AP PHYSICS 1: MECHANICSL WAVES AND SOUND WAVES

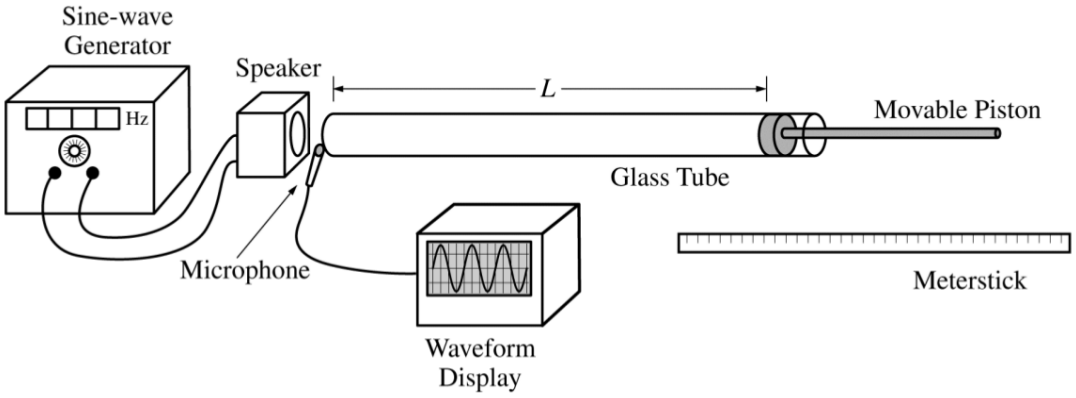
Directions: Each of the questions or incomplete statements below is followed by five suggested answers or completions. Select the one that is best in each case and place the letter of your choice in the corresponding box on the student answer sheet.

Note: To simplify calculations, you may use $g = 10\,\text{m/s}^2$ in all problems.

1. Two blocks of different sizes and masses float in a tray of water. Each block is half submerged, as shown in the figure. Water has a density of $1000\,\text{kg/m}^3$. What can be concluded about the densities of the two blocks?

AP PHYSICS 1: MECHANICAL WAVES AND SOUND WAVES
SECTION II
5 Questions

Directions: Answer all questions. The parts within a question may not have equal weight. All final numerical answers should include appropriate units. Credit depends on the quality of your solutions and explanations, so you should show your work. Credit also depends on demonstrating that you know which physical principles would be appropriate to apply in a particular situation. Therefore, you should clearly indicate which part of a question your work is for.



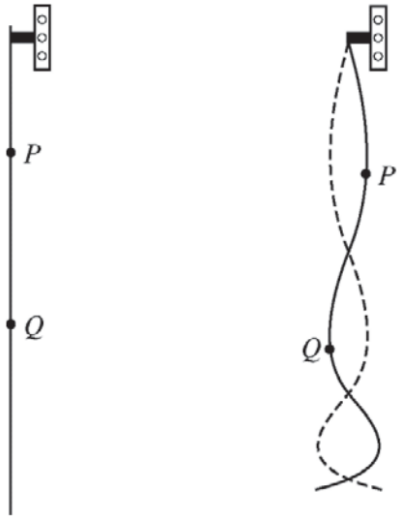
1. You are given the apparatus represented in the figure above. A glass tube is fitted with a movable piston that allows the indicated length L to be adjusted. A sine-wave generator with an adjustable frequency is connected to a speaker near the open end of the tube. The output of a microphone at the open end is connected to a waveform display. You are to use this apparatus to measure the speed of sound in air.

   (a) Describe a procedure using the apparatus that would allow you to determine the speed of sound in air. Clearly indicate what quantities you would measure and with what instrument each measurement would be made. Represent each measured quantity with a different symbol.

   (b) Using the symbols defined in part (a), indicate how your measurements can be used to determine an experimental value of the speed of sound.

   (c) A more accurate experimental value can be obtained by varying one of the measured quantities to obtain multiple sets of data. Indicate one quantity that can be varied, and describe how a graph of the resulting data could be used to determine the speed of sound. Clearly identify independent and dependent variables, and indicate how the slope of the graph relates to the speed of sound.

GO ON TO THE NEXT PAGE.



2. The figure above on the left shows a uniformly thick rope hanging vertically from an oscillator that is turned off. When the oscillator is on and set at a certain frequency, the rope forms the standing wave shown above on the right. P and Q are two points on the rope.

   (a) The tension at point P is greater than the tension at point Q. Briefly explain why.

   (b) A student hypothesizes that increasing the tension in a rope increases the speed at which waves travel along the rope. In a clear, coherent paragraph-length response that may also contain figures and/or equations, explain why the standing wave shown above supports the students hypothesis.