Temporary Hall Pass

Please allow these students access to a set of stairs for a physics lab activity on Wednesday, February 28, 2018 only.

Please send them back to class if they are being disruptive. Thanks,

Mr. Bryant

Personal Power Lab

The idea: *Power* and *energy* are often confused, but the difference is simple: power is the **rate** of energy conversion or transfer. So…

$$\text{Power} = \Delta\text{Energy}/\text{Time} \qquad \text{or} \qquad P = \Delta E / t$$

In this case the change in energy will equal the change in gravitational potential energy, so we may write:

$$\text{Power} = PE_g / \text{Time} \qquad \text{or} \qquad P = mgh / t$$

In this experiment you will calculate the power output of a familiar machine -- your own body.

What you'll need: meterstick, stopwatch, hall pass, bathroom scale, and a set of stairs.

What you'll do: at some time before or after the experiment, mass yourself on the bathroom scale. You can find your mass in kilograms by dividing your weight in pounds by 2.2. (Now, if you decide to cheat a little on the mass, nobody will know but you... And if you are genuinely uncomfortable about this, you can always be the data recorder for your group.)

PLEASE GO QUIETLY TO A SET OF STAIRS; AS YOU ALREADY KNOW, MANY OTHER CLASSES ARE IN SESSION AND WE DO NOT WANT TO DISTURB THEM. Measure the height of the set of stairs of your choice, in meters. It's probably easiest to measure one step accurately in centimeters, convert it to meters, and then multiply by the number of steps. Please note that we want the *vertical rise* of the steps, not the diagonal distance along them. (You know why don't you? If not, better find out before you start.)

Names: _____

Decide in your group what kind of stair-climbing you wish to measure. Do you want to contrast someone just walking up the stairs with someone else running up them? Do you want to compare the members of your group walking up the stairs in a typical way? Or would you rather compare the group members as they scramble up as quickly as possible? Should people be allowed to use the handrails for extra power? Should they be able to skip steps, or must they touch each one? You decide, but don't make it so complicated you get swamped in data—check with your teacher if you have questions. **Just be sure to report your choice in the section below** (Suggestion: Choose methods different enough so that your measurements show a noticeable and fairly significant difference.)

Whatever you choose, for each person, use a watch to measure the time from when the subject's feet are both on the floor below the first step, until they are both on the landing above the stairs. *It might be good to do several trials per person -- climbing the stairs the same way in each trial, of course -- and then average the times per person.*

For each person, find their change in potential energy and divide by the time it took to change the potential. (Please use 9.80 m/s^2 for ***g***) The result will be the climber's power output, in Watts.

One US horsepower equals 746 Watts, so divide the power result by 746 to yield the climber's power in horsepower.

Data Table:

Person & Mass	**Climbing Method**	**Trial 1**	**Trial 2**	**Trial 3**	**Average Time**	**ΔPE_g**	**Power**	**Power**

Total Stair Height = _____

Climbing Method (detailed description):

Describe how the choices in climbing (method) affected the person's stair climbing power.

Did you include units of measurement in your data table?