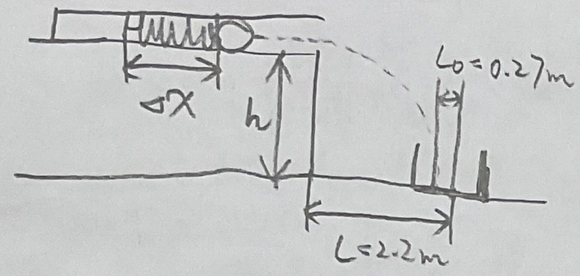
Sky Lu (lu.2845)

(9)



Suppose $L=2.2m$, $L_0=27cm=0.27m$

the coefficient of spring is k,

$\Delta x=1.1cm$

$L'=L-L_0=2.2-0.27m=1.93m$

$$\begin{cases}\Delta U=\frac{1}{2}k\Delta x^2\\ \Delta K=\frac{1}{2}mv_x^2 \Rightarrow v_x=\sqrt{\frac{k}{m}}\cdot\Delta x\\ \Delta U=\Delta K\end{cases}$$

$h=\frac{1}{2}gt^2 \Rightarrow t=\sqrt{\frac{2h}{g}}$

$L'=v_x t=\frac{\sqrt{2hk}}{\sqrt{mg}}\Delta x$

Similiarly, the correct speed

$v_x'=\sqrt{\frac{k}{m}}\Delta x'$, where $\Delta x'$ is the correct length of the spring being compressed.

$L=v_x' t=\frac{\sqrt{2hk}}{\sqrt{mg}}\cdot\Delta x'$

$\Rightarrow \frac{L'}{L}=\frac{\Delta x}{\Delta x'}$

$\Delta x'=\frac{L}{L'}\cdot\Delta x$

$=\frac{2.2m}{1.93m}\cdot 1.1cm$

$=1.25389cm$

(12) $\gamma=\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}=\frac{10}{9}\sqrt{91}=1.048285$

(a) $L=\frac{L_p}{\gamma}=\frac{27}{25}\sqrt{91}=10.3025$ light-year

(b) $L=10.8$ light-year

(c) $u=\frac{u+v}{1+\frac{vu}{c}}=0.826446628c$

$=2.4793\times10^8 m/s$