 Assessment task: Publish a paper

Investigating Science – Module 5, 6 and 7

This document references the [Investigating Science Stage 6 Syllabus](https://syllabus.nesa.nsw.edu.au/investigating-science-stage6/) © 2017 [NSW Education Standards Authority (NESA)](http://syllabus.nesa.nsw.edu.au/copyright/) for and on behalf of the Crown in right of the State of New South Wales.

Outcomes

Working scientifically

* INS11/12-1 develops and evaluates questions and hypotheses for scientific investigation
* INS11/12-2 designs and evaluates investigations in order to obtain primary and secondary data and information
* INS11/12-3 conducts investigations to collect valid and reliable primary and secondary data and information
* INS11/12-7 communicates scientific understanding using suitable language and terminology for a specific audience or purpose

Knowledge and understanding outcomes

* INS12-12 develops and evaluates the process of undertaking scientific investigations
* INS12-13 describes and explains how science drives the development of technologies
* INS12-14 uses evidence-based analysis in a scientific investigation to support or refute a hypothesis

Learning across the curriculum

Cross-curriculum priorities

Aboriginal and Torres Strait Islander histories and cultures

Asia and Australia's engagement with Asia

Sustainability

General capabilities

Critical and creative thinking

Ethical understanding

Information and communication technology capability

Intercultural understanding

Literacy

Numeracy

Personal and social capability

Other areas of learning

Civics and citizenship

Difference and diversity

Work and enterprise

Teacher notes

This assessment task is designed to be completed over a full 3 terms worth of work and covers 3 knowledge and understanding outcomes. Below is a sample of the content that could be used in this assessment task. Students are encouraged to choose a practical investigation based on their own interests and passions.

The task enables the teacher to provide support depending on the needs and level of ability of the students. For example, teachers may wish to develop a more comprehensive timeline, allow opportunities for students to use scaffolds or provide exemplar models. Teachers should decide which content descriptors would be used for Part B or if students will complete their own in addition to the 4 examples included.

You are encouraged to contact a University to have an academic partner (such as a third or fourth year Science student or lecturer) throughout the task. This person could be useful to launch the project, be part of the feedback and critique process or be a guest at an exhibition of the students’ final product.

Suggested Links to the Content Descriptors

| Part | Unit | Content Descriptors |
| --- | --- | --- |
| Part A | Module 5 - Scientific Investigations | * Use a sample of a published and peer-reviewed secondary source to identify:   + the purpose of the report   + measures taken to reduce error   + the language style used   + the presentation and structure of the report |
| Part B | Module 6 - Technologies | * Design a practical investigation that uses available technologies to measure both the independent and dependent variables that produce quantitative data to measure the effect of changes of, including but not limited to:   + temperature on reaction rate   + temperature on volume of gas   + speed on distance travelled   + pressure on volume of gas |
| Part C | Module 7 - Fact or Fallacy | * Plan and conduct an investigation based on testing a claim, and consider:   + validity of the experimental design   + reliability of the data obtained   + accuracy of the procedure, including random and systematic error * Using examples, evaluate the impact that sample selection and sample sizes can have on the results of an investigation * Analyse the benefits of peer review in relation to the advancement of science. |
| Part D | Module 5 - Scientific Investigations | * Publish and present your scientific research * You need to consider the:   + intended audience   + quality and standard required for publication |

Develop a scientific research paper ready for publication

Task

Your task is to publish a high quality scientific paper based on an investigation that you will conduct. Class time will be allocated to assist you in preparing for this task.

| Time frame | Requirements |
| --- | --- |
| Throughout the duration of the whole task | Part A - Write a blog about your experience  Throughout the completion of this task, you are required to blog at least once a fortnight about your experiences and give constructive feedback and comments to other students. A blog is a regularly updated online journal that is written in an informal style. It can include pictures and video clips. To complete the blogging component of this task you should use blogED found on your Student Portal. |
| Due at the end of the 1st Term | Part B - Analyse and dissect a scientific research paper  Choose an area of scientific research that interests you. For example, artificial intelligence, building materials, climate science, food production and cookery, renewable resources, genetics, aeronautical engineering, biomedical devices etc. Find a research paper related to your chosen topic that has been published in the last 5 years and:   * Download and print the paper. (Use Google Scholar or the online library system Oliver to assist you in your search) * Use different colours to highlight:   + titles and headings   + terminology and vocab   + definitions and explanations   + clear examples of scientific method and good investigative practices   + any other features you deem important * Create a scaffold based on the structure/outline of the paper. This can then be used when producing your own investigation for Part B in this assessment. * In your own words, write a 1-page summary that discusses the purpose, validity, reliability and accuracy of the investigation using specific examples that you find from the article. You need to consider the language that the scientist uses, data collected and how it is presented and how the article was reviewed. |
| Due at the end of 2nd Term | Part C - Plan and conduct your own scientific investigation  Design a practical investigation that uses available technologies to measure both the independent and dependent variables that produce quantitative data to measure the effect of a change. Produce a scientific report that includes the following features:   * background information * aim * hypothesis * materials and method (including variables, focussing on ensuring validity, reliability, large sample size and accuracy) * risk assessment * results * discussion * conclusion |
| Due at the end of the 3rd Term | Part D - Publish and present your scientific research  Present your scientific research in ONE of the following 3 ways:   1. an A1 sized poster suitable for display on a university hallway wall 2. a 3-minute podcast or vodcast suitable for general broadcast 3. a journal article presented as a double page spread in a magazine such as *New* *Scientist*, *Cosmos* or *Double Helix*.   For each of the above types of media, you need to consider the audience you are exhibiting to. The work must be of the highest quality and standard.  The first draft of your work must be uploaded to your blog by the end of Week 5. This allows for peer critique. The critique of each other's work will be completed during a lesson. This is to ensure that feedback is helpful, clear, specific and kind. Your final copy of the task is due at the end of the 3rd term. |

Student Declaration

The following student declaration is an example and may be amended to suit the needs of your faculty and school.

By submitting this task, I acknowledge the following:

* The work submitted is my own work and appropriate acknowledgement of all sources has been made
* Where the work of others is used and not acknowledged, a finding of plagiarism will be made and a mark of zero will be awarded. I will have to then resubmit the task.
* I have kept an original copy of the task if the original is lost or stolen

Student signature:

Date:

Teacher signature:

Date:

Marking rubric - Part A

Blogging

| Mark | Criteria |
| --- | --- |
| High | The blog shows insight, depth and understanding. There are clear connections with the processes in the task. Entries are relevant with links to supporting material. The student's opinion is expressed in an appropriate manner and is clearly related to the activity or process. The posts and opinions show a high level of understanding and they relate to events, learning activities and processes of the course.  All blog entries are posted in a regular and timely manner. Post frequency meets or exceeds every 2 weeks. Makes regular comments on colleague’s work.  Few spelling and grammatical errors. The entries have structure and are formatted to enhance readability. The entries flow and link to previous posts. The content demonstrates that the student is well read, synthesizing learned content and constructing new meaning.  The student actively participates in the blogging community by commenting on classmate’s entries and by providing feedback and constructive suggestions. The feedback is kind, specific and helpful.  Student has used graphics and enhancements to personalise the blog. Images and videos are acknowledged. They are also captioned or referred to within the text. Colour theme is clean and easy to read. Student uses headings and fonts to improve the flow of the blog. |
| Sound | The blog entries show insight, depth and connection with the task. Entries may contain some irrelevant material. The student's opinion is expressed in an appropriate style and these entries show a good depth of understanding.  The blog entries are posted in a timely manner meeting the 2 week expectation OR makes regular comments on colleague’s work.  There are few spelling and grammatical errors. The entries have structure. The posts flow and have cohesion to previous posts. The content demonstrates that the student has read new information and form meaning.  The student participates in the blogging community by commenting on other student’s entries.  The student has personalised their blog. Entries contain appropriate links and/or images. These are referred to within the text. |
| Basic | The blog entries show some connection with the task. Entries are typically short and may contain some irrelevant material. There are some personal comments or opinions which may be on task. The entries show some understanding of the topic.  The blog entries show some timeliness however they are below expectations. Infrequent comments on colleague’s work.  Some of the entries have poor spelling and contain grammatical errors. The entries are written without any structure. The entries do not have consistent flow. There is little cohesion between entries.  The student shows limited participation in the blogging community by commenting irregularly and infrequently on other student’s entries.  The student has personalised their blog. However, there is very little evidence of multimedia enhancements of their blog. Entries are primarily text based. |
| Limited | The blog entries lack insight, depth or are very superficial. The entries are short and frequently irrelevant. They show little understanding of course work completed.  The blog entries are irregularly posted, and the post frequency is well below course expectations.  The entries have poor spelling and contain many grammatical errors. They are short. They lack structure and/or flow. The entries appear to be hastily written often using informal language.  The student shows minimal evidence of any participation in the blogging community outside their own blog entries.  The student made minimal changes to their blog; maybe gave themselves an avatar or posted a simple link or image or both. |

Marking rubric - Part B

Analysis of scientific research paper

| Mark | Criteria |
| --- | --- |
| High | Student correctly identifies the following in a research paper from the past 5 years:  Title and headings, scientific terminology, definitions/ explanations, scientific method.  Clearly summarises the aims of and methods used by the authors.  Clear understanding of experimental design, including use of controls. Clear understanding what was observed and how it relates to the authors' model or hypothesis. Student makes clear reference to accuracy, reliability and validity.  There is a clear understanding of the authors' interpretation, of the implications of the results for the hypothesis. Information is compared with other sources when evaluating the design and conclusions.  Student selected the data most relevant to the author’s aims. Students’ conclusions make results clearer.  No spelling or grammatical errors. |
| Sound | Student correctly identifies ONLY 3 of the previous in a research paper from the past 5 years.  Summary is complete, but lacks clarity.  Some parts of the experiment have not been understood. Student demonstrates some understanding of the model being tested, or the relevance of the data. Student makes some reference to accuracy, reliability and validity  There is some understanding of the authors' interpretation, of the implications of the results for the hypothesis. There is some comparison between information and other sources.  Student selected data relevant to the author’s aims. Students’ conclusions are not as clearly articulated.  Very few spelling or grammatical errors. |
| Basic | Student correctly identifies ONLY 2 of the previous in a research paper from the past 5 years.  Picture communicated is not clear; connection to paper is not obvious.  There are significant gaps in understanding of the experiment. Student has shown some understanding, but there are clearly large parts of the paper that is not clearly understood. Poor reference to accuracy, reliability and validity.  Student has shown some critique of authors' conclusions. Or baseless objections to them.  Some of the data student selected does not seem as relevant to the overall aims of the paper. Student has missed some important parts.  Some spelling or grammatical errors. |
| Limited | Student correctly identifies ONLY 1 of the previous in a research paper from the past 5 years.  No real introduction.  Student shows little understanding of the data presented.  Little or no mention of authors' intent. Little or no evaluation.  Student has no clear understanding of the paper or its context. Authors' aims are not explained clearly.  Many spelling or grammatical errors. |

Marking Rubric - Part C

Scientific investigation report

| Mark | Criteria |
| --- | --- |
| High | Information comes from at least 3 different reliable sources (Internet, books, journals). Information is related to the topic and written in own words. Correctly cited.  Aim clear and well stated. Hypothesis is clearly stated in correct format. Hypothesis is testable. Hypothesis is based on observation and research.  All materials used in the investigation are listed clearly. Specific amount and size of materials are stated.  A detailed description of the variables in the investigation is identified. An experimental control is present. The procedure is detailed, clear and stated in a step by step process and can be replicated by others. The procedure directly tests the stated hypothesis.  At least 3 risks identified, and safety procedure described.  Data is accurate, well organised and clear. Appropriate vocabulary is used to record qualitative data. Appropriate formats are used to record quantitative data. Tables, drawings and charts are labelled appropriately.  Important relationships, patterns and changes are explained based on observation through the investigation. Calculations are clearly laid out and when appropriate, data are correctly graphed and labelled. Graphs, tables and illustrations are clearly explained. Possible errors, importance of the investigation, practical use, and/ or expansion of the investigation is summarised.  The outcome of investigation is explained and whether the hypothesis is rejected or accepted based on the data. Conclusion is fully supported by data, and not an inference. |
| Sound | At least 2 sources of reliable information. Information relates to the topic and written in the students’ own words. Correctly cited.  Aim clear and well stated. Hypothesis is stated in correct format. Hypothesis is testable and based on observation and general knowledge.  All material used in the investigation is listed clearly.  The variables of the investigation are correctly identified. An experimental control is present. The procedure is written in a step by step process and could be replicated. The procedure adequately tests the hypothesis.  Two risks identified, and safety procedure described.  Data is accurate, organised, and clear. Qualitative and/or quantitative data is gathered. Tables, charts and drawings are labelled appropriately but contains minor errors.  Important relationships, patterns and changes are stated based on observation through the investigation. Calculations are present and when appropriate, data is graphed and labelled. Graphs and tables are explained. The importance of the investigation is summarised.  The outcome of the investigation is explained and whether the hypothesis is rejected or accepted based on the data. Conclusion is based on data, and some points are based on inference. |
| Basic | At least 2 sources of information. Citation with errors. Information somewhat related to the topic and written in the student’s own words.  Hypothesis is not in correct format Hypothesis may not be testable. Hypothesis is not based on observation or research.  List of materials is missing one or more important items.  Variables are stated. The design has a general relevance to the hypothesis, but may not be replicated. Procedure may result in safety risk and should be revised.  At least 2 risks identified and/or safety procedures.  Data is poorly organised and presented. Major errors are present on the tables, graphs and drawings.  The data lacks detail, patterns and relationships are based on misconceptions. Minimal use of data is used to explain results. Student does not demonstrate understanding of purpose of the investigation.  The outcome of the investigation does not adequately relate to the hypothesis. |
| Limited | Little or no background information is used. Information is copied from the source.  Hypothesis is missing or unrelated.  List of materials are incomplete or missing.  Procedure design has no relevancy to the hypothesis.  Only 1 risk or safety procedure.  Data is incomplete and poorly presented and organised. Tables and drawings are poorly done with major flaws or missing.  No mention of the relationships and patterns in the data. Poor use of data is used to explain the results. Student does not understand the purpose of the investigation.  The outcome of the investigation does not relate to the hypothesis. |

Marking Rubric - Part D

Publishing and Presenting of your article

| Mark | Criteria |
| --- | --- |
| High | Concepts are presented clearly and succinctly. Science terms used are appropriate and easy to understand. Writing is logical and coherent. Demonstrates clear understanding of scientific information and has a clear sense of purpose.  Structure has a clear flow and builds upon prior information. Information well organised and highly effective. Includes a clear introduction.  Podcast/Vodcast  Length keeps the listener interested and engaged. Volume of voice, music, and effects enhance the presentation. Presentation is recorded in a quiet environment without background noise. Well-rehearsed, smooth delivery in a conversational style. Expression and rhythm engage the listener. Highly effective enunciation and presenter's speech is clear and intelligible.  Poster/Journal article  Design is highly attractive to the reader and well structured. Central and other pictures draw attention and are relevant. Font and colours complement design. Features of poster are evenly spaced. |
| Sound | Scientific terms are used. Structure of article builds information. Is logical and coherent. Demonstrates understanding of scientific information. Has a sense of purpose.  Structure has flow and attempts to link prior information. Information is well organised. Includes an introduction.  Podcast/Vodcast  Length is either somewhat long or short to keep listener engaged. Volume is acceptable. Presentation is recorded in a quiet environment with minimal background noise. Rehearsed, smooth delivery. Enunciation, expression, and pacing are effective. Enunciation, expression, rhythm are sometimes distracting.  Poster/Journal article  Design is attractive to the reader. Pictures are included and are relevant. Font and colours are clear. Features of poster are evenly spaced. |
| Basic | Some scientific terms are used. Information is well structured but lacks coherency. Demonstrates some understanding of scientific information. Has a sense of purpose but is not clear throughout.  Structure attempts to flow and build information. It is somewhat organised. Brief introduction.  Podcast/Vodcast  Is either too long or too short to keep the listener engaged. Volume is inconsistent. Presentation is recorded with some background noise and distractions. Delivery is hesitant and choppy. Expression and rhythm are distracting throughout.  Poster/Journal article  Design is somewhat attractive to the reader. Pictures are included. Font and colours are good but unclear at times. Features of poster are unevenly spaced. |
| Limited | Some scientific terms are included but not defined. Information is not logical and demonstrates limited understanding. Irrelevant or inappropriate information included.  Information is illogically presented. There is limited flow or build-up of information.  Podcast/Vodcast  Length is inadequate. Volume changes are highly distracting. Presentation is recorded in a noisy environment with constant background noise and distractions. Sounds like the presenter is reading. Appears unrehearsed with uneven delivery. Enunciation of spoken word is distant, muddled and not clear.  Poster/Journal article  Article design is poor. Pictures are included. Font and colours clash. Unevenly spaced or is less than required length. |