Chapter 6   Problem 78 [†]

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.

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[†]Problem from Essential University Physics, Wolfson