Power

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

Required Equipment and Supplies:
Stairs
Stopwatch
Meterstick
Weights
Rope

Discussion

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 newton-meters (or *joules*), and time is in seconds, power is in *watts*.

Procedure

Step 1: Select an activity from the following lists:

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

Step 2: Perform the activity and record in Table A. Express force in newtons, distance moved by the force in meters, and time required in seconds. Calculate the power in watts. Show your calculations.

Step 3: Repeat for 3 more activities

Questions:

1. Suppose you lifted a 25-N brick vertically one meter using your arm. How much work do you do *lifting* the brick? How much work do you do on the brick *lowering* it one meter?

2. Which of the activities done in class produced the greatest *power*? 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 exerting a large force can result in small power.

4. Can a pulley, winch, or lever increase the *rate* at which a person does work? Be careful of the wording of this question and explain your answer.

Table A

DATA TABLE POWER = $\frac{F \cdot d}{t}$

FORCE					
DISTANCE					
TIME					
POWER					