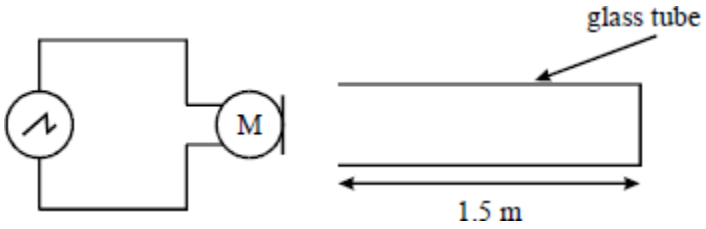
Name of the Student:_____
Max. Marks : 22 Marks **Time : 22 Minutes**

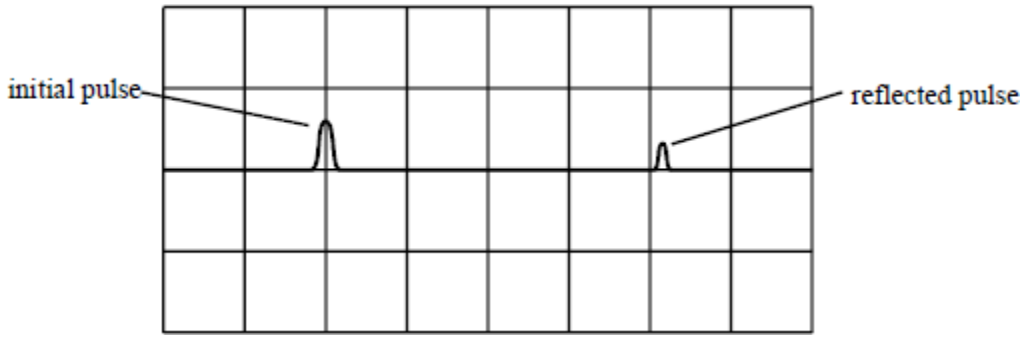
Q1.

(a) The diagram shows the apparatus required for a simple experiment to measure the speed of sound.



A pulse of sound is sent down a hollow glass tube and is reflected at the sealed end of the tube. A microphone, M, placed at the open end detects the initial pulse and, at a later time, the reflected pulse. The microphone is connected to an oscilloscope which gives a signal when the microphone detects a pulse of sound.

The signal displayed on the oscilloscope screen is shown below.



If the time base of the oscilloscope is set to 2.0 ms per division, estimate the speed of sound in air.

_____

_____

_____

_____

(3)

(b) Describe how the frequency of a sinusoidal alternating (ac) voltage source is measured using an oscilloscope.

Your answer should include a sketch of the trace seen on the oscilloscope screen and explain how the frequency is obtained from this trace.

Downloaded from www.merit-minds.com

_____

_____

_____

_____

_____

_____

_____

_____

_____

(5)

(Total 8 marks)

Q2.

(a) (i) Define the Young modulus for a material.

_____

_____

(ii) Explain what is meant by the *elastic limit* for a wire.

_____

_____

(2)

(b) A wire supported at its upper end, hangs vertically. The table shows readings obtained when stretching the wire by suspending masses from its lower end.

load / N	0	2.0	4.0	6.0	7.0	8.0	9.0	10.0	10.5
extension / mm	0	1.2	2.4	3.6	4.2	4.9	5.7	7.0	8.0

(i) Plot a graph of load against extension.

(One sheet of graph paper should be provided)

Downloaded from www.merit-minds.com

(ii) Indicate on your graph the region where Hooke's law is obeyed.

(iii) The unstretched length of the wire is 1.6 m and the area of cross-section 8.0×10^{-8} m^2. Calculate the value of the Young modulus of the material.

(8)

(c) (i) By considering the work done in stretching a wire, show that the energy stored is given by $\frac{1}{2}Fe$, where F is the force producing an extension e.

(ii) Calculate the energy stored in the wire in part (b) when the extension is 4.0 mm.

(4)

(Total 14 marks)

Downloaded from www.merit-minds.com