Investigating the stopping distance of a toy car

During the course of this investigation i will aim to find how one specific factor effects the stopping distance of a toy car down a ramp.

The factors which effect stopping distance are; Tyres, Brakes, Road surface, Speed of car, the Aerodynamics etc.

The toy car will model a real car with frictional forces between the bench top and the wheels acting as brakes.

I will choose to investigate the effect of speed because it is the most easily varied.

To change the speed of the car i can alter the height at which the car falls from.

This is done by adding or subtracting blocks which make up the height of the ramp.

Speed will be measured by using a light gate, and the stopping distance of the car will be measured using a ruler. The formula which will be used to measure the speed will be speed = Distance travelled

Time taken

With the distance of the card on top of the car being 10cm and the time taken being the time taken through which the car goes through the light gate

Equipment:

Toy car with 10cm card attached to top of car.

Wooden blocks(each 1cm in height)

Wooden plank

1metre ruler

Blue-tac to attach card to car.

Light gate

Bench top

SPACE FOR DIAGRAM OFF SET UP

To ensure the results of the experiment will be accurate we will drop the car from the same height 3 times and then make an average.

If results were also clearly wrong they would be repeated. The same part of the bench will be used every time and will ensure that the card on top of the car goes through the light gate every time at the same length.

The maximum number of blocks which make up the height of the ramp will be 8(8cm), because any more blocks than this will cause the car to crash into the bench rather than rolling down the ramp and then along the bench top.

Speed will be measured using the formula, speed = distance travelled.

Time taken

Predictions: The higher the speed of the car, the higher the stopping distance. This is because at higher speed there will be higher kinetic energy belonging to the car. Therefore it will take longer for frictional forces acting on the car to put it to rest.

I can show this using formulae:

Loss in kinetic energy = work done by frictional forces

2

1/2 MV = F x d

By rearranging this 1/2 Mv

formula i can get: D= F

x 2 = D= M

2F

So to find the theoretical stopping distance of the car I can use the above formula.

If we assume that everything remains constant i. e the frictional forces acting upon the car, the stopping distance must be proportional to the speed of the car.

E. g if the velocity of the car is 10m/s then using our previous formula we can see that

D= m 10 = D= m X 100

2F 2f

If doubled we can see that 20 = 400

From this we can see that if speed is doubled the stopping distance will increases by a factor of 4.

If speed tripled (30 = 900) stopping distance increases by a factor of 9.

By using the highway code as a secondary source I can see if my predictions are correct. I want to use the braking distances, as these show the effects of frictional force. The highway code shows that if:

SPEED(mph)

BRAKING DISTANCE(m)

20

6

30

14

40

24

50

38

60

55

70

75

This confirms my predictions; as we can see that if speed is doubled from 20mph to 40mph the braking distance increases from 6 to 24. Braking distance has been multiplied by 4. If the speed trebles from 20mph to 60mph the braking distance is multiplied by 9.

Implementing

The experiment was performed, whereby the car was dropped from varied heights, and the times which the car took to go through the light gate were noted.

The stopping distance was also recorded, and each measurement was performed three times so that an average could be made to produce more thorough results.

Height(m) Time on the light gate(secs) Stopping Distance(m)