Queensland Government | QCAA Queensland Curriculum & Assessment Authority

Queensland Curriculum and Assessment Authority

# Physics 2025 v1.2

## IA3: Sample assessment instrument

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** | sample only |
| **Student number** | sample only |
| **Teacher** | sample only |
| **Issued** | sample only |
| **Due date** | sample only |

## Marking summary

| Criterion | Marks allocated | Provisional marks |
|---|---|---|
| Forming and Finding | 5 | |
| Analysing | 5 | |
| Interpreting | 5 | |
| Evaluating | 5 | |
| **Overall** | **20** | |

# Conditions

| | |
|---|---|
| **Technique** | Research investigation |
| **Unit** | Unit 4: Revolutions in modern physics |
| **Topic/s** | Topic 1: Special relativity<br>Topic 2: Quantum theory<br>Topic 3: The Standard Model |
| **Duration** | Approximately 10 hours of class time |
| **Mode / length** | Written: up to 2000 words |
| **Individual / group** | Individual |
| **Resources** | School library (online: internet and school intranet, databases, journals) |

# Context

Investigate one of the following claims:

- aeroplanes fly accurately due to the principles of special relativity
- a machine on the ISS would have a longer lifespan than a machine on Earth
- all experimental evidence indicates that light is a particle
- quantum theory has no practical applications in day-to-day life
- neutrinos are massless particles
- all matter in the universe is made of fundamental particles called quarks and leptons.

You may identify an alternative claim in consultation with your teacher. This claim must be related to Unit 4 subject matter.

# Task

Gather evidence related to a research question to evaluate a claim relevant to Unit 4 subject matter. Develop your research question based on a number of possible claims provided by your teacher.

Obtain evidence by researching scientifically credible sources, such as books and podcasts by well-credentialed scientists, 'popular' science websites or magazines, websites of governments, universities, independent research bodies or science and technology manufacturers, and scientific journals. You must adhere to research conventions.

**To complete this task, you must:**

- select a claim to be evaluated, from a list provided by the teacher
- identify the relevant scientific concepts associated with the claim
- conduct research to gather evidence from scientifically credible sources to evaluate the claim
- pose a research question that addresses an aspect of the claim
- identify relevant evidence to answer the research question
- identify the trends, patterns or relationships in the evidence
- analyse the evidence to identify limitations
- interpret the evidence to construct scientific arguments
- interpret the evidence to form a conclusion to the research question
- discuss the quality of the evidence
- evaluate the claim by applying the findings of the research to the claim
- suggest improvements and/or extensions to the investigation
- communicate findings in an appropriate scientific genre, e.g. report, journal article, essay, conference presentation.

**You may complete the following aspects of the task as a group:**

- selecting a claim
- identifying the relevant scientific concepts associated with the claim
- conducting research.

# Checkpoints

☐ Week 1: Select claim and develop research question

☐ Week 2: Identify sources and conduct research

☐ Week 3: Analyse and evaluate evidence

☐ Week 4: Submit draft

☐ Week 5: Submit final response

# 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.
- Your teacher will conduct interviews or consultations as you develop the response.
- You will use plagiarism-detection software to submit your response.
- You must acknowledge all sources.

# Scaffolding

The response must be presented using an appropriate scientific genre (i.e. scientific essay) and contain:

- a claim
- a research question
- a rationale for the investigation
- justified scientific arguments using evidence
- a conclusion to the research question based on the interpretation of the evidence
- evaluation of the claim and suggestions of improvements and extensions to the investigation
- a reference list.

## Example of how a claim could be developed into a research question

**Claim:** Bruce Banner absorbs ambient gamma radiation, converting its energy into mass during the transformation into the Hulk.

### Developing the research question

| Step | Description | Example |
|---|---|---|
| 1 | **Break down the claim.**<br>Identify the key terms of the claim. | **Claim:** Bruce Banner absorbs ambient gamma radiation, converting its energy into mass during the transformation into the Hulk.<br>**Key terms:** *gamma radiation*, *convert energy to mass* |
| 2 | **Question the key elements of the claim.**<br>Generate questions that help clarify the key terms as they relate to the unit of study. | • How much ambient gamma radiation exists on Earth?<br>• How much mass increase occurs during the transformation?<br>• How much energy is equivalent to the mass increase? |
| 3 | **Pose possible research questions.**<br>Extend the questions from Step 2 to ask how the key terms could be linked. | • Is there a biological structure that can convert energy into mass?<br>• How much energy is required to convert Bruce Banner's mass into the Hulk? |
| 4 | **Critique the questions.**<br>Examine the possible research questions for their suitability to the task:<br>• do they only consider one independent variable?<br>• do they include an element that can be measured using data?<br>• is the scope suitable to allow for a detailed 1500–2000-word answer? | • Is there a biological structure that can convert energy into mass?<br>– Not relevant to the unit topics.<br>• How much energy is required to convert Bruce Banner's mass into the Hulk?<br>– Not specific to the type of radiation in the claim.<br>– Not specific to a version of the Hulk, e.g. the Incredible Hulk or Grey Hulk. |
| 5 | **Finalise the research question.**<br>Use the results of the critique to select and finalise the research question. | • Assuming there was a way to convert gamma radiation directly into mass, how much gamma radiation, and from what source, would change Bruce Banner's mass into the Incredible Hulk's mass? |

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

# Instrument-specific marking guide (IA3): Research investigation response (20%)

| Forming and Finding | Marks |
|---|---|
| The student response has the following characteristics: | |
| • a considered rationale identifying clear development of the research question from the claim<br>• a specific and relevant research question<br>• selection of sufficient and relevant sources<br>• appropriate use of genre conventions<br>• acknowledgment of sources of information through appropriate use of referencing conventions | 4–5 |
| • a reasonable rationale that links the research question and the claim<br>• a relevant research question<br>• selection of relevant sources<br>• use of basic genre conventions<br>• use of basic referencing conventions | 2–3 |
| • a vague or irrelevant rationale for the investigation<br>• an inappropriate research question<br>• selection of insufficient or irrelevant sources<br>• inadequate use of genre conventions<br>• inadequate acknowledgment of sources. | 1 |
| The student response does not match any of the descriptors above. | 0 |

| Analysing | Marks |
|---|---|
| The student response has the following characteristics: | |
| • the identification of sufficient and relevant evidence<br>• thorough identification of relevant trends/patterns/relationships in evidence<br>• thorough and appropriate identification of limitations of evidence | 4–5 |
| • the identification of relevant evidence<br>• identification of obvious trends/patterns/relationships in evidence<br>• basic identification of limitations of evidence | 2–3 |
| • the identification of insufficient and irrelevant evidence<br>• identification of incorrect or irrelevant trends/patterns/relationships in evidence<br>• incorrect or insufficient identification of limitations of evidence. | 1 |
| The student response does not match any of the descriptors above. | 0 |

| Interpreting | Marks |
|---|---|
| The student response has the following characteristics: | |
| • justified scientific argument/s<br>• justified conclusion linked to the research question<br>• fluent and concise use of scientific language/representations | 4–5 |
| • reasonable scientific argument/s<br>• reasonable conclusion relevant to the research question<br>• competent use of scientific language/representations | 2–3 |
| • inappropriate or irrelevant argument/s<br>• inappropriate or irrelevant conclusion<br>• incorrect use of language/representations. | 1 |
| The student response does not match any of the descriptors above. | 0 |

| Evaluating | Marks |
|---|---|
| The student response has the following characteristics: | |
| • justified discussion of the quality of evidence<br>• extrapolation of credible findings of the research to the claim<br>• suggested improvements and extensions to the investigation that are considered and relevant to the claim | 4–5 |
| • reasonable description of the quality of evidence<br>• application of relevant findings of the research to the claim<br>• suggested improvements and/or extensions to the investigation that are relevant to the claim | 2–3 |
| • cursory or simplistic statements about the quality of evidence<br>• application of insufficient or inappropriate findings of the research to the claim<br>• ineffective or irrelevant suggestions. | 1 |
| The student response does not match any of the descriptors above. | 0 |