Sign Problem

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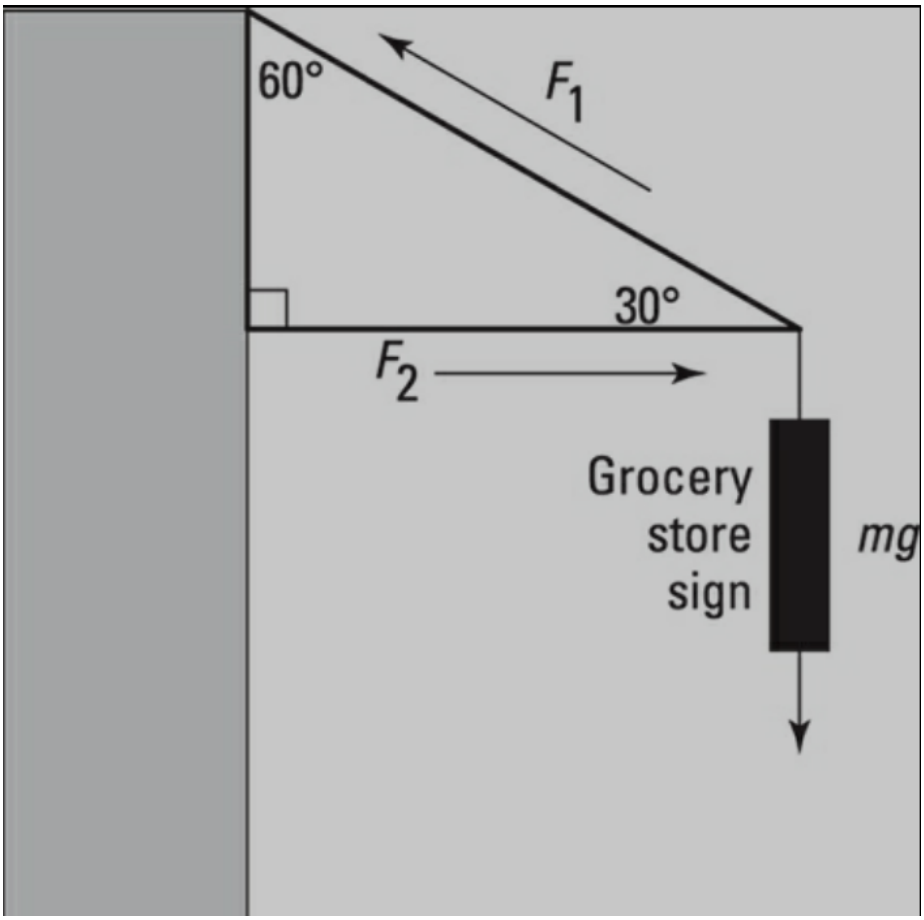
1 Problem

For example, take a look at Figure 5-9, where you've started your own grocery store and bought a wire rated at 15 newtons to hang the sign with. The sign weighs only 8.0 newtons, so hanging it should be no problem, right? Obviously, you can tell from my phrasing that you have a problem here. Coolly, you get out your calculator to figure out what force the wire, F1 in the diagram, has to exert on the sign to support it.



Holzner, Steven. Physics I For Dummies (For Dummies (Math & Science)) (p. 97). Wiley. Kindle Edition.

2 Solution

$$F_1 = 15N$$

$$F_s = 8N$$

$$a = 0$$

$$F_{sign-y} = 15\cos(60)$$

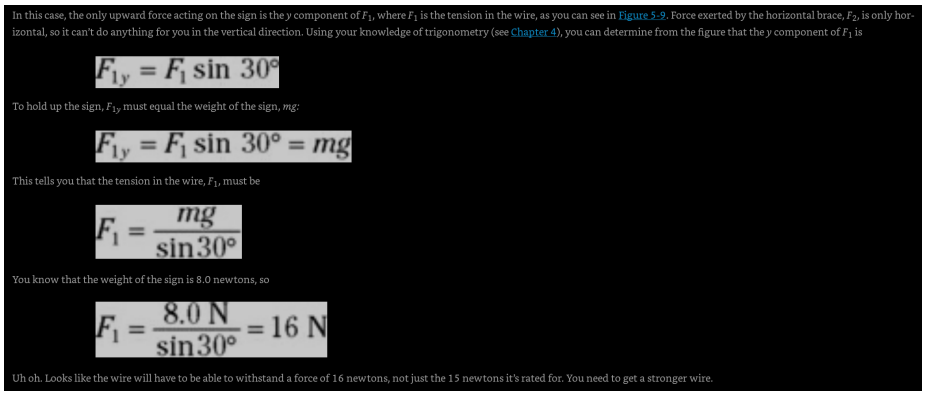
$$F_{sign-y} = 7.5$$

El letrero require 8N de fuerza para sostenerse. El alambre solo puede apoyar 7.5N de fuerza en la eje y lo que es insuficiente.

The sign requires 8N of force to support itself. The wire can only support 7.5N in the y axis, which is insufficient for the 8N required by the wire.

3 Question

The book used the following explanation. Mine seems logical, but is it mathematically correct?



In this case, the only upward force acting on the sign is the y component of F_1, where F_1 is the tension in the wire, as you can see in Figure 5-9. Force exerted by the horizontal brace, F_2, is only horizontal, so it can't do anything for you in the vertical direction. Using your knowledge of trigonometry (see Chapter 4), you can determine from the figure that the y component of F_1 is

$$F_{1y} = F_1 \sin 30°$$

To hold up the sign, F_{1y} must equal the weight of the sign, mg:

$$F_{1y} = F_1 \sin 30° = mg$$

This tells you that the tension in the wire, F_1, must be

$$F_1 = \frac{mg}{\sin 30°}$$

You know that the weight of the sign is 8.0 newtons, so

$$F_1 = \frac{8.0\ \text{N}}{\sin 30°} = 16\ \text{N}$$

Uh oh. Looks like the wire will have to be able to withstand a force of 16 newtons, not just the 15 newtons it's rated for. You need to get a stronger wire.