

An investigation to find the stopping distance of a margarine tub



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Aim: I am trying to find out the stopping distance of a margarine tub when changing the mass.

Variables: I will change the mass of the margarine tub. I will measure the distance the tub travels. To make it a fair test I will keep the margarine tub the same. I will also keep the force I use to pull back the elastic band the same, and will do the experiment on the floor - keeping the surface the same.

Prediction: I think that the bigger the mass of the margarine tub the shorter the distance it will travel. I predict this because I know that friction will be caused.

Friction is resistance of the motion of one surface over another. Most surfaces are not smooth. The ridges in the 2 surfaces catch against each other - causing friction.

Newton's second Law of motion:

The acceleration produced by certain force acting on a body, is directly proportional to the magnitude of a force, and it is inversely proportional to the mass of the body.

It also says that F (force from elastic band) = ma , this means that as the mass increases, the acceleration will decrease.

The more mass the object has, the greater the force of friction will be acting on the object. Friction is a force that is exerted in the opposite direction to the force that brings about the motion.

Plan:

To do the experiment I will use:

? Margarine tub. ? Tape measure/ruler.

? Elastic band. ? Masses.

? Stool. ? Masking tape.

? Newton meter.

A 2D diagram:

I did initial tests to find out what the best range of masses to use were. I got these results:

mass

(g)

Stopping distance

(cm)

100

32

200

21

300

12

400

4

500

2

Because these results are quite short distances I have decided to use smaller masses to see a wider range of distances. I am going to use 50g – 300g, going up in 50g steps.

Step by step instructions:

- * Set up equipment as shown in diagram.
- * Tape a 50g mass in the margarine tub.
- * Pull the elastic band back using a force of 5 N.
- * Let the elastic band go and measure and record the distance that the margarine tub travels, from the front leg of the stool to the back of the margarine tub.
- * Repeat this 2 more times for the 50g mass.
- * Repeat this process for each mass – 100g, 150g, 200g, etc.

I will collect accurate results by repeating results and calculating the averages. I am going to do this because although I will measure as accurate as possible it is possible that the margarine tub may not travel in a straight line etc.

To make the experiment safe I will do it on the floor so that nothing i. e. masses/stool, can be dropped. I will also take extra care when using the elastic band and make sure that it is secure around the stool.

Table of results:

5N force

Mass (cm)

Distance

Travelled

(cm) 1

Distance

Travelled

(cm) 2

Distance

Travelled

(cm) 3

Average

50

58

55

63

58.6

100

22

24

28

24.6

150

22

20

23

21.6

200

11

13

10

11.3

250

10

9

8

9.0

300

7

8

5

6.6

Graph:

Analysis:

The graph shows that the bigger the mass the shorter the stopping distance.

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On the basis of my results, I am satisfied that my prediction has been proven. I knew that this would happen because my research shows that the acceleration produced by certain force acting on a body, is directly proportional to the magnitude of a force, and it is inversely proportional to the mass of the body.

Also that F (force from elastic band) = ma , this means that as the mass increases, the acceleration will decrease.

The graph also showed that there was a big difference between the stopping distance of 50g – 58.6cm and 100g – 24.6cm. This also meant that the best fit line was a curve.

Evaluation:

What went right?

My results showed a clear pattern (the bigger the mass the shorter the stopping distance.)

I believe that my results were quite accurate. There were no obvious exceptions, as all my results fall close to the best-fit line on my graph, and this was quite easy to draw. To make my results more reliable I also took an average of 3 readings for each mass.

I think that my results are quite reliable. For example the results of the mass 250g were 10cm, 9cm, and 8 cm, when a force of 5N is applied. These are quite consistent, because all 3 are close to the average of 9cm.

What went wrong?

The experiment went fine. The only main problem we had was that we found it hard to get the margarine tub to travel in a straight direction. To overcome this we did 3 tries rather than 1 or 2 to try and make the results more accurate.

How could you improve then investigation?

To improve the investigation we could measure the results to the nearest 0.5cm, making the measurements even more accurate.