Name: Date: Period:

Stair Lab

$$W = Fd \qquad P = \frac{W}{t} \qquad F_G = mg$$

Pre-Lab

1. *Practice Problem:* A 20-kg box is lifted 3 m into the air:
   (a) Calculate the force that you are doing work against.

   (b) How much work is needed to lift the box that high?

   (c) If it took you 12 s to lift it 3 m, what is your power?

Hypotheses

In this lab you will change the *speed* you climb the stairs, the *height* of the stairs, and the *mass* you are carrying.

2. Which (if any) of these will affect work? Explain why you think this.

3. Which (if any) of this will affect power? Explain why you think this.

Procedure

1. Pick two members of your group to go up the stairs. Person A will carry 1 book; person B will carry 3 textbooks.
2. Start at the bottom of the stairs for trial 1 (long stairs) or trial 2 (short stairs).
3. One person in the group will time how long it takes person A to climb the stairs at a slow rate (think how fast you would go on a Monday morning). Record the time
4. Return to the bottom of the stairs, and repeat step #2, but this time at a moderate pace (think how fast you go on a regular day)
5. Return to the bottom of the stairs, and repeat step #2, but this time at a fast pace (think how fast you go if you're running late to class)
6. Repeat steps #2-5, but this time do it for the other set of steps
7. Repeat steps #2-6 with person B.

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Data

Trial #1: Tall stairs

	Stair Height	Mass carried	Climb Time (s)	Work (J)	Power (W)
fast	3.5 m	(1 book) 2.7 kg			
medium					
slow					
fast		(3 books) 8.1 kg			
medium					
slow					

Show at least one calculation for work and at least one calculation for power:

Trial #2: Short stairs

	Stair Height	Mass carried	Climb Time (s)	Work (J)	Power (W)
fast	0.7 m	(1 book) 2.7 kg			
medium					
slow					
fast		(3 books) 8.1 kg			
medium					
slow					

Show at least one calculation for work and at least one calculation for power:

$$W = Fd \qquad P = \frac{W}{t} \qquad F_G = mg$$

Conclusion Questions

Justify all your answers using your data!!

4. Compare the work you did carrying one book vs. carrying multiple books. How did mass seem to affect the amount of work done?

5. Compare your power output for the different speeds in trial one. How did the speed with which you climbed the stairs seem to affect your power?

6. How did the height of the stairs seem to affect your work?

7. Of the power calculations you made, which ones are similar? Why does this make sense?

Post-Lab

8. A crane lifts a 1200-kg car to height of 10 meters in a time of 8 seconds. What power does the motor produce in accomplishing this task?