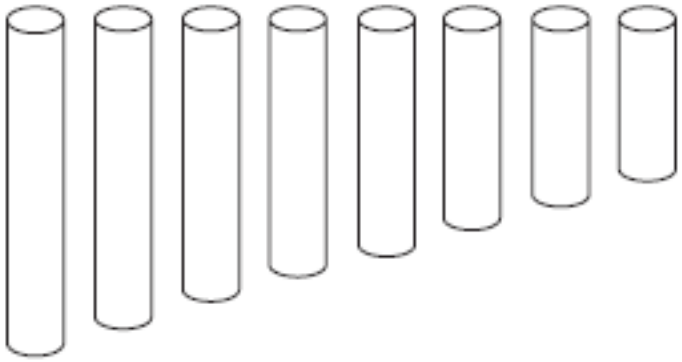
Sample Free Response Question

Experimental Design



1. You are given a set of chimes that consists of eight hollow metal tubes open at both ends, as shown above. The chimes are played by striking them with a small hammer to produce musical sounds. Your task is to use the chimes to determine the speed of sound in air at room temperature. You have available a set of tuning forks and other common laboratory equipment but are not allowed to use electronic equipment, such as a sound sensor. (A tuning fork vibrates when struck and produces sound at a particular frequency, which is printed on the tuning fork.)

   (a) Describe your experimental procedure in enough detail so that another student could perform your experiment. Include what measurements you will take and how you will take them.

   (b) Describe how you will use your measurements to determine the speed of sound, in enough detail that another student could duplicate your process.

   (c) Describe one assumption you made about the design of your experiment, and explain how it might affect the value obtained for the speed of sound.

   (d) A student doing a different experiment to determine the speed of sound in air obtained wavelength and period measurements and created the following plot of the data. Use the graph to calculate the speed of sound and include an explanation of your method.