SPH3U – Solving Energy Problems

Potential Energy + Kinetic Energy = Total Mechanical Energy

$E_{T\ inital} = E_{T\ final}$

1. A car of mass 1050 kg is travelling at 100 km/hr. What is its' kinetic energy? **[4.05x10⁵J]**
2. A cyclist and her bike have a combined mass of 80.0kg, and due to her velocity, she has a kinetic energy of 4.07KJ. What velocity is she travelling at? **[10.1 m/s]**
3. A bungee jumper is standing in a tower preparing to jump. The tower is 45m high, which gives the bungee jumper a potential energy of 33,075J relative to the ground. What is his mass? **[75kg]**
4. A Canadian penny (2.35g) is being held over the observation deck on the CN Tower at a height of 450m above the ground. What is the penny's gravitational potential energy? **[10.4J]**
5. A ball of mass 3.20kg is thrown straight up, giving it an initial energy of 48.4J. The point at which it is released will be called "height=0.00m."
   a. What is the kinetic energy just as the ball is released? **[48.4J]**
   b. What is the potential energy when the height equals 0.0m? **[0J]**
   c. What is the ball's initial velocity just as it is released? **[5.5m/s]**
   d. What does 59.0cm equal when changed to a value in m? **[0.59m]**
   e. What is the total energy at a height of 59.0cm above a height of 0.0m? **[48.4J]**
   f. What is the potential energy at a height of 59.0cm? **[18.5J]**
   g. What is the kinetic energy at a height of 59.0cm? **[29.9J]**
   h. What is the maximum height the ball rises to? **[1.54m]**
   i. What is the kinetic energy at this height? **[0J]**
   j. After reaching this height, the ball will fall straight back down to the point that it started from. As it is falling, is its' kinetic energy increasing or decreasing? **[increasing]**
   k. What is the ball's potential just before it lands? **[0J]**
   l. What is the ball's kinetic energy just before it lands? **[48.4J]**
   m. With what velocity does the ball strike when it lands? **[5.5 m/s]**
   n. What happens to the 48.4 J of energy once the ball has landed? **[lost to heat *(and sound)* into the ground]**

Challenge Problem
6. An object of mass 3.01kg is suspended above a pile of firm mud. When released, it drops for 0.904s and then lands in the mud. The mud exerts a constant force on the mass of 1475N, which allows the mass to sink down a bit before coming to rest.
   How far will the mass sink into the mud? **[8.0 cm]**