

9.47 Stretching a certain spring 0.10 m from its relaxed length requires 18 J of work. How much more work does it take to stretch this spring an additional 0.10 m?

$$W = \Delta E = \Delta U_s = \frac{1}{2} k \Delta x^2$$

$$\Rightarrow k = \frac{2W}{\Delta x^2} = \frac{2(18\text{ J})}{(0.1\text{ m})^2} = 3600\text{ N/m}$$

To stretch 0.2 m,

$$W = \frac{1}{2} (3600\text{ N/m}) (0.2\text{ m})^2$$
$$= 72\text{ J}$$

Requires an additional,

$$72\text{ J} - 18\text{ J} = 54\text{ J}$$