PHY151H1F – Practice Problem Set 7

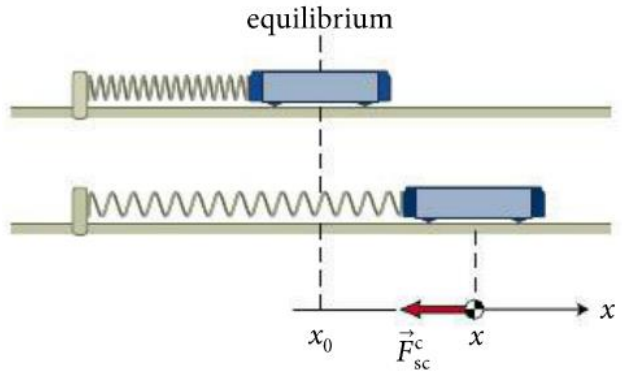
Ch. 7, Q. 59

You drop a rubber ball from a height of 3.0 m. It bounces off a concrete surface to a height of 2.7 m. (*a*) What is the coefficient of restitution for this collision? (*b*) You want to get the ball to bounce upward to a height of 7.3 m. From the same starting point, how fast must you throw the ball, and in which direction? ●●

Ch. 7, Q. 65

You drop a ball from rest from a window 12 m above the ground, and just before it hits the ground its speed is recorded to be 14.6 m/s. What percentage of the ball's kinetic energy is dissipated due to air resistance? ●

Question not from Mazur:



A cart on a horizontal track is attached to a spring. The other end of the spring is attached to a fixed post.

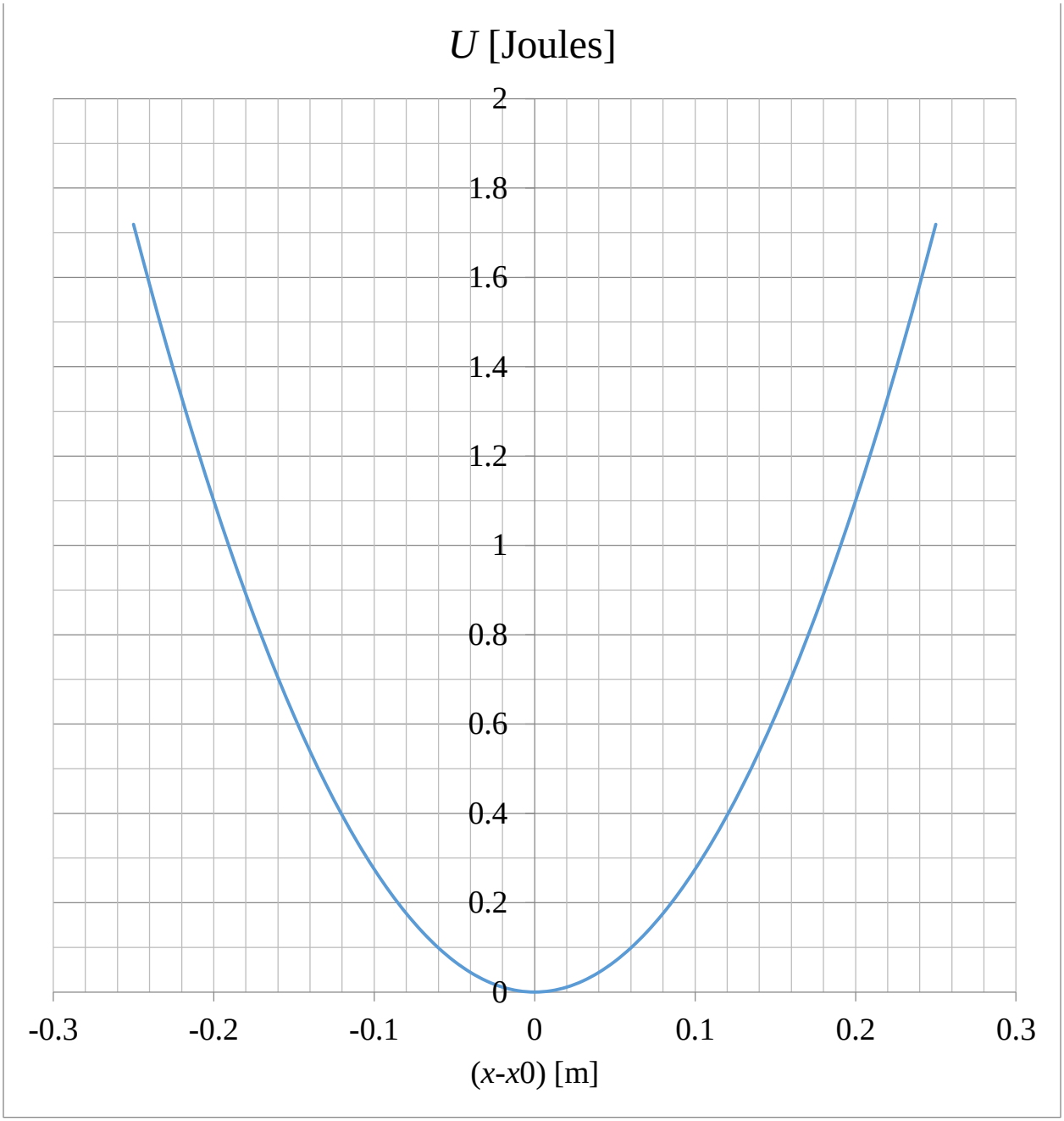
When the system is at the equilibrium position $x = x_0$, the spring has zero potential energy. When the cart is not at equilibrium, the potential energy is a parabola: $U = \frac{1}{2} k (x - x_0)^2$. Here k is the spring constant $k = 55$ N/m.

(a) When the spring is stretched to $(x - x_0) = 0.2$ m, what is U?

(b) If the cart is released from rest at $(x - x_0) = 0.2$ m, and there is no friction, describe the subsequent motion of the cart. What is the total energy of the system? Draw a horizontal line on the graph on the reverse showing the total energy of the frictionless system.

(c) Now suppose the cart is released from rest at $(x - x_0) = 0.2$ m, and there is a constant kinetic frictional force of 1 Newton opposing its motion. As the cart moves 0.1 m in either direction, how much energy will it lose? Draw a diagonal straight line on the graph showing how the total mechanical energy, $U + K$, changes as the cart moves to the left from its starting position.

(d) In the 1 N friction case, about how many times could the cart travel back and forth before losing all its energy?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2
1.8
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0.1
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(x-x0) [m]