Experiment to calculate Young Modulus

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① **SET-UP**

E = find
Copper wire
L = 0.85m   d = 2.5mm

Initial Pointer   8°   final   Scale
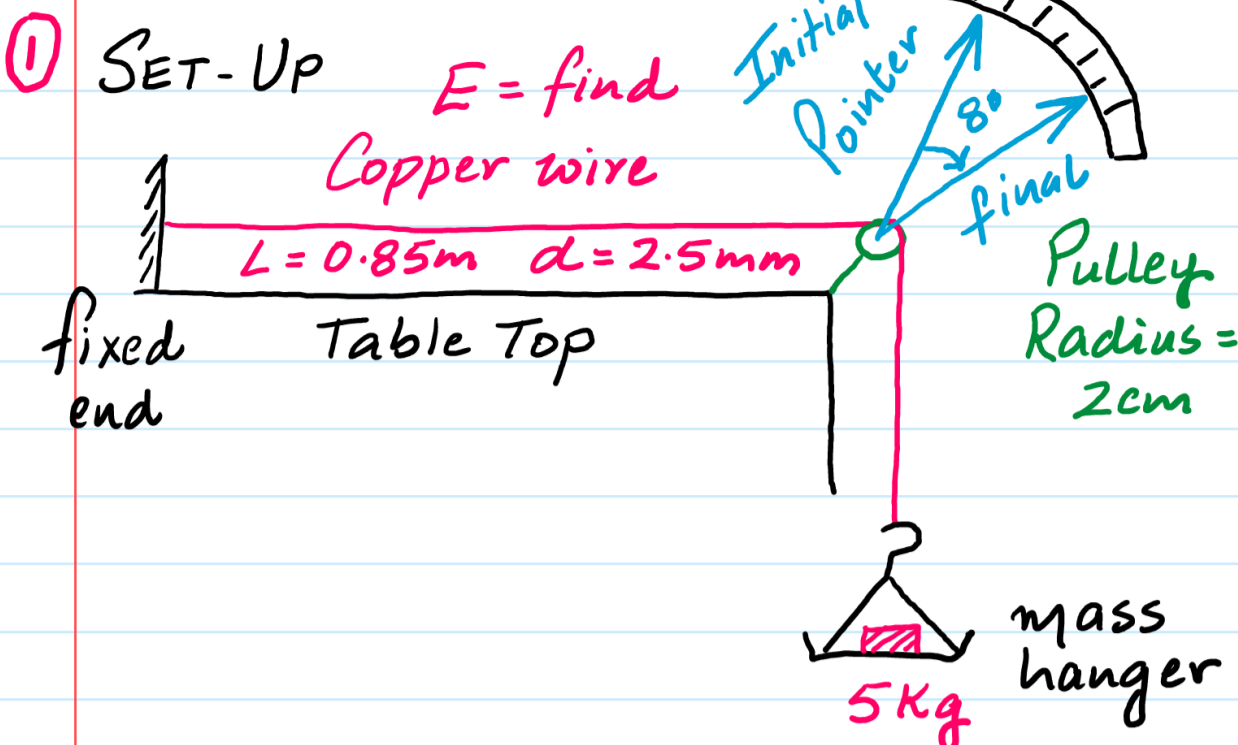
Pulley
Radius = 2cm

fixed end   Table Top

5Kg   mass hanger

As mass is placed in the mass hanger, the pointer deflects (due to extension of the wire) by 8° as shown above

② What measurements are to be taken

- L = 0.85m

- $A = \dfrac{\pi d^2}{4} = \dfrac{\pi (2.5 \times 10^{-3})^2}{4} = 4.9 \times 10^{-6} m^2$

- $F = W = mg = 5(9.81) = 49 N$

extension ??
if pulley rotates by 360° than
- ext = Circumference of pulley i.e $2\pi r$

$$360° \longrightarrow e = 2\pi(0.02) m$$
$$8° \longrightarrow e = ?$$

$$e = \dfrac{8}{360} \times 2\pi(0.02) \qquad \therefore e = \dfrac{\theta}{360} \times 2\pi r$$
$$e = 2.8 \times 10^{-3} m$$

③ What measuring instruments are to be used

L = meter Rule
A = micrometer to measure diameter
F = W = Newton meter / Spring Balance
e = Scale / protractor.

④ How to calculate Young's Modulus

$$E = \dfrac{F \cdot L}{A \cdot e} = \dfrac{(49)(0.85)}{(4.9 \times 10^{-6}) \times (2.8 \times 10^{-3})}$$

$$\boxed{E = 3.0 \times 10^{9} Pa}$$

⑤ **Precautions taken**

- Do preliminary trials to ensure that the weight attached does not cause the wire to reach its breaking point

- After loading the wire, the wire must be deloaded so that it can be checked that the pointer returns back to its original position (this is done to ensure that the elastic Limit has NOT BEEN EXCEEDED).

- The pulley must be oiled to minimize friction

- Ensure that the wire is taut (i.e it is free from any bends or kinks).