Problem Set 6: **Energy**

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1 Simple Harmonic Motion

For a spring of length L with a small mass m attached at the end, identify

(a) the force $\mathbf{F}_{\text{pend.}}$
(b) the potential energy $V(x)$
(c) Under what conditions is $V(x)$ valid? What assumptions were made in its derivation?
(d) the maximum velocity of the mass in terms of the max displacement from equilibrium of the spring

2 Classical Pendulum

A pendulum system is shown in Fig. 1. As shown, a peg is a height $h = L/3$ above the pendulum's lowest point. From what minimum angle ϕ must the pendulum be released in order for the ball to go over the top of the peg without the string going slack?

(a) Make a guess as to what variables the answer should depend upon.
(b) Write down the potential energy of the pendulum as a function of height.
(c) Now, write down potential energy as a function of θ.
(d) Explain qualitatively the necessary conditions for the ball to wrap around the peg without the string going slack.

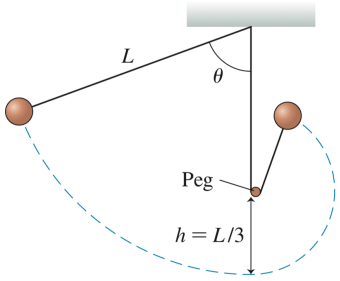

Figure 1: Pendulum is formed from a small ball of mass m on a string of length L.