

CHAPTER

10

Physics Lab Worksheet

Materials



■ Avoid wearing loose clothing.

- meterstick (or tape measure)
- stopwatch
- bathroom scale

Stair Climbing and Power

Can you estimate the power you develop as you climb a flight of stairs? Climbing stairs requires energy. As the weight of the body moves through a distance, work is accomplished. Power is a measure of the rate at which work is done. In this activity you will try to maximize the power you develop by applying a vertical force up a flight of stairs over a period of time.

Question

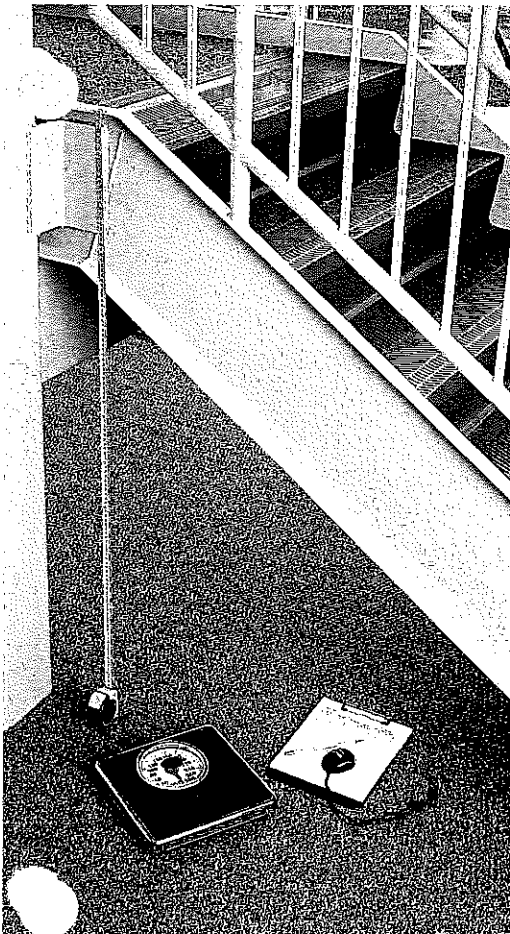
What can you do to increase the power you develop as you climb a flight of stairs?

Objectives

- Predict the factors that affect power.
- Calculate the power developed.
- Define power operationally.
- Interpret force, distance, work, time and power data.
- Make and use graphs of work versus time, power versus force, and power versus time.

Procedure

1. Measure and record the mass of each person in your group using a bathroom scale. If the scale does not have kilogram units, convert the weight in pounds to kilograms. Recall that $2.2 \text{ lbs} = 1 \text{ kg}$.
2. Measure the distance from the floor to the top of the flight of stairs you will climb. Record it in the data table.
3. Have each person in your group climb the flight of stairs in a manner that he or she thinks will maximize the power developed.
4. Use your stopwatch to measure the time it takes each person to perform this task. Record your data in the data table.

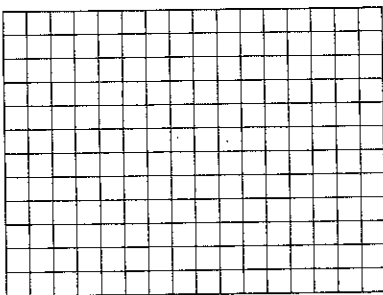
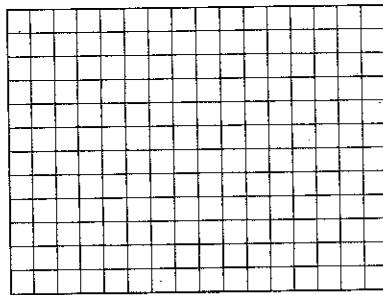
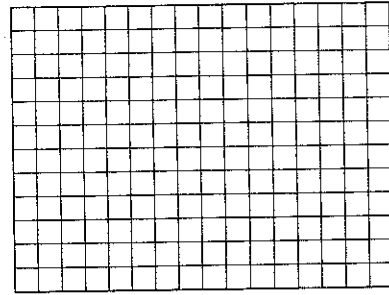


10 **Physics Lab Worksheet**

Data Table					
Mass (kg)	Weight (N)	Distance (m)	Work Done (J)	Time (s)	Power Generated (W)

Analyze

1. Calculate Find each person's weight in newtons and record it in the data table.
2. Calculate the work done by each person.
3. Calculate the power developed by each person in your group as he or she climbs the flight of stairs.
4. **Make and Use Graphs** Use the data you calculated to draw a graph of work versus time and draw the best-fit line in Graph 1 below.
5. Draw a graph of power versus work and draw the best-fit line in Graph 2 below.
6. Draw a graph of power versus time and draw the best-fit line in Graph 3 below.

**Graph 1****Graph 2****Graph 3**

Conclude and Apply

1. Did each person in your group have the same power rating? Why or why not?

2. Which graph(s) showed a definite relationship between the two variables?

3. Explain why this relationship exists.

4. Write an operational definition of power.

Going Further

1. What three things can be done to increase the power you develop while climbing the flight of stairs?

2. Why were the fastest climbers not necessarily the ones who developed the most power?

10 Physics Lab Worksheet*continued*

3. Why were the members of your group with more mass not necessarily the ones who developed the most power?

4. Compare and contrast your data with those of other groups in your class.

Real-World Physics

1. Research a household appliance that has a power rating equal to or less than the power you developed by climbing the stairs.

2. Suppose an electric power company in your area charges \$0.06/kWh. If you charged the same amount for the power you develop climbing stairs, how much money would you earn by climbing stairs for 1 h?

3. If you were designing a stair climbing machine for the local health club, what information would you need to collect? You decide that you will design a stair climbing machine with the ability to calculate the power developed. What information would you have the machine collect in order to let the climber know how much power he or she developed?

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