

Determination of the acceleration of a moving object

Introduction

An object moving down an inclined ramp will accelerate. The velocity of the object as it leaves the ramp can be used to calculate the mean acceleration of the object using the formula:

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$$

Since the object starts from rest at the top of the ramp this means that:

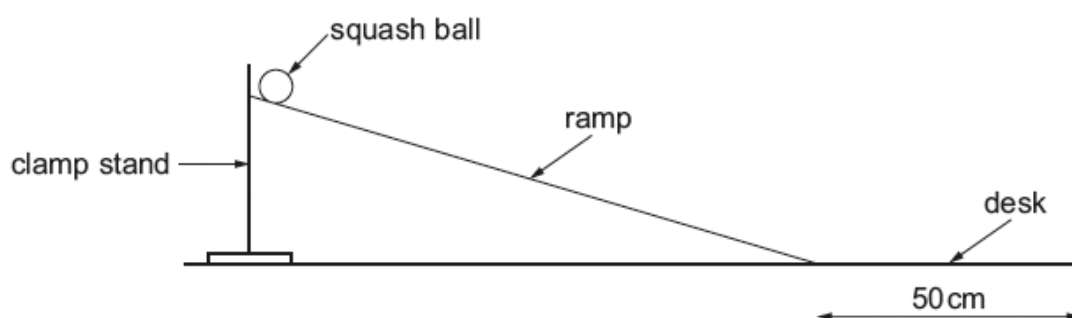
$$\text{acceleration} = \frac{\text{velocity at bottom of ramp}}{\text{time to reach bottom of ramp}}$$

The velocity at the bottom of the ramp can be calculated from the time the object takes to travel a certain distance along the bench.

Apparatus

ramp
squash ball
metre ruler ± 1 mm
stopwatch
clamp stand, clamp and boss

Diagram of Apparatus



Method

1. Set the height of the ramp to 10cm above the desk.
2. Measure a distance of 50cm from the end of the ramp and mark this point.
3. Release the squash ball from the top of the ramp starting the stopwatch as you do.
4. When the squash ball reaches the bottom of the ramp press the lap button on the stopwatch.
5. Stop the stopwatch when the squash ball reaches the 50cm mark.
6. Record the time taken for the ball to travel down the ramp (lap time) and the total time.
7. Repeat steps 1-6 increasing the height in 5cm intervals each time up to 25cm.
8. Repeat the experiment twice more.

Analysis

1. Calculate the time taken for the ball to travel 50cm along the bench;
this is the total time – the lap time.
2. Calculate the velocity at the bottom of the ramp using the formula

$$\text{velocity} = \frac{0.5}{\text{mean time taken to travel 50cm along the bench}}$$

3. Calculate the acceleration using the formula

$$\text{acceleration} = \frac{\text{velocity at bottom of ramp}}{\text{mean time to reach bottom of ramp}}$$

4. Plot a graph of ramp height against acceleration.