27 Muscle Up!

Purpose

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

Required Equipment/Supplies

bleachers and/or stairs
stopwatch
meterstick
weights
rope

Discussion

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 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.

Procedure

Step 1: Select five different activities from the following list:

Measure force and distance.

Possible Activities

- Lift a mass with your wrist only, forearm only, arm only, foot only, or leg only.
- Do push-ups, sit-ups, or some other exercise.
- Run up stairs or bleachers.
- Pull a weight with a rope.
- Jump with or without weights attached.

Perform these activities, and record in Data Table A the *force* in newtons that acted, the *distance* in meters moved against the force, the number of repetitions (or "reps"), and the *time* in seconds required. Then calculate the *power* in watts. (One hundred seconds is a convenient time interval.)

Count the number of reps and measure the time.

Activity

Data Table A

	1	2	3	4	5	6	7	8	9	10
Force										
Distance										
# Reps										
Work										
Time										
Power										

Step 2: Complete the table by recording the results of four other activities performed by other class members.

Analysis

1. What name is given to the rate at which work is done? What are the units of this rate?

2. In which activity done by your class was the largest power produced? Which muscle groups were used in this activity?

3. Did the activity that used the largest force result in the largest power produced? Explain how a large force can result in a relatively small power.

4. Can a pulley, winch, or lever increase the rate at which a person can do work? Pay careful attention to the wording of this question, and explain your answer.