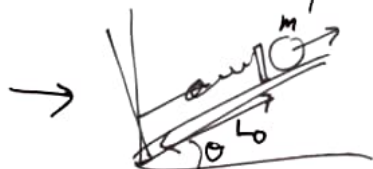


Q3

"initial"



"final"



the ball contains the spring energy, U_s
 the potential energy, U_g
 the kinetic energy, K

Using the energy principle, we can say,

$$(final) \quad \overset{\text{"no compression"}}{\cancel{U_{s,f}}} + U_{g,f} + K_f = U_{s,i} + U_{g,i} + \overset{\text{"at rest"}}{\cancel{K_i}} \quad (initial)$$

That is,

$$mg(L \sin \theta) + K = \frac{1}{2} k (L - L_0)^2 + mg(L \sin \theta)$$

Thus,

$$\frac{1}{2} m v^2 = \frac{1}{2} k (L - L_0)^2 + mg(L - L_0) \sin \theta$$

$$m v^2 = k (L - L_0)^2 + 2mg \sin \theta (L - L_0)$$

$$v^2 = \frac{k}{m} (L - L_0)^2 + 2g \sin \theta (L - L_0)$$

$$\therefore v = \sqrt{\frac{k}{m} (L - L_0)^2 + 2g \sin \theta (L - L_0)}$$

"absolute value"
 to prevent
 misunderstanding