

## Powerhouse

### Purpose

To determine the power that can be produced by the muscles in your legs.

### Background Information

Power is usually associated with mechanical engines or electrical motors. Many other devices also consume power to make light or heat. A lighted incandescent bulb may dissipate 100 watts of power. The human body dissipates about 100 watts as it converts the energy of food to heat. The human body is subject to the same laws of physics that govern mechanical and electrical devices.

The different muscle groups of the body are capable of producing forces that can act through distances. Work depends upon the force and the distance when both have the same direction. A person running up stairs does work against gravity. The work done can be measured by the person's weight multiplied by the vertical distance moved (not the distance along the stairs). This work per time it takes is power. When work is in Joules and time is in seconds, power is in watts.

The equation for power is:

### Procedure

1. Measure your mass in kilograms or convert your weight in pounds to mass in kilograms. 1 kilogram = 2.2 pounds.
2. Determine the change in height of the bleachers.
3. Run or walk the bleachers to complete the table below.

### Data and Calculations

Height of Bleacher (show your work)

Calculate your GPE at the top of the bleachers. How many Joules of work did you do to get there?

	Time	Power (show your work!)
Trial 1		
Trial 2		
Trial 3		

### Follow-up Questions

1. A 60 kg box is lifted by a rope a distance of 10 meters straight up at constant speed. How much power is required to complete this task in 5 seconds?

2. Hulky and Bulky are two workers being considered for a job at the UPS loading dock. Hulky boasts that he can lift a 100 kg box 2.0 meters vertically, in 3.0 seconds. Bulky counters with his claim of lifting a 200 kg box 5.0 meters vertically, in 20 seconds. Which worker has a greater power rating?

3. A 1994 Ford Mustang is driving down a road with a constant speed of 30 m/s. The engine must exert a 5000 N force to maintain this speed.  
a. What is the power rating of the engine?

b. How does the Mustang's power rating compare to the 220 hp Dodge Stealth engine (1 hp = 746 W)?

4. PG & E sends you a monthly bill informing you of the number of kilowatt-hours you have used that month.  
a. Is the utility charging you for energy or power? Explain.

b. How many joules does your 1600W blow drier transfer if you dry your hair in 5.0 min?

**Conclusion** (Write a short paragraph summarizing your results and what you learned.)