SC1: Investigating Speed

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Investigating Speed

Aim

I am investigating if the speed of an object changes when the size or shape is changed. I will investigate this through 2 experiments.

Apparatus list

Stopwatch
20 pieces of tracing paper
Scales

Preliminary work

Before my main experiment, I decided to do some practices to determine how high to drop the paper from. I started at 1m and noticed immediately that the time it took to reach the ground was too quick for us to take a reading in. I decided to increase the height by 1m. When I dropped the paper from 2m, I was able to take an accurate reading and decided to increase the height again by 1m. I then encountered a problem being that it was too dangerous to drop the paper from this height, so I chose to drop the paper from a height of 2m.

Plan

Experiment 1: An A4 piece of paper will be dropped from a height of 2m, 3 times. When the paper is released, a stopwatch will be used to time how long it takes to reach the floor, and this will be recorded in a table. The average of the three results will be found and the speed will be calculated. The paper will then be halved to A5 size and the above will be repeated. I will then fold the paper and repeat the experiment as many times as possible. 2.389g

Prediction

I predict that as the size of the paper decreases, the time taken for the paper to reach the ground also decreases. I think this because as the size of paper decreases, the surface area exposed to Upthrust also decreases. Gravity stays the same throughout the experiment because the mass of the object never changes, but Upthrust does change. This results in gravity being more dominant on an A5 piece of paper than an A4 piece of paper, resulting in the time taken for the A5 piece of paper to reach the floor being quicker than the A4 piece of paper takes to reach the floor. So as the size of the paper decreases, the amount of Upthrust decreases, therefore the time taken for the paper to reach the ground also decreases.

Fair Test

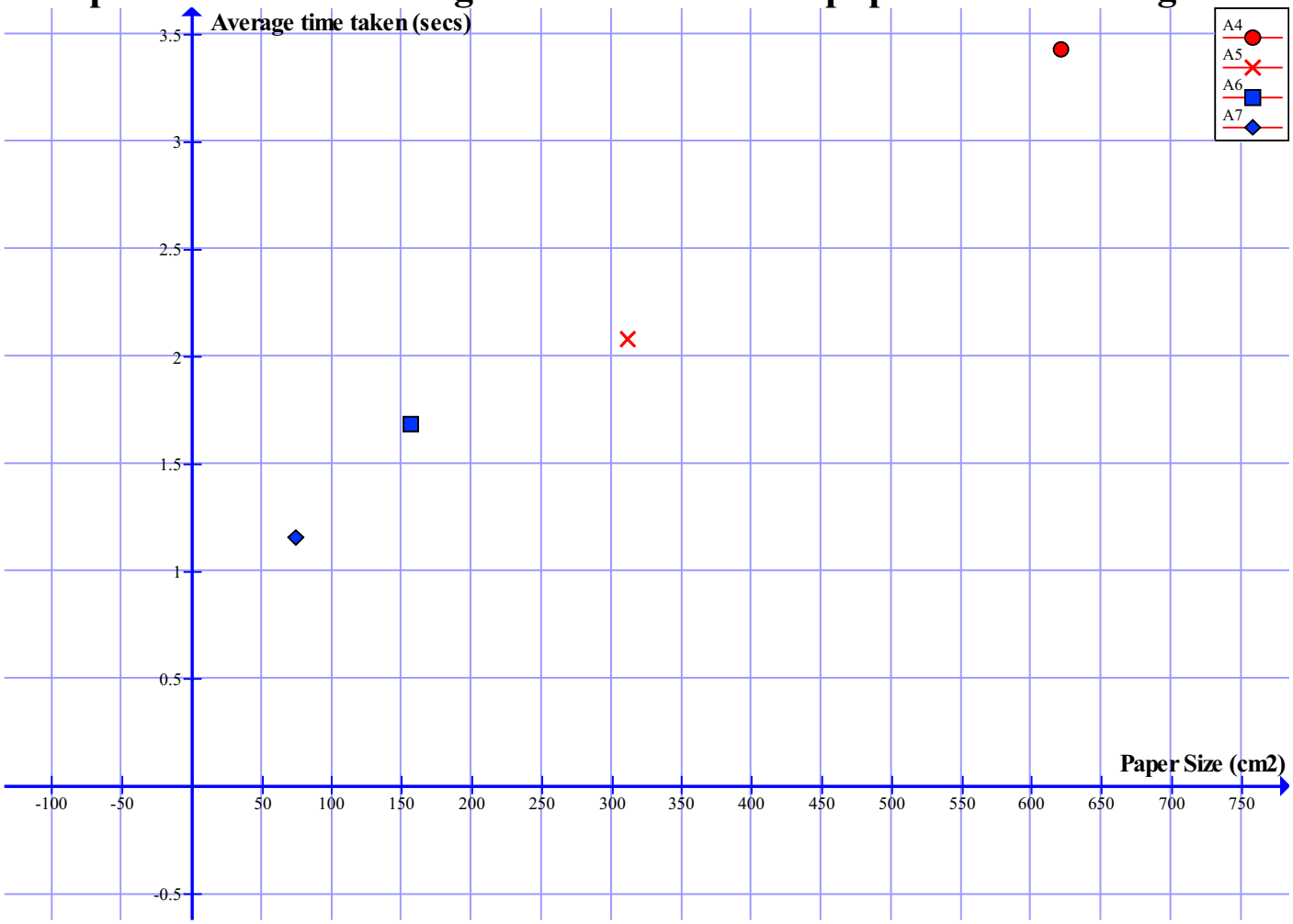
I will make this experiment a fair test because the only variable I am controlling is the size of the paper. By using the same stopwatch throughout the experiment, I will be ensuring valid results every time. I will also use the same piece of paper because if I

used a different piece of paper then it may have a slight difference such as mass or surface area, which would result in different results.

Results

Area (cm^2)	Time taken (secs)	Average (secs)	Ave Speed (m/s)
621.60 (A4)	**3.06**	**3.43**	**2/3.43 = 0.58**
621.60 (A4)	3.37		
621.60 (A4)	3.85		
310.80 (A5)	**2.00**	**2.08**	**2/2.08 = 0.96**
310.80 (A5)	2.13		
310.80 (A5)	2.10		
155.93 (A6)	**1.53**	**1.69**	**2/1.69 = 1.18**
155.93 (A6)	1.59		
155.93 (A6)	1.94		
73.44 (A7)	**1.18**	**1.16**	**2/1.16 = 1.72**
73.44 (A7)	1.10		
73.44 (A7)	1.19		

Graph to show the average time taken for the paper to reach the ground



Analysis

My prediction was right. From my graph, I can see that as the size of the paper decreases, the time taken for the paper to reach the ground also decreases. This is because, as I said in my prediction, when the size of the paper decreases, there is less surface area exposed to wind resistance and Upthrust, therefore the time taken for the paper to fall to the ground is decreased also.

Evaluation

Although in my experiment, I have no anomalous results, the results I recorded are not as accurate as possible. This is partly due to the stopwatch. It could have been more accurate because we recorded to 2 decimal places, but if we recorded to 3 decimal places, our results would have been more accurate. If I did the experiment again, I would make it better by using more accurate equipment such as a computer controlled stopwatch that would give precise results every time. I could extend this investigation by raising the height of where I release the paper from and see what effect this would have on the speed of an object.

Apparatus List

1000ml plastic tube
50 cm of thread
2g of plasticine
Scales
Stopwatch

Preliminary work

Before my main experiment, I decided to do some practices to determine how much plasticine to use and also how much water to use. I started by half filling the plastic tube with water and using 5g of plasticine. I found that the time it took for the plasticine to reach the bottom was far too quick for me too take a reading in. So, I increased the amount of water, by filling the tube to the top. I then dropped the plasticine again. I still found that the reading was too quick so I decreased the amount of plasticine I used. I now used 2g of plasticine and found that the reading I took was much easier and more accurate because I was not delaying. I had another problem which was that every time I dropped the plasticine in the water, I found it hard to get it out, so I attached a piece of string to it and solved this problem.

Plan

Experiment 2: Fill a 1000ml tube to 5cm from the top. Then measure from the bottom of the tube to the top of the water. Using accurate scales, measure 2g of plasticine. Attach a piece of string to the plasticine. Mould the plasticine into a torpedo shape and measure the diameter. Place the plasticine above the water and when released start the stopwatch. Stop when the plasticine reaches the bottom. Do not release the thread when dropping the plasticine. Hold the very end of the plasticine. Now repeat this three times. Record the results in a table and calculate the average. Then change the shape of the plasticine by making it into a flatter shape such as a cylinder. Repeat the above as many times as possible.

Prediction

I predict that as the shape of the plasticine becomes flatter, the time taken for the plasticine to reach the bottom will increase. I think this because when the plasticine is a torpedo shape, the water resistance will be smaller than if the plasticine was a cube shape. Therefore, if the water resistance is less, the time taken for the plasticine to reach the bottom will also be less. Also when the plasticine is a torpedo shape there is less Upthrust acting upon it if the plasticine was a cube shape. This will also result in a quicker time for the torpedo.

Fair Test

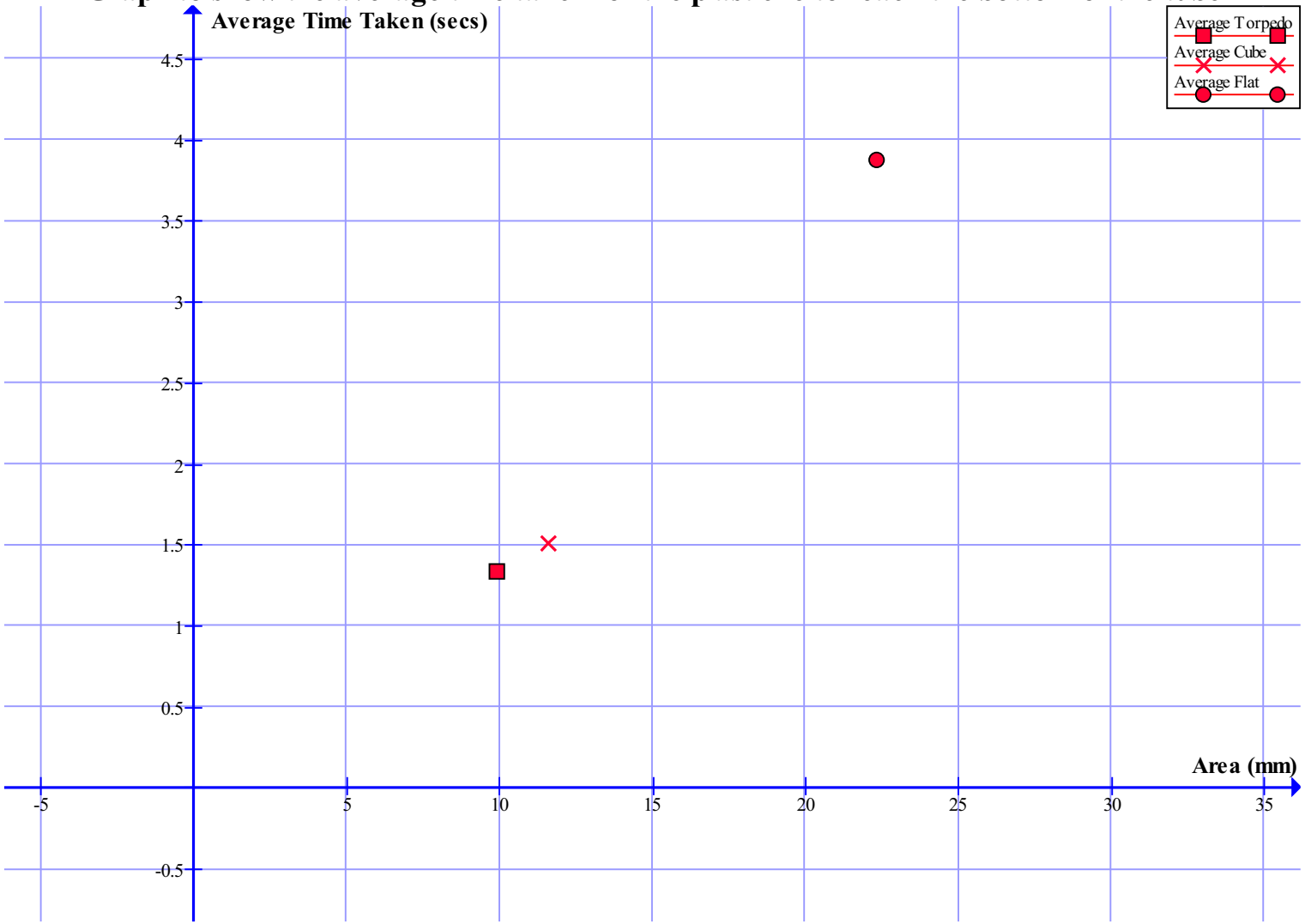
I will make this experiment a fair test because the only variable I am controlling is the shape of the plasticine. By using the same stopwatch throughout the experiment, I will be ensuring valid results every time. I will also use the same piece of plasticine because if I used a different piece of plasticine then it may have a slight difference such as density, which would result in void results.

Results

In my experiment, the height of water I used was 39.15cm.
39.15cm = 0.391 5m

Shape	Area (mm)	Time taken (s)	Time taken (s)	Time taken (s)	Ave time (s)	Speed (m/s)
Torpedo	5.5	1.00	1.09	1.09	1.06	0.37
Torpedo	7.9	1.09	1.13	1.18	1.13	0.35
Torpedo	10	1.13	1.20	1.24	1.19	0.33
Torpedo	11	1.32	1.40	1.37	1.36	0.29
Torpedo	15	1.78	1.97	2.06	1.94	0.20
Ave Torpedo	**9.88**				**1.34**	**0.29**
Cube	7	1.22	0.82	0.99	1.01	0.39
Cube	10	1.03	0.97	1.19	1.06	0.37
Cube	12	1.33	1.37	1.34	1.35	0.29
Cube	14	2.00	1.94	1.91	1.95	0.20
Cube	15	1.97	2.39	2.25	2.20	0.18
Ave Cube	**11.60**				**1.51**	**0.26**
Flat	20	3.56	3.72	3.28	3.52	0.11
Flat	22	3.92	3.90	4.03	3.95	0.1
Flat	25	4.25	4.10	4.18	4.18	0.09
Ave Flat	**22.34**				**3.88**	**0.10**

Graph to show the average time taken for the plasticne to reach the bottom of the tube



Analysis

My prediction was right. From my graph I can see that as the shape of the plasticine becomes flatter, the time taken for it to reach the bottom of the water also decreases. This is because, as I said in my prediction, when the plasticine is a torpedo shape, the water resistance will be smaller than if the plasticine was a cube shape. Therefore, if the water resistance is less, the time taken for the plasticine to reach the bottom will also be less. Also when the plasticine is a torpedo shape there is less Upthrust acting upon it if the plasticine was a cube shape. This will also result in a quicker time for the torpedo.

Evaluation

Although in my experiment, I have no anomalous results, the results I recorded are not as accurate as possible. This is partly due to the stopwatch. It could have been more accurate because we recorded to 2 decimal places, but if we recorded to 3 decimal places, our results would have been more accurate. If I did the experiment again, I would make it better by using more accurate equipment such as a computer controlled stopwatch that would give precise results every time. I could extend this investigation by raising the height from which I dropped the plasticine from and also by using a different liquid instead of water such as a soft drink.