Human Power

Name___________________

Purpose:
To calculate the amount of work done by muscles in the human body with various tasks.

Introduction:
Though power is usually associated with mechanical engines or electrical appliances, the human body does work with its muscles and therefore, human power can be calculated. Two different scenarios will be considered for calculating human power in this experiment. The first will be the power associated with lifting a mass through a known vertical distance. The second scenario will be the power associated with climbing stairs, or lifting the mass of the body through a certain vertical distance. The point of exerting force vertically is that the change in gravitational potential energy can be calculated with the formula:

$$\Delta U = mg\Delta y$$

Through the work-energy theorem, the work can then be calculated:

$$W = \Delta U$$

If the time is recorded, power is then the ratio of work to time.

Procedure:
Take the pull scale and attach the mass hanger with a 100g slotted mass. Using the pull-scale, lift the mass through a meter of vertical distance with a constant velocity (keep your arm straight). Record the time it takes to do this. Repeat this procedure once and then use a 500g slotted mass twice as well. Record the data in Table 1. Also, show at least one sample calculation of work and the corresponding power.

Force (N)	***Vertical Distance (m)***	***Time (s)***	***Work (J)***	***Power (Watts)***
Climbing Stairs				

Table 1: Data for calculating power of lifting mass through fixed distance & climbing stairs

Now calculate the work/power of climbing stairs. Show a sample calculation of this.

Sample Calculations:

Questions:

1. Which of the activities produced the greatest power? Did the activity that required the largest force result in the largest power produced? Can a small amount of power result from an activity that requires a large amount of force? Explain.

2. How do you compare to a 100 watt light bulb? A human being must take in about 2500 Calories (kilocalories) of energy in his or her food each day in order to continue to function properly. This means that he or she uses up energy at a rate of (power) of 2500 kilocalories/day. Using the fact that 1 calorie = 4.2 joules, and the appropriate time conversions show that this rate of energy usage is about the same as a 100 watt light bulb.