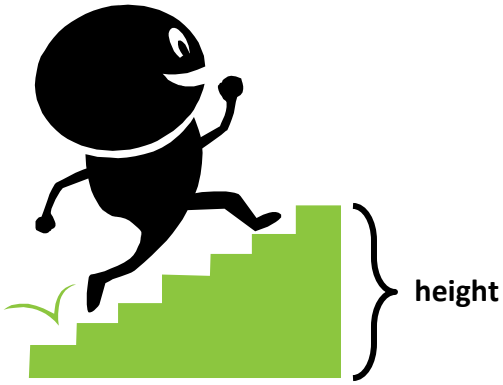
Integrated Science Name _____ Hour _____

YOUR POWER LAB



Purpose

To determine the work and power as you climb stairs.

Materials

Meter stick, stopwatch, stairs, people

Procedure

1. Form a group of 2-4 people. Write your names in the Data Table. If there is less than four people, a person will have to go twice.
2. Measure the vertical height of stairs in meters. (Multiply the height of 1 step in meters by the total number of steps.)
   The vertical distance is probably the same for everyone if you climb up the same number of stairs.
3. Be careful when running up the stairs. Do not trip.
4. Start the timer as the climber starts climbing on the first stair. Stop timing when the climber reaches the top of the vertical height measured.
5. Take turns climbing and timing. Each person should climb at different speeds.
6. Then move on to the calculations.

Data and Calculations

1. Only the component of the force in the y direction contributes to the work done. Remember gravity work in the downward direction against your mass to produce weight. Since gravity is the only force in the y-direction, the force is simply your weight in Newtons. Convert your weight in pounds to Newtons by multiplying by 4.45, and write that in the Force column.
   1lb = 4.45N

2. Calculate the work for each person in your group, and record it in the data table.
   Work = Force x vertical distance

3. Calculate the power for each person in your group, and record it in the data table.
   Power = Work / time

Climber's Name	Vertical Distance (m)	Time (s)	Force (N)	Work (J)	Power (W)

Conclusions

1. Which student did the most work? How?

   _____

   _____

   _____

2. Which student had the most power? How?

   _____

   _____

   _____

3. Calculate **your** power in **horsepower**. Show your work here and circle your final answer.

   (Hint: If 1 hp = 746 Watts, simple divide by 746 watts).

4. Do you think your power will stay the same if you were climbing stairs up to the twelth floor of a building? Explain.

   _____

   _____

Power

$$\text{Power} = \frac{\text{Work}}{\text{Time}}$$

Work

$$\text{Work} = \text{Force} \times \text{Distance}$$

1. Amy uses 20N of force to push a lawn mower 10 meters. How much work does she do? If Amy does this in 8 second, what is her power?

2. Joe balances a stationary coin on the tip of his finger 20cm from the top of the table. How much work is Joe doing?

3. Frank does 2400J of work in climbing a set of stairs. If he does the work in 6 seconds, what is his power output?

4. How much power is required to pull a sled if you use 60J of work in 5 seconds?

5. How much work does an elephant do while moving a circus wagon 20meters with a pulling force of 200N?

6. If it takes 5 seconds for you to do 1000J of work, what is your power output?

7. A 900N mountain climber scales a 100m cliff. How much work is done by the mountain climber?