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|  | **Year 11 Physics**  Investigation: Investigation of stick collision compared to mass |

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| **Name:** | **Partner/s:** | **Mark / 60** |

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| **Background information** |
| *Use secondary sources to introduce the investigation.*  *Include a summary of the relevant theory, and specific data values where necessary.*  *This should include enough information that no new information other than the data and its analysis is presented anywhere else.*  *Provide in line citations for information obtained from secondary sources (textbooks, websites, scientific journal articles). Include a full reference for each source in the References section at the end of the report.*  *Sticky collision is a form of inelastic collision and is sometimes referred to as “perfect inelastic collision” in regard to a transfer of motion when after the collision the two objects remain in contact with each other and travel at the same relative velocity, the velocity is found by:*    Where v is the final velocity, u is the initial velocity.  M is the mass of the moving glider  m is the velocity of the stationary glider  u is the initial velocity of the incoming cart |
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| **Research Question** |
| What is the effect of the mass of a stationary object compared to the final speed as a result of sticky collision which indicates whether the increase of mass on a stationary object decreases final velocity. |

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| ***Hypothesis*** |
| *It is predicted that as the mass of the hit (stationary glider increases) the velocity because of the collision between the two gliders would be lower as force transferred from the incoming glider remains the same whilst the mass of the stationary glider increases. Newton’s second law of motion (F = m\*a) would show that as a result the acceleration of the glider would be lower resulting in a lower speed.* |

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| **Definition of variables** |
| **Independent variable**  *State what you changed AND what specific values you used.*  *Explain why these values were chosen – why are they relevant?*  The independent variable is the mass of the stationary glider this is a component of the sticky collision formula and in Newton’s second law with the relation of mass, force and acceleration. The values were from 0.2 to 0.6 kg in 0.1 increments. |
| **Dependent variable**  The dependent variable is the final velocity of the two gliders after they have collided it takes the time the photogate sees darkness and multiplied by the length of the card in meters (being 0.40 meters) |
| **Controlled variables**  *List at least three variables that must be controlled (stay the same) – include the value that was used*   1. The incoming velocity of the cart 2. The weight of the incoming cart 3. The surface the carts moved along |

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| **Materials and equipment** | | |
| **Quantity / volume required** | **Apparatus / material** | **Uncertainty of apparatus** |
| 2 x | Gliders, same mass | ± 0.05 |
| 1 x | Compression Spring | N/A |
| 2 x | Photogates and Event Timer | ± 0.005 N |
| 1 x | Air track | N/A |
| 2 x | 50 g weights | ± 5 |
| 4 x | 100g weights | ± 5 |
| 1 x | 40 mm card | ± |
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| **Method** |
| 1. Placed Photogates a set distance apart 2. Secured the compression spring to the end of the AirTrack 3. Inserted Velcro weights onto the carts to allow for joining 4. Placed one cart in between the two photogates and one cart next to the spring 5. Pull cart into the spring and release 6. Record time on the event timers 7. Repeat 2 more times 8. Increase weight by the interval 9. Repeat steps 4-8 till all data is collected |

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| **Quantitative data table** | | | | |
| Mass of Stationary Glider (kg) | Velocity of Combined Gliders (m/s) | | | *Average Velocity of combined* |
| Trial 1 | Trial 2 | Trial 3 |
| 0.2 | 0.643 | 0.617 | 0.664 | 0.6416 |
| 0.3 | 0.528 | 0.552 | 0.514 | 0.5317 |
| *0.4* | 0.396 | 0.395 | 0.451 | 0.4141 |
| *0.5* | 0.424 | 0.391 | 0.396 | 0.4036 |
| *0.6* | 0.354 | 0.324 | 0.362 | 0.3465 |

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| **Graph of quantitative data** |
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| **Analysis and discussion of results** |
| *The discussion will have three paragraphs. In the first paragraph, describe the trends and patterns seen in the graph. Try to be specific, but don’t explain why it happened (yet). You can refer to equations of trendlines here.*  *In the second paragraph, discuss how clear the trend is. Think about how close the data points are to the trend line or R2 value. If values were calculated for variation (eg. standard deviation, or max‒min), discuss these here too. This should include your discussion of* ***precision*** *and* ***accuracy****.*  *In the third paragraph, explain why the results turned out the way they did. It is important to explain this with reference to the relevant scientific theories. This is a scientific argument, so it must be supported by information from secondary sources. Provide a citation for information obtained from secondary sources.*  *During the experiment the mass of the stationary cart was steadly increased this corelated with a strong negetive corelation in the average speed of the two combined carts after undergoing sticky collision the relation is of for every increase in the mass of a stationary cart there is a 0.2632x0.557 decrease in the final velocity of the two carts*  *The trend of the graph contains a high degree of precision with a coefficent of determination percentage of 97.9% across the data however the accuracy is partially off what was expected where the expected power value was* ***–1***  *The results of sticky collision follow the sticky collision forumla where* ***INSERT*** *this is supported by theories including:* ***FINISH*** |

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| **Evaluation – To be completed in class under test conditions** |
| **Error Source 1:** |
| **Error Type (systematic/random):** |
| **Effect on results:** |
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| **Suggested improvements/ways to minimise:** |
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| **Evaluation – To be completed in class under test conditions** |
| **Error Source 2:** |
| **Error Type (systematic/random):** |
| **Effect on results:** |
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| **Suggested improvements/ways to minimise:** |
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| **Conclusion – To be completed in class under test conditions.** |
| *The conclusion should start with a specific answer to the research question.*  *THEN*  *Include a judgement of the level of support for the hypothesis. The data may not support the hypothesis – this is fine. Remember, a hypothesis CAN be supported or not supported, but it CANNOT be proven or disproven.*  *Decide on this based on these main things – how clear the trend is in the graph, how well the results agree with other scientific studies, the effect of your errors on results, and how well-designed the experiment is.* |

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| **References** |
| *Use a recognised system for referencing to present a full reference for each secondary source used in the investigation.*  *List the references in alphabetical order.*  *An online reference generator is available at:* [*https://org.slasa.asn.au/harvard*](https://org.slasa.asn.au/harvard) |