



Year 12 Physics 2024

Assessment Task 1: First Hand Investigation: Mechanics of Projectiles

TOPIC: Advanced Mechanics	MARKS: / 20	
SUBMISSION REQUIREMENTS: The assessment will be submitted to CANVAS on Friday 6th December 2024 by 11.59 PM.	WEIGHTING:	
	Knowledge & Understanding	Skills
	5 %	15 %

TASK DESCRIPTION:

Students will design a first hand Investigation to investigate projectile motion.

This will require students to gather primary information and test the following experimental aim:

- How effectively can the landing site of a projectile be predicted, as the object's velocity increases?

Students will need to **process** information to **explain** their data collected from the primary investigation. They may also refer to secondary data that they've used by applying relevant formulae related to projectile motion. This **analysis** of both primary and secondary data will be compiled to **evaluate**: 'How effectively can the landing site of an object be predicted, as its velocity increases?'

Students will have 3 lessons in class to research, design and test their projectile motion investigation hypothesis.

During class, students will be provided with the following equipment in order to **conduct** their investigation:

- Ramp
- Ramp support
- Ball bearing
- Protractor
- Ruler
- Table
- Stopwatch
- Pneumatic trough

They will **develop** a hypothesis from their calculations based on the experimental setup.

In the **design** of the investigation, students are expected to alter the height of the ramp in order to alter the velocity of the falling object. Students are at look at 5 different velocities.

Students must **conduct** their task individually.

Students are expected to **conduct** 10 repetitions of each velocity data point, in order to obtain reliable results as well as identify any anomalies that may have occurred.

Students are also expected to accurately record the uncertainty of their measurements.

They will then **analyse** their experimental results to determine how the change in velocity has altered the projectiles displacement, both graphically, conceptually and mathematically.

Students are then the **evaluate** their researched fall distance compared to the predicted horizontal displacement from their calculations, suggesting reasons why there may be variations between what was predicted and what occurred, clearing **solving** the statement "how effectively can the landing site of a projectile be predicted as the velocity increases.

Students will be expected to allocate time at home to the evaluation of their investigation.

OUTCOMES TO BE ASSESSED:

- PH12-1** **Develops** and evaluates questions and hypotheses for scientific investigation.
- PH12-2** **Designs** and **evaluates** investigations in order to obtain **primary** and secondary data and information.
- PH12-3** **Conducts** investigations to collect valid and reliable primary and secondary data and information.
- PH12-6** **Solves** scientific problems using **primary** and secondary data, critical thinking skills and scientific processes.
- PH12-12** **Describes** and **analyses** qualitatively and quantitatively circular motion and motion in a gravitational field, in particular, the projectile motion of particles.

DIRECTIONAL VERBS:

- Analyse** Identify components and the relationship between them; draw out and relate implications
- Conducts** To carry out
- Designs** To create, fashion, execute, or construct according to plan
- Develops** To bring to a more advanced stage
- Evaluate** Make a judgement based on criteria; determine the value of
- Solves** To find an answer to, or an explanation for something

Investigation Scaffold

Introduction: (relevant formulae /concepts etc)

Experimental Design

independent variable:	dependent variable:	controlled variables: (At least 5)

Aim:

Hypothesis:

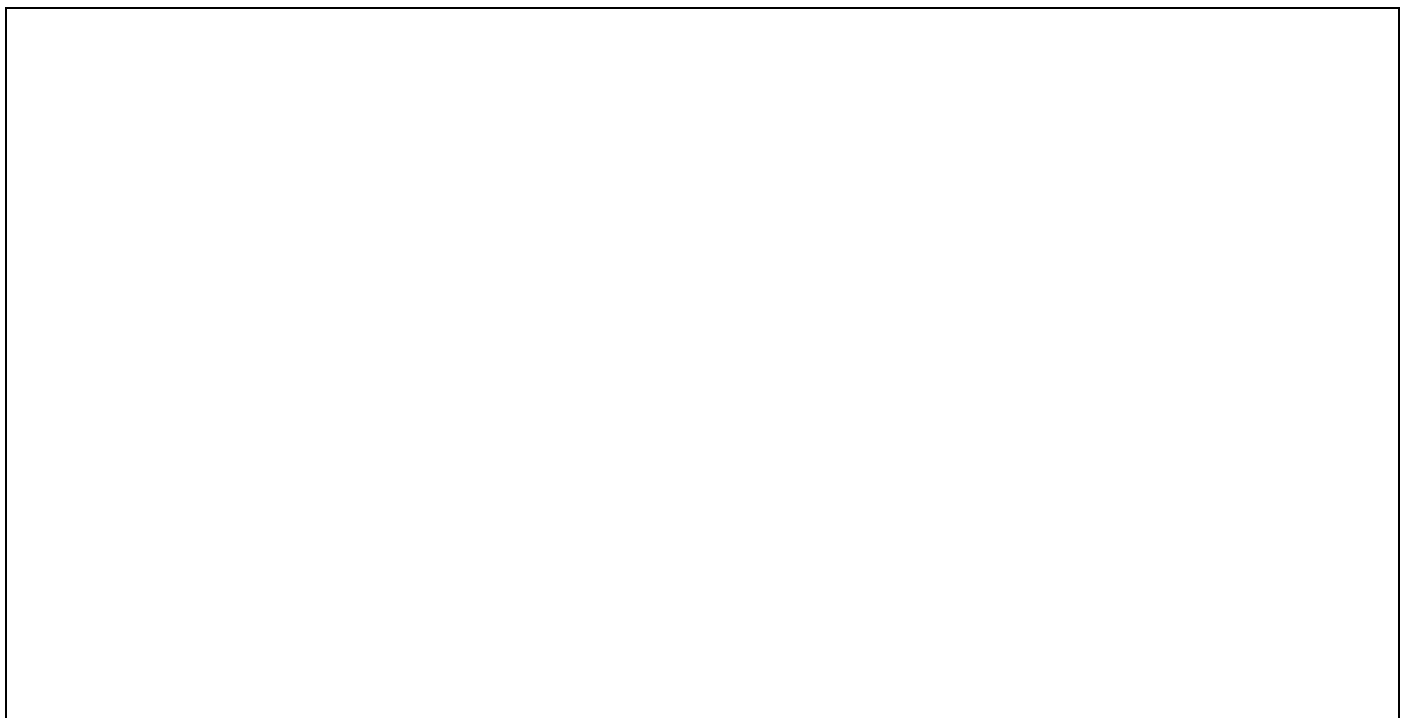
Safety:

Hazards	Management

Equipment:

Method:

Diagram:



Discussion:

What trends did your experiment show:

Explanation of the trends:

Did you need to modify your experiment?

What possible errors could there have been when making measurements?

How did you calculate the uncertainty of your measurements?

How could you improve the reliability of your experiment?

How could you improve the accuracy of your experiment?

How could you have improved the validity of your experiment? Related to the design of your experiment?

Evaluate your experimental results, compared the predicted results from your calculations.

ASSESSMENT MARKING CRITERIA

<i>(Outcomes PH12-1, PH12-2, PH12-4, PH12-6, PH12-12)</i>	Mark	Grade
<p>Produces a comprehensive investigation that analyses primary / predicted data and evaluates any differences. All of the following are included:</p> <ul style="list-style-type: none"> - investigation designed using correct scientific language and conventions, 5 controlled variables and sufficient background information. - comprehensive experimental plan developed which includes a risk assessment statement, a procedure to record accurately 10 data points for 5 stated velocities, and the stated angles of the ramp's inclination. - experiment conducted in an outstanding manner that is safe and records accurately 10 data points for 5 stated velocities, with the uncertainty measurements for both velocity and horizontal displacement. - comprehensive analysis of the data measured, displaying a correctly labelled graph of velocity vs average displacement, states the trends observed as velocity increases, provides a statement related to whether there were any modifications to the investigation and any possible errors are identified. - comprehensive evaluation of the investigation, explaining how the uncertainty values were calculated, improvements in accuracy, reliability and validity of the experiment. Provides a comprehensive comparison of the predicted results and the measured results, including suggestion on why there may have been variations between both of them, as well addressing how increasing the velocity has altered the ability to predict the horizontal displacement. Finally, provides a concluding statement to solve the question, "How effectively the landing site of a projectile can be predicted, as the object's velocity increases?". 	17-20	A
<p>Produces a thorough investigation that analyses primary / predicted data and evaluate any differences. Most the following are included:</p> <ul style="list-style-type: none"> - investigation designed using correct scientific language and conventions, 5 controlled variables and sufficient background information. - comprehensive experimental plan developed which includes a risk assessment statement, a procedure to record accurately 10 data points for 5 stated velocities, and the stated angles of the ramp's inclination. - experiment conducted in an outstanding manner that is safe and records accurately 10 data points for 5 stated velocities, with the uncertainty measurements for both velocity and horizontal displacement. - comprehensive analysis of the data measured, displaying a correctly labelled graph of velocity vs average displacement, states the trends observed as velocity increases, 	13-16	B

<p>provides a statement related to whether there were any modifications to the investigation and any possible errors are identified.</p> <ul style="list-style-type: none"> - comprehensive evaluation of the investigation, explaining how the uncertainty values were calculated, improvements in accuracy, reliability and validity of the experiment. Provides a comprehensive comparison of the predicted results and the measured results, including suggestion on why there may have been variations between both of them, as well addressing how increasing the velocity has altered the ability to predict the horizontal displacement. Finally, provides a concluding statement to solve the question, “How effectively the landing site of a projectile can be predicted, as the object’s velocity increases?”. 		
<p>Produces a sound investigation that analyses primary / predicted data and explains any differences. Most the following are included, (may contain some omissions):</p> <ul style="list-style-type: none"> - experimental plan design which includes (with several omissions) a risk assessment statement, a procedure to record accurately 10 data points for 5 stated velocities, and the stated angles of the ramp’s inclination. - experiment conducted in a manner (with several omissions/errors) that is safe and records accurately up to 10 data points for 5 stated velocities, with the uncertainty measurements for both velocity and horizontal displacement. - Analysis of the data measured (with several omissions/errors), displaying a mostly correctly labelled graph of velocity vs average displacement, stating the trend observed as velocity increases, provides a statement related to whether there were any modifications to the investigation. - Detailed evaluation of the investigation, explaining, with several omissions / errors, how the uncertainty values were calculated, improvements in accuracy, reliability and validity of the experiment. Provides a brief comparison of the most aspects of predicted results and the measured results, including briefly, suggestions on why there may have been variations between both of them, as well addressing aspects of how increasing the velocity has altered the ability to predict the horizontal displacement. Finally, provides a brief concluding statement to solve the question, “How effectively the landing site of a projectile can be predicted, as the object’s velocity increases?”. 	9-12	C
<p>Produces a basic investigation that attempts to analyse primary and predicted data and evaluate any differences. Most the following are included with some omissions:</p> <ul style="list-style-type: none"> - brief design for the investigation. - brief experimental plan developed with major omissions for the risk assessment statement and procedure to record accurately up to 10 data points for 5 stated velocities, and the stated angles of the ramp’s inclination. - experiment conducted safely, though with major omissions/errors up to 10 data points for 5 stated velocities and the projectiles horizontal displacement. - analysis of the data measured (with major omissions/errors), displaying a graph of velocity vs average displacement (with plotting errors or not following scientific graphing conventions) 	5-8	D

<ul style="list-style-type: none"> - Brief evaluation of the investigation, describing with major omissions / errors, aspects of how the uncertainty values were calculated, improvements in accuracy, reliability and validity of the experiment. Provides some comparison of the predicted results and the measured results. Neglects to provides a concluding statement to solve the question, “How effectively the landing site of a projectile can be predicted, as the object’s velocity increases?”. 		
<p>Produces a limited investigation lacking in detail for its design and development.</p> <ul style="list-style-type: none"> - There is insufficient testing conducted and limited records of results. - A limited explanation has been provided. 	<p>0-4</p>	<p>E</p>