Lesson 2 Power and Efficiency Assignment #2

1. An airport baggage handler lifts 42 pieces of luggage, averaging 24 kg each, through a height of 1.6 m onto a baggage cart, in a time of 3.6 min. In this situation, what is the power of the baggage handler? Ans: 73

2. How much energy (in J) does a 150 W light bulb convert to heat and light in 1.0 h? Ans: $5.4 \times 10^4$ J

3. An incandescent light bulb is approximately 5% efficient. This means that only 5% of the electrical energy used to operate the bulb is converted into light. If a 150 W bulb is used for 2.0 h, how much light energy (in J) does it produce in that time? How much heat does it produce?
   Ans: Light=$5.4 \times 10^4$ J, Heat=$1.0 \times 10^6$ J

4. How much work will a 4.0 HP (3 kW) motor do in half an hour? Ans: $5.4 \times 10^6$ J

5. One watt is equivalent to one joule per second, so a joule is the same as a watt-second. How many joules are there in 1 kilowatt-hour (kW·h)? Ans: $3.6 \times 10^6$ J
6. A 75 kg girl runs up a 3.0 m flight of stairs in 2.5 s. What is her 'horsepower' in this situation?
   Ans: $8.8 \times 10^2$ W which is 1.2 HP

7. A student pushes 14 kg of their physics homework up a 40° ramp at a constant velocity of 3.2 m/s. The friction force is 26 N. How much power must the student exert?

8. The Top Thrill Dragster is one of the tallest roller coaster in the world. The car is accelerated along a level track until they take a 90° vertical turn and travel to the peak, 120 m high. A typical fully loaded car has a mass of 2800 kg.

   a) Calculate the minimum amount of work done on the car in order for it to reach the peak.

   b) In reality the roller coaster is accelerated from 0 to 193 km/h in 3.8 s. Find the actual power input of the ride.

   c) Determine the efficiency of the ride from start to peak.