**BeeSpiV experiments**

Experiment 1 – velocity down a slope - variation of v with s

You will need:

BeeSpiV

Toy car

3 or 4 sections of track

Metre stick

Ramp

Block of wood to support one end of ramp

A close up of text on a black background

Description generated with very high confidence

A picture containing athletic game, sky, sport

Description generated with very high confidence

A close up of a device

Description generated with high confidenceA picture containing cellphone, building, ground, phone

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What to measure

We measured speed after s = 5 cm to s = 30cm in 5 cm intervals.

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Description automatically generated

Beware track joints and cars rubbing against the sides of the track...

Theory

Since *v2 – u2 = 2as*,

If the trolley is released from rest, *u2* = 0, so *v2 = 2as*

Graph of *v2* versus *s* should therefore be a straight line through the origin, with gradient *2a*.

*a,* the acceleration, should be equal to *gsinϴ* where *ϴ* is the angle between the slope and the horizontal and *g* is the gravitational field strength.

Chart, line chart

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Experiment 2 – variation of range with horizontal speed

You will need:

BeeSpiV

Ball bearing

3 or 4 sections of track or a curtain rail

Metre stick

Clamp stand

Piece of carbon paper

Piece of white paper

Set up the apparatus as in the photo below.



Run the ball bearing down the slope to establish a typical ‘landing site’. Use a small piece of adhesive tape to temporarily fasten the white paper to the floor at this point.

Place the piece of carbon paper ‘dark side’ down on top of the white paper. The ball bearing will now leave a mark on hitting the carbon paper.

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Measurements

Allow the ball bearing to run down the slope and record the horizontal velocity from the BeeSpiV and the range – the horizontal distance measured from directly below the end of the curtain rail.

Cross out or otherwise mark the impression to prevent confusion in future measurements. After several measurements you will have recorded a range of horizontal velocities and corresponding ranges.

A picture containing text, businesscard, envelope

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Theory

Distance = speed x time so range = horizontal velocity x time of flight

If the vertical height is constant the time of flight is constant and range is directly proportional to horizontal speed. Typical results are shown below. If the height is known g can be calculated using the gradient of this graph.

Experiment 3 – variation of range with height

You will need:

BeeSpiV

Ball bearing

3 or 4 sections of track or a curtain rail

Metre stick

2 x Clamp stands

Piece of carbon paper

Piece of white paper

Several gratnell trays

This experiment uses much the same equipment as the previous experiment.

In this experiment however we keep the horizontal velocity constant by using a second clamp stand as a stop to ensure we release the ball bearing from the same point on the track and we adjust the height by ‘raising the floor’ using gratnell trays. (see photos below).

In this experiment we measure the horizontal range (as before) and the vertical height from the end of the curtain rail to the surface of the top tray with the carbon paper.

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Description automatically generated

Theory

From s = ut + ½ at2 if u =0, s=h and a =g we have h = ½ g t2

from experiment 2 we have range(R) = horizontal velocity(vh) x time of flight(t)

So range R = vh  if vh is constant then R α and plotting R v gives a gradient m of value vh  a straight line through the origin.

A typical graph of results is shown below.