PARACHUTE INVESTIGATION

Research Question.

My research question is "How does the mass of a parachute affect the amount of time it takes to fall?" I believe that there should be some sort of inverse relationship here—that as the mass increases the fall time gets smaller.

The independent variable is the mass of the parachute, and the dependent variable is the amount of time to descend. Constant variables include the surface areas of the canopy of the parachute; the distance dropped the lengthy of the strings connecting the canopy to the base of the parachute, and the material of the parachute.

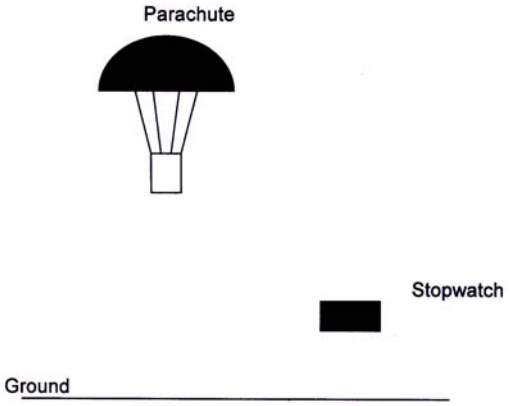
Materials and Method.

The materials I used are a plastic cup, string, garbage bag, masses of 10 g each, and a stopwatch.

My procedure was as follows.

1. A 50 by 50 cm square was cut out of the garbage bag and the corners were tied to the strings. Then the free ends of the strings were tied to the plastic cup
2. 10 grams was placed inside the cup and the cup was released, from a constant height as the stopwatch started timing. When the parachute hit the ground, the stopwatch was stopped. The time was recorded.
3. Step 2 was repeated twice to minimize potential sources of error.
4. Steps 2 and 3 were then repeated for masses of 20, 30, 40, 50 and 60 grams.

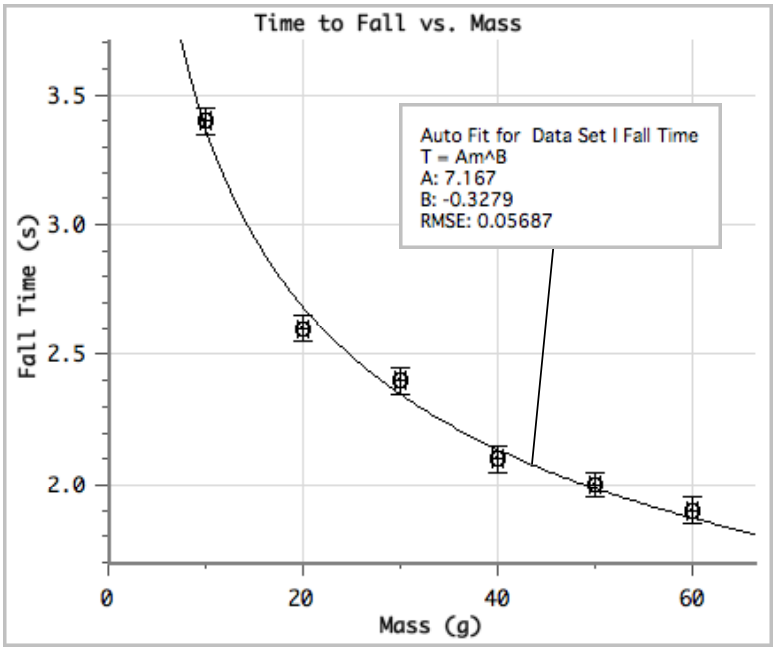
Figure Sketch of Setup



Data.

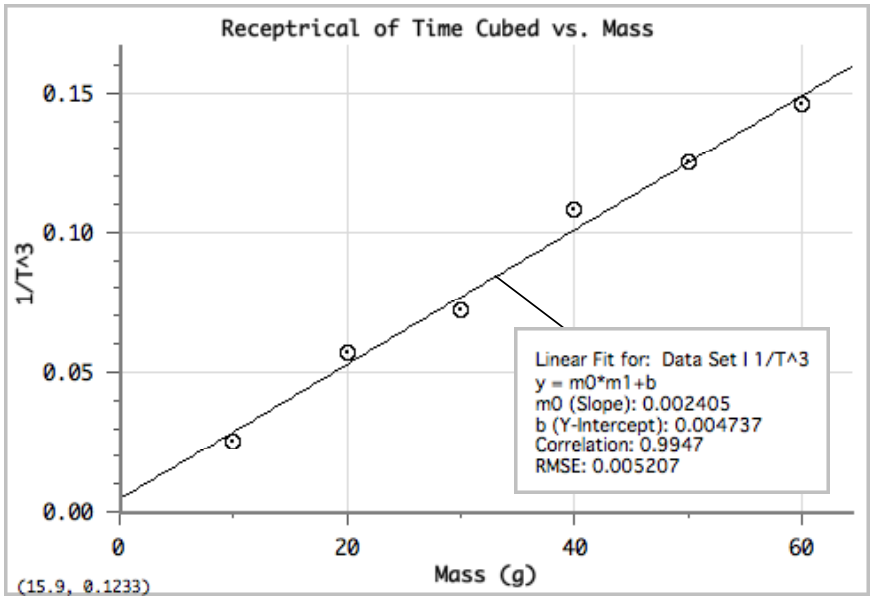
Mass of the parachute m / g $\pm\Delta m = \pm 0.5$ g	Time to fall to the ground t / s $\pm\Delta t = \pm 0.05$s
10	3.4
20	2.6
30	2.4
40	2.1
50	2.0
60	1.9

Analysis.



Sure enough, there is an inverse relationship here: as the mass increases the time decreases.

The computer's best curve fit tells me that $\text{Time} = \text{Constant} \times \text{Mass}^{-0.3279}$ or $t \propto m^{-0.33}$ which is the same as $t^{-3} \propto m$. Hence I now graph $1/t^3$ against m.



Conclusion.

From the results it is apparent that a correlation exists between the mass of the parachute and the time required to fall to the ground. It is not linear but rather parabolic, to the power three. I found that the reciprocal of time cubed is proportional to the mass.

One limitation of the experiment occurred when the parachute fell. Because it never fell straight down towards the ground, the distance traveled was never constant. This means that the apparently controlled variable of height was in not perfectly controlled. This would produce the results that are not entirely accurate but merely relativity close.

Another limitation is the timing system. Because the person timing is not perfectly accurate when pressing the button to stop and start, the time will vary even if the actual time for the fall remains the same.

To improve the experiment it could be done in an area with no wind so that the parachute falls straight to the ground without being blown off course. This would allow the distance fallen to remain constant and produce accurate results. Secondly, multiple timers could be used for each drop and the average could be taken so that any times that do not concur could be eliminated. I would need help doing this.