**MASSACHUSETTS INSTITUTE OF TECHNOLOGY**
**Department of Physics**

Physics 8.01T                                                          Fall Term 2004

# In-Class Problems 20-21: Work and Kinetic Energy

Section_____Table and Group Number _____

Names _____

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**Hand in one solution per group.**

We would like each group to apply the problem solving strategy with the four stages (see below) to answer the following two problems.

I.      **Understand – get a conceptual grasp of the problem**
II.     **Devise a Plan - set up a procedure to obtain the desired solution**
III.    **Carry our your plan – solve the problem!**
IV.     **Look Back – check your solution and method of solution**

## In-Class-Problem 20 *Calculating Work Integrals*

**a) Work done by Gravity Near the Surface of the Earth:** Consider an object of mass m near the surface of the earth falling directly towards the center of the earth. The gravitational force between the object and the earth is nearly constant. Suppose the object starts from an initial point $y_0$ and moves to a final point $y_f$ closer to the earth. How much work does the gravitational force do on the object as it falls?

**b) Work Done by the Spring Force:** Connect one end of a spring with spring constant k to an object resting on a smooth table and fix the other end of the spring to a wall. Stretch the spring a distance $x_0$ and release the object. How much work does the spring do on the object as a function of the stretched or compressed length of the object?

**c)** Work done by the Inverse Square Gravitational Force: Consider an object of mass m moving directly towards the sun (mass $m_s$). Initially the object is at a distance $r_0$ from the center of the sun. The object moves to a final distance $r_f$ from the center of the sun. How much work does the gravitational force between the sun and the object do on the object during this motion?

## In-Class Problem 21: Spring-Object on an Inclined Plane with Friction

A object of mass $m$ is pushed against a spring at the bottom of a plane that is inclined at an angle $\theta$ with respect to the horizontal and held in place with a catch. The spring compresses a distance $x_0$ and has spring constant $k$. The catch is released and the object slides up the inclined plane. At x = 0 the object detaches from the spring and continues to slide up the inclined plane.
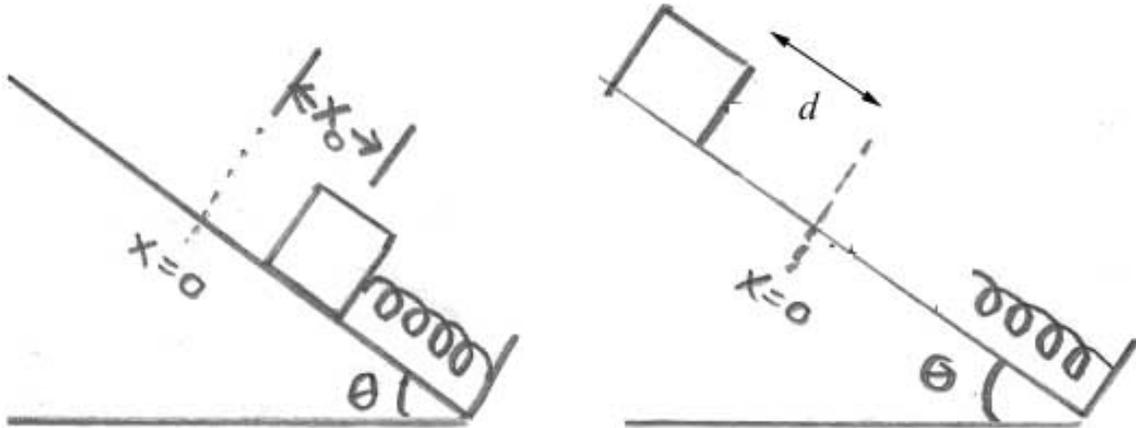


Assume that the incline plane has a coefficient of kinetic friction $\mu_k$. How far up the inclined plane does the object move from the point where the object detaches from the spring?