Bounce frequency $f_B = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$ (1) correct f_B

(this is the vertical SHM)

pendulum frequency (small amplitude)

$f_P = \frac{1}{2\pi}\sqrt{\frac{g}{L}}$ (1) correct f_P

The equilibrium length L of the spring is when the object hangs at rest on the end of the spring, given when

$$f_P = \frac{1}{2} f_B$$

$$\Rightarrow \frac{1}{2\pi}\sqrt{\frac{g}{L}} = \frac{1}{2}\left(\frac{1}{2\pi}\sqrt{\frac{k}{m}}\right)$$

$$\Rightarrow L = \frac{4mg}{k}$$ (1)

(1) correct relation

given that $mg = 1.00$ N, (1)

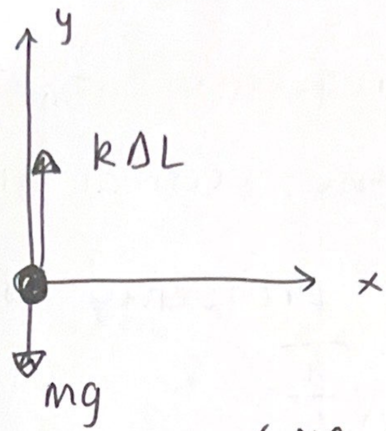
$$L = \frac{4 \cdot 1.00}{1.48} \approx 2.70 \text{ m}$$ (1)

correct stretched length.

which is the ~~=m~~ / stretched length.

for the unstretched length, consider the free-body diagram

$(a_y = 0)$



① correct free-body diagram OR explicit consideration of forces

(mg perpendicular to spring is small)

$$\Rightarrow \quad \Sigma F_y = m a_y$$

$$\Rightarrow \quad k\Delta L - mg = 0$$

$$\Rightarrow \quad \Delta L = \frac{mg}{k} = \frac{1.00}{1.48} \approx 0.68\,m$$

① correct weight – extension relation

So the unstretched length is

$$L - \Delta L = 2.70 - 0.68 = 2.02\,m$$

① correct $L - \Delta L$.

9 marks – solution

1 mark – presentation + explanations.