

$$E = \frac{1}{2}mv^2 + mgh$$

$$h = L(1 - \cos\theta) + d$$

$$\begin{aligned} U_{\max} &= mg(L(1 - \cos(\frac{\pi}{2})) + d) \\ &= mg(L + d) \\ &= E \end{aligned}$$

$$\begin{aligned} mg(L + d) &= \frac{1}{2}mv^2 + mgh \\ g(L + d) &= \frac{1}{2}v^2 + gh \end{aligned}$$

$$\begin{aligned} v^2 &= 2g(L + d) - 2gh \\ &= 2gL + 2gd - 2gh \\ &= 2g(L + d - h) \\ &= 2g(L + d - L + L\cos\theta - d) \\ &= 2g(L\cos\theta) \end{aligned}$$

$$v = \sqrt{2gL\cos\theta}$$