People Power!
Your Personal Stair Climbing Power

Introduction: Watt did you say?? Where did the unit "watt" come from? James Watt, inventor of the steam engine, conducted an experiment to determine how the power of his engine compared to that of a horse. Power is the rate at which work is done by (or to) an object. Work is simply the use of energy in order to perform a mechanical motion, such as lifting, pushing, or even walking. Watt's experiment measured how fast the average horse could do work. He found the answer and defined the amount of work performed per second by a horse as **horsepower**. One horsepower (**hp**), expressed in modern SI units equals 746 N·m/s or 746 J/s or 746 W (watt).

Purpose: To determine the amount of work you must do to climb a flight of stairs.
To determine the power of your climb up a flight of stairs.
To compare your power to that of the average horse.

Materials: stairs ½ meterstick stopwatch

Procedure:

Complete the following in the room:

1. Hypotheses: How much horsepower do you think you have? Who in your group do you think would generate the greatest horsepower?

2. Use a bathroom scale to determine your weight in pounds. *Record your weight (pounds) below your data table.* Convert your weight into Newtons. Show your conversion work below your data table.
   1 lb = 4.5 N

Have your teacher approve your hypotheses and weight conversion.

Complete the following on the stairs:

3. Measure and record the height (in centimeters) of one step on the stairs. Convert to meters and *record above your data table.*
4. You will be making four climbs: 3, 6, 9, and 12 steps. You need to calculate the height (in meters) of each climb. *Record these as the height in your data table.*
   Have your teacher approve up to this point.
5. Have your partner time you while you climb the stairs, **WITHOUT RUNNING**. *Record all four of your climb times in your data table.*
   Have your teacher approve up to this point.
6. When every person in your group has climbed the stairs…sit down and work on the Lab Questions.

Lab Questions

In physics work can only be done when a force is applied to or by an object in the same direction as the resulting motion. This is why we are climbing stairs. Your weight is a vertical force. Climbing the stairs is quite vertical, so you will use your weight as the force and the vertical height climbed as the distance to determine the work you did. You will then determine your power. Power is the rate at which work is done. Recall that rates are divided by time, so... **Power = Work/time**

1. Calculate your work for each climb. Show K-U-E-S for one.
   Work = Force · distance (both in the same direction)
   Have your teacher approve up to this point.
2. Construct a **work v. time** graph from your group's data. Draw a best fit line for each person's data points.
3. Calculate (K-U-E-S) the slope of your line. What physical quantity is the slope measuring? Have your teacher approve up to this point.
4. Use your 12 step data to calculate (K-U-E-S) your power. Is this close to your slope calculated in the previous question?
5. Convert (show conversion) your power to horsepower.
6. How close was your initial horsepower prediction? Which group member has the greatest horsepower and why? Did your results surprise you?
   Have your teacher approve up to this point.

Your weight= _____ lb = _____ N

Show your unit conversion here ⟶

_____ X _____

Approval _____

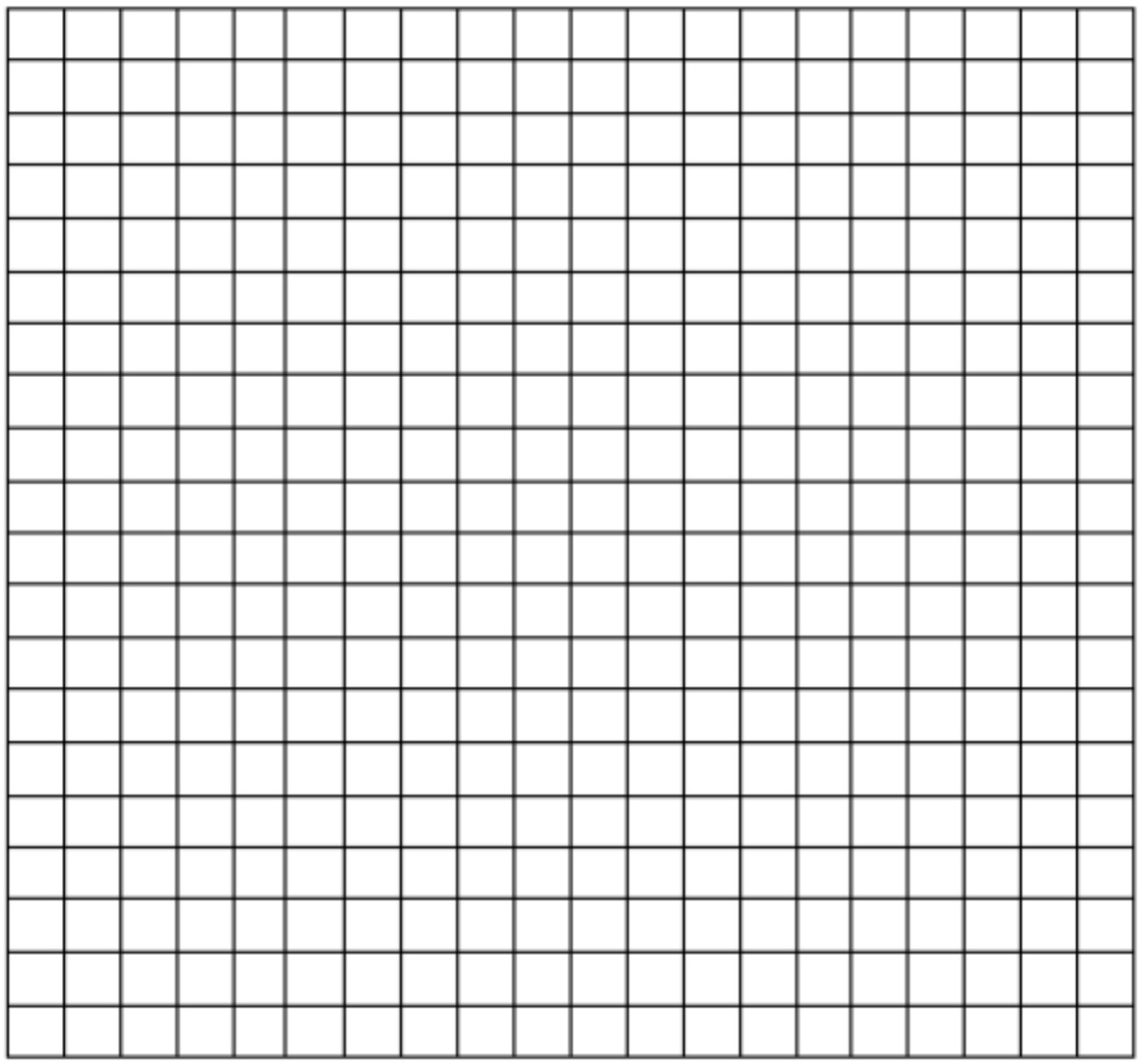
Single step height = _____ cm = _____ m

Name ⟶				
	Height (m)	**Time (s)**	**Time (s)**	**Time (s)**
3 steps				
6 steps				
9 steps				
12 steps				

K-U-E-S for Work **Approval** _____

Results table

Name ⟶			
	Work (J)	**Work (J)**	**Work (J)**
3 steps			
6 steps			
9 steps			
12 steps			



Graph/slope Approval _____

Show K-U-E-S for Slope

K-U-E-S for 12 step Power and horsepower conversion

_____ X _____

Approval _____