

Human Power

Purpose: To determine the power output of a person

Equipment: two meter metersticks, stopwatch, kilogram bathroom scale

Introduction: Power is defined to be the rate at which work is done or equivalently, the rate at which energy is converted from one form to another. In this experiment you will do some work by climbing from the first floor of the science building to the second floor. By measuring the vertical height climbed and knowing your mass, the change in your gravitational potential energy can be found:

$$\Delta PE = mgh$$

Where m is the mass, g the acceleration of gravity, and h is the vertical height gained. Your power output can be determined by

$$\text{Power} = \frac{\Delta PE}{\Delta t}, \quad \text{where } \Delta t \text{ is the time to climb the vertical height } h.$$

Procedure:

1. Determine your mass by weighing on the kilogram bathroom scale. Record your mass in kg..
2. Measure the vertical distance between the ground floor and the second floor for the science building. This can most easily be done by using two meter long metersticks held end to end in the stairwell at the west end of the building. Make a careful sketch of the stairwell area that explains the method used to determine this height.
3. Designate a record keeper and a timer for the class. At the command of the timing person, run or walk (*whatever you feel comfortable doing*) up the stairs from the ground floor to the second floor. Be sure that your name and time are recorded by the record keeper.
4. After everyone in the class has completed one trip up the stairs, repeat for one more trial.
5. Return to class and calculate your personal power output in watts using the data collected from each of your climbing trip up the stairs. Obtain the average power output from the two trials.
6. Put your average power on the board and then calculate the average power for the entire class once everyone has reported their numbers on the board.
7. Determine your average power output in units of horsepower.

Questions: 1. Is it okay to use your hands and arms on the handrailing to assist you in your climb up the stairs? Explain why or why not.
2. Discuss some of the problems with the accuracy of this experiment.