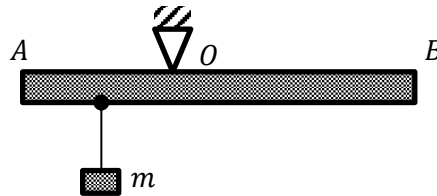


Answer on Question#79244 - Physics - Other

A uniform load AB of length 5cm is suspended at a 2cm from end A if the mass of the rod is 10kg, calculate the mass of the body which must be suspended at 1cm from end A so as the rod to balance horizontally.

Solution:



Let's denote the unknown mass as m . The torque of the body about point O is given by

$$\tau_b = m \cdot g \cdot 1 \text{ cm},$$

where $g = 9.81 \text{ m/s}^2$ – acceleration due to gravity.

The torque of the load AO about point O is (center of mass of the load is situated in the middle between points A and O , and its mass is equal to the fraction $2/5$ of the mass of load AB)

$$\tau_{AO} = \left(\frac{2}{5} 10 \text{ kg}\right) \cdot g \cdot 1 \text{ cm}$$

Similarly we get the expression for the torque of the load OB :

$$\tau_{OB} = \left(\frac{3}{5} 10 \text{ kg}\right) \cdot g \cdot 1.5 \text{ cm}$$

Since the system is balanced, the torques must satisfy the following condition

$$\tau_b + \tau_{AO} = \tau_{OB}$$

$$m \cdot g \cdot 1 \text{ cm} + \left(\frac{2}{5} 10 \text{ kg}\right) \cdot g \cdot 1 \text{ cm} = \left(\frac{3}{5} 10 \text{ kg}\right) \cdot g \cdot 1.5 \text{ cm}$$

$$m = 5 \text{ kg}$$

Answer: 5 kg.

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