



How does shape and surface area affect air resistance and fall speed?

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5B**



Acknowledgements

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Question

My question is:

How does shape and surface area affect air resistance and fall speed?



Introduction

Hello everyone, my name is Sahibjot and today I will be presenting my Science Fair Project.

My question is, how does shape and surface area affect air resistance and fall speed?

I will be determining how the shape of an object affects air resistance and fall speed.



Purpose of this project

I was always very interested in the gravitational pull of the earth, so I thought of testing how surface area and different shapes were affected by air resistance and the fall speed of any object. So this topic was very compelling to me as I wanted to explore more on this topic.

The Purpose of this project is to find out the different falling speeds of objects of different shapes and surface areas. I also wanted to educate my classmates and my friends on this topic.



Abstract

I am trying to find out how shape and surface area impact the fall speed. My project is about measuring the fall speed of a falling object.

First I made several shapes to test my hypothesis. Then I dropped them from the same height which was 192 cm. I repeated these steps 4 times and calculated the average.

Once I had the average, I was able to determine which shape took the longest and shortest time to hit the ground.



Materials

Materials I will need are:

1. 3 A4 Size papers
2. 1 Stopwatch
3. Tape



Key words

Surface area	The area of the surface for a 3d object
Fall speed	The speed in which the object falls down to the earth
Air resistance	The force that is opposing the gravity that is pulling object to the ground
Average	The central value of a group of numbers
Terminal velocity	When drag force equals the gravitational pull of the earth
Drag force	The amount of air resistance that is opposing the object being pulled to the ground



Hypothesis

I think, the parachute shape will take the longest time to reach the ground because it has the most surface area and it will most impacted by air resistance.

I think, the crumbled ball will be the first the reach the ground because it has the least surface area and hence air resistance will be minimal.



Procedure

1. Make different shapes like cone, crumpled ball and a parachute.
2. Drop them from the same height and measure the time it takes for them to reach the ground.
3. Repeat the process with other shapes.
4. Repeat this process four times.
5. Calculate average time for each shape.



Research

I learned that as the object falls towards the ground, it keeps increasing in speed. If an object reaches the terminal velocity, which is when the drag force equals the gravitational pull, it stops increasing in speed. The exact time an object will reach terminal velocity depends on the object's weight, texture, size, and shape. Newton's third law states that for every action, there is an equal and opposite reaction. So, when objects fall through the air that is a downwards action to which air resistance is pushing upwards. That is the opposite reaction.



Research

Aristotle's theory states that heavier objects fall faster than lighter objects. His theory was ignored for almost 2000 years until Galileo Galilei came along. Galileo proved Aristotle's theory wrong by going up the Leaning Tower of Pisa and dropping two balls with different weights. Both balls hit the ground at the same time proving Aristotle's theory incorrect.



Variables

Independent Variables: Shape of the object.

Dependent Variables: Time it took to reach the ground.

Controlled Variables: The Weight of the objects.

Shapes that were used



Crumpled ball



Cone



Parachute

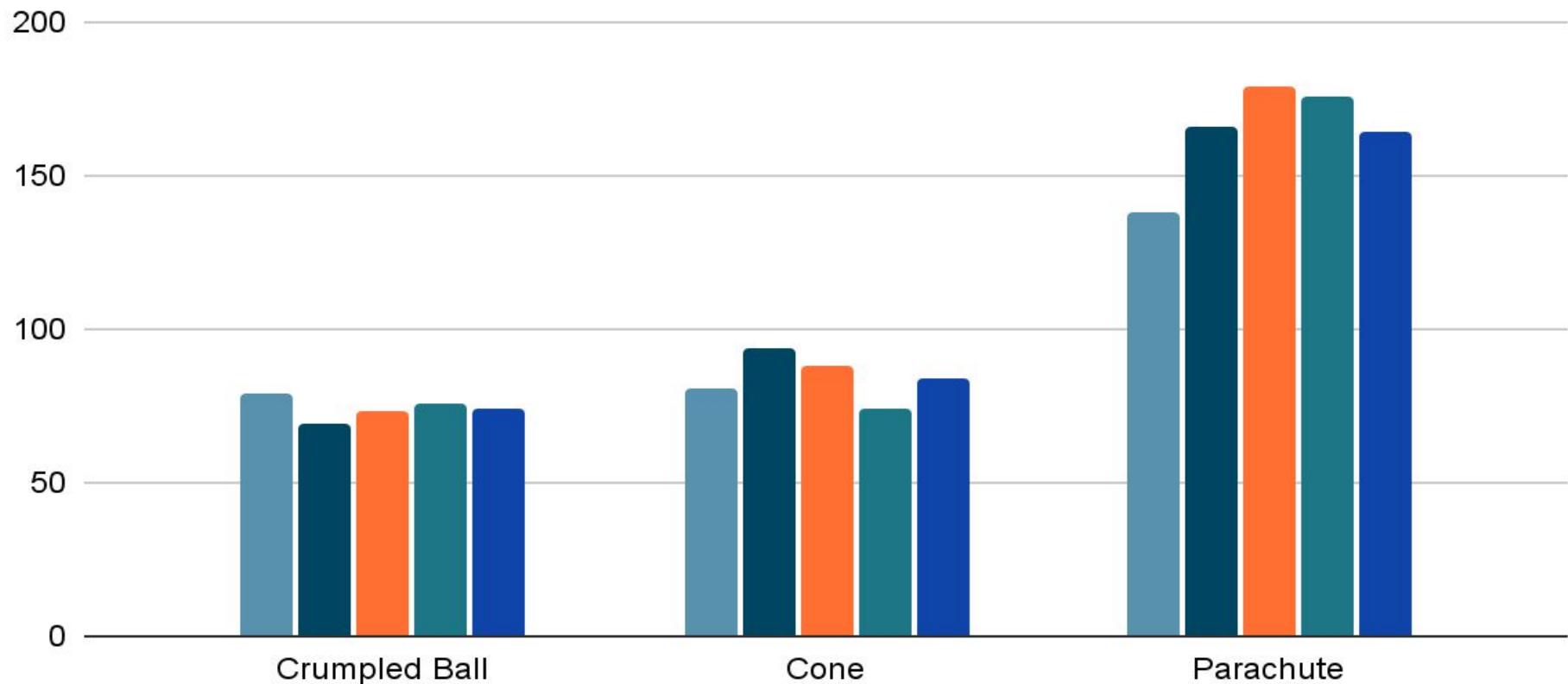


Observations

Particulars	Crumpled ball	Cone	Parachute
Trial 1	79 millisec	81 msec	1.38 sec
Trial 2	69 msec	94 msec	1.66 sec
Trial 3	73 msec	88 msec	1.79 sec
Trial 4	76 msec	74 msec	1.76 sec
Average	74 msec	84 msec	1.64 sec

Time to Drop (in msec)

Trial 1 Trial 2 Trial 3 Trial 4 Average





Analysis

The parachute had the most surface area, so it reached the ground with an average of 1.64 seconds. Whereas, the crumpled ball had the least surface area and took the shortest time to reach the ground with an average of 74 msec. On the other hand, the cone had a surface area in the middle, so it reached the ground with an average of 84 msec.



Conclusion

From this experiment, we can prove that shape and surface area does affect air resistance and fall speed and the results prove that.

The parachute, having the largest surface area took the longest time to reach the ground while the cone was in between the other two samples. Since the crumpled ball had the smallest surface area, it hit the ground the fastest.



Application

Engineers can use this information to design parachutes. Parachutes are used by many people. They are used by the army, astronauts returning from space, skydivers, and paragliders. This information tells engineers that the more surface area an object has, the greater time it stays in the air. Using this information, engineers can design parachute that slow down the fall of a person even more than parachutes do today. Parachutes should have the most surface area they can and the shape should be as flat as possible.



Sources of error

- On some of the trials, I stopped the Stopwatch a few Milliseconds after the shape had touched the ground. It would be more accurate if I had reacted sooner.
- I used tape which might have increased the weight by a few milligrams.
- Also since I used tape it might have increased the fall speed since the surface of the tape is smoother than the surface of the paper.



Future project

If I were to do this project again, I would do some things differently.

- I would use a actual stopwatch rather than the one on my watch.
- I would make more shapes to experiment with.
- I would also drop them from a larger height.
- Also , I would use glue rather than tape to get more accurate results.



References

Air resistance. (2021, December 16). Primary Science Online. <https://primaryscienceonline.org.uk/glossary-of-terms/air-resistance/>

Debunked. (2023, June 3). *Do heavy objects actually fall faster than light objects? DEBUNKED* [Video]. YouTube.

<https://www.youtube.com/watch?v=ZggJ5wQF944>

Free fall and air resistance. (n.d.). <https://www.physicsclassroom.com/class/newtlaws/Lesson-3/Free-Fall-and-Air-Resistance>

How does air resistance impact a falling object? | TutorChase. (n.d.).

<https://www.tutorchase.com/answers/ib/physics/how-does-air-resistance-impact-a-falling-object>

Manocha Academy. (2023, October 28). *Motion under Gravity | Free fall* [Video]. YouTube. <https://www.youtube.com/watch?v=6mFGzESImxl>

NASA Glenn Research Center. (2024, July 18). *Falling Object with Air Resistance | Glenn Research Center | NASA*. Glenn Research Center | NASA.

<https://www1.grc.nasa.gov/beginners-guide-to-aeronautics/falling-object-with-air-resistance/>

Parachutes: Does size matter? (2025, September 25). Science Buddies.

https://www.sciencebuddies.org/science-fair-projects/project-ideas/Aero_p017/aerodynamics-hydrodynamics/parachutes-does-size-matter

Phantastic Physics. (2025, April 22). *Do heavier objects fall faster? (Gravity & Air Resistance Experiment)* [Video]. YouTube.

<https://www.youtube.com/watch?v=Vn5EK9pwEws>



Thank you!