# PRACTICAL FIRST-HAND INVESTIGATION

# Weighting: 30%

# TOPIC: Motion in a straight line

# Due Date: Friday 6th March 2020 - Week 6 Term 1

**Task Overview:**

This task contains two parts.

**PART 1 – Conducting a scientific investigation to gather data**

To complete this task you are required to perform a scientific investigation to observe and describe the motion of an object travelling in a straight line.

The practical investigation will be performed in class as an individual task. The data gathered will be collated into an excel spreadsheet that will be attached to the appendix of the assessment task.

**PART 2 – Formal investigation report**

Students will then be required to analyse and interpret the data collected from the scientific investigation and present it in the format of a formal written scientific report. (see provided scaffold) Students will be required to answer a series of questions as part of their analysis.

## Syllabus Outcomes:

**PH11 – 1** Develops and evaluates questions and hypotheses for scientific investigation
**PH11 – 2** Designs and evaluates investigations in order to obtain primary and secondary data and information
**PH11 – 3** Conducts investigations to collect valid and reliable primary and secondary data and information
**PH11 – 4** Selects and processes appropriate qualitative and quantitative data and information using a range of appropriate media
**PH11 – 5** Analyses and evaluates primary and secondary data and information
**PH11 – 7** Communicates scientific understanding using suitable language and terminology for a specific audience or purpose
**PH11 – 8** describes and analyses motion in terms of scalar and vector quantities in two dimensions and makes quantitative measurements and calculations for distance, displacement, speed, velocity and acceleration

**Content:**

- conduct practical investigations, selecting from a range of technologies, to record and analyse the motion of objects in a variety of situations in one dimension in order to measure or calculate:

  - time
  - distance
  - displacement
  - speed
  - velocity
  - acceleration

- conduct a practical investigation to gather data to facilitate the analysis of instantaneous and average velocity through:

  - quantitative, first-hand measurements
  - the graphical representation and interpretation of data (ACSPH061)

# Scientific Report Writing Scaffold:

To write your formal scientific report you must include the following:

**Aim** – what was the purpose of the investigation?

**Background information** – A paragraph that informs the reader of the science behind the investigation you are undertaking. For example, if you were to conduct an investigation to prove that any two objects inside the Earths gravitational field, regardless of their mass, will accelerate towards the Earth's surface at the same rate, you would conduct research into Galileo and Newton's previous investigations and understanding of gravity. You would include any information relevant to your investigation in this section, such as the effect that air resistance would have on your investigation, and include any information that would influence your experimental design (method).

**Hypothesis** - A tentative explanation for an observed phenomenon, expressed as a precise and unambiguous statement that can be supported or refuted by the investigation. An hypothesis is based on prior knowledge and clearly identifies how the independent variable will affect the dependent variable.

**Equipment list** – a detailed list of all equipment used to perform the investigation.

**Variables Identified** – Correctly identify the variables in the experiment including; independent, dependent and controlled variables.

**Risk Assessment** – Students are to conduct a risk assessment of the investigation. At least 3 risks should be included, and three control measures. The risk assessment should be presented as a table. (see below)

| Risk: | Control Measure: |
|---|---|
| Risk 1 | |
| Risk 2 | |
| Risk 3 | |

**Method** –You must include the method in your report. Your method will need to include any changes that were made to the way the investigation was conducted. It should be in step form, provide clear logical instructions, include how/what equipment is used to collect the data, and include repetition.

**Results (table)** - first-hand data should be presented in an appropriate table. All tables should be labelled.

**Results (graphs)** – The following graphs must be included in the scientific report:

- displacement-time graph
- velocity-time graph

Make sure that your graphs have appropriate headings, labels on the axis, even scales, and appropriate units. You may draw your graphs using a computer program (excel) or by hand. All graphs should be labelled.

**Discussion -** This is the section in which you analyse your results. Your discussion should have at least 4 sections.

Section 1: This is the section in which you interpret your results. You should refer directly to the data that was gathered and analyse it using your graph. Any calculations that you do to interpret and analyse your results should be demonstrated with full working out in an appendix section at the end of your report.

In this section you should focus on describing the motion of the objects/vehicles. Make sure you use specific information from the two graphs you have drawn. Your displacement-time graph and velocity-time graphs tell you a lot about the motion. (Remember – this is your chance to show the marker what you can do!)

Section 2: This is the section in which you analyse the accuracy and precision of the data you collected. It is a good idea to give a definition of each term before you start discussing how your investigation performed. You also need to make sure that you provide evidence (specific examples) of how your

investigation was/wasn't accurate or precise. You should also include how you could improve the investigation to increase accuracy and precision.

<u>Section 3:</u>  This is the section in which you analyse the reliability of the data you collected. It is a good idea to give a definition of the term before you start discussing how your investigation performed. You also need to make sure that you provide evidence (specific examples) of how your investigation was/wasn't reliable. You should also include how you could improve the investigation to increase reliability.

<u>Section 4:</u>  This is the section in which you analyse the validity of the data you collected. It is a good idea to give a definition of the term before you start discussing how your investigation performed. You also need to make sure that you provide evidence (specific examples) of how your investigation was/wasn't valid. You should also include how you could improve the investigation to increase validity.

**Conclusion** – A paragraph summarising the main findings of the investigation. A concluding paragraph should refer to the aim of the investigation and state whether the hypothesis was proven or disproved, and the consequences/implications of this. You conclusion may identify an area of potential future research based on your investigation. You conclusion should always be based on evidence and refer directly to evidence from your investigation.

**Reference list** – This is where you include any references that you used/referred to in your investigation. You should try to use references in your background information section and in your discussion. Please see addition information on how to reference using the APA style.

**Appendix/appendices** – An appendix is always included in a scientific investigation. An appendix is where you include any calculations that you made during your investigation, any additional data that you collected, your raw data collected in the investigation (this is where you put your messy table from when you actually conducted the investigation), any additional data manipulation that isn't required in the main results section.

**Marking Rubric: Practical first-hand investigation – Motion in a straight line**

| Outcomes Assessed: | Developing | Achieving | High | Exemplary | Total: |
|---|---|---|---|---|---|
| **PH11 – 1** Develops and evaluates questions and hypotheses for scientific investigation | • Simple aim of investigation included<br>• Hypothesis is unclear<br><br>**1 mark** | • Clear aim of investigation included<br>• Clear hypothesis that reflects the purpose of the investigation<br><br>**2 marks** | • Clear hypothesis that directly links to the aim of the investigation<br>• Hypothesis is reflective of the background information<br><br>**3 marks** | • Clear hypothesis that directly links to the aim of the investigation<br>• Sophisticated hypothesis that is developed from the background information<br><br>**4 marks** | |
| **PH11 – 2** Designs and evaluates investigations in order to obtain primary and secondary data and information | • Identifies variables correctly<br>• Chooses appropriate equipment<br><br><br><br><br><br><br><br>**1 mark** | • Clear risk assessment<br>• Chooses appropriate equipment to complete the practical investigation<br>• Identifies variables correctly, including a number of controlled variables<br>• Method is clear and easy to follow<br><br>**2 marks** | • Clear risk assessment<br>• Chooses appropriate equipment to complete the practical investigation<br>• Identifies variables correctly, including a number of controlled variables<br>• Modifies the method as a result of testing<br>• Method allows for the reliably collection of data<br><br>**3 - 4 marks** | • Clear risk assessment that assesses a range of risks in the investigation<br>• Chooses appropriate equipment to complete the practical investigation<br>• Identifies variables correctly, including a number of controlled variables<br>• Method allows for the reliably collection of data<br>• Evaluates and modifies the method as a result of testing and new evidence<br>**5 marks** | |
| **PH11 – 3** Conducts investigations to collect valid and reliable primary and secondary data and information | • Requires teacher assistance to conduct the investigation and to select appropriate equipment<br><br><br><br><br><br><br>**1 mark** | • Conducts investigation effectively to collect valid and reliable data<br>• Employs safe work practices and manage risks<br>• Works effectively as a member of team to collect valid and reliable data<br><br>**2 marks** | • Secondary sources are referenced appropriately<br>• Employs safe work practices and manage risks<br>• Uses appropriate technologies to ensure accuracy<br>• Primary data collection is included in appendix<br>• Works effectively as a member of team to collect valid and reliable data<br>**3 – 4 marks** | • Secondary sources are referenced appropriately including in text citations.<br>• Employs safe work practices and manage risks<br>• Uses appropriate technologies to ensure accuracy<br>• Primary data collection is included in appendix<br>• Works effectively as a member of team to collect valid and reliable data<br>**5 marks** | |

| Outcomes Assessed: | Developing | Achieving | High | Exemplary | Total: |
|---|---|---|---|---|---|
| **PH11 – 4** Selects and processes appropriate qualitative and quantitative data and information using a range of appropriate media | • Data is disorganised and incomplete<br><br>**1 mark** | • Gathered data is presented in appropriate tables and graphs in the results section of the report<br>• Qualitative and quantitative data is described<br><br>**2 marks** | • Gathered data is presented clearly in appropriate tables and graphs in the results section of the report<br>• Qualitative and quantitative data is described and processed where appropriate<br><br>**3 – 4 marks** | • Gathered data is presented clearly in appropriate tables and graphs in the results section of the report<br>• Qualitative and quantitative data is described and processed where appropriate<br>• Calculations are included in the appendix section of the report.<br><br>**5 marks** | |
| **PH11 – 5** Analyses and evaluates primary and secondary data and information | • Presents data with limited analysis<br><br><br><br><br><br><br><br><br>**1 – 2 marks** | • Identifies trends, patterns and relationships in data and information with limited analysis<br>• Identifies errors and limitations in data<br>• Attempts to evaluate the accuracy, reliability and validity of the investigation<br><br>**3 – 5 marks** | • Describes trends, patterns and relationships in data and information<br>• Describes errors and limitations in data<br>• Evaluates the accuracy, reliability and validity of the investigation<br>• Suggests improvements to the investigation<br><br>**6 – 8 marks** | • Explains trends, patterns and relationships in data and information<br>• Assesses errors and limitations in data<br>• Sophisticated and thorough evaluation of the accuracy, reliability and validity of the investigation<br>• Suggests improvements to the investigation<br><br>**9 – 10 marks** | |
| **PH11 – 7** Communicates scientific understanding using suitable language and terminology for a specific audience or purpose | • Presents limited information<br>• Shows limited understanding of the scientific method<br>• Shows limited understanding of the scientific concepts<br><br>**1 mark** | • Communicates basic information in the form of a scientific report<br>• Uses some scientific terminology<br><br><br><br>**2 marks** | • Presents a well-organized report<br>• Selects and uses suitable forms of digital, visual and written forms of communication<br>• Selects and applies appropriate scientific notations, nomenclature and scientific language to communicate<br><br>**3 – 4 marks** | • Presents a sustained, logical and cohesive report supporting conclusions/ideas with evidence<br>• Selects and uses effective forms of digital, visual and written forms of communication<br>• Selects and applies appropriate scientific notations, nomenclature and scientific language to communicate in a variety of contexts<br><br>**5 – 6 marks** | |

| Outcomes Assessed: | Developing | Achieving | High | Exemplary | Total: |
|---|---|---|---|---|---|
| **PH11 – 8** describes and analyses motion in terms of scalar and vector quantities in two dimensions and makes quantitative measurements and calculations for distance, displacement, speed, velocity and acceleration | • Demonstrates a limited understanding of motion of an object in a straight line | • Describes the motion of an object moving in a straight line<br>• Applies understanding to quantify measurements and basic calculations | • Describes and explains the motion of an object travelling in a straight line<br>• Applies understanding to calculate distance, displacement, speed, velocity and acceleration | • Applies understanding of the motion of an object moving in a straight line to describe and explain the motion of an object<br>• Analyses motion in terms of vectors and correctly quantifies measurements and calculations for distance, displacement, speed, velocity and acceleration | |
| | **1 mark** | **2 marks** | **3 - 4 marks** | **5 marks** | |
| | | | | **Total Marks:** | **__/40** |

**Teacher Feedback:**

_____

_____

_____

_____

_____

_____

_____