Parachute Design Challenge

[redacted]

Period 9

Introduction to Technology/Art
Brooklyn Technical High School
Mr. Goldman, Teacher
February 15, 2001

Name [redacted] Period 9

Excellent work (A+) here. Glad you enjoyed it so much! Hope you learned something about problem solving process

Parachute Report Assessment

1. **Cover** Neat ✓ Correct Format ✓ Correct Information ✓

2. **Table of Contents** Included ✓ Pages Numbered ✓ Page Numbers on T of C ✗ Woops.

what about after p. 7?

3. **The Design Challenge** Included ✓

4. **Orthographic Projection** Included ✓ (A-)

   3 views shown ✓ Views correctly oriented ✓ Major dimensions included ✓
   Ruled border ✓ Title Block ✓ Title Block information complete/correct ✓

You've got the idea, in general. (was it this round?)
~~needed to show~~
You aren't showing the ropes properly. Also need to include them in top view. See me on this.

5. **Discussion** Included ✓ Titled ✓ (A+)
   Process described ✓+ Variables listed ✓ Variables' affect examined ✓+

   What worked well/what did not ✓ Changes suggested ✓ Extra Credit ✓

process Very complete description of what you did (+ well written too.) Would have liked to know more about the value of the reading + working in a group, for you. Also how you timed it, dropped it, etc.
Your discussion of variables + how you worked w/ them was excellent. Keep it up J.
See back →

6. **Appendix** Title Page ✓ Test Records included 10 (A+) Other items ——

Excellent work. Good solid record here.
As noted on the back, be sure you take into account all previous tests when doing #2 in conclusions.

See back for additional comment

Table of Contents

ıme [redacted] Period 9

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Parachute Design Challenge I

tuation:

rachutes are devices most often used to increase the time it takes for an object to fall a given distance rough the air. (They are also be used to slow a vehicle or airplane to assist it in coming to a stop.) When ed in vertical drops, parachutes generally look like large canopies with a cargo tethered or tied to them.

e force of gravity causes objects, including parachutes, to fall towards the earth's surface. If we increase mass (weight) of a falling parachute or the load it is carrying (without changing anything else) we crease the force due to gravity, and the parachute and its load will fall faster.

falling parachute is designed to resist the pull of gravity. As it falls through the air, it collides with air olecules under it. Air has mass, and this provides a resistance to the falling motion of the parachute and its rgo. This air resistance is called drag. If we increase the surface area of a parachute (without changing ything else) we increase the number of collisions between the parachute and surrounding air molecules, at is we increase the drag, and it will drop slower.

oblem:

esign a parachute that takes the longest time to fall a specified distance.

ecifications:

Only the coffee filters provided by the teacher may be used to fabricate the parachute "canopy."

A minimum load of at least three washers (1/4", provided by the teacher) must be attached to the parachute as a load or cargo. Additional weight may be added.

The drop height will be from the bottom of the light fixtures. Only one person may hold the parachute in preparation for dropping. The parachute must be touching the light fixture when it is dropped/released.

ıles:

Students will work in groups. Every student must make his/her own parachute for the final "contest."

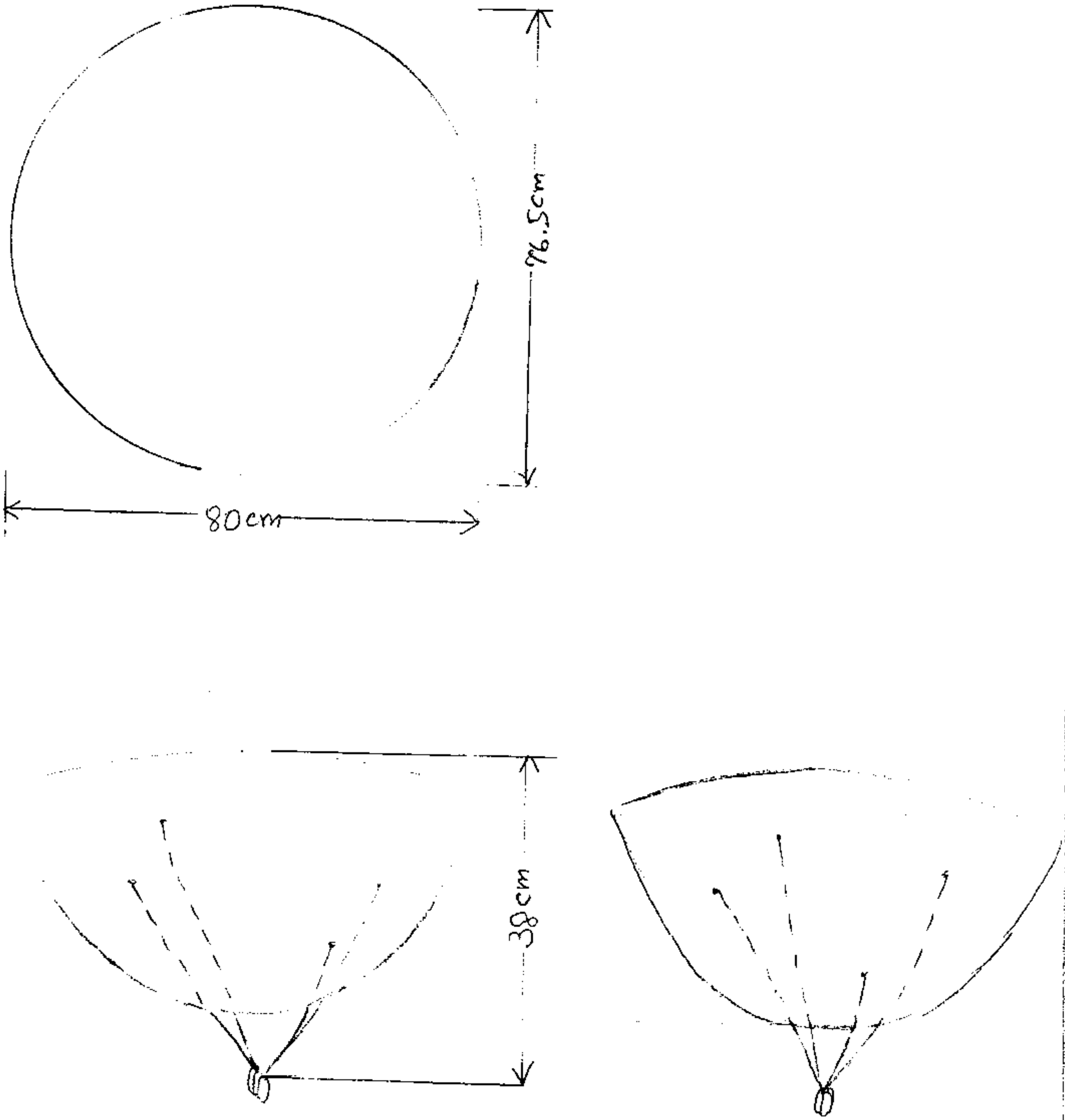
Drop time will be determined with a stopwatch provided by the teacher and will be kept by a students appointed by the teacher as "time keeper."

Each student will drop his/her parachute a maximum of 3 times. The number of drops will be determined by the teacher, depending of the time available.. The longest time aloft will be counted.

Group drop times will be determined as follows:
All team members' drop times will be totaled and the sum divided by the number of team members. If a student does not have a qualifying parachute to drop on the day of the "contest" his/her drop time will be zero seconds and will be added to the teams total before dividing the total.

The team with the highest score, calculated as defined in #4, will be declared the winner.

The date of the contest will be 2/8.



PARACHUTE	Period #9 Group #3	2/15/01	Drawn By [redacted]

Parachute Discussion

-First, I made a list of variables that could affect the dropping time of a parachute. Those variables included:

- Flatness of the coffee filters
- The amount of them
- Weight tied to the parachute
- Length of string
- Hole in the top/middle
- The way you drop it
- How many people hold it as its being dropped

- Next I made the simplest parachute that I could think of. In fact, it might not be a parachute at all. I took one coffee filter and attached three washers right to the middle of it. I did not use any string in the design. I dropped it from three different heights, and each time, it fell straight down. As the height increased, so did the drop time. But that was obvious. It became evident that the shorter the string (in this case no string), the straighter the fall.

- In the next design, I actually used a piece of string (6.5 inches long). Again, I made use of three washers. Pretty much the same thing happened as with my first design. The drop heights were the same, but the time increased by just milliseconds. So I decided to move on to testing how the amount of coffee filters would alter the results.

- In my 3rd design, I attached two coffee filters together. I hung three washers from them on a 7.5 string. With this change, the drop time was prolonged by once again, milliseconds. The fall of the parachute was a little less "direct" than the previous two. It began to get clear that the greater the surface area of the canopy, the more "flow" there is to the fall.

- My fourth design of the parachute incorporated 3 coffee filters instead of 2. The load and the string remained the same. However the results of the test were not great. In fact, the drop times actually seemed to decrease. At this point I made the inference that when there is merely one string, the size of the canopy cannot not play a big role. It actually plays no role at all. So I decided to play around with the string in the next test.

- In my 5th design, I used 3 coffee filters and three washers, again. However, this time I used 8 strings. I did not make three for instance, because I felt that the more places strings were connected to the canopy, the more efficient the parachute would be. Also, it just seemed to be fitting with the three- filter canopy, in regards to where I stuck on each string. The results of this test were relatively good. The dropping times ranged from 1.3 seconds at 143 cm. To 1.54 seconds at 261 cm. (Later I understood that the dropping height was supposed to be the same for all three tests, but at that point I was under the impression that we were supposed to pick three different heights. So that's what I had for the first 7 designs)

- Next, I decided to attach the coffee filters differently to each other. In this design I kept them more cup-like than flat, to see if they would then capture more air and fly slower. Also, using 8 strings had been cumbersome so I used 4 this time. I glued 4 filters together, and a fifth one on top, to kind of straighten it out. Again, I used only three washers. The dropping times were about the same as the ones from the last design. That was because this parachute fell straight to the floor (just like my first designs). Since I was trying to aim at a design of a parachute that does not flip and get messed up in its fall, I liked this sixth design. So I decided to continue with this idea.

- In my seventh design, I used the same idea, but instead of gluing 4 filters together, I glued six together. In addition, I glued another two on the top of the canopy. I used 4 strings and 3 washers. The resulting times were better for this design. It seemed that the umbrella-like design kept the air from escaping out one side and flipping over the parachute.

- The next design, I just wanted to try a whole new idea, to see how it would work out. I make a flower-like canopy with coffee filters folded like leaves. I used five filters, 3 washers, 1 long string in the middle and four shorter ones attached to the "leaves" and the long string. The dropping times decreased and as the parachute fell, it twisted up. I didn't like this design; I developed it no further.

- Design number 9 went back to the idea of design 6 and 7. But this time, I tried to make a double canopy like some of the other people were doing. I had 4 coffee filters on top and 3 on the bottom. I used 5 strings and 3 washers. But the times were pretty bad. From a height of 143 cm, the parachute fell for an average of 1.5 seconds. The result gave me an idea that having a double parachute does not help you if their canopy area is not very great.

- At that point I had parachutes that were not extremely successful, so I took a new approach. I decided to make the same parachute the rest of my group was making. So I made a plain canopy of 19 filters (circular design). I attached four strings with 3 washers. When I tested it, the parachute fell for an average of 1.7 seconds. That was pretty good time when compared to my other designs. So that is the design that I stuck with.

After the contest in class, I realized that my last design was one based on luck. It either flew right and didn't twist, of it flipped in its flight and fell straight to the floor. In the case in class, each of the 3 times it disappointed me. The canopy, and the strings really didn't work well together. I really should have stuck the strings closer to the edges. Plus, a hole at the top might have helped the parachute too. I think the size of the canopy was pretty good. It had the potential to work very well. The thing I realized during the contest was that every "good" parachute in class had long strings! But I really had not experimented with the strings that much. In each design I had kept them kind of short. So if I had a chance to change it, I would definitely make the strings longer. I think that would certainly make my parachute fly pretty slowly and gracefully.

Extra Credit:

I did enjoy working on this challenge, at first. I was really happy to be making the parachutes. On the first day, I couldn't wait to get home and devote literally hours to this challenge. But then I ruined it for myself by making too many. I had really spent a lot of time at home making them and timing them. Timing them over, and over was particularly annoying. I just got really tired. But even though that was the case for me, I think it should be included next year. The point is, its really enjoyable in small doses!

Appendix

Name [redacted] [redacted] Period 9 Date ______

Parachute Design Test Record

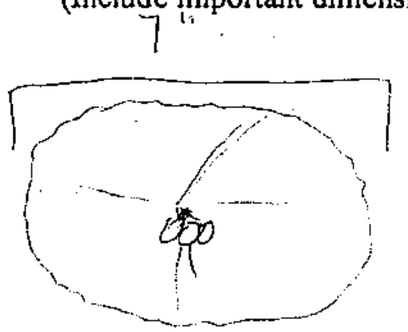
COLDMAN

Instructions:

1. You must complete a new "Test Record" each time you significantly change your parachute design.
2. You must complete all parts of the "Test Record."
3. Make at least three tests for each modification or each time you change or adjust a variable.
4. Record all data every time you test your parachute.

Design # 1

Sketch
(Include important dimensions)



Data

Test #	Drop Height	Drop Time
1	148 cm	77 milisec.
2	210 cm	97 milisec.
3	261 cm	

Changes since last test
Including changes in design of parachute, ropes, drop height, load, etc.

Conclusions:

1. Summarize your data. 2. State what you think you learned with this test. 3. What you plan to do next.
(Use the back of this paper if you need more space.)

I tied 3 washers to the middle of a coffee filter. When I dropped it from 3 diff. heights, it fell straight to the floor. As the height increased, the drop time also increased. I think I learned that the closer the load is to the coffee filter, the straighter the drop. Also, the less strings there are the straighter the fall. Next, I'll make the string longer to see if the drop time is longer.

Name [redacted] [redacted] Period 9 Date ______

Parachute Design Test Record

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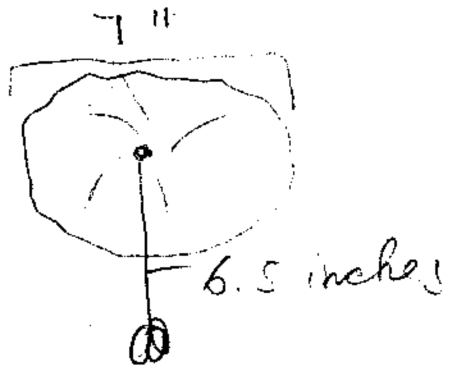
4. Record all data every time you test your parachute.

CO: DMAN

Design # 2

Sketch

(Include important dimensions)



Data

Test #	Drop Height	Drop Time
1	143 cm	84 milisec
2	210	103 milisec
3	261 cm	104 "

Changes since last test

Including changes in design of parachute, ropes, drop height, load, etc.

The rope is 6.5 inches longer.

Conclusions:

1. Summarize your data. 2. State what you think you learned with this test. 3. What you plan to do next.
(Use the back of this paper if you need more space.)

I tied three washers on 6.5 inch string and attached it to the middle of a filter. As drop height increased, drop time increased. I think when there's one string, the length makes a very small if any difference. Next, I want to try to use more that one filter.

Name [redacted] [redacted] Period 9 Date ________

Parachute Design Test Record

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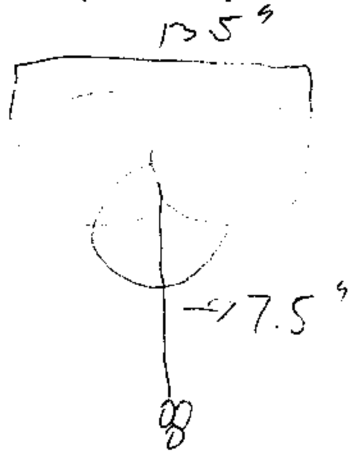
3. Make at least three tests for each modification or each time you change or adjust a variable.
4. Record all data every time you test your parachute.

Design # 4 **COLDMAN**

Sketch

(Include important dimensions)



Data

Test #	Drop Height	Drop Time
1	143	61 ms
2	210	1 S
3	261	1.3 S

Changes since last test

Including changes in design of parachute, ropes, drop height, load, etc.

One more filter

Conclusions:

1. Summarize your data. 2. State what you think you learned with this test. 3. What you plan to do next. (Use the back of this paper if you need more space.)

I dropped 3 washers on a 7.5 string attached to 3 filters. As drop height increased, drop time increased. There was not a big difference from the last design. I think now that the amount of filters does not make a difference unless there is more than 1 string. I will add more strings.

Name [redacted] Period 8 Date 2/9/01

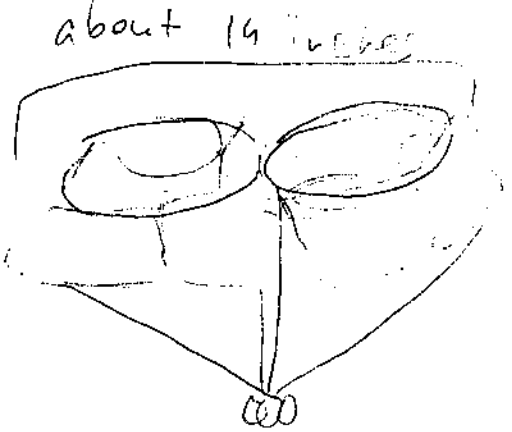
Parachute Design Test Record

Instructions:

1. You must complete a new "Test Record" each time you significantly change your parachute design.
2. You must complete all parts of the "Test Record."
3. Make at least three tests for each modification or each time you change or adjust a variable.
4. Record all data every time you test your parachute.

Design # 7

Sketch
(Include important dimensions)



6 filters on bottom

2 flat ones on top

Data

Test #	Drop Height	Drop Time
1	143 cm	.05 sec
2	210 cm	1.42 sec
3	261 cm	1.65

Changes since last test
Including changes in design of parachute, ropes, drop height, load, etc.

3 more filters

Conclusions:
1. Summarize your data. 2. State what you think you learned with this test. 3. What you plan to do next.
(Use the back of this paper if you need more space.)

-4 strings, 8 filters, 3 washers. Increase drop height, increase drop time. The more "cuplike" filters there are, the straighter and slower the drop. The strings don't have to be very long to serve this parachute. I think this umbrella-like design keeps air from escaping from one side and turning the parachute upside down.

Parachute Test Record.wa

Name [redacted] Period 9 Date 2/5/01

Parachute Design Test Record

Instructions:

1. You must complete a new "Test Record" each time you significantly change your parachute design.
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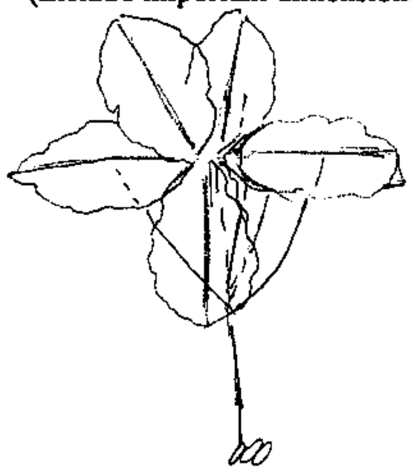
3. Make at least three tests for each modification or each time you change or adjust a variable.
4. Record all data every time you test your parachute.

Design # 8

COLDMAN

Sketch
(Include important dimensions)



Data

Test #	Drop Height	Drop Time
1	143 cm	1.35 sec
2	143 cm	1.18 sec
3.	143 cm	1.18 sec
4	261 cm	1.28 sec
5	261 cm	1.28 sec

Changes since last test
Including changes in design of parachute, ropes, drop height, load, etc.

- I folded the corners [illegible] less
- One more string, longer than the rest

Conclusions:
1. Summarize your data. 2. State what you think you learned with this test. 3. What you plan to do next.
(Use the back of this paper if you need more space.)

The canopy twisted up as it flew. The parachute did not go straight down, it falls to the side. I think the shorter the string the better. I saw that in the other designs I do. The shorter the string, the straighter the parachute falls. I think the canopy has to be symmetrical so it will be held straight and the air won't spill out from one side more than the other.

Name [redacted] Period 9 Date 2/7/01

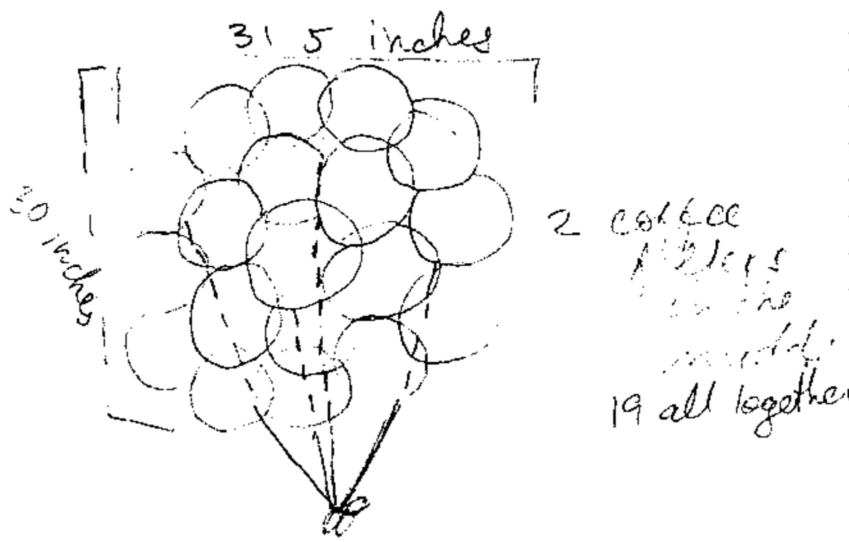
Parachute Design Test Record

Instructions:

1. You must complete a new "Test Record" each time you significantly change your parachute design.
2. You must complete all parts of the "Test Record."
3. Make at least three tests for each modification or each time you change or adjust a variable.
4. Record all data every time you test your parachute.

Design # 10 **GOLDMAN**

Sketch
(Include important dimensions)



Data

Test #	Drop Height	Drop Time
1	143 cm	1.66 sec
2	143 cm	1.73 sec
3	143 cm	1.59 sec
4	143 cm	1.81 sec

Changes since last test
Including changes in design of parachute, ropes, drop height, load, etc.

I increased the size of the canopy instead of making small "double canopy"

Conclusions:
1. Summarize your data. 2. State what you think you learned with this test. 3. What you plan to do next.
(Use the back of this paper if you need more space.)

The parachute fell for an average of 1.70 seconds. This is the best time so far.