-s III
work

Ch 7-36

$\vec{F} = -kx - cx^3$, $c = 3.6\ kN/m^3$, $k = 220\ N/m$

$$W = -\int_{x_0}^{x_1} kx + cx^3 = -\left(\tfrac{1}{2}kx^2 + \tfrac{1}{4}cx^4\right)\Big|_{x_0}^{x_1}$$

$$\Delta U = -W = \left(\tfrac{1}{2}kx^2 + \tfrac{1}{4}cx^4\right)\Big|_{x_0}^{x_1}$$

let: $x_0 = x_{eq} = 0$

then: $\Delta U = \left(\tfrac{1}{2}kx^2 + \tfrac{1}{4}cx^4\right)\Big|_{0}^{x} = \tfrac{1}{2}kx^2 + \tfrac{1}{4}cx^4$

$x = 15\,cm = 15\times10^{-2}\,m$

$\Delta U = \tfrac{1}{2}(220)(15\times10^{-2})^2 + \tfrac{1}{2}(3.6\times10^{3})(15\times10^{-2})^4$

$\Delta U = 3.4\,J$