

# Power Lab

**Objective** Determine your power output when going up a flight of stairs.

**Equipment** bathroom scale meter stick or ruler stopwatch

## Experimental Method

1. Use a bathroom scale to measure your mass. If you wish, you may wear a backpack it to increase your total mass. Record your Mass: \_\_\_\_\_
2. Count the number of steps: \_\_\_\_\_  
Measure the height of a single step: \_\_\_\_\_  
Total height: \_\_\_\_\_
3. Climb the stairs as quickly (and safely) as possible while your partner times you. Record the time below.

Time (s)				
Trial 1	Trial 2	Trial 3	Trial 4	Trial 5

Calculate the average time for the trials.

## Analysis and Discussion

1. Determine the total amount of work done in climbing the stairs.
2. Determine your power output in watts.
3. If your power output could be harnessed and the energy converted to electricity, how many 100-watt lightbulbs could you have kept on during your climb?
4. A typical horse can output an average of 1 horsepower over the course of a day. 1 horsepower = 735.5 W. Express your power output in horsepower.
5. Humans are about 25% efficient. 1 Calorie = 4184 J. How many Calories did you burn when climbing the stairs one time?

# Electric Kettle

To calculate the power efficiency of a hot plate while heating water in a beaker.

## Materials

Beaker

Thermometer

Hot Plate

Water

## Experimental Method

1. Record the power rating of the hot plate: \_\_\_\_\_
2. Calculate the weight of water in a beaker using a scale:  
First measure the weight of a beaker: \_\_\_\_\_  
Then measure the weight of the beaker & water: \_\_\_\_\_  
Then, calculate the weight of the water: \_\_\_\_\_
3. Heat up the water on the hot plate while making the following measurements:  
Initial Temperature of water: \_\_\_\_\_  
Final Temperature of water: \_\_\_\_\_  
Time to heat the water: \_\_\_\_\_
4. Determine the energy required to heat the water using  $Q = m \cdot c \cdot \Delta T$ , where  $m$  is the mass of the water,  $c$  is the specific heat capacity of water ( $4.2 \frac{J}{g^{\circ}C}$ ), and  $\Delta T$  is the change in temperature.
5. Determine the work done by the hot plate using the time to heat the water and the power rating of the hot plate.
6. Determine the efficiency of the kettle:

$$\% \text{ Efficiency} = \frac{\text{energy to heat the water}}{\text{work done by the hot plate}}$$

7. Is the hot plate an efficient method of heating water?