Physics 2019 v1.3

IA2: Sample assessment instrument

Student experiment (20%)

This sample has been compiled by the QCAA to assist and support teachers in planning and developing assessment instruments for individual school settings.

Student name

Student number

Teacher

Issued

Due date

Marking summary

Criterion	Marks allocated	Provisional marks
Research and planning	6	
Analysis of evidence	6	
Interpretation and evaluation	6	
Communication	2	
Overall	**20**	

Conditions

Technique	Student experiment
Unit	Unit 3: Gravity and electromagnetism
Topic/s	Topic 1: Gravity and motion Topic 2: Electromagnetism
Duration	10 hours class time
Mode/length	Written response (e.g. scientific report): 1500–2000 words
Individual/group	Individual response: students may collaborate to develop the methodology and perform the experiment
Resources	School science laboratory and library (online: internet and school intranet, databases, journals)

Context

You have completed the following practicals in class:

- Conduct an experiment to determine the horizontal distance travelled by an object projected at various angles from the horizontal (mandatory practical).
- Conduct an experiment to investigate the force acting on a conductor in a magnetic field (mandatory practical).
- Conduct an experiment to investigate the strength of a magnet at various distances (mandatory practical).

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 3 (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 data 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 the 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 2, Week 3: Select experiment and identify proposed modifications.

☐ Term 2, Week 4: Perform experiment and process data.

☐ Term 2, Week 6: Analyse and evaluate evidence.

☐ Term 2, Week 7: Submit draft.

☐ Term 2, Week 9: Submit final response.

Authentication strategies

- The teacher will provide class time for task completion.
- Students will provide documentation of their progress at indicated checkpoints.
- The teacher will collect and annotate one draft.
- Students will use plagiarism-detection software at submission of the response.
- Students must acknowledge all sources.
- The 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 data and/or quantitative data
- analysis of the evidence
- conclusion/s based on the interpretation of the evidence
- an evaluation of the methodology and suggestions of 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 investigate the parallel component of the weight of an object down an inclined plane at various angles.

Research question: What is the relationship between the angle of inclination and the magnitude of the frictional force for a given rectangular-based wooden object on a given wooden surface?

Developing the research question:

Steps	Details
Identify the independent variable to be investigated.	Angle of inclination.
Identify the dependent variable.	Magnitude of the frictional force acting parallel to the inclined surface.
Identify the methodology to be used.	A rectangular wooden object will be placed on an inclined plane. The angle of inclination will be modified and the parallel component of the object's weight will be measured using a data-logger force meter. This measured force will be subtracted from the theoretically expected value of the parallel-to-the-surface component of the weight to determine the magnitude of the frictional force acting parallel to the inclined surface.
Draft research questions.	What is the relationship between angle of inclination and the frictional force on an inclined surface?
Present research question to teacher for approval.	What is the relationship between the angle of inclination and the magnitude of the frictional force for a given rectangular-based wooden object on a given wooden surface?

Note: You cannot use this sample research question for your experiment.

Instrument-specific marking guide (IA2): Student experiment (20%)

Criterion: Research and planning

Assessment objectives

2. apply understanding of gravity and motion, or electromagnetism to modify experimental methodologies and process primary data
5. investigate phenomena associated with gravity and motion, or electromagnetism through an experiment

The student work has the following characteristics:	Marks
• informed application of understanding of gravity and motion, or electromagnetism 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 gravity and motion, or electromagnetism 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 gravity and motion, or electromagnetism to modify experimental methodologies demonstrated by – a reasonable rationale for the experiment – feasible modifications to the methodology • effective investigation of phenomena associated with gravity and motion, or electromagnetism 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 gravity and motion, or electromagnetism 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 gravity and motion, or electromagnetism 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

2. apply understanding of gravity and motion, or electromagnetism to modify experimental methodologies and process primary data
3. analyse experimental evidence about gravity and motion, or electromagnetism
5. investigate phenomena associated with gravity and motion, or electromagnetism through an experiment

The student work has the following characteristics:	Marks
• appropriate application of algorithms, visual and graphical representations of data about gravity and motion, or electromagnetism demonstrated by correct and relevant processing of data • systematic and effective analysis of experimental evidence about gravity and motion, or electromagnetism 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 gravity and motion, or electromagnetism demonstrated by the collection of sufficient and relevant raw data.	5–6
• adequate application of algorithms, visual and graphical representations of data about gravity and motion, or electromagnetism demonstrated by basic processing of data • effective analysis of experimental evidence about gravity and motion, or electromagnetism demonstrated by – identification of obvious trends, patterns or relationships – basic identification of uncertainty and limitations of evidence • effective investigation of phenomena associated with gravity and motion, or electromagnetism demonstrated by the collection of relevant raw data.	3–4
• rudimentary application of algorithms, visual and graphical representations of data about gravity and motion, or electromagnetism demonstrated by incorrect or irrelevant processing of data • ineffective analysis of experimental evidence about gravity and motion, or electromagnetism 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 gravity and motion, or electromagnetism 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

4. interpret experimental evidence about gravity and motion, or electromagnetism
6. evaluate experimental processes and conclusions about gravity and motion, or electromagnetism

The student work has the following characteristics:	Marks
• insightful interpretation of experimental evidence about gravity and motion, or electromagnetism demonstrated by justified conclusion/s linked to the research question • critical evaluation of experimental processes about gravity and motion, or electromagnetism 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 gravity and motion, or electromagnetism demonstrated by reasonable conclusion/s relevant to the research question • basic evaluation of experimental processes about gravity and motion, or electromagnetism 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 gravity and motion, or electromagnetism demonstrated by inappropriate or irrelevant conclusion/s • superficial evaluation of experimental processes about gravity and motion, or electromagnetism 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 objectives

7. communicate understandings and experimental findings, arguments and conclusions about gravity and motion, or electromagnetism

The student work has the following characteristics:	Marks
• effective communication of understandings and experimental findings, arguments and conclusions about gravity and motion, or electromagnetism 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 gravity and motion, or electromagnetism 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