LAB: Your Stair-Climbing Power Name: _____
Period: ____Date: _____

Problem: How much power do you use when climbing stairs?
Materials: meter stick/ruler, stairs, stopwatch

PREDICTION: Predict how your power output compares to that of an average horse. Give your prediction in fraction or decimal form. Give the reasons for your prediction.

Procedure:
1. Convert your weight in pounds to Newtons by multiplying by 4.45. Record this number in Data Table 1.
2. Measure the height of one stair step in centimeters. Convert to meters by dividing by 100, and record the result.
3. Count the number of steps you will be climbing and multiply this by the height of a step to find the total height, in meters. Record this number.
4. Climb the stairs as quickly as you can **WITHOUT RUNNING**, while your partner times you. Record the time in seconds to the nearest tenth of a second.
5. After resting for a few minutes, carry out a second climb by repeating procedure step 4. Rest again, and carry out a third climb. Average the three times and record this number.

Observations:
DATA TABLE 1 *Weight, Distance, and Time Information*

Weight in Newtons (N)	
Height of one step (m)	
Number of steps	
Total height of stairs (m)	
Time of Climb 1 (s)	
Time of Climb 2 (s)	
Time of Climb 3 (s)	
Average Time (s)	

1. Were the three climbing times roughly the same, or did they vary considerably?

2. Did you feel as if you exerted the same effort on each climb? Explain.

Analysis and Conclusions:

1. For each climb, calculate your work in climbing the stairs.
   (Remember: Work = force × distance)

2. Calculate your power output in each climb. What was your average power output for all the climbs? (Remember: Power = work/time)

3. If you had climbed more slowly, how would the work have been affected? How would the power output have been affected? Explain your answer.

4. Compare your power with other students. Did all of the students who climbed the stairs in the same amount of time have the same power output? Explain your answer.

5. Calculate your horsepower. To do so, divide the average power output you calculated, in watts, by 746, the number of watts in 1 horsepower.

Conclusions:

1. How does your power output in climbing the stairs compare to the power output of a typical horse? Such a horse could maintain its typical power output for hours. How long do you think you could have maintained your power output if you had continued to walk quickly up many flights of stairs without resting?

2. How does your power output in climbing the stairs compare to the power output of a 100-watt light bulb? If your power could have been harnessed and the energy converted to electricity, how many 100-watt bulbs could you have kept burning during your climb? Why is it good that we can rely on generators to provide us with power?