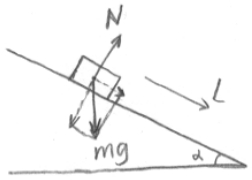
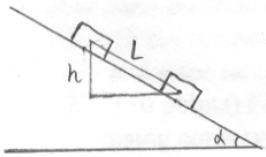
Quiz #4 Solutions

1. 

$m\ddot{L} = mg\sin\alpha \Rightarrow$ block will move downward.

2. 

$$\frac{1}{2}mv^2 - 0 = mgh - \frac{1}{2}kL^2 \qquad (*)$$

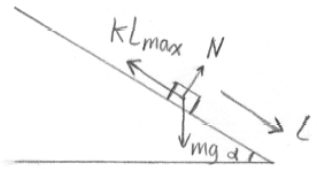
$$\Rightarrow v = \sqrt{2gL\sin\alpha - \frac{kL^2}{m}} \qquad (h = L\sin\alpha)$$

3. differentiate $(*)$ with L: $mv\frac{dv}{dt} = mg\sin\alpha - kL_c$

At v_{max}: $\frac{dv}{dt} = 0 \Rightarrow L_c = \frac{mg\sin\alpha}{k}$, $v_{max} = \sqrt{2gL_c\sin\alpha - \frac{kL_c^2}{m}} = g\sin\alpha\sqrt{\frac{m}{k}}$

At equilibrium: $mg\sin\alpha - kL_{eq} = 0 \Rightarrow L_{eq} = \frac{mg\sin\alpha}{k} = L_c$

4. $v = 0 \Rightarrow mgL_{max}\sin\alpha - \frac{1}{2}kL_{max}^2 = 0 \Rightarrow L_{max} = \frac{2mg\sin\alpha}{k}$ $(= 2L_{eq})$

5. 

$$m\ddot{L} = mg\sin\alpha - kL_{max}$$
$$= mg\sin\alpha - 2mg\sin\alpha$$
$$= -mg\sin\alpha < 0$$

So the block will move upward