Answer on Question # 76349, Physics / Mechanics | Relativity

Question. A box of mass $0.8\ kg$ slide at speed of $10\ m/s$ across a smooth level floor before it encounter a rough patch of length $3.0\ m$ The friction force on the box due to this part of the floor is $70\ N$. What is the speed of box when it leave this rough surface? What length of the rough surface would being the box completly to rest?

Given.

$m = 0.8\ kg; v = 10\ m/s; F = 70\ N; l = 3\ m.$

Find. $u, s-?$

Solution.

The kinetic energy of the box is

$$E = \frac{mv^2}{2} = \frac{0.8 \cdot 10^2}{2} = 40\ J$$

The work done by friction is

$$A = Fl = 70 \cdot 3 = 210\ J$$

So, in this case, the box will not overcome 3 meters of the path and stop faster.

The box will stop at the point

$$E = Fs \ \rightarrow \ s = \frac{E}{F} = \frac{40}{70} = 0.57\ m$$

Similar results can be obtained as follows

$$a = \frac{F}{m} = \frac{70}{0.8} = 87.5\ m/s^2$$

$$u = v - at \ \rightarrow \ t = \frac{(v-u)}{a} = \frac{10-0}{87.5} = 0.11\ s$$

Finally

$$s = vt - \frac{at^2}{2} = 10 \cdot 0.11 - \frac{87.5 \cdot 0.11^2}{2} = 0.57\ m$$

Answer. The box will not overcome 3 meters of the path and stop faster; $s = 0.57\ m$.