Wattage & Horsepower Lab

Name _____Pd_____
Lab Partners:_____
_____
_____

Purpose:
In this lab, you will be determining your own personal wattage and horsepower. You will be doing this lab using metric units of **kilograms, meters,** and **seconds,** and then converting to the British units mentioned below. These units will give you your power in terms of the metric unit of **Watts (W) first**, which you will then convert to **hp.**

Testable Question:
What kind of wattage and horsepower can a student generate?

Discussion:
Work (**W**) can be done in many ways. The amount of time you take to do the work affects the power (**P**) necessary to do the work. The quicker you do work, the more **power** you need to do it. Power is the **rate** at which you do work, or.....

$$\textbf{P}\text{ower} = \frac{\textbf{W}\text{ork}}{\textbf{t}\text{ime}}$$

One of the useful ways of expressing power is in terms of **horsepower (hp).** This unit came about historically as an expression of the amount of power necessary for a horse to move a **550 pound** load so as to move it at a speed of **1 foot/second** . Horsepower is the British, or English unit for power.

$$\textbf{1 hp} = \textbf{550 lb.} \times \frac{\textbf{1 ft.}}{\textbf{1 sec}} \quad \text{or.....} \quad \textbf{1 hp} = \textbf{550} \frac{\textbf{ft. lb}}{\textbf{sec}}$$

You can compare your power to the average lawnmower horsepower (1 and 1/2 hp) or to the average car horsepower (90 to 120 hp) or to a 100 watt light bulb (1/7th hp), or you can compare your power to the current Whitman High School record for student horsepower (1.3 hp), by using the conversion factor of…

1 hp = 746 Watts

Procedure:
In order to determine your horsepower, you will need to identify and measure several different things. First of all, you need to know the amount of ***work*** you will be doing to lift your body up a flight of stairs. The work you do is the product of the **Force** you use to lift your body times the **Distance** you lift your body. The force you use to lift your body is your weight, which should be in units of **Newtons.**

Work **= F**orce (or ***weight***) **x D**istance

Record your weight in pounds here: **Weight:** _____ lbs.

Convert your weight in pounds to weight in newtons: _____**lbs. x (4.45 newtons/lb) = _____ N**

Now you will need to measure the distance over which you will be doing the work. You are lifting your body and doing work vertically against the force of gravity, so you need to measure the vertical height up which you lift your body. This can be accomplished by measuring the height of one of the stairs using meters as the measurement, and multiplying that height by the total number of stairs you climbed:

Height of one stair: _____ cm. **Height of one stair: _____ m.** **Number of stairs: _____**

Total vertical **Distance** of lift (number of stairs x height per stair) = **_____ m.**

So the work you'll be doing would be:

Work (J) = Weight (N) x *total vertical* **Distance (m)** = _____ **Nm** *(or Joules).*

Now you're ready to figure out your power. In order to do this you must determine how quickly you did the work of lifting your body. You and your lab partner will time each other while running as quickly as you can up the flight of stairs you have measured. Do this three different times each. Record your times here:

time 1: _____secs. **time 2: _____**secs. **time 3: _____**secs

To figure out your power in **Joules/sec** or **Watts** , divide the work you did by the time it took you to do it:

$$\textbf{P}\text{ower} = \frac{\textbf{W}\text{ork (J)}}{\textbf{t}\text{ime (secs.)}}$$

Power 1: _____watts **Power 2: _____**watts **Power 3: _____**watts

The final step in figuring out your horsepower is to divide your **wattage** power by **746 watts/ hp.** This final step will give you your ***Horsepower.***

hp 1: _____ **hp 2: _____** **hp 3: _____**

So how do you rate? Can you light up a light bulb? Mow a lawn? Beat a car on a race track? :)
Do the research and find out the horsepower for the following common items. Be sure to include your source for your information.

Object	Wattage	Horsepower	Information Source
Lawnmower			
Light bulb			
Microwave Oven			
Bayliner boat			
Toyota Prius			