Earth, Space and Radiation: Falling Down

Aim: Do things fall at a steady speed? And do all things fall at the same speed? Do heavy things fall faster than light things? How does a free falling parachute work?

Theory:

Cup cake holders will be dropped from a certain point on a meter ruler, and the time it takes to reach the ground will be measured and then noted down.

When you drop objects, it will fall to the ground. It falls down because the object is pulled towards the centre of the Earth by a force . This force is the Earth's pull and is called the pull of gravity or gravitational force.

When an object falls to the ground there is also another force, which acts on the object, resisting its fall to the ground. This force is called air resistance.

The acceleration due to gravity is the same for all falling objects, providing there is no air resistance. When there is air resistance the speed of a falling object builds up to a constant. This value is called the terminal speed of the object.

All falling objects accelerate at the same rate, g, providing air resistance it negligible.

Hypothesis:

My theoretical work has helped me immensely in helping me with an accurate prediction.

I predict that increasing the Cup cake holder will increase the rate i n which it falls to the ground. Due to the fact that there is less air resistance acting against the Cup cake holder. But when there are less cup cake holders I will find that they will reach the ground later on. Gradually when I add more cup cake holders I will find that they will reach the ground much quicker because there is less Air resistance acting against it.

On the Graph, the first result will be highest and the last result will be the lowest compared to the other results I will be taking.

Plan

Apparatus: 8-cup cake holders
Watch or clock
Meter Ruler
Calculator

1) Set up the apparatus as shown in the diagram below but leaving out the paper cups.

2) Get the amount of paper cups needed and in this case it is about eight cup cake holders.

3) Set the metre Ruler so it is straight against the table, so you can use it as a starting position for the paper cup in order for it too be a fair test.

4) As soon as you have got the starting position for the cup cake holder, you then turn on the clock and then drop and write down the time.

5) Take three reading at the current number of cup cake holder.

6) Repeat Steps 4 and 5 until the table have all the values written in.

7) Proceed to the data analysis stage.

Fair Test:

In order for my results to be accurate I must always start my cup cake holder each time at 0. By repeating each of my results a further two times, an average can be taken and any anomalous results can be s potted before they are taken as genuine ones. As soon as the Cup cake holder is dropped I must try and start the Timer immediately. When dropping the object I must not force the cup cake holder to go down it has to go by itself.

Table of Results:

Number of Cup Cake Holders	Time 1	Time 2	Time 3	Average
1	1.23	1.13	1.29	1.22
2	1.15	1.19	1.15	
3	1.09	1.05	1.06	
4	0.97	0.91	0.91	
5	0.87	0.81	0.88	
6	0.72	0.67	0.75	
7	0.69	0.66	0.65	
8	0.44	0.59	0.55	0.52

Graph

Conclusion:

From the results I have gathered I can state that an increase in Cup cake holders without a doubt does increase the rate in which it reaches the ground. Which was also expected in my prediction, the relationship between the Cup cake holder and the time reac hed the ground was non linear.

The gradual decrease was attributed to the fact that more cup cake holder's means less time for it too reach the ground. The upward force is less than the downward force acting against it. If this were not so you find out th at when you added more cup cake holders it would not reach the ground quickly.

However my predictions about, if I put seven cup cake holders together well I predicted that it will reach the ground in 0.65 seconds, I was nearly right as, but it reached the ground 0.67 seconds so I was very close. I drew my graph as a straight line it started very high and ended very low. This is because at that stage there was less air resistance. In some way we could relate this too a free falling parachute. It uses the fact that air resistance opposes (acts against) the motion of parachute to control there fall through the air.

Overall, my graph and my results supported my predictions fully. My idea that the more Cup cake holders the faster it will reach the ground was comprehensibly backed up my results. Which was very good.

Evaluation:

Overall, I would state the experiment as a success since my predictions were supported by my results. This Cup cake holder investigation was probably not performed as accurately as it could have been due to some controllable and uncontrollable conditions.

While performing the experiment, when I did for example seven cup cake holders sometimes they would just separate, even though they were put together. The Last reading when I was testing one-cup cake holder was far greater than the first reading when we were using one-cup cake holder. There seemed to be a

there seemed to be few anomalies apart from when the lamp was 20cm away. To improve the accuracy of the results, the readings would have to be taken several more times. The entire experiment could have been performed again, and the new results could be combined if the same plant is used. But the photosynthetic rate of the same piece of pondweed would eventually decrease over time anyway. Repetitions would however, improve the overall reliability of the results.

The negative effects from this problem may be inaccurate data for some readings. These would show up on my graph. However, there seemed to be few anomalies apart from when the lamp was 20cm away. To improve the accuracy of the results, the readings would have to be taken several more times. The entire experiment could have been performed again, and the new results could be combined if the same plant is used. But the photosynthetic rate of the same piece of pondweed would eventually decrease over time anyway. Repetitions would however, improve the overall reliability of the results.

There are quite a few factors that could affect the results of my experiment. Some of these are variables that were mentioned earlier and could not be controlled, or they were variables that were not initially considered.

While performing the experiment, some of the oxygen produced from photosynthesis may have dissolved into the water. Microorganisms living on the pondweed may have even used some oxygen. As the rate of photosynthesis decreased due to a decrease in light intensity, the size of the bubbles produced also became smaller. This change in bubble size was not accounted for when the results were analysed. For a more accurate analysis of the collected data, volume should have been measured instead of bubble quantity since the size of bubbles can vary. Using a capillary tube in place of the test tube so that the volume of each bubble could have been measured could have done this.

During the high intensities I had experienced counting difficulties of the bubbles being produced. There are also factors affecting accuracy at low light intensities. With low light intensity, the pondweed receives some light energy from background light such as sunlight seeping through curtains or the light from the lamp of another student's experiment. To eliminate most all background light, the experiment must be performed in a completely dark room. Even then, some of the light from the lamp in my experiment would reflect of the table and reach the plant though this amount of light is probably insignificant in affecting the rate of photosynthesis.

Temperature was also another factor that was controlled by the lamp being used. So I should have used a heat shield. The method of the experiment could probably also be improved to obtain more reliable results. Due to the high rates of photosynthesis of the pondweed, readings should be taken within shorter time periods. I had originally chosen to count the number of bubbles in two minute but these produced miscounts in the readings. If during a repeated experiment, counting bubbles is still used, there is a smaller chance for human error when counting within a smaller time frame. If the capillary tube option was to be chosen, volume should be measured for a smaller time frame to reduce the overall time to complete the experiment.

Due to the nature and convenience of the experiment, it could be easily modified to investigate another variable of photosynthesis. Since sodium hydrogen carbonate ($NaHCO_3$) is used to provide the pondweed with carbon dioxide. Performing the experiment with different volumes of $NaHCO_3$ could vary the amount of CO_2. The plant would be kept at a constant distance from the lamp and a constant volume of water would be added to the sodium hydrogen carbonate. Although I feel that my experiment was sound overall, I thought there were many points at which the accuracy was not perfect. As I have already stated, mostly due to the fact that I was relying on all the bubbles being the same size, which they clearly weren't, however many of the smaller inaccuracies also apply to my main experiment.

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