Worksheet 10: Potential Energy and Power

Objective

- Examine how quickly a force does work.

Summary

Hooke's law (ideal spring): $F = -kx$;

Work to stretch or compress an ideal spring from rest to displacement x: $W = \frac{1}{2} kx^2$

Work to lift an object of mass m a height h: mgh

Rate of doing work = Power = dW/dt

Problems

1. Two springs with spring constant k are connected end-to-end. What is the spring constant of the compound spring?

2. Two springs with spring constant k are combined side-to-side. What is the spring constant of the compound spring?

3. An egg is released from rest from the roof of a building and falls to the ground. Its fall is observed by a student on the roof of the building, who uses coordinates with origin at the roof, and by a student on the ground, who uses coordinates with origin at the ground.

   Do the students assign the same or different values to:

   a. The initial gravitational potential energy U_{grav}?

   b. The final gravitational potential energy U_{grav}?

   c. The change in gravitational potential energy ΔU_{grav}?

   d. The kinetic energy K of the egg just before it lands?

4. The 2004 Tour de France's Alpe d'Huez time trial stage was a steep climb with its finish 1200 m higher than the start. Lance Armstrong won with a time D*t* of 39:41 (2381 s). He and his gear had a combined mass of 84 kg.

   a. What work did Lance do against gravity over the stage?

   b. What was Lance's average power during the stage?

5. Show that the units of work/time are the same as the units of force·velocity.