The title of my investigation is how I can change the acceleration of a trolley?

Prediction:

The prediction of this investigation will be more mass, more acceleration and the more force the more acceleration.

Method:

The method for this investigation will be:

Firstly the trolley is rolled down the slope, making sure that the height of the slope is keeping the same. With this method it was hard to get accurate measurement of the acceleration that was because gravitational potential energy (G.P.E) will be applied in the results which is not needed.

G.P.E= mass×height×gravity.

In method two elastic was used to push the trolley forward. The mass was changed and the measurement of acceleration was measured by the light gates.

Using elastic the investigation was still not successful because the force should have been kept the same, so that the trolley can accelerate. Working with the elastic only applies force for a very short time. The force would only be in the beginning of the push of the trolley.

To make a successful investigation, a constant force must be applied to the trolley so that the acceleration of the trolley can be measured. Using a Newton meter I will pull the trolley with a constant force. The problem will be that it is difficult to provide constant force using a Newton meter.

Thinking about the formula that Force= acceleration× mass I came up with another method.

In the method the mass would be changed and some mass would be tied to the string which will be kept the same. The weight will give a constant force. The gravity will be the same, using a falling mass tied with the string I can provide the trolley with a constant force and now in this investigation it has been proved that Acceleration= force/mass

Is correct.

By keeping the force constant and changing the mass the acceleration could be measured. From Newton's Second law of Motion, I know that the acceleration of the object depends upon both the force acting upon the object and it's mass.

$a = F/m$

If we combine these results we get:

$a = (mg)/m$

$a = g$

The apparatus that I will use is a trolley, light gates, slope, masses, elastic and a string. The light gates will measure the acceleration of the trolley to gain accurate results we will use a light gate and a computer. Five results will be taken and it will be repeated three times for any changes.

The variables that will be kept the same to make it a fair test will be the type of trolley and the distance.

The variables that will be changed are the acceleration of the trolley, the mass on the trolley, the surface of the slope and the height of the slope.

The independent variable that I will change would be the mass on the trolley. The dependent variable that could be measured will be the acceleration of the trolley through the light gates.

The results that I had taken from the elastic were not accurate as shown below:

1/mass(kg) on the trolley	mass(kg) on the trolley	acceleration(m/s^2)			Average
		1	2	3	
0	0	3.39	3.44	3.42	3.42
0.2	0.2	2.37	2.48	2.39	2.41
0.4	0.4	1.85	2.10	2.07	2
0.6	0.6	1.95	1.95	1.88	1.93
0.8	0.8	1.90	1.81	1.70	1.8
1	1	1.71	1.75	1.70	1.72

The results of the pulley gave us the accurate results. I will make a graph with a best line fit. The mass of the trolley will be plotted on the x-axis and the acceleration on the y-axis. Because I have got some accurate results I will not need to repeat this experiment. The results in the below table was taken from the pulley experiment:

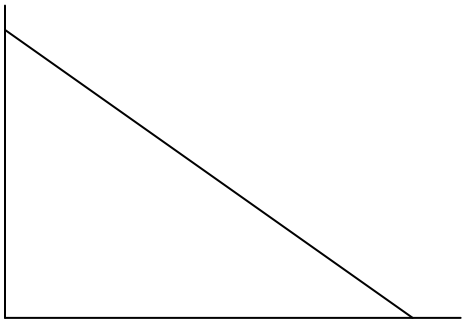
1/mass(kg) on the trolley	mass(kg) on the trolley	acceleration(m/s^2)			Average
		1	2	3	
0	0	3.39	3.44	3.42	3.42
0.2	0.2	2.37	2.48	2.39	2.41
0.4	0.4	1.85	2.10	2.07	2
0.6	0.6	1.95	1.95	1.88	1.93
0.8	0.8	1.90	1.81	1.70	1.8
1	1	1.71	1.75	1.70	1.72

In both the graphs the line is of best fit. The graph is plotted in a curve.

From 0 to 2 the trolley is decelerating and from 2 to 4 the trolley is still decelerating. From 4 to 6 the trolley is still decelerating. From 4 to 6 the trolley is traveling at a constant speed. From 6 to 8 it is decelerating again. And from 8 to 10 it is constant.

The results are reliable because each experiment is carried out three times. And all the results I got are near or the same to each other.

I expected the graph to be a straight line as shown below:



But instead I got this

To improve this experiment I would use a frictionless surface like an air track.

This would prove that a= force/ mass.

I think that the method which I used was the finest. The results I got were very good and reliable. On looking at my results I was sure that the results are good because the line of best fit is a best fit line with out any analomus results.

The result that I got was not what I expected. I know that Force is proportional to acceleration. From this I can say that the force needed to just start an object moving is equal to the static friction value for the surfaces. I can terminate that friction must be acting at all times during the experiment. In this experiment I noticed that the force needed to keep an object moving steadily on a surface is equal to the forceful friction rate for the surface.

My conclusion to this experiment would be…

As increasing forces are applied to a constant mass, the acceleration of the mass also increases (F = ma).

- *The force needed to just start an object moving is equal to the static friction value for the surfaces.*
- *The force needed to keep an object moving steadily (with constant velocity) on a surface is equal to the dynamic friction value for the surface.*

My readings did not have any anomalous results which mean that my results were accurate.

Using an air track would give me the results a lot more accurate.

If I would carry out another experiment to improve my experiment I would keep the force acting on the trolley constant but change the mass of the trolley each time to further investigate the formula of F = ma.