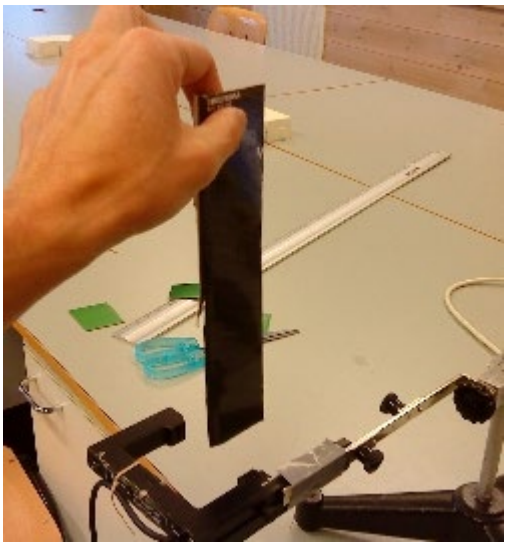
Practical: Measuring the value of g

Introduction

Measure the acceleration due to gravity by dropping a strip of card through a photo gate.



Method

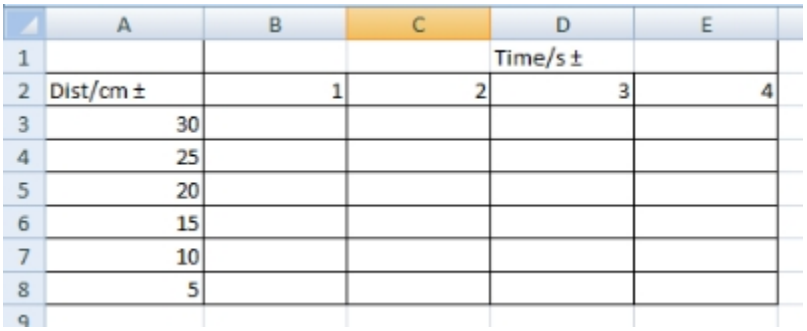
1. Connect the interface to the computer and power supply.
2. Connect the photo gate to the interface and set up the software so that it recognizes there is a photo gate connected.
3. Press the start button so that the computer starts recording.
4. Try blocking then unblocking the photo gate to see if it works. Data studio should record the time between blocking and unblocking.
5. Arrange the photo gate so that the cardboard strip can be dropped through it.
6. Measure the time taken for the strip to fall through the photogate.

Theory

$L=\frac{1}{2}gt^2$

Data Collection

Prepare a table in excel for the raw data like the one below:



	A	B	C	D	E
1				Time/s ±	
2	Dist/cm ±	1	2	3	4
3	30				
4	25				
5	20				
6	15				
7	10				
8	5				
9					

Uncertainties

You need to decide on the reading uncertainties in distance and time.
Distance (L)is measured by a ruler but it is also dependent on how well you have cut your piece of card.
Time (t)is measured with the photo gate, how many decimal places is this measured to?

Data Processing

- Average

  You have measured time 4 times so you need to find the average value. Do this by adding a column to the excel table and use the average formula to find the average time.

- Linearizing

  Before you can plot this you must calculate t^2 do this by adding a column to your table

Propagating the uncertainties

You need to find the uncertainty in t^2.

Data Presentation

Plot L vs t^2 in Logger pro

Display error bars on the points

Place steepest and least steep lines using the manual option under curve fit.

Conclusion and evaluation

Quoting your value for g with its uncertainties

Compare your answer with the expected value

Justify whether the value is believable or not.

Using LINEST in excel is also a good idea.

Are the points close to the line?

Is the intercept zero?

Do the error bars reflect the spread of data?

From your graph can you suggest where the biggest uncertainties lie?

Can you think of a reason why your line did not pass though (0,0)?

Is there any non linear trend in the data? What might have caused this?

Improvements

Suggest how you could improve your method to make the result better.

Use your graph as evidence for weakness in the method and then suggest improvements that will address these weaknesses.