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|  | St Paul’s School | |
| Student name: | Student number: |
| Teacher name: | |
| Date handed out: Fri 22 Jul 2022 | Date due: Fri 26 Aug 2022 |

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| Subject | Physics |
| Technique | Student Experiment |
| Unit | Unit 2: Linear motion and waves |
| Topic | Topic 1: Linear motion and force  Topic 2: Waves |

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| Conditions | | | |
| Duration | 10 hours class time | | |
| Mode | Written response – scientific report | Length | 1500 – 2000 words |
| Individual/ group | Group work with individual report | Other | - |
| Resources available | School science laboratory and library (online: internet, databases and journals) | | |
| Context | | | |
| You have completed the following practicals in class:   * Conduct an experiment that requires you to investigate conservation of momentum in collisions * Conduct an experiment that requires you to verify Newton’s Second Law * Conduct an experiment on the reflection and refraction of light | | | |
| Task | | | |
| Modify (i.e. refine, extend or redirect) an experiment in order to address your own related hypothesis or question.  You may use a practical performed in class, a related simulation or another practical related to Unit 2 (as negotiated with your teacher) as the basis for your methodology and research question. | | | |
| To complete this task, you must: | | | |
| * identify an experiment to modify\* * develop a research question to be investigated\* * research relevant background scientific information to inform the modification of the research question and methodology * conduct a risk assessment and account for risks in the methodology\* * conduct the experiment\* * collect sufficient and relevant qualitative and/or quantitative data to address the research question\* * process and present the data appropriately * analyse the evidence to identify trends, patterns or relationships * analyse the evidence to identify uncertainty and limitations * interpret the evidence to draw conclusion/s to the research question * evaluate the reliability and validity of the experimental process * suggest possible improvements and extensions to the experiment * communicate findings in an appropriate scientific genre, i.e. scientific report.   \* The steps indicated with an asterisk above may be completed in groups. All other elements must be completed individually. | | | |
| Checkpoints | | | |
| Term 3 Week 2: Select experiment and identify proposed modifications Fri 22 Jul | | | |
| Term 3 Week 3: Perform experiment and process data Mon 25 Jul | | | |
| Term 3 Week 4: Analyse and evaluate evidence Mon 1 Aug | | | |
| Term 3 Week 5: Submit **draft** Fri 12 Aug | | | |
| Term 3 Week 7: Submit **final** response Fri 26 Aug | | | |
| Assessment objective/s | | | |
| 2. apply understanding of linear motion and force, or waves to modify experimental methodologies and process primary data | | | |
| 3. analyse experimental evidence about linear motion and force, or waves | | | |
| 4. interpret experimental evidence about linear motion and force, or waves | | | |
| 5. investigate phenomena associated with linear motion and force, or waves through an experiment | | | |
| 6. evaluate experimental processes and conclusions about linear motion and force, or waves | | | |
| 7. communicate understandings and experimental findings, arguments and conclusions about linear motion and force, or waves | | | |
| Authentication strategies | | | |
| * You will be provided class time for task completion. | | | |
| * You will provide documentation of your progress at indicated checkpoints. | | | |
| * Your teacher will collect and annotate a draft. | | | |
| * You will use plagiarism-detection software to submit your response. | | | |
| * You must acknowledge all sources. | | | |
| * Your teacher will compare the responses of students who have worked together in groups. | | | |
| Scaffolding | | | |
| The response must be presented using an appropriate scientific genre (i.e. scientific report) and contain:  • a research question  • a rationale for the experiment  • reference to the initial experiment and identification and justification of modifications to the methodology  • raw and processed qualitative and/or quantitative data  • an analysis of the evidence  • conclusion/s based on the interpretation of the evidence  • an evaluation of the methodology and suggestions for improvements and extensions to the experiment  • a reference list  **An example of how one of the practicals could be modified to develop a research question**  **Practical that will be modified:** Conduct an experiment to verify the value of acceleration due to gravity on the Earth’s surface  **Research question:** What is the relationship between the Earth’s gravity and a plastic ball of radius 6 cm with varying masses?  **Developing the research question:**   |  |  | | --- | --- | | **Description** | **Example** | | Identify the independent variable to be investigated | Mass of the ball | | Identify the dependent variable | Time taken for the object to fall | | Identify the methodology to be used | * A camera with ‘slow motion’ capabilities will be set up at the bottom of a two-storey building * A hollow, plastic ball containing sand will be dropped from the building and its motion recorded by the camera * The acceleration of the ball will be calculated by reviewing the recorded footage   This experiment will be repeated with different amounts of sand in the ball (i.e., to change the mass) | | Draft research question | What is the relationship between the Earth’s gravity and the mass of an object? | | Refine and focus the research question | What is the relationship between the Earth’s gravity and a plastic ball of radius 6 cm with varying masses? |   **Note:** You cannot use this sample research question for your experiment. | | | |

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| **Criterion** | **Marks allocated** | **Result** |
| **Research and planning**  Assessment objectives 2, 5 | 6 |  |
| **Analysis of evidence**  Assessment objectives 2, 3, 5 | 6 |  |
| **Interpretation and evaluation**  Assessment objectives 4, 6 | 6 |  |
| **Communication**  Assessment objectives 7 | 2 |  |
| **Total** | 20 |  |

## **Criterion: Research and planning**

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### Assessment objectives

2. apply understanding of linear motion and force, or waves to modify experimental methodologies and process primary data

5. investigate phenomena associated with linear motion and force, or waves through an experiment

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| **The student work has the following characteristics:** | **Marks** |
| * informed application of understanding of linear motion and force, or waves to modify experimental methodologies demonstrated by * a considered rationale for the experiment * justified modifications to the methodology * effective and efficient investigation of phenomena associated with linear motion and force, or waves demonstrated by * a specific and relevant research question * a methodology that enables the collection of sufficient, relevant data * considered management of risks and ethical or environmental issues | 5–6 |
| * adequate application of understanding of linear motion and force, or waves to modify experimental methodologies demonstrated by * a reasonable rationale for the experiment * feasible modifications to the methodology * effective investigation of phenomena associated with linear motion and force, or waves demonstrated by * a relevant research question * a methodology that enables the collection of relevant data * management of risks and ethical or environmental issues | 3–4 |
| * rudimentary application of understanding of linear motion and force, or waves to modify experimental methodologies demonstrated by * a vague or irrelevant rationale for the experiment * inappropriate modifications to the methodology * ineffective investigation of phenomena associated with linear motion and force, or waves demonstrated by * an inappropriate research question * a methodology that causes the collection of insufficient and irrelevant data * inadequate management of risks and ethical or environmental issues | 1–2 |
| * does not satisfy any of the descriptors above | 0 |

**Criterion: Analysis of evidence**

### Assessment objectives

1. apply understanding of linear motion and force, or waves to modify experimental methodologies and process primary data
2. analyse experimental evidence about linear motion and force, or waves

5. investigate phenomena associated with linear motion and force, or waves through an experiment

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| **The student work has the following characteristics:** | **Marks** |
| * appropriate application of algorithms, visual and graphical representations of data about linear motion and force, or waves demonstrated by correct and relevant processing of data * systematic and effective analysis of experimental evidence about linear motion and force, or waves demonstrated by * thorough identification of relevant trends, patterns or relationships * thorough and appropriate identification of the uncertainty and limitations of evidence * effective and efficient investigation of phenomena associated with data about linear motion and force, or waves demonstrated by the collection of sufficient and relevant raw data. | 5–6 |
| * adequate application of algorithms, visual and graphical representations of data about linear motion and force, or waves demonstrated by basic processing of data * effective analysis of experimental evidence about linear motion and force, or waves demonstrated by * identification of obvious trends, patterns or relationships * basic identification of uncertainty and limitations of evidence * effective investigation of phenomena associated with data about linear motion and force, or waves demonstrated by the collection of relevant raw data. | 3–4 |
| * rudimentary application of algorithms, visual and graphical representations of data about linear motion and force, or waves demonstrated by incorrect or irrelevant processing of data * ineffective analysis of experimental evidence about linear motion and force, or waves demonstrated by * identification of incorrect or irrelevant trends, patterns or relationships * incorrect or insufficient identification of uncertainty and limitations of evidence * ineffective investigation of phenomena associated with data about linear motion and force, or waves demonstrated by the collection of insufficient and irrelevant raw data. | 1–2 |
| * does not satisfy any of the descriptors above. | 0 |

**Criterion: Interpretation and evaluation**

### Assessment objectives

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4. interpret experimental evidence about linear motion and force, or waves

6. evaluate experimental processes and conclusions about linear motion and force, or waves

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| **The student work has the following characteristics:** | **Marks** |
| * insightful interpretation of experimental evidence about linear motion and force, or waves demonstrated by justified conclusion/s linked to the research question * critical evaluation of experimental processes about linear motion and force, or waves demonstrated by * justified discussion of the reliability and validity of the experimental process * suggested improvements and extensions to the experiment that are logically derived from the analysis of evidence. | 5–6 |
| * adequate interpretation of experimental evidence about linear motion and force, or waves demonstrated by reasonable conclusion/s relevant to the research question * basic evaluation of experimental processes about linear motion and force, or waves demonstrated by * reasonable description of the reliability and validity of the experimental process * suggested improvements and extensions to the experiment that are related to the analysis of evidence. | 3–4 |
| * invalid interpretation of experimental evidence about linear motion and force, or waves demonstrated by identifying inappropriate or irrelevant conclusion/s * superficial evaluation of experimental processes about linear motion and force, or waves demonstrated by * cursory or simplistic statements about the reliability and validity of the experimental process * ineffective or irrelevant suggestions. | 1–2 |
| * does not satisfy any of the descriptors above. | 0 |

**Criterion: Communication**

### Assessment objective

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7. communicate understandings and experimental findings, arguments and conclusions about linear motion and force, or waves

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| **The student work has the following characteristics:** | **Marks** |
| * effective communication of understandings and experimental findings, arguments and conclusions about linear motion and force, or waves demonstrated by * fluent and concise use of scientific language and representations * appropriate use of genre conventions * acknowledgment of sources of information through appropriate use of referencing conventions | 2 |
| * adequate communication of understandings and experimental findings, arguments and conclusions about linear motion and force, or waves demonstrated by * competent use of scientific language and representations * use of basic genre conventions * use of basic referencing conventions. | 1 |
| * does not satisfy any of the descriptors above. | 0 |