Question#18438

A pulley system with 76% efficiency is set up to lift a 18kg bag of nails. The bag is lifted to a height of 2.1m by a person pulling on the rope with a force of 58.0N.

3) What is the actual mechanical advantage of this pulley system?

4) What is the ideal mechanical advantage of this pulley system?

5) What is the distance the rope must be pulled in order to lift the bag of nails?

Solution:

Let:

$m_1 = 18 \, kg$

$H = 2.1 \, m$

$F_2 = 58 \, N$

$n = 76\% = 0.76$

$MA(ideal) - ?$

$MA(actual) - ?$

$S - ? \, distance \, of \, the \, rope$

$$MA(ideal) = \frac{F_1}{F_2} = \frac{mg}{F_2} = \frac{18*9.8}{58} = 3.04$$

$$MA(actual) = n * MA(ideal) = 0.76 * 3.04 = 2.31$$

Such as $MA(ideal) = \frac{F_1}{F_2} = \frac{S}{H}$

$$S = MA(ideal) * H = 3.04 * 2.1 = 6.384 \, m$$

Answer: $MA(ideal) = 3.04, \; MA(actual) = 2.31, \; S = 6.384 \, m$