

# Muscle Up!

## Objectives

To determine the power that can be produced by various muscles of the human body.

## Materials

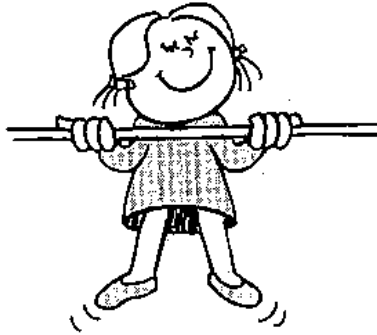
Stopwatch

Meterstick

Fitness center

Ropes

Stairs



## Background

Power is usually associated with mechanical engines or electric 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 also dissipates power as it converts the energy of food to heat and work. 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 is the product of the force and the distance, provided they both act in the same direction. When a person runs up the stairs, the force lifted is the person's weight, and the distance is the vertical distance moved – not the distance along the stairs. If the time it takes to do work is measured, the power output of the body, which is the work divided by the time, can be determined in watts.

$$F_G = mg$$

$$W = Fd$$

$$P = \frac{W}{t}$$

$$1kg = 2.2lb$$

## Procedure

1. Select five different activities from the following list:

Lift a mass with your wrist only

Do pushups, sit ups, or pull ups

Lift a mass with your forearm only

Run up stairs (use the stairs leading to the wrestling room)

Lift a mass with your arm only

Pull a weight with a rope

Lift a mass with your foot only

Jump rope

Lift a mass with your leg only

Perform these activities, and record in Data Table 1 the force in Newtons that acted, the distance in meters moved against this force, the number of repetitions, and the time in seconds required. Then calculate the work done in each instance and finally the power. The minimum time interval for each activity is **100 seconds**.

Data Table 1

	1	2	3	4	5
Activity					
Pounds					
Mass					
Gravity					
Force					
Distance					
Work of 1 Rep					
# of Reps					
Total Work					
Time					
Power					

Name: \_\_\_\_\_ Per: \_\_\_\_\_

2. Complete the table by recording the results of five other activities performed by other classmates.

Data Table 2

	1	2	3	4	5
Activity					
Pounds					
Mass					
Gravity					
Force					
Distance					
Work for 1 Rep					
# of Reps					
Total Work					
Time					
Power					

Show Force, Work, and Power calculations for one of your activities

**Force**

**Work**

**Power**



Name: \_\_\_\_\_ Per: \_\_\_\_\_

3. Did the activity that used the largest force result in the largest power produced? Why or why not? Explain how a large force can result in a relatively small power.

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4. Pick one activity from your Data Table that you think would accomplish 10,000 joules of work the fastest. Why did you pick that activity? How many reps of this activity would you have to do to accomplish 10,000 Joules of Work? Be sure to show all calculations to support your answer.

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**Calculations:**