1(a) \((2000 \text{ cal/d}) (4.2 \times 10^3 \text{ J/cal}) \times \frac{1 \text{ day}}{86,400} = 97 \text{ W}\)

(b) I took 2.5 s to go up stairs 7 height 1.7 m.

\[
\text{Power} = \frac{\text{energy}}{\text{time}} = \frac{mgh}{t} = \frac{(80 \text{ kg})(9.8 \text{ N/kg})(1.7 \text{ m})}{2.5 \text{ s}} = 533 \text{ W}
\]

or about 0.7 hp.

(c) For Mt. Everest \(\Delta U = mgh = (80 \text{ kg})(9.8 \text{ N/kg})(8848 \text{ m}) = 6.9 \times 10^6 \text{ J}\)

at 2000 cal/d = \(8.4 \times 10^6 \text{ J/day}\), it takes

\[
\frac{6.9 \times 10^6 \text{ J}}{8.4 \times 10^6 \text{ J/day}} = 0.8 \text{ d}
\]

2 Energy per unit time \(\frac{45 \text{ kwh}}{3 \text{ h}} = 15 \text{ kw} = 1.5 \times 10^4 \text{ J/s}\)

The original \(\Delta T\) was 20\(^\circ\). At 25\(^\circ\) the heat loss should be

\[
\left(\frac{25}{20}\right) (1.5 \times 10^4 \text{ J/s}) = \left(\frac{25}{20}\right) (45 \text{ kwh}) = 57 \text{ kwh}
\]

3

\[
\begin{align*}
\text{Net}_x &= F_s \cos \theta - F_f = m \frac{dv}{dt} \\
\text{Net}_y &= N + F_s \sin \theta - mg = 0 \\
N &= mg - F_s \sin \theta \\
F_f &= \mu N = \mu (mg - F_s \sin \theta)
\end{align*}
\]

\[
\Delta v = \frac{t}{m} \left[ F_s \cos \theta - F_f \right] = \frac{t}{m} \left[ F_s \cos \theta - \mu (mg - F_s \sin \theta) \right]
\]

\[
U = U_0 + \frac{t}{m} \left[ k_s \sin \theta - \mu (mg - k_s \sin \theta) \right]
\]
(a) At the bottom of the incline:
\[ E_i = U_i + K_i = 0 + \frac{1}{2} mv_i^2 = 91.9\, J \]

At the highest point:
\[ E_f = U_f + K_f = mgh + 0 = mg\, d\, \sin\theta \]

\[ E_i = E_f \Rightarrow d = \frac{E_i}{mg\, \sin\theta} = 1.25\, m \]

(b) At the new highest point:
\[ E_f = U_f + K_f = mgh' + 0 = mg\, d'\, \sin\theta = 69.8\, J \]

\[ W_{net} = E_f - E_i = 69.8\, J - 91.9\, J = -22.1\, J \]

(c) Let \( E_i \) be the energy at the highest point = 69.8 J

\[ E_f \text{ at bottom} = U_f + K_f = 0 + \frac{1}{2} mv_f^2 \]

\[ W_{net} = E_f - E_i \Rightarrow E_f = W + E_i = 69.8\, J - 22.1\, J = 47.7\, J \]

\[ v_f = \sqrt{\frac{2(47.7\, J)}{15\, k_i}} = 2.5\, m/s \]