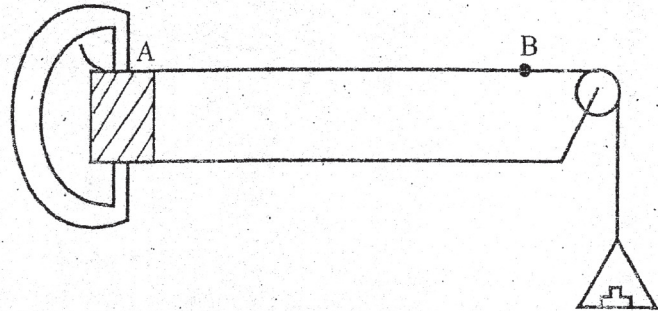


1993 A/L Structured Essay Question No (01)

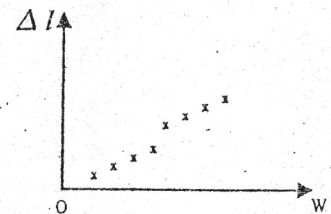
01. A uniform thin steel wire is fixed at A and passes over a smooth pulley as shown in the figure. Section AB of the wire is horizontal and about 1 m in length. The tension in the wire is adjusted by keeping weights on the scale pan.



- (a) In this experiment it is required to measure the extension Δl of the section AB of the wire due to a weight W placed on the scale pan. A fine mark is made at B on the wire for this purpose. State what would be the most suitable laboratory measuring instrument that could be used to obtain this measurement. *(one line)*
- (b) (i) To determine Young's modulus Y of the material of the wire what other additional measurements would you take? Give suitable measuring instruments.

Measurement	Instrument
1	α (say)
2:	β (say)

- (ii) Write down an expression for Y in terms of Δl , α , β and W . *(one line)*
- (c) A student measured extension Δl for increasing loads W and plotted Δl vs W . The points corresponding to his measurements are shown in the diagram.



- (i) What would have happened to the wire, for the last four points to displace with respect to the first four points? *(3 lines)*
- (ii) Draw on the diagram in (c) above, the best graph through the point's that would enable you to obtain the best possible value for Young's modulus Y of the material of the wire.
- (d) Suppose that you want to calculate the speed of sound in this steel wire.
- (i) In order to find this; state what property, of the material of the wire you would require in addition to the property you have already found. *(one line)*
- (ii) If you are provided with an additional piece of the same wire what measurements would you take in order to determine the above property? *(2 lines)*
- (e) Obtain an expression for the velocity of transverse waves in the wire in terms of Y , the density ρ of the material of the wire and the strain ϵ of the wire. *(one line)*