59 $W = \Delta E = E_{p2} - E_{p1} = \frac{1}{2}kx_2^2 - \frac{1}{2}kx_1^2$

$= \frac{1}{2}k\left(x_2^2 - x_1^2\right) = \frac{1}{2}\,200\,N\,m^{-1}\left((0.050\,m)^2 - (0.030\,m)^2\right)$

$= 0.16\,J$

60 a i) $E_k \rightarrow E_p$

$\frac{1}{2}mv^2 = mgh$

$\frac{v^2}{2} = gh$

$v = \sqrt{2gh} = \sqrt{2 \cdot 9.82\,m\,s^{-2} \cdot 4\,m}$

$\approx 8.9\,m\,s^{-1}$

ii) $E_p \rightarrow E_k$

$mgh = \frac{1}{2}mv^2$

$v = \sqrt{2gh} = \sqrt{2 \cdot 9.82\,m\,s^{-2} \cdot 2\,m}$

$\approx 6.3\,m\,s^{-1}$

b) initial velocity: $12\,m\,s^{-1}$

$E_k \rightarrow E_p + E_k$

$\frac{1}{2}mv_1^2 = mgh + \frac{1}{2}mv_2^2 \quad | \cdot 2$

$v_1^2 = 2gh + v_2^2$

$v_2 = \sqrt{v_1^2 - 2gh}$

v_2 at A: $v_2 = \sqrt{(12\,m\,s^{-1})^2 - 2 \cdot 9.82\,m\,s^{-2} \cdot 4\,m}$

$\approx 8.1\,m\,s^{-1}$

v_2 at B: $v_2 = \sqrt{(12\,m\,s^{-1})^2 - 2 \cdot 9.82\,m\,s^{-2} \cdot 2\,m}$

$\approx 10\,m\,s^{-1}$

66 a) $P = \frac{\Delta E}{t} = \frac{mgh}{t} = \frac{50\,kg \cdot 9.82\,m\,s^{-2} \cdot 15\,m}{125\,s}$

$\approx \frac{7350\,J}{125\,s} \approx 59\,W$

b) $\eta = \frac{\text{useful}}{\text{total}} = \frac{59\,W}{80\,W} \approx 0.74 = 74\,\%$

c) twice as long!