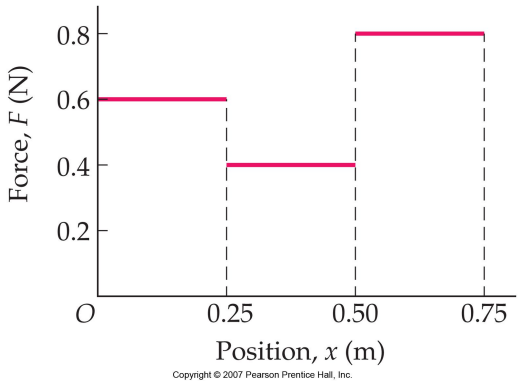
NAME _____ PERIOD ____

UNIT 9 PRACTICE PROBLEMS AP PHYSICS

9.1 WORK

1. A farmhand pushes a 23-kg bale of hay 3.4 m across the floor of a barn. If she exerts a horizontal force of 86 N on the hay, how much work has she done?
2. Early one October, you go to a pumpkin patch to select your Halloween pumpkin. You lift the 3.2-kg pumpkin to a height of 1.2 m, then carry it 50.0 m (on level ground) to the check-out stand.
    a. Calculate the work you do on the pumpkin as you lift it from the ground.
    b. How much work do you do on the pumpkin as you carry it from the field?
3. To clean a floor, a janitor pushes on a mop handle with a force of 50.0 N.
    a. If the mop handle is at an angle of 55° above the horizontal, how much work is required to push the mop 0.50 m?
    b. If the angle the mop handle makes with the horizontal is increased to 65°, does the work done by the janitor increase, decrease, or stay the same? Explain.
4. A spring with a force constant of 3.5×10^4 N/m is initially at its equilibrium length.
    a. How much work must you do to stretch the spring 0.050 m?
    b. How much work must you do to compress it 0.050 m?
5. The force shown in **Figure 7–17** moves an object from to x = 0 to x = 0.75 m
    a. How much work is done by the force?
    b. How much work is done by the force if the object moves from x = 0.15 m to x = 0.60 m?



9.2 KINETIC ENERGY AND THE WORK-ENERGY THEOREM

6. A 9.50-g bullet has a speed of 1.30 km/s.
    a. What is its kinetic energy in joules?
    b. What is the bullet's kinetic energy if its speed is halved?
    c. If its speed is doubled?
7. When Skylab reentered the Earth's atmosphere on July 11, 1979, it broke into a myriad of pieces. One of the largest fragments was a 1770-kg lead-lined film vault, and it landed with an estimated speed of 120 m/s. What was the kinetic energy of the film vault when it landed?

8. How much work is needed for a 68-kg runner to accelerate from rest to 7.5 m/s?
9. A 1300-kg car coasts on a horizontal road with a speed of 18 m/s. After crossing an unpaved, sandy stretch of road 30.0 m long, its speed decreases to 15 m/s.
    a. Was the net work done on the car positive, negative, or zero? Explain.
    b. Find the magnitude of the average net force on the car in the sandy section.
10. On October 9, 1992, a 27-pound meteorite struck a car in Peekskill, NY, creating a dent about 22 cm deep. If the initial speed of the meteorite was 550 m/s, what was the average force exerted on the meteorite by the car?
11. Initially sliding with a speed of 2.2 m/s, a 1.8-kg block collides with a spring and compresses it 0.31 m before coming to rest. What is the force constant of the spring?

9.3 POWER

12. An ice cube is placed in a microwave oven. Suppose the oven delivers 105 W of power to the ice cube and that it takes 32,200 J to melt it. How long does it take for the ice cube to melt?
13. A new record for running the stairs of the Empire State Building was set on February 3, 2003. The 86 flights, with a total of 1576 steps, was run in 9 minutes and 33 seconds. If the height gain of each step was 0.20 m, and the mass of the runner was 70.0 kg, what was his average power output during the climb? Give your answer in both watts and horsepower.
14. You raise a bucket of water from the bottom of a deep well. If your power output is 108 W, and the mass of the bucket and the water in it is 5.00 kg, with what speed can you raise the bucket? Ignore the weight of the rope.
15. A kayaker paddles with a power output of 50.0 W to maintain a steady speed of 1.50 m/s.
    a. Calculate the resistive force exerted by the water on the kayak.
    b. If the kayaker doubles her power output, and the resistive force due to the water remains the same, by what factor does the kayaker's speed change?
16. The average power output of the human heart is 1.33 watts.
    a. How much energy does the heart produce in a day?
    b. Compare the energy found in part (a) with the energy required to walk up a flight of stairs. Estimate the height a person could attain on a set of stairs using nothing more than the daily energy produced by the heart.