Lab: Up and Down (work and power)

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Objective:

The objective of the lab was to measure the work and power produced when going up and down a hill. For this lab, I used a skateboard. The experiment was performed by myself first walking up the hill with the skateboard and timing the time it took me to get there. Then the time that it took to skate down the hill was timed. The altitude at the top and the bottom of the hill was recorded. The measured power output when going up the hill was 269.7 W. The power that gravity did to bring me back down the hill was 553.3 W.

Discussion/Results:

To measure work and power produced first a hill was identified to climb. I used the hill located at the Civic Center Park. The measured height of the hill was 20ft. This was determined by taking the top altitude and subtracting the bottom altitude of the hill. At the bottom of the hill, the measured altitude was 10ft while at the top of the hill there was a measured altitude of 30ft. Going up the hill with the skateboard took me 14.15 seconds, and going down on the hill riding the skateboard took me 8.76 seconds. The gravitational acceleration was 9.81 m/s^2.

Data Table:

Elevation and Time to get to the top and bottom of the hill on a skateboard:

	Elevation	Time
Top of Hill	30ft	17.97 sec
Bottom of Hill	10ft	8.76 sec

My Weight: 180 lb

Gravitational Acceleration: 9.81 m/s^2

Step 1: Conversions

1lb → 0.45kg

180lb → 81.8kg

1ft→ 0.38 m

Conversions were used to convert lb to kg and ft to m. This was so that these data values could be used for the equation when determining power.

Step 2: Calculating Height of Incline

Initial elevation - final elevation= height of incline

30ft - 10ft = 20ft

To determine the height of the hill first the altitude that the top of the hill was taken. Then the altitude at the bottom of the hill was taken. These values were subtracted from another.

Step 3: Calculating Work Done Going Down

work = force x distance

Power going down →

W= force x distance

F=81.kg x 9.81 m/s^2 = 794.61 N

W= 794.61 N X 6.1 m = 4847.12 J

To determine the work done going down the hill first the force was determined. Once the force was calculated this value (N) was then multiplied by the distance (m).

Step 4: Calculating the Power that Gravity did to bring myself back down the hill

Power= Work (mass x acceleration x distance) / Time

Power = 4847.12 J / 8.76 sec =

553.3 W

To determine the power that Gravity did to bring me back down the hill the previously calculated value for work was taken and divided by the time it took to go down the hill.

Step 5: Calculating Work Done Going Up

W=force x distance

F=81.kg x 9.81 m/s^2 = 794.61 N

To determine the work done going up the hill first the force was determined. Once the force was calculated this value (N) was then multiplied by the distance (m).

W= 794.61 N X 6.1 m = 4847.12 J

Step 6: Calculating Power Output Going Up

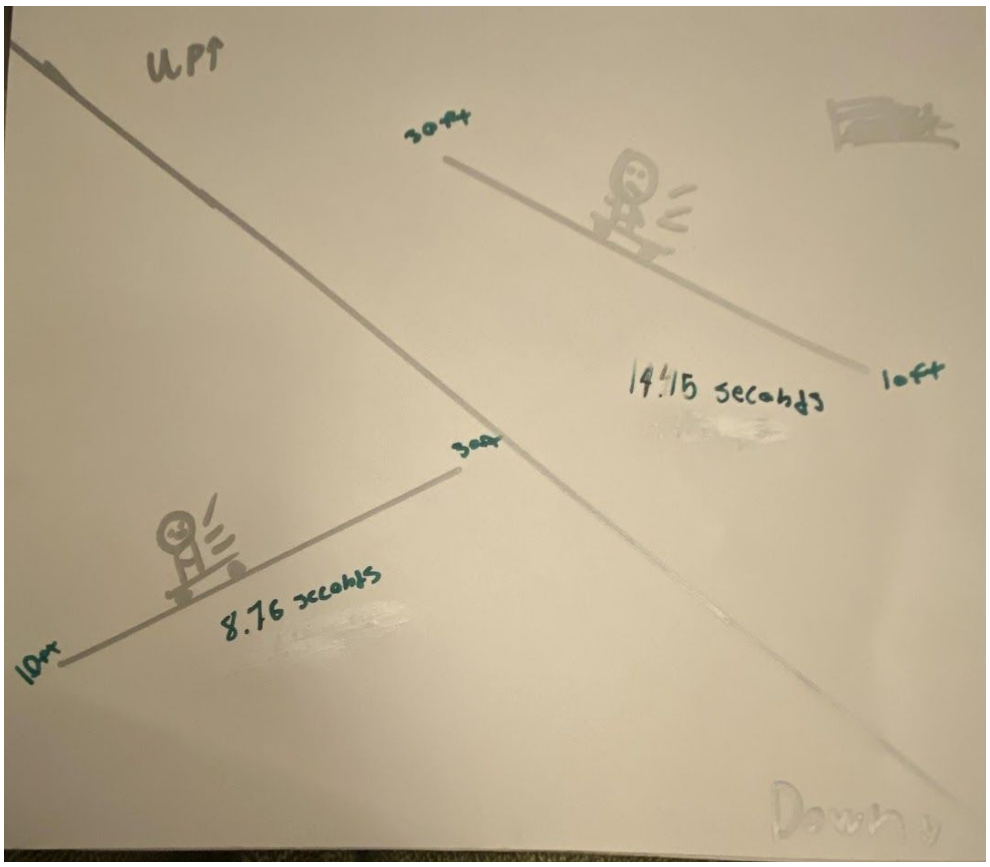
Power= Work (mass x acceleration x distance) / Time

Power = 4847.12 J / 14.45 sec =

335.4 W

To determine the power output going up the previously calculated value for work was taken and divided by the time it took to go up the hill.

Illustration: Going up and down on a skateboard on a hill



Summary:

From the results of the lab, it took more power going down up than it did uphill. The independent variable was the work and power done. More power going downhill would signal that there was a greater speed than going uphill. The dependent variable was the amount of time that it took to go up and down the hill. The constant variable was the mass, distance, and gravitational acceleration. The amount of mass has a direct impact on the amount of work that one had to do.