Name_____

Date_____Pd____

UNIT III: Worksheet 1

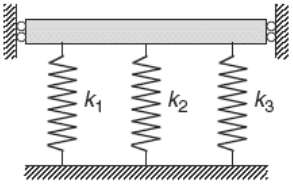
1. A factory worker pushes a 30 kg crate at constant velocity a distance 4.5 m across a factory floor. The coefficient of friction between the crate and the floor is 0.2. Suppose the worker pushes downward at an angle of 30^0 below the horizontal.
   a. How much work is done on the crate by this force when the crate is pushed a distance of 4.5 m?

   b. How much work is done on the crate by friction during this displacement?

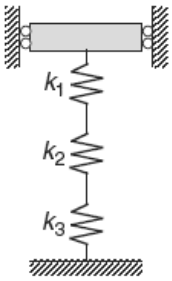
   c. What is the total work done on the crate?

2. The dinosaur Tyrannosaurus rex is thought to have had a mass of about 7000 kg.
   a. Treat the dinosaur as a particle and estimate its kinetic energy at a walking speed of 4.0 km/hr.

   b. With what speed would a 70 kg person have to move to have the same kinetic energy as a walking T. rex?



3. A 5 kg beam is suspended by three springs as shown above to the left. In this orientation, the springs each stretch 15 cm. If you were to arrange the springs as shown to the right, an the beam were attached, how far could you lower the beam?

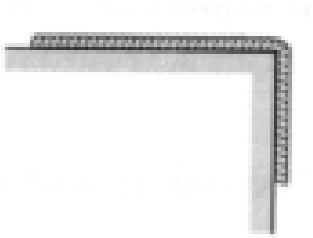


4. A car is travelling on a level road with speed v_0 at the instant when the brakes lock, so that the tires slide rather than roll. The car stops in a distance of 91.2 m if $v_0 = 80\ km/hr$. What is the stopping distance if $v_0 = 60\, km/hr$? Assume that the value of μ_k remains the same.

5. The total consumption of electrical energy in the United States is about 1.4 x 10^{19} joules per year.
   a. If the population of the United States is 332 million, what is the average rate of electrical energy consumption per person?

   b. The sun transfers energy to the earth by radiation at a rate of approximately 1.0 kW per square meter of surface. If this energy could be collected and converted to electrical energy with 40% efficiency, how great an area (in square kilometers) would be required to collect the energy used by the United States?

6. A uniform chain of length L and mass M rests on a frictionless table. A tiny segment of the chain hangs off the edge of the table.
   a. Derive an expression for the force of gravity on the hanging part of the rope as a function of y (the amount of chain hanging off the table).



   b. Derive an expression for the work done by gravity on the rope as a function of y.

   c. Use the work-energy theorem to derive an equation for the velocity of the rope as a function of y.