Chapter 6   Problem 72 [†]

Given

$x = 0.50 \; m$

$m = 45 \; kg$

$E = 230 \; kcal$

Solution

Are five reps in lifting a weigh enough to burn off the calories from a candy bar?

The work done lifting the barbell is

$$W = F \cdot x$$

The force exerted by the person is equal and opposite of the force of gravity, which is parameterized as $F = mg$. Therefore, the work done lifting the barbell once is

$$W = mgx = (45 \; kg)(9.8 \; m/s^2)(0.50 \; m) = 220 J$$

Lifting the barbell five times consumes $5(220 \; J) = 1100 \; J$ of energy. The energy of the candy bar is $230 \; kcal$. Converting this to joules gives us

$$E = 230 \; kcal \left(\frac{4184 \; J}{1.00 \; kcal} \right) = 962,000 \; J$$

Therefore, the work done lifting the barbell is

$$\frac{1100 \; J}{962,000 \; J} = 0.00114 = 0.114\%$$

of the energy from the candy bar. If the person's body is 100 % efficient at converting energy into work, she would need to do 874 times as much work.