

MAGNETIC FIELDS QUIZ

1. A wire, whose linear mass density is 1.3 kg/m , carries a current of $1.0 \times 10^5 \text{ A}$. This wire lies parallel to, and on top of, another horizontal wire on a table. What current must flow through the bottom wire in order to repel and support the top wire at a height of $1.3 \times 10^{-3} \text{ m}$ above it? Include the direction of the current in the wires (in the same direction as in the top wire or in the opposite direction).

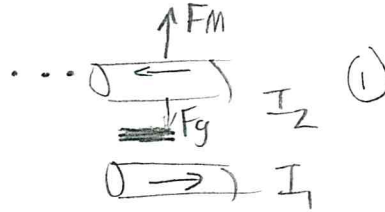
$$D = 1.3 \text{ kg/m}$$

$$I_2 = 1.0 \times 10^5 \text{ A}$$

$$I_1 = ?$$

$$d = 1.3 \times 10^{-3} \text{ m}$$

$$[] = ?$$



$$F_{\text{net}} = 0 \text{ N} \quad \textcircled{1}$$

$$F_e = F_g \quad \textcircled{1}$$

$$\textcircled{1} \quad \frac{\mu_0 I_1 I_2 L}{2\pi r} = mg \quad \textcircled{1}$$

$$I_1 = \frac{2\pi r mg}{\mu_0 I_2 L}$$

$$D = \frac{m}{L} \Rightarrow m = DL$$

$$I_1 = \frac{2\pi r D g}{\mu_0 I_2} \quad \textcircled{1}$$

$$I_1 = \frac{2\pi r D g}{\mu_0 I_2} = \frac{2\pi (1.3 \times 10^{-3} \text{ m})(1.3 \text{ kg/m})(9.8 \text{ N/kg})}{(4\pi \times 10^{-7} \text{ Tm/A})(1.0 \times 10^5 \text{ A})}$$

$$I_1 = 0.9291 \text{ A} \Rightarrow \approx 0.93 \text{ A} \quad \textcircled{1}$$