

**W7.08****MOMENTUM & ENERGY**

*Givens: 1 HP = 745.7 Watts Electricity costs 10 cents per kW-hr*

1. How much does it cost to operate a 30-Watt nightlight for a year?
2. If it costs \$3 per day to operate an air conditioner, what is its power rating in Watts?
3. A 5-kg block moving at 20 m/s collides head on with a 4-kg block moving at 10 m/s in the opposite direction, and the blocks stick together.
  - a. What is the speed of the two stuck together blocks after the collision?
  - b. How much energy was lost in the collision?
  - c. How high would the blocks slide up a  $36.87^\circ$  incline before stopping if the incline were frictionless?
  - d. How far would the blocks slide along a level surface with a  $\mu=0.1$  before stopping?
4. A 1-kg ball falls from a height of 20 meters and hits the ground at 16 m/s.
  - a. How much energy is lost during the fall?
  - b. What was the average force of air friction slowing its fall?
  - c. What power was being dissipated by the “drag force” (air resistance)?
5. A new 1,000-kg Honda Accord accelerates from 0 m/s to 30 m/s on a level road in 200 m. What is the average power generated by the engine in Watts and HP?
6. A 40-kg girl sitting on a swing catches a 5-kg medicine ball thrown at her at 18 m/s.
  - a. How fast is she moving after the catch?
  - b. To what height above her starting point will she swing?
  - c. What angle does that height represent if the swing rope is 2.5 meters long?
7. A man lifts a weight of 200 N 1 meter by applying a constant force of 300 N. If 50.0 Joules of energy are lost due to friction while lifting, what is the speed of the 200 N weight while he is lifting it through the 1-m mark?
8. A man sitting in the center of a frictionless pond attempts to move to the east edge by throwing a baseball. A) In what direction should he throw the baseball? B) If the man’s mass is 70 kg and the baseball’s mass is 150 grams, how fast must he throw the ball in order to slide to the east edge 20 meters away in 10 minutes? C) How much energy would he use throwing the ball at that speed?
9. Water pours vertically into a bucket sitting on a scale at a rate of 5-kg per second from a tap located 5 meters above the bucket. What does the scale read (in Newtons) when the total mass of the bucket and its contents is 25-kg (the water is still pouring into the bucket!)?
10. A team of horses drags a barge of mass 4,000-kg down a canal using a force of 5,000 N to overcome the resistance of the water and accelerate the barge. What power is the team generating when the barge is moving at 0.2 m/s (in Watts)? What is the resistive force of the water, if the barge is accelerating at  $0.05 \text{ m/s}^2$ ?