Name:_____ Date:_____

Mr. Croom's Physics Chapter 5: Work and Energy

# Power 2

**Solve the following problems.**

1. (Walker, p. 195 #43) Human-powered aircraft require a pilot to pedal, as in a bicycle, and produce a sustained power output of about 0.30 hp. The Gossamer Albatross flew across the English Channel on June 12, 1979 in 2 h 49 min. **(a)** How much energy did the pilot expend during the flight? **(b)** How many Snickers candy bars (280 Cal per bar) would the pilot have to consume to be "fueled up" for the flight? (Note: The nutritional calorie, 1 Cal, is equivalent to 1000 calories (1000 cal) as defined in physics. In addition, the conversion factor between calories and joules is as follows: 1 Cal = 1000 cal = 1 kcal = 4186 J.)

2. (Walker, p. 195 #44) A grandfather clock is powered by the descent of a 4.00-kg weight. **(a)** If the weight descends through a distance of 0.750 m in 3.00 days, how much power does it deliver to the clock? **(b)** To increase the power delivered to the clock, should the time it takes for the mass to descend be increased or decreased? Explain.

3. (Walker, p. 195 #46) A certain car can accelerate from rest to the speed 12.5 m/s in 3 seconds. If the power output of the car remains constant, **(a)** how long does it take for the car to accelerate from 12.5 m/s to 25m/s? **(b)** How fast is the 1000kg car moving at 6 seconds after starting? (**c**) If there are $1.3 \times 10^8$J in 1 gallon of gasoline, how much gasoline is used to accelerate the car from 0 to 25m/s. Ignore all frictions.

4. (Serway, p. 181 #1) A $1.0 \times 10^3$ kg elevator carries a maximum load of 800.0 kg. A constant frictional force of $4.0 \times 10^3$N retards the elevator's motion upward. What minimum power, in kilowatts must the motor deliver to lift the fully loaded elevator at a constant speed of 3.0 m/s?

5. (Serway, p. 181, #3) A rain cloud contains 2.66 x $10^7$ kg of water vapor. How long would it take for a 2.00 kW pump to raise the same amount of water to the clouds altitude of 2.00 km

6. (Giancoli, p. 177, #59) If a car generates 18hp when traveling at a steady 90km/h, what must be the average force exerted on the car due to friction and air resistance? What is the cars average fuel consumption at this rate?

7. (Giancoli, p. 177, #61) Based on the fact that 1kWh is equals o 3.6 x $10^6$J (*Power 1, #8)* and that the typical family uses energy at a rate of 500 how many kWh would their electric bill for 30 days be? How many Joules would this be? At a cost of $0.12 per kWh what would their monthly bill be in dollars? Does this bill depend on the rate at which they used the electric energy?

8. (Giancoli, p. 17, #62) A driver notices that her 100kg car slows down from 90km/h to 70km/h in about 6.0s on a level road, when the car is in neutral. Approximately what power (watts and hp) is need to keep the car traveling at a constant 80 km/h. Based on this power requirement, how much gas is burned in 1km? What is the fuel efficiency at this rate?

9. (Giancoli, p. 17, #66) During a workout, the football players at State U ran up the stadium stairs in 61s. The stars are 140m long and inclined at an angle of 30°. If a typical player has a mass of 105kg, estimate the average power output of the way up? Ignore friction and air resistance. How many Calories do these players burn running the stairs 3 times?

10. (Giancoli, p. 17, #67) How fast must a cyclist climb a 6.0°h hill to maintain a power output of 0.25hp? Neglect the work done by friction and assume the mass of the cyclist plus the bicycle is 70kg

11. (Giancoli, p. 17, #68) A 100 kg car has a maximum power output of 120hp. How steep a hill can it climb at a constant rate of 70 km/h if the frictional forces add up to 600N

12. (Giancoli, p. 17, #69) Squaw Valley ski are in California claims that its lifts can move 47,000 people per hour. If the average lift carries people about 200m veritably higher, estimate the minimum total power needed? If the rate of electricity in California is $0.14 per kWh. How much money per hour is spent to power the lifts?