W6.08 **Power Worksheet-Physics I**

1 HP = 745.7 Watts

1. If a ride at Disneyworld goes from rest to 27 m/s in 2.8 seconds and the mass of the ride and riders together is 5000 kg (true data!), what is the average power required to do this? Give your answer in both Watts and horsepower.

2. A weightlifter raises a barbell of mass 100 kg from the floor to over his head (2.5 meters) in 2 seconds. What is his average power input? Give your answer in both Watts and horsepower.

3. A 60-kg hiker wishes to climb a hill 1200 meters high. If he can generate a sustained average power of 500 Watts (realistic!), how long will it take him to climb the hill assuming he is 100% efficient? What would the answer be if he were only 10% efficient?

4. A car moving at 60 mph (27 m/s) encounters a resistive air frictional force of 200 Newtons. How much power must the engine generate to maintain this speed? If the engine is only 40% efficient, how much power is wasted in heat losses?

5. A 100 Watt lightbulb has an average life of 2000 hours. How much energy does it consume over its lifetime? Give your answer in Joules and kW-hours.

6. A barge is towed in a canal by a force, F at a speed of 2 m/s. If the force required to tow the barge is proportional to its speed squared, how much power (in terms of F) is required to tow the barge at 6 m/s? (Hint: How much force is required at 6 m/s?)

7. A 2-HP winch is used to raise loads of bricks up a 30 meter building. If the bricks need to get to the top of the building in 2 minutes, what is the maximum allowable mass of a load of bricks?

8. A small power station can generate 10 Megawatts of electrical power. How many 100 Watt lightbulbs can it keep burning at the same time? If energy is billed at 10 cents per kW-hour, how much money does the power station gross in a day?

W6.08 Key

1. 650900 W; 874 HP
2. 1250 W, 1.7 HP
3. 1440 sec (24 min), 14400 sec (4 h)
4. 5400 W, 8100 W
5. 7.2×10^8 J, 200 kW·h
6. 27F (9 times as much force)
7. 596 kg
8. 100,000 bulbs, $24,000.00