

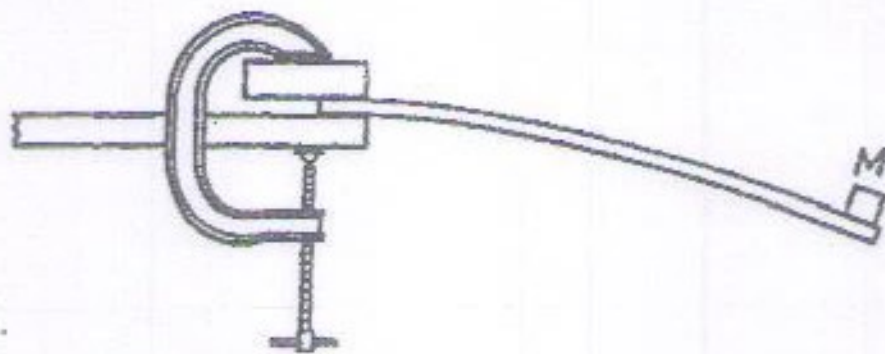
## Cantilever I (1)

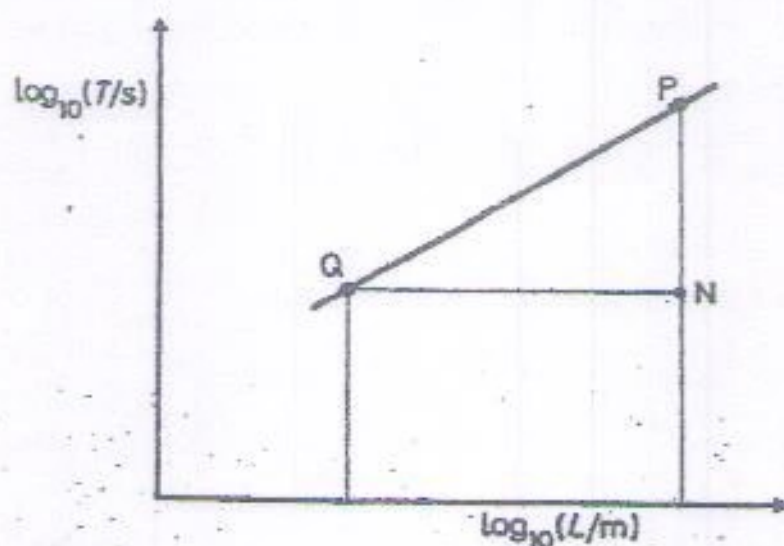
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**Apparatus:** boxwood meter G- scamp, stop-watch set of masses.

**purpose:** to investigate how the time of vibration varies with the length Vibrating and determination the Young modules  $E$ .

**Method:** fix a 100 g mass to the end of the meter scale firmly with sell tape and then securely clamp the other end to the edge of the bench so that the scale can vibrate as a cantilever of length, say 90cm . Record this length and with the stop watch take the time for 20 vibrations. take two further observations of this time reduce the length that is free vibrate to 50cm and repeat the timings continue to reduce the length vibrating until the vibrations are too rapid to count .





$$T \propto L^a$$

$$T = K L^a \quad (K = \text{constant})$$

$$\log T = \log K + a \log L$$

Where  $a$  = slope between  $\log T$  and  $\log L$  as shown in this fig. and you can choose the middle value from table to  $\log T$ ,  $\log L$  and then find  $K$ .

$$\log T = \log K + a \log L$$

### Discussion:

Q1- prove that  $(N/m^2)$  is the unit of Young modulus  $E$ ?

Q2- find the theoretical Young modulus  $E$  for wood?

Q3- Find the percentage error of  $E$ ?

Length vibrating L (L *0.01)m	t <sub>1</sub> (sec)	t <sub>2</sub> (sec)	t mean (sec)	T= t mean /20 ( sec)	Log T (sec)	log L (m)
90						
80						
70						
60						
50						

Theory shows that the full relationship between the period time T, the length vibrating L and the mass M attached to the free end is

$$T = 2\pi \sqrt{\frac{4ML^3}{\epsilon bd^3}}$$

$$\epsilon = (16\pi^2 M / bd^3) / (T^2 / L^3)$$

$$\epsilon \text{ in } (N/m^2)$$

Where (  $T^2 / L^3$  ) is the slope between  $T^2$  in y-axis and  $L^3$  in x-axis

b= width of cantilever

d= thickness of cantilever

Finally find K , a