Investigation: Finding gravitational acceleration by accelerating masses

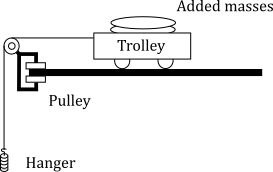
**Practical**

Cecil Andrews College 2023

Mark: \_\_\_\_\_\_\_\_/19 Name:\_\_\_Answer key\_\_

**Materials**

|  |  |
| --- | --- |
| * Dynamics Trolley | * Stopwatch |
| * String | * Tape Measure |
| * Mass Hanger and brass 50 g masses | * Power Supply |
| * Several 1 kg masses | * Cushioning Material. |
| * Desk-mountable pulley wheel with clamp | * Masking tape |
| * Electronic Balance |  |

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**Method**

1. Clamp the pulley wheel to the edge of the desk. Try to arrange the largest height above the floor as possible.
2. Attach one end of the string to the dynamics trolley and the other end to the mass hanger, carrying a total of approximately 200g of mass
3. Hang the masses over the pulley so they can pull the trolley along as they fall to the floor. Place the cushioning material under the weights to reduce impact.
4. Let the mass hanger touch the floor then mark the position of the front wheel of the trolley with masking tape when the string is tight. This is the finish line.
5. Pull the trolley back until the mass hanger nearly touches the pully. Mark the location of the front wheel of the trolley with tape. This is the start line.
6. Measure out your control variables and fill them in the section below.
7. Pull the trolley back to the start line. Let it go. Using the stopwatch, record the time it takes for the trolley to reach the finish line (in provided table). Repeat to record three times and average the result.
8. Add approximately 1kg mass to the trolley (record its true weight), and record three time trials. Keep adding 1kg masses and recording times.

**Group Work**

**Control variables**

1. Measure and record the control variables below. (1 mark)

Mass of the hanger + weights, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Distance between the start line and finish line, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mass of the trolley without weights, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Results**

1. Record the total trolley mass and time trial results in the first four columns of the table below. 1 mark masses, 1 mark times, 1 mark units (3 marks)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Mass of trolley and weights,  (kg) | Trial 1  Time (s) | Trial 2  Time (s) | Trial 3  Time (s) | Average time,  (s) | Time squared,  (\_\_) |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

**Analysis**

1. Calculate the average time it takes for the trolley to travel from the start to finish for each set of masses. Record this average time in the fifth column. (2 marks)

2 marks reasonable values, -1 mark for error

1. Fill in the final column by taking the average time and squaring it. Include the units for time squared in the gap provided. (2 marks)

1 mark values, 1 mark units

**Individual Work**

1. On the grid paper provided, plot the data using on the -axis and on the -axis. (4 marks)

Title [1], axes labels + units [1], axes spacing [1], correct data plotted [1],

1. Using a ruler, draw the Line of Best Fit. (1 mark)

Reasonable LOBF[1]

1. Calculate the gradient of the Line of Best Fit. Show your construction lines, and include units. (3 marks)

Gradient value [1] units = [1]

Construction lines [1]

Gradient = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The time squared that it takes for the trolley to travel from the start line to the finish line is given by:

1. Using this equation and the value you calculated for the gradient, determine the experimental value of gravitational acceleration, . Comment on your answer; do you think it is correct? (3 marks)

looks like

The gradient is given by Gradient = [1]

Therefore

(or thereabouts) [1]

Comment: I think this answer is (correct/incorrect), because it (is / is not) close to the theoretical value of g=9.80 m s^(-2). [1]

**End of Practical Investigation**