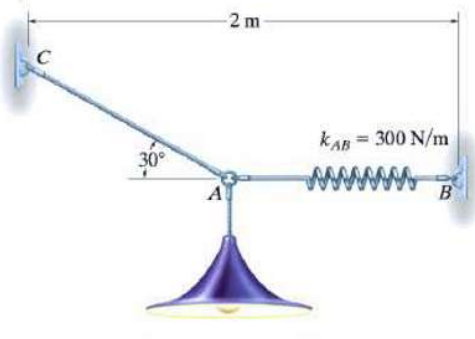


Problem Solutions of: Cable and cord analysis in Statics and Mechanics

Determine the required length of cord AC in fig. 3-8a so that the 8-kg lamp can be suspended in the position shown. The unstretched length of spring AB is $l_{AB} = 0.4$ m, and the spring has a stiffness of $k_{AB} = 300$ N/m.



Solution:

Determine the required length of cord AC in Fig. 3-8a so that the 8-kg lamp can be suspended in the position shown. The *unstretched* length of spring AB is $l_{AB} = 0.4$ m, and the spring has a stiffness of $k_{AB} = 300$ N/m.

$$\sum F_x = 0:$$

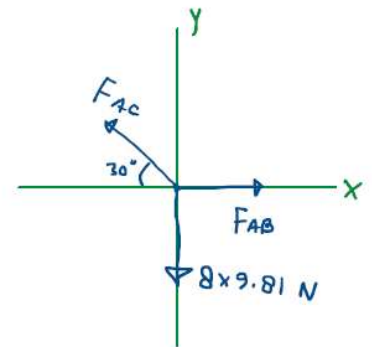
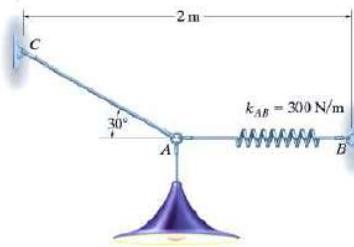
$$F_{AB} - F_{AC} \cos 30^\circ = 0$$

$$\Rightarrow F_{AB} = F_{AC} \cos 30^\circ \quad \text{--- ①}$$

$$\sum F_y = 0: F_{AC} \sin 30^\circ - 8 \times 9.81 = 0$$

$$F_{AC} = 156.96 \text{ N}$$

$$\text{From ①: } F_{AB} = 135.93 \text{ N}$$



$$L_{AC} \cos 30^\circ + L_{AB, \text{stretched}} = 2 \text{ m}$$

$$L_{AC} = \frac{2 - L_{AB, \text{stretched}}}{\cos 30^\circ} \quad \text{--- ②}$$

From ①: $f_{AB} = 135.93 \text{ N}$

$$L_{AC} = \frac{2 - L_{AB, \text{stretched}}}{\cos 30^\circ} \quad \text{--- ②}$$

$$L_{AB, \text{stretched}} = L_{AB, \text{unstretched}} + \Delta L_{AB}$$

\downarrow 0.4 m

$$f_{AB} = K_{AB} \cdot \Delta L_{AB}$$

$$\Delta L_{AB} = \frac{f_{AB}}{K_{AB}} = \frac{135.93 \text{ N}}{300 \text{ N/m}}$$

$$\Rightarrow \Delta L_{AB} = 0.4531 \text{ m}$$

$$L_{AB, \text{stretched}} = 0.4 \text{ m} + 0.4531 = 0.8531 \text{ m}$$

Put in ②:

$$\Rightarrow L_{AC} = 1.32 \text{ m}$$

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