37. Mass $m$ of water must be raised from an initial temperature $T_i = 59°\text{F} = 15°\text{C}$ to a final temperature $T_f = 100°\text{C}$. If $c$ is the specific heat of water then the energy required is $Q = cm(T_f - T_i)$. Each shake supplies energy $mgh$, where $h$ is the distance moved during the downward stroke of the shake. If $N$ is the total number of shakes then $Nmgh = Q$. If $t$ is the time taken to raise the water to its boiling point then $(N/t)mgh = Q/t$. We note that $N/t$ is the rate $R$ of shaking (30 shakes/min). This leads to $Rmgh = Q/t$. The distance $h$ is $1.0\,\text{ft} = 0.3048\,\text{m}$. Consequently,

$$\begin{aligned} t &= \frac{Q}{Rmgh} = \frac{cm(T_f - T_i)}{Rmgh} = \frac{c(T_f - T_i)}{Rgh} \\ &= \frac{(4190\,\text{J/kg}\cdot\text{K})(100°\text{C} - 15°\text{C})}{(30\,\text{shakes/min})(9.8\,\text{m/s}^2)(0.3048\,\text{m})} \\ &= 3.97 \times 10^3\,\text{min} = 2.8\ \text{days}\ . \end{aligned}$$