Answer on Question#40533 – Physics – Mechanics

A person having mass 60 kg lifts a load of 20 kg and climbs up 20 steps of a ladder in 10 s. If the height of each step is 0.2m. Find the power of the person.

Solution:
Power is the rate at which work is done. It is the work/time ratio.

$$\mathrm{P} = \frac{\mathrm{W}}{\mathrm{t}} \qquad (1)$$

Work done by person:

$$\mathrm{W} = \mathrm{F} \cdot \mathrm{S} \qquad (2)$$

Person acts on the mass and raises itself:

$$\mathrm{F} = \mathrm{Mg} + \mathrm{mg} = (\mathrm{M} + \mathrm{m})\mathrm{g} \qquad (3)$$

Traversed distance:

$$\mathrm{S} = \mathrm{N} \cdot \mathrm{h} \quad (4)$$

$(4)\mathrm{in}(3)$:

$$\mathrm{W} = (\mathrm{M} + \mathrm{m})\mathrm{g} \cdot \mathrm{Nh} \quad (5)$$

$(5)\mathrm{in}(1)$:

$$\mathrm{P} = \frac{(\mathrm{M} + \mathrm{m})\mathrm{g} \cdot \mathrm{Nh}}{\mathrm{t}} = \frac{(20\mathrm{kg} + 60\mathrm{kg}) \cdot 9.8\frac{\mathrm{N}}{\mathrm{kg}} \cdot 20 \cdot 0.2\mathrm{m}}{10\mathrm{s}} = 314\ \mathrm{Watts}$$

Answer: power of the person is equal to 314 Watts.