# ­­Unit 2 AOS3 Practical Investigation 2023

## Scope of Assessment

### Unit 2 Outcome 3

### In this area of study you will design and conduct a practical investigation related to knowledge and skills developed in Area of Study 1 and/or Area of Study 2.

### Task Outline

### The investigation requires you to develop a question, plan a course of action that attempts to answer the question, undertake an investigation to collect the appropriate primary qualitative and/or quantitative data, organise and interpret the data, and reach a conclusion in response to the question. You need to design and undertakes an investigation involving two independent variables one of which should be a continuous variable. You will need to use a logbook for recording, authentication and assessment purposes.

The task is divided into three phases:

* Planning the experiment
* Conducting the experiment
* Communicating your findings on a poster

### Task 1: Planning and Design - Rubric 1

Your background research, investigation design and introduction will be assessed prior to you conducting your experiment.

### Task 2: Results and Findings - Rubric 2

The presentation of your results and discussion of your findings will be assessed at the end of the investigation.

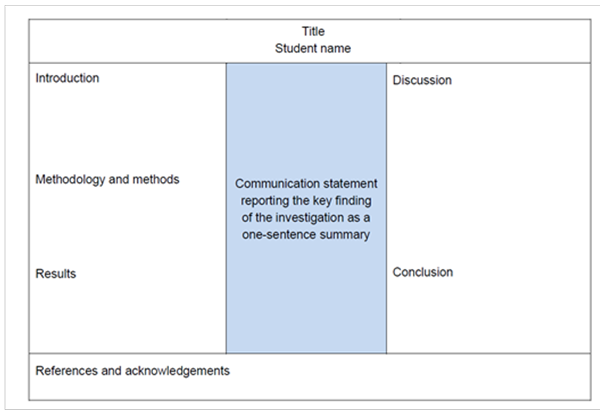
### Topic Areas

There are four research topics to choose from. You will complete an individual research task within a research group. In your research group you will be able to support each other. However, you will have individual research questions.

1. Crumple zones
2. Safety barriers
3. Ski jump safety
4. Protective air bags

### Required Poster Layout and Sections

* The centre of the poster will occupy between 20 to 25 per cent of the poster space and will be a one-sentence summary of the major finding of the investigation that answers the investigation question.
* The poster may only include 600 words. Poster title, student name/identification number, tables, graphs, flowcharts, figure captions, references and acknowledgements are not included in the poster word count.
* Posters are generally written in past tense, as they report on what has been done. They are also written in an impersonal style with no pronouns such as ‘we’, ‘you’, or ‘I’ included.



 The presentation format of the poster will include the following sections:

|  |  |
| --- | --- |
| **Poster section** | **Content** |
| Title | Question under investigation |
| Introduction | Brief explanation or reason for undertaking the investigation, including a clear aim, a hypothesis and/or prediction and relevant background biological concepts |
| Methodology and methods | * Brief outline of the selected methodology used to address the investigation question * Summary of data generation method/s and data analysis method |
| Results | Presentation of generated data/evidence in appropriate format to illustrate trends, patterns and/or relationships |
| Discussion | * Interpretation and evaluation of analysed primary data * Identification of limitations in data and methods, and suggested improvements * Cross-referencing of results to relevant chemical concepts * Linking of results to investigation question and to the aim to explain whether or not the investigation data and findings support the hypothesis * Implications of the investigation and/or suggestions as to further investigations that may be undertaken |
| Conclusion | * Conclusion that provides a response to the investigation question * Identification of the extent to which the analysis has answered the investigation question, with no new information being introduced |
| References and acknowledgements | Referencing and acknowledgement of all quotations and sourced content relevant to the investigation |

## Timeline

|  |  |  |
| --- | --- | --- |
| **Lesson** | **Content** | **Checkpoints** |
| 1 | Topic Selection Background questions | Checkpoint 1  Checkpoint 2 - Assessed |
| 2 | Research question, aim and variables | Checkpoint 3 - Assessed |
| 3 | Introduction plan and hypothesis | Checkpoint 4 - Assessed |
| 4 | Materials and procedure  Risk assessment  Design results table | Checkpoint 5  Checkpoint 6 - Assessed  Checkpoint 7 |
| 5 | Conduct experiment - Experimental log | Checkpoint 8 |
| 6 | Conduct experiment - Experimental log | Checkpoint 8 |
|  | **Rubric 1 Due** |  |
| 6 | Conduct experiment - Experimental log | Checkpoint 8 |
| 7 | Conduct experiment - Experimental log | Checkpoint 8 |
| 8 | Analyse data and draw graphs | Checkpoint 9 - Assessed |
| 9 | Discussion and Conclusion Plan | Checkpoint 10 - Assessed |
| 10 | Discussion and Conclusion Plan | Checkpoint 10 - Assessed |
|  | **Rubric 2 Due** |  |

### Assessment Rubric 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| elaborates on ideas |  |  |  | applies ideas to new contexts |
| supports ideas with evidence | justifies predictions using known theory | distinguishes between variables in prediction |  | uses evidence to support ideas |
| uses scientific ideas | makes predictions based on theory | identifies all variables | uses a risk assessment that follows requirements | explains ideas |
| lists facts | guesses outcomes | distinguishes between factors to control, measure and change | records risks and controls | identifies aims |
| **analyses ideas** | **makes predictions** | **identifies factors** | **identifies risks and controls** | **forms ideas** |
| **Planning** | | | | **Introduction** |

### Assessment Rubric 2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | makes generalisations based on key findings |  | makes recommendations to overcome limitations | communicates scientifically |
| uses graphs that includes statistical analysis | evaluates quality of data | uses theory to link or reconcile key findings including outliers | assesses effect of errors on quality of data | identifies limitations of key findings | uses graphics to convey ideas |
| uses graphs that follows the set conventions | summarises data | explains key findings using theories | explains effect of errors on experimental design | explains implications of key findings | Includes scientific conventions |
| includes graphs and/or tables | lists data | matches key findings with theory | identifies errors | summarises key findings | uses required poster format |
| **represents data** | **reports data** | **analyses results** | **evaluates method** | **makes conclusions** | **presents ideas** |
| **Graph** | **Discussion and conclusion** | | | | **Poster** |

## 1.Topic selection

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| **CHECKPOINT 1:** Complete the task summary and topic selection table |

**Instructions**

1. Read through the topics and evaluate what interests you personally about each of the topics.
2. Indicate your preference for each topic where 1 represents the topic that interests you most.

|  |  |  |
| --- | --- | --- |
| **Topics** | **Interesting aspects/facts?** | **Preference (1-4)** |
| [**Crumple Zones**](https://myaitken.fireflycloud.net.au/science/year-11/physics/unit-2/assessment/aos3-practical-investigation/crumple-zones)  Crumple zones were first introduced into passenger cars in 1952. The main purpose of the crumple zone is to absorb the kinetic energy from the crash to reduce the amount of force being distributed to the occupants of the car. |  |  |
| [**Safety barriers**](https://myaitken.fireflycloud.net.au/science/year-11/physics/unit-2/assessment/aos3-practical-investigation/safety-barriers)  The design of safety barriers is important in preventing severe injuries when cars run off the road. The main aim of safety barriers is to slow down the impact time of cars during collisions. |  |  |
| [**Ski jump safety**](https://myaitken.fireflycloud.net.au/science/year-11/physics/unit-2/assessment/aos3-practical-investigation/ski-jump-safety)  When a skier falls they transform gravitational potential energy into kinetic energy. Therefore, if they fall from greater heights they will generate more kinetic energy and will have a higher final velocity. It is important that a skier comes to a stop slowly otherwise they will experience a large deceleration which in turn can cause an injury. |  |  |
| [**Protective air bags**](https://myaitken.fireflycloud.net.au/science/year-11/physics/unit-2/assessment/aos3-practical-investigation/protective-air-bags)  Air bags were first installed in a passenger car in 1980. They have contributed to a reduction in fatalities in car collisions with estimates that along with seat belts they reduce the risk of death in frontal clashes by almost 60%. |  |  |

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## 2.Background questions

**Instructions**

1. Insert the topic and names of the students who are in your research team.
2. Answer the background questions in the area below.
3. Record the details of your sources so that you can access them again.
4. Refer to the rubric for how you will be assessed. It is important to include relevant scientific ideas.

|  |
| --- |
| **CHECKPOINT 2**: Answer the background questions - **ASSESSED Rubric 1** |

### Crumple Zones

1. When were crumple zones introduced in vehicles and why?
2. Which aspect of a crumple zone makes the vehicle safer in a collision?
3. What types of materials are used in crumple zone and how do materials increase the time of impact?
4. How does increasing the collision time lead to fewer injuries in impact collisions?

### Safety barriers

1. When were safety barriers introduced in vehicles and why?
2. Which aspect of a safety barrier makes vehicle collisions safer?
3. What types of materials are used in safety barriers and how do these materials increase the time of impact?
4. How does increasing the collision time lead to fewer injuries in impact collisions?

### Ski jump safety

1. What is ski jump safety and why is it important?
2. Which aspect of ski jump protection makes the participant safer?
3. What types of materials are used in ski jump and how do these materials increase the time of impact?
4. How does increasing the collision time lead to fewer injuries in impact collisions?

### Protective air barriers

1. When were protective air bags introduced in vehicles and why?
2. Which aspect of a protective air bag makes the vehicle safer in a collision?
3. What types of materials are used in air bags and how does using these materials increase the time of impact?
4. How does increasing the collision time lead to fewer injuries in impact collisions?

|  |  |
| --- | --- |
| **Background questions** | **Reference** |
|  |  |

## Research Question, Variables and Aim

**Instructions**

1. Write your research question in the space provided. Remember to make it specific.
2. Identify your variables by completing the table.
3. Include the units for your dependent variable.
4. List as many controlled variables as possible to ensure it will be a fair test.
5. Write the aim of your practical investigation, taking note of the aim checklist.

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| --- |
| **CHECKPOINT 3:** Identify your research question, variables and aim - **ASSESSED Rubric 1** |

### Research Question

A research question is used to guide all parts of the investigation. It is important that your research question is not too broad or too generalised. For example, "What is the effect of the mass of the person on the force of impact on the person at the lowest point of a bungy jump?"

**Research Question Checklist**

|  |  |
| --- | --- |
| Includes the variable(s) that will be changed. |  |
| States what will be effected |  |

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### Variables

Identify the independent, dependent and controlled variables. Use the table below as a guide.

|  |  |  |
| --- | --- | --- |
| **Independent Variable**  (what will you be changing?) | **Dependent variable**  (what change will you be measuring? Include units) | **Controlled variables**  (What will you keep constant? – You will need at least 5 controlled variables) |
|  |  |  |

**Aim Checklist**

|  |  |
| --- | --- |
| States what will be done |  |
| States how it will measured |  |
| Uses a verb to begin sentence |  |

### Aim

The aim states the purpose of the experiment. In the aim, you need to explain what will be done, and how it will be measured. The sentence should also start with a verb, such as “to investigate, to measure, to verify, to determine, to compare or to calculate.”

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## 4.Introduction Plan and Hypothesis

**Instructions**

1. Use the information from your background and variables research to complete your introduction plan below by:
2. describing the problem and the importance of your investigation
3. explaining what scientists already know about the topic
4. identifying the current gaps in scientific knowledge or understanding that need to be addressed
5. stating your research question
6. stating your hypothesis with a justification for your prediction. This is usually written using the 'If… then… because' sentence structure.

Complete the plan as a series of dot points.

\*Note down your in-text citations with your 'facts' so that they can be easily incorporated into your introduction.

|  |
| --- |
| **CHECKPOINT 4:** Plan the introduction and design the hypothesis - **ASSESSED Rubric 1** |

|  |
| --- |
| Describe the problem |
|  |
| What is already known |
|  |
| Gaps in knowledge |
|  |
| Research question or aim |
|  |
| Hypothesis |
| If \_\_\_\_\_\_\_\_\_ then \_\_\_\_\_\_\_\_\_\_because\_\_\_\_ |

## 5.Materials and Procedure

**Instructions**

1. Write a list of the equipment and materials that you will use in the experiment.
2. Indicate the quantity of each item that you will need.
3. Write out the procedure for your investigation. This should be in step by step instructional tense.

|  |
| --- |
| **CHECKPOINT 5:** Propose your materials and procedure |

### Materials

|  |  |
| --- | --- |
| **Materials/Equipment** | **Quantity** |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

**Method Checklist**

|  |  |
| --- | --- |
| Numerical steps are used |  |
| The steps are in correct order |  |
| Quantity of each item included |  |
| Is written in instructional tense |  |

### Procedure

The procedure outlines how you will conduct your experimental work. It is a set of instruction that should be written as a clear and correctly ordered steps. The procedure should also include how much of each item you plan to use and be written in instructional tense like a recipe.

### Visualise your procedure

Draw an A3 diagram to show the steps you will follow in your experiment.

## 6. Risk Assessment

**Instructions**

1. List any equipment or process that you plan to use that may create a hazard.
2. Identify the hazard and describe the required safety precautions.

|  |
| --- |
| **CHECKPOINT 6: Consider and rate risks - ASSESSED Rubric 1** |

### Hazard Assessment

Whenever conducting an experiment, it is important to identify the hazards and then state what precautions will be taken to prevent injury. This section must be completed before the experiment is conducted.

|  |  |  |
| --- | --- | --- |
| **Equipment or Process** | **Hazard** | **Safety Precaution** |
|  |  |  |
|  |  |  |
|  |  |  |

## 7. Results Table

**Table Checklist**

|  |  |
| --- | --- |
| Includes a descriptive title and three replicates |  |
| Units are included |  |
| The independent variable is in the left column |  |

**Instructions**

1. Design the results table
2. Write a descriptive title
3. Label your independent and dependent variables
4. Including your units
5. Record your data directly into your results table as you are completing your experiment

You need to include a MINIMUM of 3 replicates

|  |
| --- |
| **CHECKPOINT 7:** Design and complete your results table including statistical analysis. |

### Table of Results

|  |  |
| --- | --- |
| **Title:** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Dependent Variable (unit):** | | | |
| **Independent Variable:** | **Replicate 1** | **Replicate 2** | **Replicate 3** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

## 8. Experimental Log

**Instructions**

1. Record your experimental observations.

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| --- |
| **CHECKPOINT 8:** Record the progress of your experimental work. Collect observations and notes. |

### Experimental Session - Date:

|  |
| --- |
| Observations and notes |
|  |

### Experimental Session - Date:

|  |
| --- |
| Observations and notes |
|  |

### Experimental Session - Date:

|  |
| --- |
| Observations and notes |
|  |

### Experimental Session - Date:

|  |
| --- |
| Observations and notes |
|  |

## 9. Graph

**Instructions**

1. Use the instructions below to create an electronic graph of your results using Excel.
2. Insert your graph in the space provided.

|  |
| --- |
| **CHECKPOINT 9:** Create an electronic graph of your results - **ASSESSED Rubric 2** |

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| The choice of graph needs to be suitable for the data that is collected. Generally, line graphs are used for continuous data, while bar graphs are used for data for separate categories.  Graphs need to include a title that describes the data, labels on the axes with units and an appropriate scale. The independent variable should be on the x axis. The graph needs to be drawn electronically. | **Graph Checklist**   |  |  | | --- | --- | |  | Is a suitable graph for the data | |  | Includes a title and axes are labelled | |  | Units are included and appropriate scale | |  | The independent variable is on the x axis | |  | 95% CI included | |

Use the provided excel spreadsheet to generate your graph