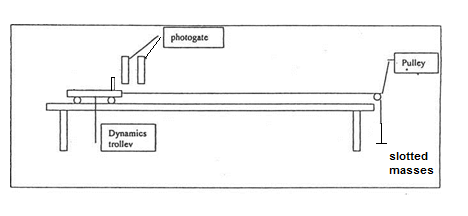
|  |  |  |
| --- | --- | --- |
| **Year 11 Physics – NEWTONS 2nd LAW of MOTION**  **Science Inquiry Skills**  **Validation Test** | | |
|  | | |
| **Name:** | **Teacher:** | **Score /20** |
| **Comment:** | | |

***The following excerpts have been taken from student’s a poorly written lab book.***

***Hypothesis:***

*If the mass of an object is changed, then the acceleration of the object will also change*

***Method***



1. *Set up the trolley with a digital accelerometer as shown in the diagram.*
2. *Record the combined mass of the mass of the trolley and the unknown mass.*
3. *Suspend* ***unknown mass*** *from the* ***pulley****. This provides the accelerating force.*
4. *Run the program, release the trolley and record the acceleration.*
5. *Repeat for another two trials before resetting the program*
6. *Add an extra 100 g* ***on the trolley*** *and repeat steps 3-5.*
7. *Repeat the procedure using total additional masses of 200 g, 300g****,*** *400g and 500g on the trolley.*
8. Quote Newtons 2nd Law of motion.

|  |
| --- |
| An unbalanced force will cause an object to accelerate. |
| The rate of Acceleration is proportional to the Force use and |
| inversely proportional to the mass of the object. |

**(2 marks)**

1. Rewrite the student’s hypothesis so that it is more appropriately stated.

|  |
| --- |
| If the mass of the object is (increased / decreased), |
| then the acceleration with (increase / decrease) |

**(1 mark)**

1. What is the independent variable? mass **(1 mark)**
2. What is the dependent variable? acceleration **(1 mark)**
3. Describe two variables which would need to be controlled in this experiment to make it a fair test.

|  |
| --- |
| accelerating force/mass (this must be stated) (1) |
| any other relevant variable (1) |

**(2 marks)**

**The student’s results are presented below.**

Table: Mass and acceleration of a motion trolley

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Mass on trolley  (g) | Total accelerated mass  (Trolley, + unknown accelerating mass + mass on trolley)  (g) | Acceleration (ms-2) | | | | 1/m  (kg-1) |
| Trial 1 | Trial 2 | Trial 3 | Average |
| 0 | 1125 | 4.45 | 4.65 | 4.61 | **4.57** | **0.89** |
| 100 | 1225 | 4.2 | 4.15 | 4.25 | **4.20** | **0.82** |
| 200 | 1325 | 3.96 | 3.9 | 3.78 | **3.88** | **0.75** |
| 300 | 1425 | 3.5 | 3.6 | 3.7 | **3.60** | **0.70** |
| 400 | 1525 | 3.5 | 3.2 | 3.41 | **3.37** | **0.66** |
| 500 | 1625 | 3.1 | 3.2 | 3.21 | **3.17** | **0.62** |
| 600 | 1725 | 2.99 | 2.99 | 2.96 | **2.98** | **0.58** |

1. Process / manipulate the data above to produce results which could be then plotted and interpreted to find the size of the accelerating force and thus the unknown mass.

You have been provided with extra space to right of the table to add any necessary processing of results.

**(4 marks)**

**Averages (2 Marks) – ½ for each error**

**Inverse of Mass (2 Marks) – ½ for each error**

**Correct units for 1/m (1 Mark)**

**Allow manipulation of 1/a instead of 1/m if done correctly,**

**🡪 however this will mean that the gradient in Q7.**

**is no longer equal to F, but 1/F instead**

**1/a units should be m-1s2**

Plot your processed data below, and then use the graph to determine:

1. the size of the accelerating force
2. the mass of the unknown weight.
3. the mass of the motion trolley.

To achieve full marks, your answer must include **detailed logic** and **complete workings.**

There is space available on the back of this page for calculations**.**

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**Graph [4 Marks]**

-1 for

* + - Lack of title
    - Axes without labels or units (do not penalise incorrect unit for 1/m twice)
    - VERY poor plotting
    - Lack of Line of Best Fit
    - Correct Variables drawn on each axis.
    - Broken Axes

**Workings [5 Marks]**

* Lines drawn in on graph to show points used for gradient (not too close) (1)
* Gradient calculation using Does not need to be correct gradient (1)

Actual gradient is close to 5.14

* Manipulation of y = mx and F = ma to show that

a = F x 1/m

therefore gradient = total FORCE (1)

i.e 5.14 N

* Calculation of mass from FORCE in above. (1)

F = ma

5.14 = m x 9.8

m = 0.524 kg

* Calculation of Trolley mass from above. (1)

Mass of trolley = Total Mass – 0.524

= 1.125 – 0.524

= 0.601 kg

\*\*\*\* Pay follow through marks from process that is well set out. \*\*\*\*

**(9 marks)**