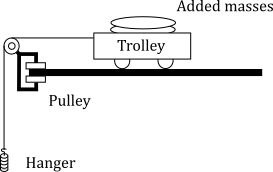
Investigation: Finding gravitational acceleration by accelerating masses

**Take Home**

Cecil Andrews College 2023

Mark: \_\_\_\_\_\_\_\_/15 Name:\_\_Answer key

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

Where is the distance from the start to finish, , is gravitational acceleration, is the total mass of the trolley plus added masses, and is the mass of the hanger.

1. (Hard question) Use Newton’s second law (, show that the above equation is correct (3 marks)

,

(The mass of the hanger exerts a gravitational force)

, , or (acceleration of trolley) [1]

Total mass being accelerated is [1]

becomes

Or

Or [1]

Miss Tee decides to investigate the effect of the trolley mass on the trolley’s travel time. She records her control variables and results below.

**Control variables**

Mass of the hanger + weights, g

Distance between the start line and finish line, 80 cm

Mass of the trolley without weights, g

**Results**

|  |  |  |
| --- | --- | --- |
| Mass of trolley and weights,  (kg) | Average time,  (s) | Time squared,  (\_\_) |
| 0.2 | 0.56 | 0.31 |
| 0.7 | 0.91 | 0.82 |
| 1.2 | 1.05 | 1.11 |
| 1.7 | 1.25 | 1.56 |
| 2.2 | 1.42 | 2.01 |

**Analysis**

1. Fill in the final column by taking the average time and squaring it. Include the units for time squared in the gap provided. (1 marks)
2. On the grid paper provided, plot the data using on the -axis and on the -axis. **See last page** (4 marks)
3. Using a ruler, draw the Line of Best Fit. (1 mark)

**See last page**

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

Gradient calculated [1]

Construction lines shown [1]

Units displayed [1]

Gradient = 0.8279 (or thereabouts)

1. Using the control variables 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 . [1]

**End of Written Investigation**

**Q 2 & 3 solutions**

Axis labels including units [1]

Regularly spaced gridlines [1]

Title [1]

Data plotted correctly [1]