**Year 10 Physics Investigation – Newton’s second law**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_

**Weighting: 10%**

**Total marks 26**

**/26**

**Aim: (1 mark)**

**To determine how changing pulling force affects the acceleration of a trolley. 0.5 mark independent/0.5 dependent**

**Variables**

Independent variable: **(1 mark)**

**The slotted masses (0.5) and the pulling force (0.5)**

Dependent variable: **(1 mark)**

**The time taken (0.5) and acceleration (0.5)**

2 controlled variables: Any 2 **(2 marks)**

**The slope of the bench**

**The trolley type**

**The starting position of the trolley**

**Same timer and person timing etc**

**Hypothesis: (2 marks)**

**If the pulling force of the trolley is increased, then the trolley will move with greater acceleration.**

**Results: (5 marks)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Table 1: Newton’s Second Law Trolley Experiment** | | | | | | |
| **Hanging mass (g)** | **Force applied (N) (hanging mass x gravity** | **Time for trolley to reach pulley across 50cm distance (d)** | | | **Average time (s)** | **Acceleration (m/s2)**  **a = 2d**  **t2** |
| **Trial 1 (s)** | **Trial 2 (s)** | **Trial 3 (s)** |
| **100** | **1** | **3.3** | **2.7** | **3.0** | **3** | **1/9 = 0.111** |
| **200** | **2** | **2.3** | **2.2** | **3.0** | **2.5** | **1/6.25 = 0.160** |
| **300** | **3** | **1.5** | **1.5** | **1.5** | **1.5** | **1/2.25 = 0.444** |
| **400** | **4** | **0.8** | **0.75** | **0.7** | **0.75** | **1/0.56 = 1.77** |
| **500** | **5** | **0.5** | **0.6** | **0.4** | **0.5** | **1/0.25 = 4** |

**Draw a graph on the graph paper provided by your teacher. (6 marks)**

**Title –0.5 for appropriate title, 1 mark if title has both IV and DV in it**

**Line graph- 1**

**Ruler – 0.5**

**Pencil- 0.5**

**Axis Labels – 1, 0.5 each**

**Units on axis – 1, 0.5 each**

**Scale- 1**

**Written statement of results (1 for DV, 1 for IV) (2 marks):**

**The higher the weight of the slotted masses, the greater the pulling force. As a result, the trolley had a faster acceleration as the time was quicker.**

**State whether the hypothesis supported by using specific data from the table to support your answer.**

**(2 marks)**

**Variable responses depending on hypothesis**

**For answer using the word hypothesis and supported/unsupported (1)**

**Using data from table (1)**

**Discuss whether these results support Newton’s second law (2 marks)**

**Force increased with increasing mass (1)**

**Acceleration increased with increasing force (1)**

**Suggest some future improvements for this experiment (2 marks)**

**Any reasonable explanation (1 per improvement)**

**Such as – accurate timers for motion detection, better designed trolleys, longer string and bench space, securely placed string, better quality string, higher tensile strength of string etc**