

Names: _____
Date: _____ Block: _____

Horsepower: Your Stair Climbing Power

Safety First!! Be very careful when climbing stairs. If you become tired, out of breath, or experience any other symptoms of discomfort, do not continue with the procedure. If you are unable to climb stairs for health reasons, tell your teacher then participate by timing another student who is able to climb the stairs without risk.

Background Information!!

The rate at which work is done is called **power**. Power equals work/time. If work is in joules (J) and time is in seconds (s), power is expressed in joules/second (J/s). One J/s is the same as 1-watt (1W), a unit named after British scientist James Watt, inventor of the steam engine. To find out how the power of his engine compared to that of a horse, Watt measured how fast an average horse could do work. He found the answer and expressed the amount of work performed per second as **horsepower**. One horsepower expressed in modern metric units, equal 746 J/s, or 746 W.

Purpose: To determine how much DTE would pay you to produce power for them.

Materials: stopwatch, ruler

Procedure:

1. Since power is Work/ time, you first need to calculate the work that you will do to climb the staircase in front of you. The force you exert will be about equal to your weight. Calculate your weight in Newtons. Convert pounds to Newtons by multiplying pounds by 4.4.
2. Use the ruler to measure the height of one stair step, in meters. Use these measurements to calculate the vertical distance you will travel up the stairs.
3. Calculate the work done to climb the stairs.
4. Without asking anyone, what type of person do you think did the most work? (think about the definition) Do not give any names, just describe the type.

5. Climb the stairs 3 times at each pace. The 1 hr pace is a pace that you could keep up for at *least* an hour. **Only climb the stairs as quickly as you safely can.**

	Time (s): 1 hr pace	Time (s): faster pace
Trial 1		
Trial 2		
Trial 3		
Average		

6. Now calculate your power at each pace.
7. Please make a data table showing your power and horsepower for each of your two paces.
8. Give some ways in which you could maximize your power.
9. Now, calculate each of your powers (not horsepower) in kW (1000 watts).
10. DTE supplies us with 1 kWhr of energy for \$0.088. That is \$0.088/kWhr. Multiply your power in kW by your average time (in hours) to climb one flight of stairs. This is the energy you produced in kWhr by climbing the stairs once.
11. How much would DTE pay you to climb the stairs once?
12. If you could climb the stairs continuously at each pace, what would your hourly salary be if DTE was willing to give you all the money they charged for the energy you produced?
(Hint: kW x 1hr x rate/kWhr)