

## ENVIRONMENTAL SCIENCE (ESS315118)

External Assessment Specifications inform the development of external assessments. The primary audience for this document is the course Setting Examiner and Exam Critics. It may also be of use to teachers and students.

These specifications must be read in conjunction with the current Course Document on the TASC website.

The external assessment for this course consists of a written exam.

### WRITTEN EXAM STRUCTURE

The written exam is THREE hours.

Students will have an additional 15-minute preparation time during which students can take notes on the note paper provided and highlight any key words in the exam booklet during the allocated time. Students will not be permitted to start their exam until advised by the Exam Supervisor.

The written exam includes FIVE sections.

The criteria to be externally assessed are:

Criterion 2: develop, interpret and analyse experiments and investigations

Criterion 5: apply ecological concepts and processes

Criterion 6: apply concepts and processes of ecosystem change

Criterion 7: apply concepts relating to human dependence and impact on ecosystems

Criterion 8: apply principles and processes related to ecologically sustainable management of the environment.

### SPECIFIC MATERIALS AND EQUIPMENT APPROVED FOR USE BY STUDENTS

Current TASC ESS315118 Environmental Science Information Sheet.

## ASSESSMENT

All criteria are numerically with marks out of 36.

A set of solutions or a marking tool will be developed by the Setting Examiner, provided to markers at the marking meeting that follows the external written exam; and will be available from TASC in the following year.

The external assessment must include questions that, separately or together, give opportunities to demonstrate the standards from rating C to rating A.

Final results will be awarded as a rating of A, B, C, t or z in the above criteria. These ratings are used in determining the final award according to the algorithm in the course document.

### Numerical Mark Allocation

Exam papers are designed so that the number of marks allocated to a section, part or question corresponds to the recommended time allocation for it. This is so that a student knows when answering a 10 mark question that the question has been designed for students to spend approximately 10 minutes reading, thinking and then answering the question. Students may find that they spend less or more time on certain questions throughout the exam.

## SECTION A

### Structure

- This section will take students approximately 36 minutes to respond to and will be allocated 36 marks
- This section will include between FOUR and SEVEN questions. All questions are compulsory.
- Questions will be mostly broken into items, which will be arranged in order of difficulty where possible.

This section addresses the following course content:

- Develop, interpret and analyse experiments and investigations

### Assessed Criteria

- Criterion 2 – develop, interpret and analyse experiments and investigations (all Elements).

### Nature of Questions

- See Appendix A

### Nature of Responses

- Responses will be assessed numerically.

## SECTION B

### Structure

- This section will take students approximately 36 minutes to respond to and will be allocated 36 marks.
- This section will include between FOUR and SEVEN questions. All questions are compulsory.
- Questions will be mostly broken into items, which will be arranged in order of difficulty where possible.

This section addresses the following course content:

- Ecological processes

### Assessed Criteria

- Criterion 5 apply ecological concepts and processes (all Elements).

### Nature of Questions

- See Appendix A

### Nature of Responses

- Responses will be assessed numerically.

## SECTION C

### Structure

- This section will take students approximately 36 minutes to respond to and will be allocated 36 marks.
- This section will include between FOUR and SEVEN questions. All questions are compulsory.
- Questions will be mostly broken into items, which will be arranged in order of difficulty where possible.

This section addresses the following course content:

- Ecosystem change

### Assessed Criteria

- Criterion 6 apply concepts and processes of ecosystem change (all Elements).

### Nature of Questions

- See Appendix A

### Nature of Responses

- Responses will be assessed numerically.

## SECTION D

### Structure

- This section will take students approximately 36 minutes to respond to and will be allocated 36 marks.
- This section will include between FOUR and SEVEN questions. All questions are compulsory.
- Questions will be mostly broken into items, which will be arranged in order of difficulty where possible.

This section addresses the following course content:

- Human dependence and impact on ecosystems

### Assessed Criteria

- Criterion 7 apply concepts relating to human dependence and impact on ecosystems (all Elements).

### Nature of Questions

- See Appendix A

### Nature of Responses

- Responses will be assessed numerically.

## SECTION E

### Structure

- This section will take students approximately 36 minutes to respond to and will be allocated 36 marks.
- This section will include between FOUR and SEVEN questions. All questions are compulsory.
- Questions will be mostly broken into items, which will be arranged in order of difficulty where possible.

This section addresses the following course content:

- Ecologically sustainable management of the environment

### Assessed Criteria

- Criterion 8 apply principles and processes related to ecologically sustainable management of the environment (all Elements).

### Nature of Questions

- See Appendix A

### Nature of Responses

- Responses will be assessed numerically.

## Appendix A - TYPES of Questions (All SECTIONS)

- Some extended questions should be non-routine contexts, not exceeding 6 to 8 marks within the section. The remainder should be in routine contexts.
- Some scenarios of questions are real-world scenarios.
- A balance of questions ranging from short to extended response format.
- Responses range from closed to open-ended.

### Routine context:

These questions require skills or procedures expected to be encountered by all students in Environmental Science. They are focused on the application of principles, concepts and processes that interrelate the natural world and human society to investigation and analysis, and in familiar contexts.

Routine contexts include where students provide their own context to apply specified principles, concepts or processes within questions.

Note: Within the Course Content related to criteria 2, 5, 6, 7 and 8 there are a range of example contexts given. It should be assumed that students require supporting material in relation to these examples. If these contexts are used within questions relevant contextual information needs to be provided.

(Reference: Exam Paper 2016, Part 3, Question 13)

Estuaries at the mouths of rivers, like the one pictured opposite, support their own unique ecosystems. These ecosystems are characterised by the transition from fresh water in the riverine ecosystem to the saltwater conditions in a marine environment.



*A typical estuary at the mouth of a river flowing into the ocean in the far distance*

- (a) For each of the stated time periods below, describe **one** change that is likely to occur in an estuary. (4 marks)
- diurnally
  - seasonally
  - on an irregular time frame
  - recently as a result of human activity

(Reference: Exam Paper 2015, Part 4, Question 17)

Based on reports from government agencies and representatives from the aquaculture industry, concerns about the decline in water quality, particularly lower dissolved oxygen levels, in Macquarie Harbour have been raised in the Tasmanian parliament. Recent increases in the number of salmon pens in the harbour are claimed to have been a major contributor to the low dissolved oxygen levels.

- (a) As Macquarie Harbour is a natural environment, list four factors which may naturally contribute to seasonal lowering of the dissolved oxygen level. (2 marks)
- (b) Explain clearly why the salmon pens may contribute to a lowering of the dissolved oxygen level in Macquarie Harbour. (2 marks)
- (c) Explain other possible impacts in Macquarie Harbour from the increase in the number of salmon pens. (2 marks)

### Non-routine context

These questions require procedures not previously encountered in expected prior learning activities. These require the combination, and sometimes the selection, of a set of skills in unfamiliar contexts when applying principles, concepts and processes from the specified and required Course Content.

These questions particularly lend themselves to address an A standard for the relevant criterion.

Note: Within the Course Content related to criteria 2, 5, 6, 7 and 8 there are a range of example contexts given. It should be assumed that students require supporting material in relation to these examples. If these contexts are used within questions relevant contextual information needs to be provided.

(Reference: Exam Paper 2012, Part 4, Question 13)

A proposed marina development on Mornington Peninsula in Victoria will cost \$50 million and generate 200 on-going jobs. The proposed development is in a habitat of the endangered Orange-bellied Parrot and Southern Brown Bandicoot and is to near to a Ramsar wetlands site. It is being assessed under government environmental legislation.

- (a) Why would this development proposal be assessed under government environmental legislation? (3 marks)

Supporters of the development say that the Orange-bellied Parrot has not been seen in the area for 25 years. They also argue that an ecological study, paid for by the developer, found that the development would not impact on Ramsar wetlands, and that the bandicoot was not present in the study area at the time. They say that these are good reasons for the development to proceed.

- (b) Critically analyse the supporters' argument. (3 marks)

There are believed to be only 50 Orange-bellied Parrots in the wild now, compared to 200 twenty years ago.

- (c) Discuss how the population of Orange-bellied Parrots can be increased and sustained, and the associated challenges. (3 marks)

(Reference: Exam Paper 2015, Part 5, Question 22)

### Question 22

Green developments that aim to be climate-friendly may be hurting some of the world's most vulnerable people, according to a survey of Ugandan villagers affected by carbon-offset projects.

Conclusions drawn from a study of a European carbon-offset company dismissed the company's claim that the carbon trading represented a 'win-win' for both rural communities and the environment.

Firsthand accounts from Uganda reveal that villagers have experienced forced evictions, restricted access to land and food, in addition to loss of livelihood. The company plans to have tree farms on the villagers' farmland.

The company currently holds licences on over 10 000 hectares of uncleared land in Uganda alone, with additional landholdings in neighbouring Mozambique.

In the extract of an article above, consider the ecologically sustainable development principles of:

- Intergenerational equity
- Intragenerational (social) equity
- Precautionary and anticipatory principle
- Conservation of biodiversity and ecological integrity
- Efficiency of resource use
- Pricing of environmental values and natural resources

Discuss how **five** principles of ecologically sustainable development have either been upheld or not upheld in this situation. **(10 marks)**

### Real-world scenarios

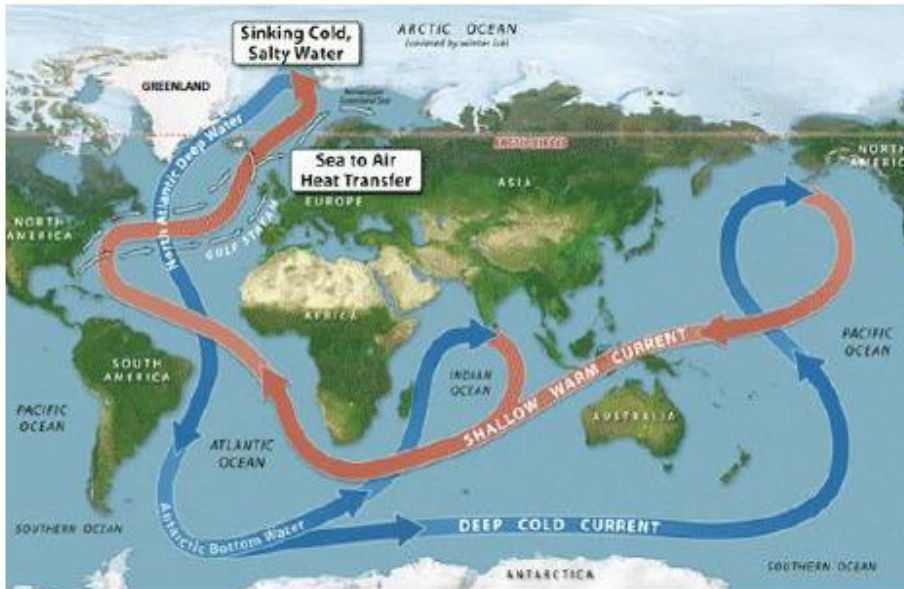
These questions relate principles, concepts and processes that interrelate the natural world and human society to information and data in the real world. The nature of approximations of theory to reality is clearly stated.

Real-world scenarios include where students provide their own scenario to apply specified principles, concepts or processes within questions.

Note: Within the Course Content related to criteria 2, 5, 6, 7 and 8 there are a range of example scenarios given. It should be assumed that students require supporting material in relation to these examples. If these scenarios are used within questions relevant information needs to be provided.

(Reference: Exam Paper 2016, Part 3, Question 15)

For centuries sailors in the Atlantic Ocean have known about the existence of The Gulf Stream, a current of warm water that flows from the tropics towards Europe. This current of warm water sinks in the North Atlantic Ocean and flows back towards the equator along the sea floor. These currents form part of the Global Oceanic Circulation System, a simplified diagram of which is shown.



The Global Oceanic Circulation System

- (a) Explain what is meant by the label 'Sea to Air Heat Transfer' shown over Europe in the diagram. (1 mark)
- (b) With global warming there is a concern that the Greenland Ice Sheet will melt and this may mean that the oceanic circulation in the Atlantic Ocean will change. Predict the likely impact on Europe if the Gulf Stream ceases to flow when the Global Oceanic Circulation System is disturbed. (1 mark)

In the last ten years climate scientists and oceanographers have made great advances in our understanding of the interaction between the atmosphere and the oceans. Oceans are important because they store heat and carbon dioxide.

- (c) Name the effect of an increased amount of carbon dioxide dissolving into the oceans. (1 mark)
- .....
- (d) Outline the likely consequence of this process for marine life such as corals, shellfish (oysters and mussels) and crustaceans (prawns and crayfish). (2 marks)

Short response format

These questions are composed of a brief prompt that demands a response to some stimulus material that varies from a single response to a few written points. This sort of question is suited to assessing the student's ability to:

- recall specific and accessible methods related to key content
- apply rehearsed methods to familiar situations
- demonstrate understanding of key concepts in previously unseen stimulus material.

(Reference: Exam Paper 2015, Part 2, Question 8)

Ecologists made the following observations of the feeding habits of a number of insectivorous birds living in a woodland community. Using your knowledge of niches and the data in the table below, answer the following questions.

Bird	Food	Where obtained
Tree Creeper	Insects (especially ants)	Crevices in tree trunk; moves <i>up</i> trunk
Varied sitella	Insects	Crevices in tree trunk; moves <i>down</i> trunk
Crested shrike tit	Insects (especially grubs)	Tears bark off tree trunk, removes insects from under bark
Spotted pardalote	Insects	In leafy foliage
Superb fairy-wren	Insects	In thick shrubs
Yellow thornbill	Insects	On ground

- (a) Briefly describe how competition for food resources is minimised between the spotted pardalote and the yellow thornbill. (2 marks)
- (b) Do the tree creeper and the varied sitella occupy the same niche? Explain. (2 marks)

(Reference: Exam Paper 2013, Part 3, Question 11)

Students often confuse the Greenhouse Effect with depletion of the Ozone Layer.

- (a) Complete the following table to show the differences between them. (4 marks)

	Greenhouse Effect	Ozone Layer Depletion
Name of the predominant gas involved		
Does this gas increase or decrease?		
One major consequence for humans		
Once other environmental consequence		

- (b) State how one of these two environmental problems has been reduced. (1 mark)

Extended response format

These questions involve lengthy responses of increasing complexity. Greater complexity may be due to one or more of, but not limited to, the following:

- o a greater cognitive demand of Environmental Science concepts
- o the necessity to select appropriate information
- o justification of a response via a logical line of reasoning.

Extended response questions should be scaffolded to ensure all students can respond to some aspects of the question. Responses that require a single long extended answer (8 to 10 marks) are less likely to provide this opportunity and should be avoided.

(Reference: Exam Paper 2015, Part 3, Question 11)

The state's Fire Management Council has recently implemented a new fuel reduction policy, with burn-off targets of up to 60 000 hectares (which comprises up to 5% of the state's arable land) annually. This strategic plan uses computer modelling to plan burns rather than just burning land at random.

(a) (i) Using your knowledge of the impact of fire in areas where eucalypts (sclerophyll forest) are found, explain the benefits of having a managed fire regime. (3 marks)

(i) What is the ecological cost of frequent burns? Explain. (2 marks)

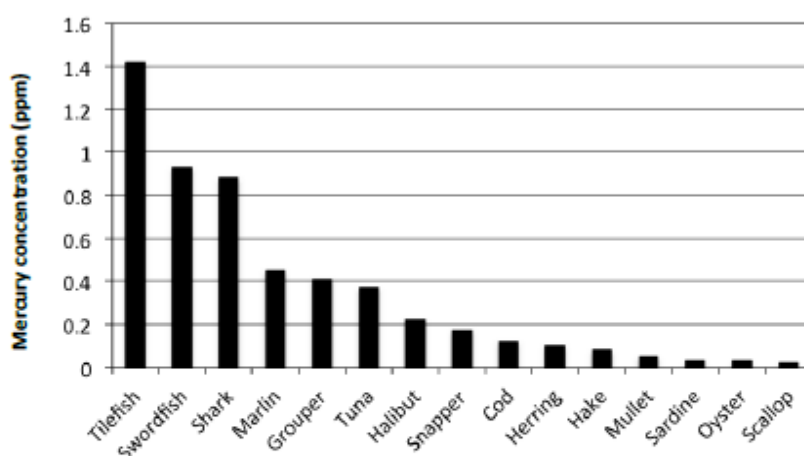
Some forest types, such as the cool-temperate rainforest found in Tasmania, do not, however, respond well to fire.

(b) Can a rainforest community survive a severe bushfire? Explain. (4 marks)

(Reference: Exam Paper 2015, Part 4, Question 15)

Fish is an excellent food source, but regular consumption of species high in mercury can be hazardous to your health.

Average Mercury levels in commercial fish and shellfish (1990–2010)



(a) What is the concentration of mercury in? (1 mark)

(i) halibut .....

(ii) tilefish .....

(b) Explain why filter-feeders, such as scallops and oysters, contain such low concentrations of mercury. (2 marks)

- (c) Explain how the larger predatory species, such as swordfish and shark, contain such high levels of mercury. (4 marks)

Despite the potential risk to human health, many species of shark are commercially fished and sold in fish markets, mostly being consumed as 'flake' in fish and chip shops.

- (d) Describe two strategies employed by fisheries and/or food standards authorities to ensure that shark flesh with high mercury levels is not eaten by consumers. (4 marks)

(Reference: Exam Paper 2017, Part 4, Question 21)

### Question 21

Currently there is concern about the eutrophication caused by aquaculture in Macquarie Harbour, on Tasmania's west coast.



*Fish pens in Macquarie Harbour*

Explain how salmon aquaculture can lead to eutrophication **and** outline how this problem is impacted by global warming. (6 marks)

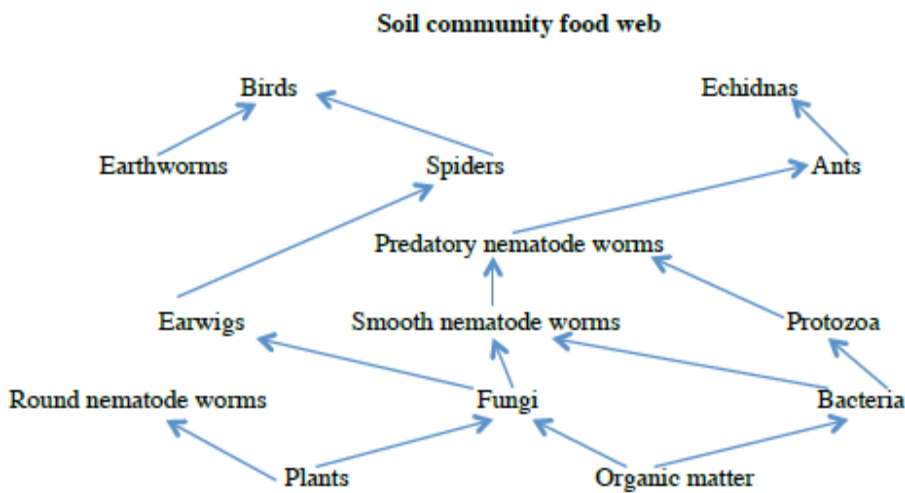
### Closed-ended response

These are questions for which there is a single 'correct' or 'best' response.

Note: Within the Course Content related to criteria 5, 6 and 8 there are a range of example contexts and scenarios given. It should be assumed that students require supporting material in relation to these examples. If these scenarios are used within questions relevant information needs to be provided.

(Reference: Exam Paper 2015, Part 2, Question 5)

Below is a generalised food web showing the organisms in a soil community.

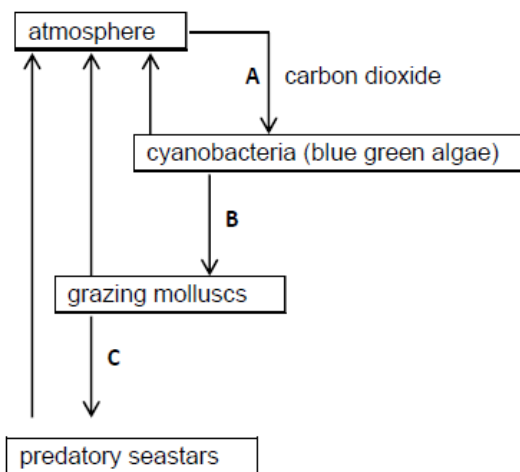


- (a) What is the ultimate source of energy for the soil community? (1 mark)
- (b) Which trophic level is occupied by the herbivores? (1 mark)
- (c) Name **three** carnivores in this food web. (1 mark)
- (d) Is there an omnivore in this soil community? If so, name it. (1 mark)
- (e) Write a food chain containing six organisms from this food web. (2 marks)

(Reference: Exam Paper 2017, Part 2, Question 8)

**Question 8**

The following is a diagram showing the processes on an intertidal rock platform.



- (a) State the name of **Process A**. (1 mark)
- (b) Name a substance containing carbon that is passed up the food chain at either **B** or **C**. (1 mark)
- (c) (i) Give the name of the process that is represented by the three upward arrows. (1 mark)
- (ii) State the name of the substance indicated by the three upward arrows. (1 mark)

Open-ended response

These are questions for which there may be multiple correct responses OR in which the quality of the argument and/or the expression is being assessed.

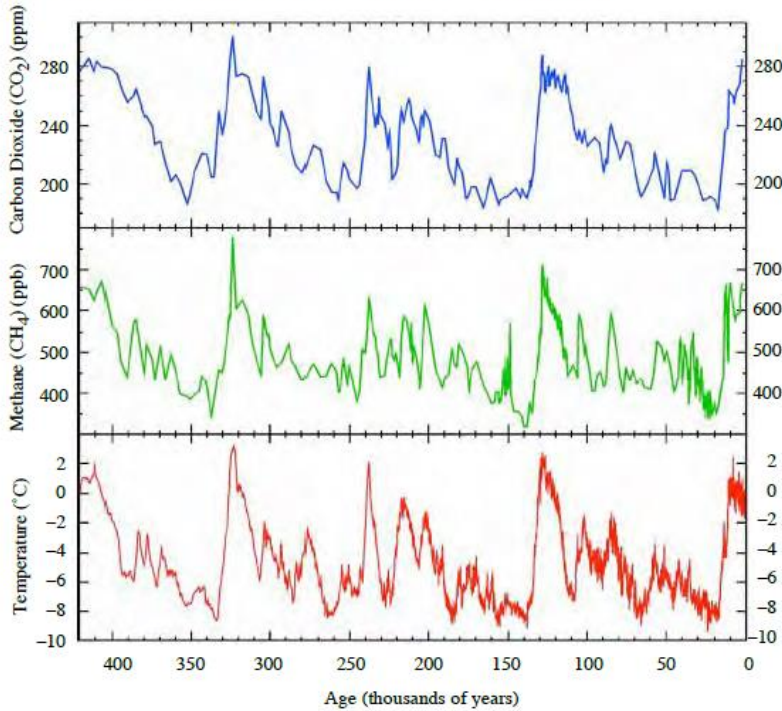
Open-ended responses should be focused on the application of principles, concepts or processes rather than testing details and definitions within the Course Content. This can be done by requesting students providing their own scenarios and context.

Note: Within the Course Content related to criteria 5, 6 and 8 there are a range of example contexts and scenarios given. It should be assumed that students require supporting material in relation to these examples. If these scenarios are used within questions relevant information needs to be provided.

(Reference: Exam Paper 2014, Part 3, Question 11a and 11c)

**Question 11**

Below is a graph showing data on global temperatures and methane and carbon dioxide concentrations in the Earth's atmosphere over the last 400 000 years.



Note: When the graph was produced the concentrations were Carbon Dioxide 379 ppm and Methane 1730 ppb.

- (a) What does this graph show about the history of the Earth's temperature? (2 marks)
- (c) Scientists today have many sources of evidence that support the theory that the Earth's climate has changed significantly over geological time.

Identify two sources of evidence for climate change over geological time that you have studied this year. Explain what the data obtained shows about the Earth's climate over geological time. (6 marks)

(Reference: Exam Paper 2017, Part 5, Question 25)

**Question 25**

A Tasmanian tourism company recently purchased some rural land that contained a number of caves. The company proposed a plan to build a small accommodation facility and develop the caves for self-guided adventure tourism. Before the development can proceed, the developer needs to approach the Local Council and the Tasmanian State Government for planning approval.

- (a) State **one** important condition that the developer must fulfil before approval of the development can be granted. (1 mark)

In any development such as this the developer must identify the stakeholders and the concerns that these stakeholders may have with the development.

- (b) List **two** stakeholders and outline any possible concerns that these groups or individuals may have in relation to this development. (4 marks)

## WRITTEN EXAM MAPPING

The Setting Examiner designs exam questions to adhere to the External Assessment Specifications (see table above). During the writing and critiquing of the exam, the Setting Examiner will map the *Environmental Science* (ESS315118) exam to the course document and external assessment specifications. This may be achieved through the mapping grids given in the tables below:

Mapping provides a summary of relationships between exam questions and:

- question type
- relative importance/weighting
- content
- achievement standard, and
- question rating.

Mapping is designed primarily to assist the Setting Examiner to:

- see at a glance the range of question types, course coverage and achievement standards used in the exam paper, and
- check for:
  - representative sampling, and
  - adherence to the exam structure specifications.

## WRITTEN EXAM MAPPING GRIDS

### SECTION 1 - Develop, interpret and analyse experiments and investigations

Criterion being assessed

Criterion 2 Standard	Question numbers	Possible ratings of response
Element 1		
Element 2		
Element 3		
Element 4		
Element 5		

Table 3: Course coverage

Development, interpretation and evaluation of experiments and practical activities	
Topic	Question numbers
Experimental design	
Biotic and abiotic surveys	

Table 4: Question type

Question type	Question numbers
<i>Context of questions</i> Routine contexts Non-routine contexts	
<i>Scenarios of questions</i> Real-world scenarios	
<i>Response format</i> Short response format Extended response	
<i>Assessment of responses</i> Closed-ended responses Open-ended responses	

## SECTION 2 - Ecological processes

Criterion being assessed

Criterion 5 Standard	Question numbers	Possible ratings of response
Element 1		
Element 2		
Element 3		
Element 4		
Element 5		

Course coverage

Ecological Processes	
Topic	Question numbers
Inputs and outputs of ecosystems	
Matter and Energy	
Relationships between species	
Populations	
The systems approach	
Ecosystems	

## Question type

Question type	Question numbers
<i>Context of questions</i> Routine contexts Non-routine contexts	
<i>Scenarios of questions</i> Real-world scenarios	
<i>Response format</i> Short response format Extended response	
<i>Assessment of responses</i> Closed-ended responses Open-ended responses	

## SECTION 3 - Ecosystem change

## Criterion being assessed

Criterion 6 Standard	Question numbers	Possible ratings of response
Element 1		
Element 2		
Element 3		
Element 4		
Element 5		
Element 6		

## Course coverage

Changes in ecosystems, locally and globally	
Topic	Question numbers
How natural cycles influence ecosystems	
Changes in climate	
Consequences of changes in atmospheric gas composition	
Introduced species	
Biodiversity and its importance	

Question type

Question type	Question numbers
<i>Context of questions</i> Routine contexts Non-routine contexts	
<i>Scenarios of questions</i> Real-world scenarios	
<i>Response format</i> Short response format Extended response	
<i>Assessment of responses</i> Closed-ended responses Open-ended responses	

SECTION 4 - Human dependence and impact on ecosystems

Criterion being assessed

Criterion 7 Standard	Question numbers	Possible ratings of response
Element 1		
Element 2		
Element 3		
Element 4		
Element 5		
Element 6		

Course coverage

Human dependence and impact on ecosystems	
Topic	Question numbers
Importance of ecosystem services	
Ecological footprint	
Concepts relating to pollution	
Impact of resource use	

Question type

Question type	Question numbers
<i>Context of questions</i> Routine contexts Non-routine contexts	
<i>Scenarios of questions</i> Real-world scenarios	
<i>Response format</i> Short response format Extended response	
<i>Assessment of responses</i> Closed-ended responses Open-ended responses	

SECTION 5 - Ecologically sustainable management of the environment

Criterion being assessed

Criterion 8 Standard	Question numbers	Possible ratings of response
Element 1		
Element 2		
Element 3		
Element 4		
Element 5		
Element 6		

Course coverage

<i>Principles for ecologically sustainable management of the environment</i>	
Topic	Question numbers
Concept of commons	
Ecologically sustainable development	
Environmental management	
Other strategies for management	

Question type

Question type	Question numbers
<i>Context of questions</i> Routine contexts Non-routine contexts	
<i>Scenarios of questions</i> Real-world scenarios	
<i>Response format</i> Short response format Extended response	
<i>Assessment of responses</i> Closed-ended responses Open-ended responses	