

48. (a) Hooke's law and the work done by a spring is discussed in the chapter. Taking absolute values, and writing that law in terms of differences  $\Delta F$  and  $\Delta x$ , we analyze the first two pictures as follows:

$$\begin{aligned} |\Delta F| &= k |\Delta x| \\ 240 \text{ N} - 110 \text{ N} &= k(60 \text{ mm} - 40 \text{ mm}) \end{aligned}$$

which yields  $k = 6.5 \text{ N/mm}$ . Designating the relaxed position (as read by that scale) as  $x_o$  we look again at the first picture:

$$110 \text{ N} = k(40 \text{ mm} - x_o)$$

which (upon using the above result for  $k$ ) yields  $x_o = 23 \text{ mm}$ .

- (b) Using the results from part (a) to analyze that last picture, we find

$$W = k(30 \text{ mm} - x_o) = 45 \text{ N} \cdot \text{m}$$