ME 230 - Dynamics Your Name:_____
Tutorial 4 Section No.:_____

Partners:_____ _____ _____
_____ _____ _____

Work and Energy Methods

Relationships of Interest

Work: $U = \int_{r_1}^{r_2} \vec{F} \bullet d\vec{r} = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$

For weight: $U = -mg(y_2 - y_1)$ For springs: $U = -\frac{1}{2}k(s_2^2 - s_1^2)$

Potential Energy:

For gravity: $V = mgy$ For springs: $V = \frac{1}{2}kS^2$ (S = stretch, $s_2 - s_1$)

Kinetic Energy: $T = \frac{1}{2}mv^2$

Conservation of Energy: $T + V$ = Constant or $T_1 + V_1 = T_2 + V_2$

1) A weight will be dropped from the edge of a table while attached to an elastic sping (rubber band), much like a bungee jumper. Determine a) the maximum length below the suspension point reached by the bottom of the weight, and b) the maximum force (tension) in the spring.

Weight of lead ball: 2 lb. Unstretched spring length: 6 in.

Spring constant: k = 1.25 lb/in.

Which of the following forces is not conservative: weight, friction, spring? Explain.

If all forces doing work on the system are conservative (are they?), then the principle of conservation of energy can be used. State the principle symbolically.

What information is necessary to determine V and T?

Draw a diagram showing a reference frame and choose appropriate positions of the weight (1 and 2 etc.) that are necessary for solving the problem.

Apply the principle of conservation of energy to solve for the stretched spring length, *s*.

Determine the maximum distance below the suspension point that the weight reaches.

Draw a free body diagram of the weight at maximum spring extension

Calculate the maximum tension in the spring.

Qualitatively, where does the maximum velocity occur?

2) If the ball is released from rest in position 1, use conservation of energy to determine the initial angle θ necessary for it to swing to position 2.