Name_____

Date _____ **Pd**____

Unit IV: Worksheet 4

1. A baseball (m = 140 g) traveling at 30 m/s moves a fielder's glove backward 35 cm when the ball is caught.
   a. Sketch an energy bar graph of the situation, with the ball as the system.

   b. Calculate the average force exerted by the ball on the glove.

2. A 60 kg student jumps from the 10 m platform at ASU's swimming complex into the pool below.
   a. Calculate her E_k just before impact. Calculate her velocity at impact.

   b. Repeat step *a* for a 75 kg diver.

   c. If she jumped from a platform that was twice as high, determine how many times greater her velocity would be at impact.

   d. Determine how much higher the platform would have to be in order for her velocity to be twice as great.

3. A spring whose spring constant is 850 N/m is compressed 0.40 m.
   a. Calculate the maximum speed it can give to a 500 g ball.

   b. If the spring in (a) were compressed twice as much, determine how many times greater the velocity of the ball would be.

4. A scrawny 20 kg Finn was shot straight up with an initial velocity of +50 m/s. Suppose that 20% of his initial E_k were lost due to friction with the air (air resistance). Calculate the maximum height he could reach.

5. Figure 1 depicts a popular loop-the-loop amusement park ride. The car and riders are initially pulled up the incline on the left to a height "H" above the ground. The car is then released, gaining enough speed as it goes down the incline to successfully traverse the entire course. The car has brakes to stop it on the right side of the course in Figure 1. There is, you will note however, the safety spring designed to safely stop the car in the event of brake failure.

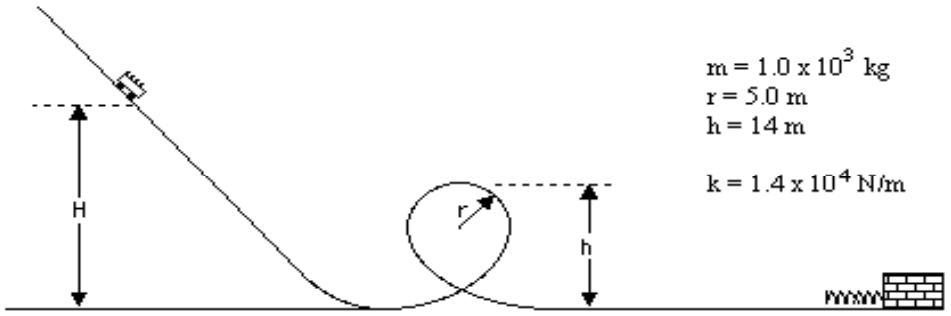

Figure 1

a. Calculate the minimum speed of the car at the top of the loop to ensure that it would not fall off of the track.

b. Calculate the minimum initial height "H" to ensure that the car would not fall off of the track.

c. In the event that the brakes were to fail, calculate how far the car would compress the emergency safety spring.

d. At what point during the compression of the spring is the acceleration maximum? Explain your reasoning.

e. Calculate the car's maximum acceleration if it were to be stopped by the emergency safety spring.