**Joseph Banks Secondary College**

Year 12 Integrated Science: General

****Unit 4 - Task 9

**Assessment type:** Investigation – Calculating acceleration

**Conditions**

Period allowed for completion of the task:

* Four Lessons of class time dedicated to completing the investigation.
* A device (ipad/laptop) may be used to access research material on Seqta and on the internet.
* Class notes/formulas from your books.

Use your prior knowledge from classwork, prior lessons and internet resources to answer the knowledge questions in this booklet. Use the marking guide on the following page as a guide to constructing your response.

**Task Weighting:**

10% of the school mark for this pair of units

**NAME:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Marking Guide:**

|  |  |
| --- | --- |
| Investigation | Marks Allocated |
| Variables | **8** |
| Hypothesis | **4** |
| Results Tables | **8** |
| Acceleration Calculations | **12** |
| Graph | **7** |
| Results Summary | **6** |
| Discussion | **6** |
| Evaluation | **10** |
| Conclusion | **4** |
| Total | **65** |

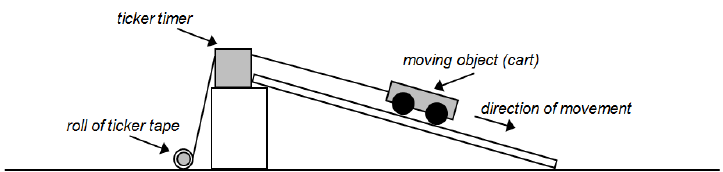
**Introduction:**

In physics, the acceleration of an object is said to be the rate of change of velocity per unit of time. In other words, acceleration is a measure of how fast something speeds up or slows down over time. An object travelling at a constant speed, or an object are said to have zero acceleration. One way in which acceleration can be determined mathematically is with a ticker timer.

**Ticker Timers:**

Ticker timers vibrate at exactly 50 ticks per second (50 Hertz or 50 Hz). They mark dots on a ticker tape which is attached to a moving object such as a trolley. Each dot on the ticker tape occurs exactly 0.02 seconds apart (which is 1/50 of a second). By measuring the distance between the dots you can easily calculate the object’s speed. To simplify, we will be measuring the distance between every 5 dots, which equates to 5 x 0.02 seconds or 0.1 seconds.

**Figure 1:** Typical setup of a ticker tape along with a moving cart.



**Formula List:**

Calculating Velocity:

V= s/t

Where s = the displacement of an object and t = time in seconds

**Calculating acceleration:**



Where Vf = the final velocity and Vi = the initial velocity and t = travel time

**Aim:** To investigate the speed of an accelerating trolley.

**Variables:**

Independent Variable:

Dependant Variable:

Controlled Variables:

Uncontrolled Variables:

**Hypothesis:**

**Method:**

* Attach the ticker timer to the AC power supply.
* Collect a 1.5m-long ticker tape and insert the tape into the ticker timer
* Elevate one end of the ramp and attach one end of the tape to the trolley.
* Turn on the power so that the ticker timer is vibrating.
* Allow the trolley to accelerate down the ramp.
* Mark the tape from the **first clear dot** to the last clear dot every **five time intervals** (which represents 0.1 seconds).
* Measure the length of each 5-tick interval and fill in the table.
* Repeat your experiment twice for two different mass trolleys.

**Results:**

**Table 1:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Time Interval | Length of each 5-tick interval. (mm) | Duration (seconds) | Speed (mm/s) | Elapsed Time (s) |
| 1 |  | 0.1 |  | 0.1 |
| 2 |  | 0.1 |  | 0.2 |
| 3 |  | 0.1 |  | 0.3 |
| 4 |  | 0.1 |  | 0.4 |
| 5 |  | 0.1 |  | 0.5 |
| 6 |  | 0.1 |  | 0.6 |
| 7 |  | 0.1 |  | 0.7 |
| 8 |  | 0.1 |  | 0.8 |
| 9 |  | 0.1 |  | 0.9 |
| 10 |  | 0.1 |  | 1.0 |
| 11 |  | 0.1 |  | 1.1 |
| 12 |  | 0.1 |  | 1.2 |
| 13 |  | 0.1 |  | 1.3 |
| 14 |  | 0.1 |  | 1.4 |
| 15 |  | 0.1 | page2image2910284192page2image2910284704 | 1.5 |

**Table 2:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Trial Number: | Trolley Number: | | Trolley Mass: | | | Ramp Height: | |
| Time Interval | | Length of each 5-tick interval. (mm) | | Duration (seconds) | Speed (mm/s) | | Elapsed Time (s) |
| 1 | |  | | 0.1 |  | | 0.1 |
| 2 | |  | | 0.1 |  | | 0.2 |
| 3 | |  | | 0.1 |  | | 0.3 |
| 4 | |  | | 0.1 |  | | 0.4 |
| 5 | |  | | 0.1 |  | | 0.5 |
| 6 | |  | | 0.1 |  | | 0.6 |
| 7 | |  | | 0.1 |  | | 0.7 |
| 8 | |  | | 0.1 |  | | 0.8 |
| 9 | |  | | 0.1 |  | | 0.9 |
| 10 | |  | | 0.1 |  | | 1.0 |
| 11 | |  | | 0.1 |  | | 1.1 |
| 12 | |  | | 0.1 |  | | 1.2 |
| 13 | |  | | 0.1 |  | | 1.3 |
| 14 | |  | | 0.1 |  | | 1.4 |
| 15 | |  | | 0.1 | page2image2910284192page2image2910284704 | | 1.5 |

**Table 3:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Trial Number: | Trolley Number: | | Trolley Mass: | | | Ramp Height: | |
| Time Interval | | Length of each 5-tick interval. (mm) | | Duration (seconds) | Speed (mm/s) | | Elapsed Time (s) |
| 1 | |  | | 0.1 |  | | 0.1 |
| 2 | |  | | 0.1 |  | | 0.2 |
| 3 | |  | | 0.1 |  | | 0.3 |
| 4 | |  | | 0.1 |  | | 0.4 |
| 5 | |  | | 0.1 |  | | 0.5 |
| 6 | |  | | 0.1 |  | | 0.6 |
| 7 | |  | | 0.1 |  | | 0.7 |
| 8 | |  | | 0.1 |  | | 0.8 |
| 9 | |  | | 0.1 |  | | 0.9 |
| 10 | |  | | 0.1 |  | | 1.0 |
| 11 | |  | | 0.1 |  | | 1.1 |
| 12 | |  | | 0.1 |  | | 1.2 |
| 13 | |  | | 0.1 |  | | 1.3 |
| 14 | |  | | 0.1 |  | | 1.4 |
| 15 | |  | | 0.1 | page2image2910284192page2image2910284704 | | 1.5 |

**Table 4:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Trial Number: | Trolley Number: | | Trolley Mass: | | | Ramp Height: | |
| Time Interval | | Length of each 5-tick interval. (mm) | | Duration (seconds) | Speed (mm/s) | | Elapsed Time (s) |
| 1 | |  | | 0.1 |  | | 0.1 |
| 2 | |  | | 0.1 |  | | 0.2 |
| 3 | |  | | 0.1 |  | | 0.3 |
| 4 | |  | | 0.1 |  | | 0.4 |
| 5 | |  | | 0.1 |  | | 0.5 |
| 6 | |  | | 0.1 |  | | 0.6 |
| 7 | |  | | 0.1 |  | | 0.7 |
| 8 | |  | | 0.1 |  | | 0.8 |
| 9 | |  | | 0.1 |  | | 0.9 |
| 10 | |  | | 0.1 |  | | 1.0 |
| 11 | |  | | 0.1 |  | | 1.1 |
| 12 | |  | | 0.1 |  | | 1.2 |
| 13 | |  | | 0.1 |  | | 1.3 |
| 14 | |  | | 0.1 |  | | 1.4 |
| 15 | |  | | 0.1 | page2image2910284192page2image2910284704 | | 1.5 |

**Calculate the acceleration of the trolley as it travels down the ramp for each trial. Show all your working below.**

**Trial 1:**

**Trial 2:**

**Trial 3:**

**Trial 4:**

**Graph:**

Using the length of each 5-tick interval in your tables above, construct a distance-time graph to show the acceleration of the trolley from, both of your experiments. Complete this graph on the graph paper provided.

**Results Summary:**

**Discussion:**

**Evaluation:**

**Conclusion:**