Approaches to using the VCE Environmental Science 2022–2026 Performance Descriptors

While the VCE Environmental Science 2022–2026 Performance Descriptors are not mandatory, there are many ways that they can be used by teachers to assess Unit 3 and Unit 4 outcomes. This document provides sample approaches to develop assessments for School-assessed Coursework (SAC) tasks for Units 3 and 4. The approaches show different ways that the VCAA Performance Descriptors can be applied to assess an outcome. Teachers should filter and customise the performance descriptors to align with each planned School-assessed Coursework (SAC) task. It is important for teachers to evaluate the effectiveness of the adapted performance descriptors to ensure there is scope for clear differentiation between students’ level of achievement.

Developing an overall assessment plan

Before using the VCE Environmental Science 2022-2026 Performance Descriptors, teachers should decide which assessment task will be allocated to each of Outcomes 1 and 2 in Units 3 and 4. [Examples of assessment task contexts across Units 3 and 4](https://www.vcaa.vic.edu.au/Documents/vce/envscience/Support%20materials/Performancedescriptors/2022EnvSciExamplesAssessmentTaskContextsUnits3and4.docx)illustrates how each assessment task type may be applied in each of Outcomes 1 and 2 for Units 3 and 4. Unit 4 Area of Study 3 has an allocated assessment task.

A teacher’s assessment plan, including selected contexts, is shown below:

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| **Unit** | **Outcome** | **Assessment task (from pages 36 and 42 of the study design)** |
| 3 | 1 | designed or practical response to a real or theoretical environmental issue or challenge: *annotated design for a bird shelter given environmental conditions at a particular location in the school, based on pre-SAC fieldwork involving evaluation of the effectiveness of different commercial bird boxes placed in the school grounds* |
| 2 | application of Earth systems thinking in the evaluation of a response to an environmental scenario, case study, issue or challenge: *comparison of hazard reduction burns for land management - media analysis* |
| 4 | 1 | presentation of recommendations using evidence-based decision-making, including analysis and evaluation of primary data: *practical work leading up to SAC task –* *eco-concrete formulations – scientific report SAC task including data analysis* |
| 2 | analysis and evaluation of a case study, secondary data or a media communication, with reference to sustainability principles and stakeholder perspectives: *case study of c40 city actions - Melbourne’s Renewable Energy Declaration – set of structured questions*  |
| 3 | communication of the design, analysis and findings of a student-designed and student-conducted scientific investigation through a structured scientific poster and logbook entries: *students will submit proposals for an investigation related to Units 3 and/or 4 prior to undertaking and reporting on their investigation.* |

This teaching plan will be used as the basis of the discussion of three different approaches to using the performance descriptors.

Tailoring the performance descriptors to assessment tasks and outcomes

In designing School-assessed Coursework tasks, teachers should adapt the set of performance descriptors for their own teaching and assessment program by selecting the rows that are most appropriate to assess the outcome, key knowledge and key science skills. Teachers may also add their own rows relevant to the task. For example, the contextualised key science skill ‘select appropriate sampling techniques in fieldwork’ may be added to the ‘designed or practical response to a real or theoretical environmental issue or challenge’ performance descriptors if the designed response involved students generating fieldwork data. Teachers should use professional judgement to decide what parts of the performance descriptors to select and/or modify, and what other performance descriptors should be added, when designing their assessment tool for their assessment tasks.

Approach 1 Developing a set of marking guides

In this example, the teacher’s planning for the SAC task for Unit 3, Outcome 1 will be discussed. The task relates to the importance and maintenance of biodiversity.

The following context for assessment was selected by the teacher:

* **Prior learning**: Students undertook fieldwork and placed different bird boxes with different designs in different locations around the school. They monitored and recorded bird visitations (species and numbers of birds) over a period of time.
* **Assessment task:** Primary data for each bird box was collated by the teacher and presented to students. The SAC task required students to draw on the data to design a bird box for a nominated position on the school ground.

Step 1: Specify the assessment task

The SAC task involved students designing a bird box for a specific location, so the teacher would advise students that the SAC task would require a ‘designed response to a real environmental challenge’. Students were advised that the SAC task was based on previous analysis of different bird box designs as part of their fieldwork. This provides students with an understanding of the scope of the SAC task.

Step 2: Identify the key science skills that will be assessed

The teacher provided the performance descriptors relevant to the task: [Assessment task: Designed or practical response to a real or theoretical environmental issue or challenge](https://www.vcaa.vic.edu.au/Documents/vce/envscience/Support%20materials/Performancedescriptors/2022EnvSciDesignedPracticalResponseTheoreticalEnviroIssuesUnits3and4.docx). The performance descriptors cover an extensive range of key science skills to allow for different assessment options for teachers. The teacher’s main focus was the key science skill of analysing, evaluating and communicating scientific ideas. The selected performance descriptors have been shown in **bold font** in the table below:

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| **Assessment task: ‘Designed or practical response to a real or theoretical environmental issue or challenge’** |
| ***Unit: 3******Outcome: 1***Explain the importance of Earth’s biodiversity and how it has changed over time, analyse the threats to biodiversity, and evaluate management strategies to maintain biodiversity in the context of one selected threatened endemic species. | **Key Science Skills** | **DESCRIPTOR: typical performance in each range** |
|  **Increasing levels of performance**  |
| ***Develop aims and questions, formulate hypotheses and make predictions*** | * **States the environmental issue or challenge which requires a designed or practical response**
* Identifies a possible outcome of the investigation.
 | * **Describes the scientific concepts (biodiversity, environmental management, climate change or energy) relevant to the issue or challenge**
* Lists possible alternative outcomes of the investigation.
 | * **Summarises the key aspects of the issue or challenge that will be addressed by the designed or practical response**
* Describes factors that may affect the outcomes of the investigation.
 | * **Explains the approach taken to develop a designed or practical response to the issue or challenge**
* Discusses how different factors may affect the outcomes of the investigation.
 | * **Supports a designed or practical approach by referring to relevant background research**
* Predicts the most likely outcome of the investigation based on prior knowledge.
 |
| ***Plan and conduct investigations*** | * Describes the development of a product, process or system relevant to a practical response to an environmental issue or challenge
* Develops a design brief relevant to the issue or challenge.
 | * Supports the development of a product, process or system methodology with relevant background information
* Breaks up the design brief into smaller tasks.
 | * Explains how the product, process or system will provide a response to an environmental issue or challenge
* Documents preliminary testing data.
 | * Discusses the use of criteria in determining the effectiveness of the product, process or system needs in responding to the environmental issue or challenge
* Modifies design based on preliminary data.
 | * Develops relevant criteria to evaluate the product, process or system
* Presents a final product, process or system based on feedback.
 |
| ***Generate, collate and record data*** | * Classifies data as primary or secondary.
 | * Distinguishes between qualitative and quantitative data.
 | * Discusses the data relevant to the investigation.
 | * Explains how data will be analysed to address the investigation question.
 | * Defends the type and amount of data required to be generated to address the investigation question.
 |
| ***Analyse and evaluate data and investigation methods*** | * **Summarises data**
* Distinguishes between the investigation methodology and method used in the selected investigation.
 | * **Selects relevant data for analysis**
* States whether the investigation methodology and method led to valid data being generated.
 | * **Identifies trends or patterns in data**
* Discusses how effectively the investigation methodology and method enabled valid data to be generated.
 | * **Makes a claim based on data**
* Discusses how effectively the investigation methodology and method enabled a valid conclusion to be drawn.
 | * **Evaluates the quality of data**
* Compares the strengths and weaknesses of the selected methodology and method used to draw a conclusion.
 |
| ***Construct evidence-based arguments and draw conclusions*** | * **Describes the current situation in relation to the environmental issue or challenge**
* **Lists advantages and disadvantages of different options as a response to an environmental issue or challenge**
* States a conclusion
* States a limitation of conclusions.
 | * **Outlines possible consequences if no action is taken in relation to the environmental issue or challenge**
* **Compares advantages and disadvantages of different options as a response to an environmental issue or challenge**
* Uses data to support a conclusion
* Describes limitations of conclusions.
 | * **Explains the importance of their response to the environmental issue or challenge**
* **Ranks different decision options, explaining the criteria used to make decisions to identify viable options**
* Connects aims, data, and conclusions
* Explains limitations of conclusions.
 | * **Discusses the possible consequences of their response to the environmental issue or challenge over time**
* **Compares possible ‘worst case’ and ‘best case’ scenarios in adopting different options**
* Explains assumptions made in data interpretation
* Discusses experimental validity.
 | * **Suggests further research to refine the designed or practical response to an environmental issue or challenge**
* **Justifies a preferred option in responding to an issue or challenge**
* Discusses assumptions made in drawing conclusions
* Identifies further evidence required to draw a valid conclusion.
 |
| ***Analyse, evaluate and communicate scientific ideas*** | * **Identifies the science concepts (biodiversity, environmental management, climate change or energy) involved in a designed or practical response to an environmental issue or challenge**
* **Identifies the sustainability principles relevant to the environmental issue or challenge**
* **Uses data to support a response to the environmental issue or challenge.**
 | * **Describes the science concepts (biodiversity, environmental management, climate change or energy) involved in a designed or practical response to an environmental issue or challenge**
* **Describes how sustainability principles are involved in the environmental issue or challenge**
* **Translates analysed data into a summary statement relevant to a response to the environmental issue or challenge.**
 | * **Makes links between science concepts (biodiversity, environmental management, climate change or energy) central to the designed or practical response to an environmental issue or challenge**
* **Explains how sustainability principles have been taken into account in developing a response to the environmental issue or challenge**
* **Explains the use of data in developing a response to the issue or challenge.**
 | * **Explains the relationships between different concepts (biodiversity, environmental management, climate change or energy) involved in developing a designed or practical response to an environmental issue or challenge**
* **Proposes short-term solutions in responding to an environmental issue or challenge in terms of sustainability principles**
* **Explains how their designed or practical response resolves the issue or challenge.**
 | * **Discusses the importance of the relationships between different concepts (biodiversity, environmental management, climate change or energy) involved in developing a designed or practical response to an environmental issue or challenge**
* **Proposes long-term solutions in responding to an environmental issue or challenge in terms of sustainability principles**
* **Discusses how further data may be generated to evaluate the response to the issue or challenge.**
 |
| * Uses provided a scientific report template
* **Sketches a response to the issue or challenge**.
 | * Adheres to conventions of scientific report writing
* **Labels a sketch of a designed or practical response.**
 | * Communicates relevant information in a scientific report.
* **Highlights distinctive features of the designed or practical response**.
 | * Modifies scientific report template to improve cohesion of communication
* **Discusses alternative designs that were considered.**
 | * Modifies scientific report template to include critical investigation information.
* **Defends choices made in determining a final design.**
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Step 3: Create a set of marking guide rubrics

The teacher constructed a set of marking guide rubrics from the performance descriptors relevant to assessing the outcome, as shown below:

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| **Assessment task: ‘Designed or practical response to a real or theoretical environmental issue or challenge’** |
| ***Unit: 3******Outcome: 1***Explain the importance of Earth’s biodiversity and how it has changed over time, analyse the threats to biodiversity, and evaluate management strategies to maintain biodiversity in the context of one selected threatened endemic species. | **Key Science Skills** | **DESCRIPTOR: typical performance in each range** |
|  **Increasing levels of performance**  |
| ***Develop aims and questions, formulate hypotheses and make predictions*** | States the environmental issue or challenge which requires a designed or practical response | Describes the scientific concepts (biodiversity, environmental management, climate change or energy) relevant to the issue or challenge | Summarises the key aspects of the issue or challenge that will be addressed by the designed or practical response | Explains the approach taken to develop a designed or practical response to the issue or challenge | Supports a designed or practical approach by referring to relevant background research |
| ***Analyse and evaluate data and investigation methods*** | Summarises data | Selects relevant data for analysis | Identifies trends or patterns in data | Makes a claim based on data | Evaluates the quality of data |
| ***Construct evidence-based arguments and draw conclusions*** | Describes the current situation in relation to the environmental issue or challenge | Outlines possible consequences if no action is taken in relation to the environmental issue or challenge | Explains the importance of their response to the environmental issue or challenge | Discusses the possible consequences of their response to the environmental issue or challenge over time | Suggests further research to refine the designed or practical response to an environmental issue or challenge |
| Lists advantages and disadvantages of different options as a response to an environmental issue or challenge | Compares advantages and disadvantages of different options as a response to an environmental issue or challenge | Ranks different decision options, explaining the criteria used to make decisions to identify viable options | Compares possible ‘worst case’ and ‘best case’ scenarios in adopting different options | Justifies a preferred option in responding to an issue or challenge |
| ***Analyse, evaluate and communicate scientific ideas*** | Identifies the science concepts (biodiversity, environmental management, climate change or energy) involved in a designed or practical response to an environmental issue or challenge | Describes the science concepts (biodiversity, environmental management, climate change or energy) involved in a designed or practical response to an environmental issue or challenge | Makes links between science concepts (biodiversity, environmental management, climate change or energy) central to the designed or practical response to an environmental issue or challenge | Explains the relationships between different concepts (biodiversity, environmental management, climate change or energy) involved in developing a designed or practical response to an environmental issue or challenge | Discusses the importance of the relationships between different concepts (biodiversity, environmental management, climate change or energy) involved in developing a designed or practical response to an environmental issue or challenge |
| Identifies the sustainability principles relevant to the environmental issue or challenge | Describes how sustainability principles are involved in the environmental issue or challenge | Explains how sustainability principles have been taken into account in developing a response to the environmental issue or challenge | Proposes short-term solutions in responding to an environmental issue or challenge in terms of sustainability principles | Proposes long-term solutions in responding to an environmental issue or challenge in terms of sustainability principles |
| Uses data to support a response to the environmental issue or challenge | Translates analysed data into a summary statement relevant to a response to the environmental issue or challenge | Explains the use of data in developing a response to the issue or challenge. | Explains how their designed or practical response resolves the issue or challenge | Discusses how further data may be generated to evaluate the response to the issue or challenge |
| Sketches a response to the issue or challenge | Labels a sketch of a designed or practical response | Highlights distinctive features of the designed or practical response | Discusses alternative designs that were considered | Defends choices made in determining a final design |

Step 4: Customise the marking guide rubrics

The teacher edited the marking guide rubrics so that:

1. only the relevant key science skills and key knowledge were included in the rubric
2. cells in rubric that were not relevant to the task were deleted (shown below as blank cells)
3. content in rubric cells was refined to better reflect the assessment task requirements (shown below in **bold font**)
4. new content was added to the rubrics to better reflect the assessment task requirements (shown below in ***bold italicised* font**)
5. performance at the lower levels that had already been achieved by students was deleted (shown below as blank shaded cells).

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| **Assessment task: ‘Designed or practical response to a real or theoretical environmental issue or challenge’** |
| ***Unit: 3******Outcome: 1***Explain the importance of Earth’s biodiversity and how it has changed over time, analyse the threats to biodiversity, and evaluate management strategies to maintain biodiversity in the context of one selected threatened endemic species. | **Key Science Skills** | **DESCRIPTOR: typical performance in each range** |
|  **Increasing levels of performance**  |
| ***Develop aims***  | States the environmental **challenge** which requires a **designed** response | Describes the **biodiversity** concepts relevant to the **challenge** | Summarises the key aspects of the issue or challenge that will be addressed by the **designed** response | Explains the approach taken to develop a **designed** response to the **challenge** | Supports a **designed** approach by referring to relevant background research |
| ***Analyse and evaluate data***  |  | Selects relevant data for analysis | Identifies trends or patterns in data | Makes a claim based on data | Evaluates the quality of data |
| ***Construct evidence-based arguments and draw conclusions*** | Describes the current situation in relation to the environmental **challenge in terms of threats to biodiversity**  | Outlines possible consequences if no action is taken in relation to the environmental **challenge** | Explains the importance of their response to the environmental **challenge in terms of reducing threats to biodiversity**  | Discusses the ***advantages*** of their response to the environmental **challenge** over time |  |
| Lists advantages and disadvantages of different options as a response to an environmental **challenge** | Compares advantages and disadvantages of different options as a response to an environmental **challenge** | Ranks different decision options, explaining the criteria used to make decisions to identify viable options |  | Justifies a preferred option in responding to an environmental **challenge** |
| ***Analyse, evaluate and communicate scientific ideas*** | Identifies the **biodiversity** concepts involved in a **designed** response to an environmental **challenge** | Describes the **biodiversity** concepts involved in a **designed** response to an environmental **challenge** | Makes links between **biodiversity** concepts central to the **designed** response to an environmental **challenge** | Explains the relationships between different **biodiversity** concepts involved in developing a **designed** response to an environmental **challenge** | Discusses the importance of the relationships between different **biodiversity** concepts involved in developing a **designed** response to an environmental **challenge** |
|  | Describes how **the** sustainability principles of **conservation of biodiversity and** **ecological integrity, intergenerational equity and intragenerational equity** are involved in the environmental **challenge** | Explains how **the** sustainability principles **of conservation of biodiversity and** **ecological integrity, intergenerational equity and intragenerational equity** have been taken into account in developing a response to the environmental **challenge** | Proposes short-term solutions in responding to an environmental **challenge** in terms of **the** sustainability principles **of conservation of biodiversity and** **ecological integrity, intergenerational equity and intragenerational equity** |  |
| Uses data to support a response to the environmental **challenge**. | Translates analysed data into a summary statement relevant to a response to the environmental **challenge** | Explains the use of data in developing a response to the **environmental** **challenge** | Explains how their **designed** response resolves the **environmental challenge** | Discusses how further data may be generated to evaluate the response to the **environmental challenge** |
| ***Outlines the importance of monitoring the effectiveness of their response over time***  | ***Explains how the effectiveness of their response can be evaluated over time*** | ***Discusses the environmental factors that may lead to their proposed response not being valid in the future***  |  |  |
| Sketches a response to the issue or challenge. | Labels a sketch of a **designed** response | Highlights distinctive features of the **designed** response | Discusses alternative designs that were considered | Defends choices made in determining a final design |

Step 5: Reformat the marking guide rubric by collapsing the table to make it easier to read and allocate marks

Unit 3 Outcome 1 is allocated 60 marks in the study design on page 36. All other outcomes across Units 3 and 4 are allocated 40 marks. When designing an assessment task, teachers decide how they wish to allocate marks for each selected performance descriptor. Teachers may consider allocating different marks and/or weight to each skill determined by the level of difficulty of the skill.

\*Note: The assessment scale below is an example only. Teachers have the flexibility to determine the assessment task design, assessment tool and assessment scale once it is compliant with the *VCE Environmental Science Study Design 2022–2026* and VCE Assessment Principles.

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| **Unit 3 Outcome 1**: Explain the importance of Earth’s biodiversity and how it has changed over time, analyse the threats to biodiversity, and evaluate management strategies to maintain biodiversity in the context of one selected threatened endemic species.**Assessment task**: ‘Designed or practical response to a real or theoretical environmental issue or challenge’ |
|  |
| **Key Science Skills** | **DESCRIPTOR: typical performance in each range** | **\*Marks****(out of 60)** |
|  **Increasing levels of performance**  |
| ***Develop aims***  | States the environmental challenge which requires a designed response(1 mark)  | Describes the biodiversity concepts relevant to the challenge(2–3 marks)  | Summarises the key aspects of the issue or challenge that will be addressed by the designed response(4 marks) | Explains the approach taken to develop a designed response to the challenge(5 marks) | Supports a designed approach by referring to relevant background research(6–7 marks) | 7 marks |
| ***Analyse and evaluate data***  | Selects relevant data for analysis(1 mark) | Identifies trends or patterns in data(2–3 marks) | Makes a claim based on data(4 marks) | Evaluates the quality of data(5 marks) |  | 5 marks |
| ***Construct evidence-based arguments and draw conclusions*** | Describes the current situation in relation to the environmental challenge in terms of threats to biodiversity (1 mark) | Outlines possible consequences if no action is taken in relation to the environmental challenge(2–3 marks) | Explains the importance of their response to the environmental challenge in terms of reducing threats to biodiversity (4 marks) | Discusses the advantages of their response to the environmental challenge over time(5–6 marks) |  | 6 marks |
| Lists advantages and disadvantages of different options as a response to an environmental challenge(1–3 marks) | Compares advantages and disadvantages of different options as a response to an environmental challenge(4–5 marks) | Ranks different decision options, explaining the criteria used to make decisions to identify viable options(6–7 marks) | Justifies a preferred option in responding to an environmental challenge(8 marks) |  | 8 marks |
| ***Analyse, evaluate and communicate scientific ideas*** | Identifies the biodiversity concepts involved in a designed response to an environmental challenge(1 mark) | Describes the biodiversity concepts involved in a designed response to an environmental challenge(2–3 marks) | Makes links between biodiversity concepts central to the designed response to an environmental challenge(4–5 marks) | Explains the relationships between different biodiversity concepts involved in developing a designed response to an environmental challenge(6–7 marks) | Discusses the importance of the relationships between different biodiversity concepts involved in developing a designed response to an environmental challenge(8–9 marks) | 9 marks |
| Describes how the sustainability principles of conservation of biodiversity and ecological integrity, intergenerational equity and intragenerational equity are involved in the environmental challenge1–3 marks) | Explains how the sustainability principles of conservation of biodiversity and ecological integrity, intergenerational equity and intragenerational equity have been taken into account in developing a response to the environmental challenge(4–5 marks) | Proposes short-term solutions in responding to an environmental challenge in terms of the sustainability principles of conservation of biodiversity and ecological integrity, intergenerational equity and intragenerational equity(6–7 marks marks) |  |  | 7 marks |
| Uses data to support a response to the environmental challenge(1–2 marks) | Translates analysed data into a summary statement relevant to a response to the environmental challenge(3 marks) | Explains the use of data in developing a response to the environmental challenge(4 marks) | Explains how their designed response resolves the environmental challenge(5 marks) | Discusses how further data may be generated to evaluate the response to the environmental challenge(6–7 marks) | 7 marks |
| Outlines the importance of monitoring the effectiveness of their response over time (1 mark) | Explains how the effectiveness of their response can be evaluated over time(2 marks) | Discusses the environmental factors that may lead to their proposed response not being valid in the future (3–4 marks) |  |  | 4 marks |
| Sketches a response to the issue or challenge(1–2 marks) | Labels a sketch of a designed response(3 marks) | Highlights distinctive features of the designed response(4 marks) | Discusses alternative designs that were considered(5–6 marks) | Defends choices made in determining a final design(7 marks) | 7 marks |

Approach 2 Developing rubrics to assess the contextualised key science skills across Units 3 and 4

The key science skills on pages 8–10 of the study design have been contextualised for VCE Environmental Science. Teachers should ensure that a representative sample of these skills is assessed across Units 3 and 4. The performance descriptors may be used to ensure appropriate coverage and mapping of these skills. A mapping template is available at [Mapping of VCE Environmental Science assessment tasks against key science skills](https://www.vcaa.vic.edu.au/Documents/vce/envscience/Support%20materials/Performancedescriptors/2022EnvSciMappingAssessmentTasksAgainstKeyScienceSkills.docx).

In the following example, planning for the SAC task for Unit 4, Outcome 1 is shown. The task, chosen by the teacher, relates to responding to climate change.

* **Prior learning**: Students completed experiments in the school laboratory to investigate the strength of three different formulations of ecologically sustainable concrete. They recorded data in their logbooks. The teacher collected logbooks and returned the logbooks to students at the beginning of the SAC task.
* **Assessment task:** Students were provided with their logbooks so that they could access their data. The SAC task involved students writing a scientific report of their experiment, including data analysis. The teacher wanted to develop a 5x8 rubric from the performance descriptors to match the allocated marks for the assessment task of 40 marks (page 42 of the study design).

Step 1: Specify the assessment task

The SAC task involved completing a practical report related to a class experiment, so the teacher would advise students that the SAC task would require ‘the presentation of recommendations using evidence-based decision-making, including analysis of primary data’. Students were advised that the SAC task related to the primary data recorded in their logbooks. This provides students with an understanding of the scope of the SAC task.

Step 2: Identify the key science skills that will be assessed

The teacher provided the performance descriptors relevant to the task: [Assessment task: Presentation of recommendations using evidence-based decision-making](https://www.vcaa.vic.edu.au/Documents/vce/envscience/Support%20materials/Performancedescriptors/2022EnvSciPresentationOfRecommendationsUsingEvidenceBasedDecisionMakingUnits3and4.docx). The performance descriptors cover an extensive range of key science skills to allow for different assessment options for teachers. The teacher’s main focus was the key science skills related to data analysis. The teacher selected seven rows of performance descriptors, shown in **bold font** in the table below, and planned to add a row of descriptors related to an evaluation of the investigation methodology and method to form the basis of a 5x8 set of rubrics. The new row is shown in **underlined bold** font.

|  |
| --- |
| **Assessment task: ‘Presentation of recommendations using evidence-based decision-making, including analysis and evaluation of primary data’** |
|  |  |  |  |
| ***Unit: 4******Outcome: 1 Analyse the major factors that affect Earth’s climate, explain how past and future climate variability can be measured and modelled, and evaluate options for managing climate change*** | **Key Science Skills** | **DESCRIPTOR: typical performance in each range** |
|  **Increasing levels of performance**  |
| ***Develop aims and questions, formulate hypotheses and make predictions***  | * **States the problem or issue that will be explored through the primary data.**
 | * **Develops an aim or question that will be investigated.**
 | * **Explains why data is required for decision-making.**
 | * **Outlines how primary data will be analysed and evaluated to make recommendations about a problem or issue.**
 | * **Suggests further data that could be generated or collated to respond to the problem or issue.**
 |
| ***Generate, collate and record data*** | * Records generated primary data to inform decision-making
* Records qualitative and/or quantitative data.
 | * Records generated primary data using provided tables to inform decision-making
* Identifies generated data as qualitative and/or quantitative.
 | * Constructs tables to record generated primary data to inform decision-making
* Distinguishes between the qualitative and quantitative data used. to inform decision-making
 | * Organises generated primary data into tables to inform decision-making
* Describes how the generated quantitative and/or quantitative data relates to the problem or issue.
 | * Selects relevant generated primary data to include in tables to inform decision-making
* Explains how the generated quantitative and/or quantitative data will be used in decision-making.
 |
| ***Analyse and evaluate data and investigation methods*** | * **Identifies the data to be plotted on a graph.**
 | * **Labels graph axes including units.**
 | * **Plots data using a suitable scale.**
 | * **Uses a bar chart to present discrete data or a line graph to represent continuous data.**
 | * **Shows patterns or relationships between variables in graphs.**
 |
| * Refers to a specific data point on a graph in the discussion of data
* **States a pattern in tabled data.**
 | * Compares specific data points on a graph in data analysis
* **Describes a relationship or pattern from graphed data.**
 | * Uses interpolation in data analysis
* **Applies mathematical skills to analyse a relationship or pattern in data.**
 | * Uses extrapolation in data analysis
* **Identifies outliers when evaluating data.**
 | * Extrapolates from data to make predictions with reference to decision options
* **Accounts for outliers in discussing a relationship or pattern in data.**
 |
| * Identifies an error or mistake in data analysis
* Identifies incomplete data.
 | * Distinguishes between errors and mistakes
* Identifies contradictory data.
 | * Distinguishes between random and systematic errors
* Suggests why incomplete or contradictory data may have been generated.
 | * Explains the effect of errors on data analysis
* Explains possible effects of using incomplete or contradictory data in decision-making.
 | * Suggests how errors could have been minimised
* Discusses how data quality could be improved.
 |
| * **Distinguishes between the investigation methodology and method used in their investigation**
 | * **States whether the investigation methodology and method led to valid data being generated**
 | * **Discusses how effectively the** **investigation methodology and method enabled valid data to be generated**
 | * **Discusses how effectively the** **investigation methodology and method enabled a valid conclusion to be drawn**
 | * **Evaluates the strengths and weaknesses of the selected methodology and method used to draw a conclusion**
 |
| **Construct evidence-based arguments and draw conclusions** | * **States their own / others’ recommendation or decision.**
 | * **Supports their own / others’ recommendation or decision based on an opinion.**
 | * **Uses data to support their own / others’ recommendation or decision.**
 | * **Explains how their own / others’ recommendation or decision is supported by data.**
 | * **Discusses the limitations of data in evaluating their own / others’ recommendation or decision.**
 |
| * Describes the current situation in relation to the decision to be made
* **Lists advantages and disadvantages of different decision options.**
 | * Suggests an immediate action in the context of the decision to be made
* **Compares advantages and disadvantages of different decision options**.
 | * Justifies an immediate action in the context of the decision to be made
* **Provides a reasoned argument for a preferred decision option**.
 | * Proposes short-term recommendations in the context of the decision to be made
* **Ranks different decision options, explaining the criteria used to make decisions to identify viable options.**
 | * Proposes long-term recommendations in the context of the decision to be made
* **Evaluates viable options by comparing possible ‘worst case’ and ‘best case’ scenarios in adopting each option.**
 |
| * Identifies an immediate impact of the recommendation or decision on the problem or issue in terms of scientific ideas.
 | * Compares impacts on the environment and humans of the recommendation or decision related to the problem or issue in terms of scientific ideas.
 | * Explains the short-term impacts of the recommendation or decision on the problem or issue in terms of scientific ideas.
 | * Makes predictions about the long-term impacts of the recommendation or decision on the problem or issue in terms of scientific ideas.
 | * Discusses the implications for future decision-making of the recommendations or decisions on the problem or issue in terms of scientific ideas.
 |
| **Analyse, evaluate and communicate scientific ideas** | * Selects relevant data for analysis to inform decision-making.
 | * Organises data related to the problem or issue requiring a decision to be made or evaluated using environmental science conventions.
 | * Analyses data related to the problem or issue requiring a decision to be made or evaluated using environmental science language.
 | * Summarises advantages and disadvantages of different options related to decision-making using environmental science language.
 | * Presents recommendations or makes decisions using environmental science language.
 |
| * **Identifies the science concepts associated with their recommendations or decisions**
* **Communicates their recommendations or decisions in language that is appropriate for the audience.**
 | * **Describes the science concepts associated with their recommendations or decisions**
* **Communicates their recommendations or decisions clearly.**
 | * **Makes links between the science concepts associated with their recommendations or decisions**
* **Sequences their communication of recommendations or decisions logically.**
 | * **Explains the relationships between the science concepts associated with their recommendations or decisions**
* **Selects relevant data and information to support the communication of their recommendations or decisions.**
 | * **Discusses the importance of the relationships between the science concepts associated with their recommendations or decisions**
* **Communicates the uncertainty associated with their recommendations or decisions.**
 |

Step 3: Create a set of rubrics including a marking scheme

The teacher constructed a set of 5x8 rubrics based on the selected set of performance descriptors in Step 2, such that:

* the set of contextualised key science skills for VCE Environmental Science on pages 8–10 of the study design were referred to and a new column was added to the set of rubrics to help students identify the specific skills that would be assessed in the SAC task (shown in the second column below)
* the contents of the rubric cells were also edited to better reflect the assessment task and to include relevant key knowledge associated with the outcome for the unit (shown below in **bold font**)
* a marking scheme was created, reflecting the increasing level of complexity of performance across rubric rows.

|  |
| --- |
| ***Unit 4 Outcome: 1*** Analyse the major factors that affect Earth’s climate, explain how past and future climate variability can be measured and modelled, and evaluate options for managing climate change**Assessment task:** Presentation of recommendations using evidence-based decision-making, including analysis and evaluation of primary data |
|  |  |  |  |
| **Key Science Skills** | **DESCRIPTOR: typical performance in each range** |
| **Very low****(1 mark)** | **Low****(2 marks)** | **Medium****(3 marks)** | **High****(4 marks)** | **Very high****(5 marks)** |
| ***Develop aims and questions, formulate hypotheses and make predictions***  | * **construct aims for the investigation**
 | States the problem or issue that will be explored through the primary data | States an aim for the investigation | Explains why data is required for decision-making | Outlines how primary data will be analysed and evaluated to make recommendations about a **problem**  | **Suggests** further data that could be generated or collated to respond to the **problem**  |
| ***Analyse and evaluate data and investigation methods*** | * **organise and present data in useful and meaningful ways**
 | Identifies the data to be plotted on a graph | Labels graph axes including units | Plots data using a suitable scale | Uses a bar chart to present discrete data or a line graph to represent continuous data | Shows patterns or relationships between variables in graphs |
| * **process and analyse data**
 | States a pattern in tabled data | Describes a relationship or pattern from graphed data | Applies mathematical skills to analyse a relationship or pattern in data | Identifies outliers when evaluating data | Accounts for outliers in discussing a relationship or pattern in data |
| * **evaluate investigation methods**
 | Distinguishes between the investigation methodology and method used in their investigation | States whether the investigation methodology and method led to valid data being generated | Discusses how effectively the investigation methodology and method enabled valid data to be generated | Discusses how effectively the investigation methodology and method enabled a valid conclusion to be drawn | Evaluates the strengths and weaknesses of the selected methodology and method used to draw a conclusion |
| **Construct evidence-based arguments and draw conclusions** | * **evaluate data**
 | States **their own** recommendation or decision **in relation to strategies for mitigating climate change** | Supports **their own** recommendation or decision based on an opinion **in relation to strategies for mitigating climate change** | Uses data to support **their own** recommendation or decision **in relation to strategies for mitigating climate change** | Explains how **their own** recommendation or decision **in relation to strategies for mitigating climate change** is supported by data | Discusses the limitations of data in evaluating **their own** recommendation or decision **in relation to strategies for mitigating climate change** |
| * **use reasoning to construct scientific arguments**
 | Lists advantages and disadvantages of different decision options | Compares advantages and disadvantages of different decision options | Provides a reasoned argument for a preferred decision option | Ranks different decision options, explaining the criteria used to make decisions to identify viable options | Evaluates viable options by comparing possible ‘worst case’ and ‘best case’ scenarios in adopting each option |
| **Analyse, evaluate and communicate scientific ideas** | * **use clear, coherent and concise expression to communicate to specific audiences and for specific purposes in appropriate scientific genres, including scientific reports**
 | Identifies the science concepts **related to climate change** associated with their recommendations or decisions | Describes the science concepts **related to climate change** associated with their recommendations or decisions | Makes links between the science concepts **related to climate change** associated with their recommendations or decisions | Explains the relationships between the science concepts **related to climate change** associated with their recommendations or decisions | Discusses the importance of the relationships between the science concepts **related to climate change** associated with their recommendations or decisions |
| Communicates their recommendations or decisions in language that is appropriate for the audience  | Communicates their recommendations or decisions clearly | Sequences their communication of recommendations or decisions logically | Selects relevant data and information to support the communication of their recommendations or decisions | Communicates the uncertainty associated with their recommendations or decisions |

Step 4: Provide students with a copy of the assessment rubrics prior to the SAC task

The teacher un-bolded the fonts used in the rubric cells and provided a copy of the rubric to students prior to the task. The rubric was discussed in class so that students were clear about what was expected in the assessment.