The Law of Conservation of Energy

Pre-Lecture Questions

Problem Set #23 (due next time)

Lecture Outline

1. Examples Using Law of Conservation of Energy

Pre-Class Summary:

Including the effect of conservative and non-conservative forces.

The Law of Conservation of Energy

"Energy may be transformed from one type to another, but the total energy always remains constant."

which can be written mathematically as,

The Law of Conservation of Energy $\Delta K + \Delta U = W_{nc}$.

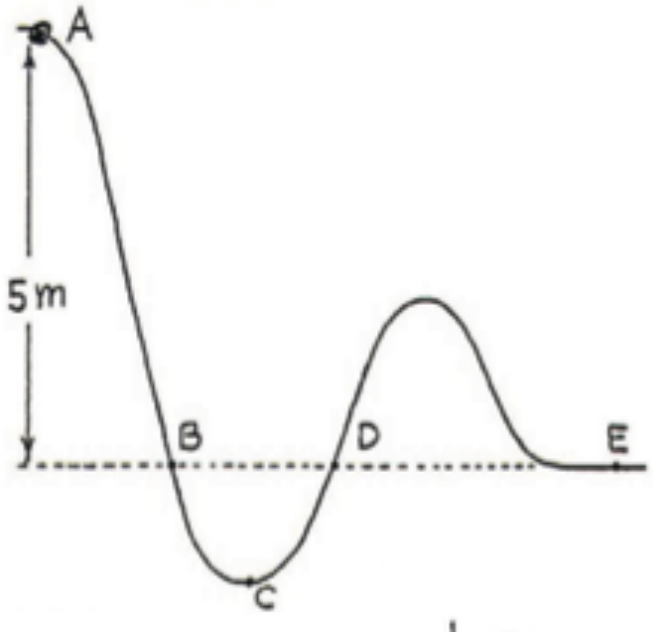
A big metal bead slides due to gravity along an upright friction-free wire. It starts from rest at the top of the wire, Point A, as shown in the sketch. How fast is it traveling as it passes

Point B? _____

Point D? _____

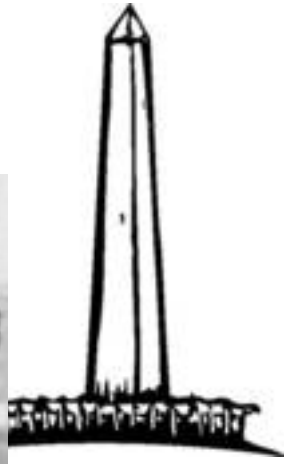
Point E? _____

Maximum speed occurs at Point _____



Revisiting an old problem…again!

Example 1: Gabby Street was a catcher for the Washington Senators from 1909 to 1911. He reputedly caught a baseball (m = 150g) dropped from the top of the Washington Monument known to be 555ft (170m) tall. Assume there is no air resistance. Find (a)the gravitational potential energy of the ball at the top, (b)the kinetic energy of the ball at the bottom, and (c) the speed of the ball when he caught it.



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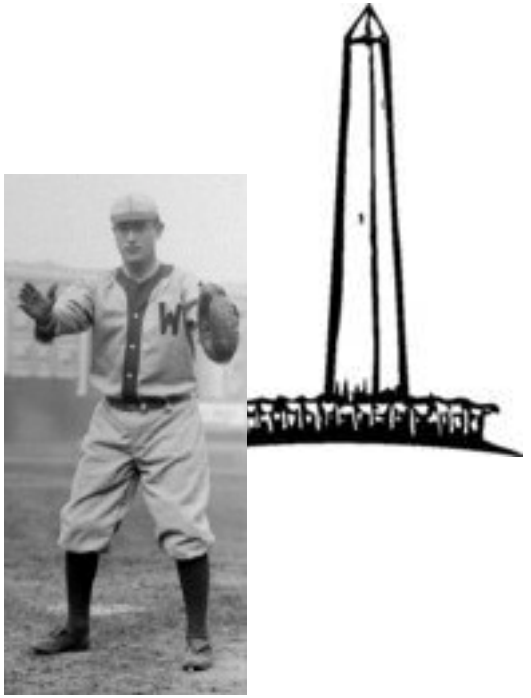
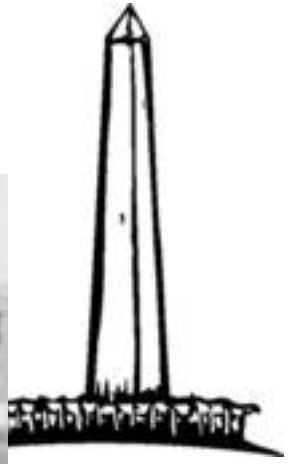


We solved this problem last time!
(a) $U_g = mgh = 250J$
(b) $K = 250J$
(c) $v = 57.7m/s = 129mph$

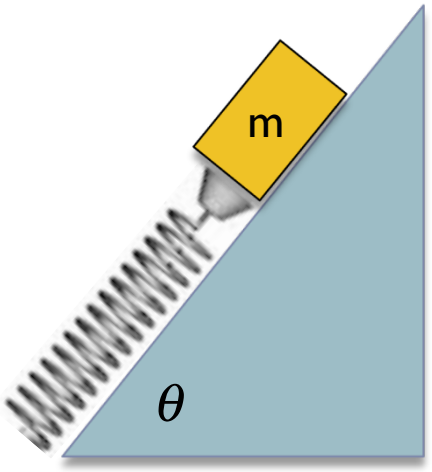
Revisiting an old problem…again!

Example 2: Gabby Street was a catcher for the Washington Senators from 1909 to 1911. He reputedly caught a baseball (m = 150g) dropped from the top of the Washington Monument known to be 555ft (170m) tall. The final speed when he caught it was 100mph (47m/s). Find the average force of air resistance during the fall of the ball.



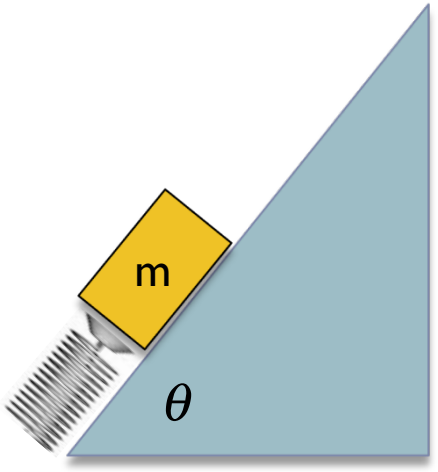
Example 3: A 500gm mass is attached to a horizontal spring with a spring constant of 8.00N/m. The mass is pulled 50.0cm and released. It oscillates back and forth. Find (a) the maximum speed of the mass and (b)the position where it reaches maximum speed.

A 2.00kg mass is gently released upon a relaxed spring that rests at the base of a 53° incline as shown. The spring compresses to a maximum of 16cm as the mass slides down along the incline again coming to rest. Ignore friction.



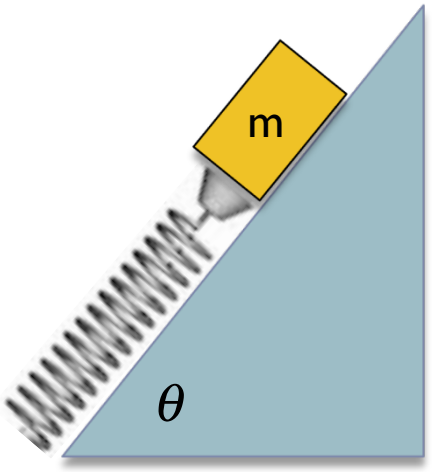
1. Write the initial potential and kinetic energies.

2. Write the kinetic and potential energies when the mass is at its lowest point.



3. Find the spring constant of the spring.

A very rough 2.00kg mass is gently released upon a relaxed spring (k = 196N/m) that rests at the base of a 53° incline as shown. The spring compresses to a maximum of 12cm as the mass slides down along the incline again coming to rest.



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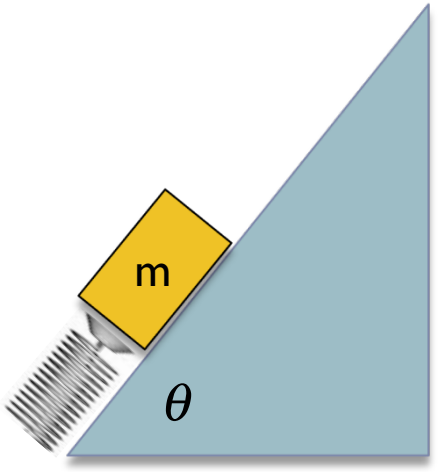

3. Find work done by the frictional force.

4. Find the average frictional force.

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