# POWER

A simple way to measure the power output of a person is to measure the time it takes the person to walk/run up a flight of stairs (or bleachers). In this experiment you will measure your power in climbing a flight of stairs and compare it to the power of your classmates.

1. Measure the height from the ground to the second floor/top of stairs (or other desired position).
2. Record your name and weight (in pounds) or use the scale to obtain your mass (in kilograms).
3. Measure the time it takes to run (or walk) to the desired height.
4. Share your values with your classmates and record their values in the data table.

***After everyone has run (or walked) up the stairs, perform the following calculations to find the power.***

1. Convert a weight from pounds to Newtons by dividing the weight in pounds by 2.2 to get the mass in kilograms. Then multiply the mass (in kilograms) by 9.8 m/s/s to obtain the weight in Newtons.
2. Find the amount of work (in Joules) each person has done by multiplying their weight (in Newtons) by the height ascended (in meters).
3. Find the power (in Watts) using the formula: *Power (W) = Work (J) / time (sec).*
4. Find the equivalent horsepower by dividing the power (in Watts) by 746 because 1 horsepower equals 746 Watts.
5. Record all values in the data table.

## **** Alternative Procedure ****

Find the power output in doing work on an object (a brick, book bag, etc...). Weigh the object and carry it up the stairs or pull it up using a rope. Calculate the power exactly as described above. In the data table, write "*your name* carrying or lifting *item*" under the "Name" column.

## Questions:

1. The work done in traveling up the flight of stairs (or lifting an object) depends only on …

2. Power depends on …

3. How would the work done in lifting a load up three flights of stairs compare to the work done in lifting the same load up one flight of stairs?

4. What happens to the power output if the same amount of work is done in one-half the time?

5. What happens to the power output if the same amount of work is done in twice the time?

6. How much work (energy) is needed to keep a 100 W light bulb lit each second?

7. How much work (energy) is needed to keep a 100 W light bulb lit each minute?

8. How much work (energy) is needed to keep a 100 W light bulb lit each hour?

9. The same amount of work (energy) needed to keep the 100 W light bulb lit for one hour could be used to lift a 2000 kg SUV to what height?

# POWER DATA TABLE

## Lifting Objects

| Name | Weight (lbs) | Mass (kg) | Weight (N) | Height (meters) | Work (Joules) | Time (sec) | Power (Watts) | Power (hp) |
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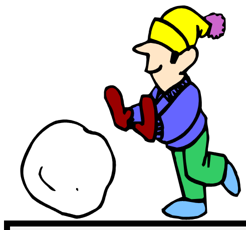
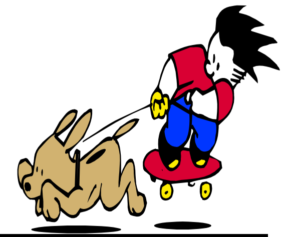


# POWER DATA TABLE
## Pulling Objects



| Name | Object | Pulling Force (N) | Distance Pulled (meters) | Work (Joules) | Time (sec) | Power (Watts) | Power (hp) |
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