

In this experiment, we will verify Newton's Second Law by changing the mass used. Newton's Second Law is shown by the equation force (F) equals mass (m) times acceleration (a).

To do this we will use:

An air track with power supply. The air track reduces the amount of friction.

A light gate which is attached to a motion sensor.

A pulley wheel at the end of the track.

A glider fitted with a double mask.

The glider is attached by a length of string to a hanger.

We will also use additional gliders.

In this set-up, the force is the weight of the hanger. As the hanger falls, it accelerates the glider, which is the mass, along the track. We will vary the mass by joining extra gliders together.

Draw up a simple table for the results. This should have columns for force, mass and calculated acceleration. We do not need to include exact units for the force as the weight of the hanger does not change.

We don't need specific units for the mass as each glider has the same mass. Acceleration is measured in metres per second per second.

Let's begin the experiment. Set up the motion sensor to measure acceleration, and enter the width of the double mask. In this case, they are one centimetre or 0.01 metres.

The first trial uses one glider. Start the blower and let the glider slide through the light gate on the air track. Use the motion sensor to record the acceleration and note this in the results table.

In this case, the acceleration was 1.81 metres per second per second.

Repeat the experiment with two gliders, which is two masses.

Three gliders, which is three masses.

We can use the results to draw a graph with mass on the x-axis and acceleration on the y-axis.

The result is a curved line with a negative gradient. It shows that as the mass increases, so the acceleration decreases.

There is an inverse relationship between force and acceleration for a constant mass.

Which verifies the equation force (F) equals mass (m) times acceleration (a).