

Background Information:

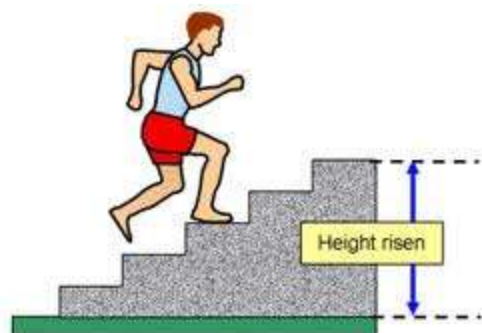
Work equals force times the distance through which the force acts. Force is expressed in newtons (N) and distance is expressed in meters (m). Work is expressed in newton-meters, or the simplification, joules (J). The rate which work is done is called power. Power equals work divided by time. If work is in joules (J) and time is in seconds (s), power is expressed in joules/second, or the simplification watt (W).

Objective:

- To find out how much power you use when climbing the stairs.
- To practice calculating work and power.

Materials:

scale metric ruler stairs stopwatch

**Procedure:**

1. Measure your mass in pounds using the scale.
2. Convert your mass in pounds to kg by multiplying by 0.45.
3. Convert your mass in kg to weight in newtons.
4. Measure the height in meters of one stair in meters.
5. Count the number of steps you will be climbing—and multiply this by the height of a step to find the total height in meters.
6. Climb the stairs as quickly and as safely as possible. Record the time it took you to run up the stairs.
CAUTION: Be very careful.
7. Repeat step 6 two more times. Record your times in the Data Table.
8. Repeat steps 6 and 7; however, this time walk up the stairs.

Data:

Mass in pounds	
Mass in kg	
Weight in newtons	
Height of stairs	

	Running Time (seconds)	Walking Time (seconds)
Trial 1		
Trial 2		
Trial 3		
Average		

Calculations:

Determine how much work was done running up the stairs.

Using the average time determine the power required to run up the stairs.

Determine how much work was done walking up the stairs.

Using the average time determine the power required to walk up the stairs.

Analysis:

1. Was the amount of work you did for each trial the same? Why or why not?
2. Was the amount of power you expended the same for each trial? Why or why not?
3. If you had climbed more slowly, how would the work have been affected? How would the power output have been affected? Explain your answer.
4. Two people climbed to the roof of a building. The older gentleman walked up a gentle ramp. The younger man climbed up a steep spiral staircase. Which person did more work? Explain.

Application:

1. You do work when you shovel your driveway. If you use a snow blower, is the work done more, less or the same? Explain.
2. What about power: when shoveling versus using a snow blower, is power more, less or the same? Explain.

