

ENVIRONMENTAL SYSTEMS AND SOCIETIES: INTERNAL ASSESSMENT: 2013-2014

The information below represents how you will be assessed on your internal assessments. It also includes guidelines on completing your work.



Planning (PL)

Levels/marks	Aspect 1	Aspect 2	Aspect 3
	Defining the problem and selecting variables	Controlling variables	Developing a method for collection of data
Complete/2	States a focused problem/research question and identifies the relevant variables.	Designs a method for the effective control of variables.	Describes a method that allows for the collection of sufficient relevant data.
Partial/1	States a problem/research question that is incomplete or identifies only some relevant variables.	Designs a method that makes some attempt to control the variables.	Describes a method that does not allow for the collection of sufficient relevant data.
Not at all/0	Does not state a problem/research question and does not identify any relevant variables.	Designs a method that does not allow for the control of the variables.	Describes a method that does not allow for the collection of any relevant data.

Data Collection and Processing (DCP)

Levels/marks	Aspect 1	Aspect 2	Aspect 3
	Recording data	Processing data	Presenting processed data
Complete/2	Systematically records appropriate quantitative and/or qualitative data*, including units.	Processes primary and/or secondary data correctly.	Presents processed data appropriately and effectively to assist analysis.
Partial/1	Records appropriate quantitative and/or qualitative data but with some mistakes and/or omissions.	Processes primary and/or secondary data but with some mistakes and/or omissions.	Presents processed data appropriately but lacks clarity or with some mistakes and/or omissions.
Not at all/0	Data is not recorded or is recorded incomprehensibly.	No processing of data is carried out or major mistakes are made in processing.	Presents processed data inappropriately or incomprehensibly.

Discussion Evaluation and Conclusion (DEC)

Levels/marks	Aspect 1	Aspect 2	Aspect 3
	Discussing and reviewing	Evaluating procedure(s) and suggesting improvements	Concluding
Complete/2	Discussion is clear and well reasoned, showing a broad understanding of context and the implications of results.	Identifies weaknesses and limitations and suggests realistic improvements.	States a reasonable conclusion, with a correct explanation, based on the data.
Partial/1	Discussion is adequate, showing some understanding of context and implications of results.	Identifies weaknesses and limitations but misses some obvious faults. Suggests only superficial improvements.	States a reasonable conclusion or gives a correct explanation, based on the data.
Not at all/0	Discussion is inadequate, showing little understanding of context and implications of results.	The weaknesses and limitations are irrelevant or missing. Suggests unrealistic improvements.	States an unreasonable conclusion or no conclusion at all.

Personal Skills

Levels/marks	Aspect 1	Aspect 2	Aspect 3
	Carrying out techniques	Working in a team	Working safely and ethically
Complete/2	Fully competent and methodical in the use of a range of techniques and equipment.	Consistently collaborates and communicates in a group situation and integrates the views of others.	Always pays attention to safety issues and shows due regard for the environmental consequences of his or her actions and academic integrity.
Partial/1	Usually competent and methodical in the use of a range of techniques and equipment.	Occasionally collaborates and communicates in a group situation.	Usually pays attention to safety issues and shows some regard for the environmental consequences of his or her actions and academic integrity.
Not at all/0	Rarely competent and methodical in the use of a range of techniques and equipment.	Makes little or no attempt to collaborate in a group situation.	Pays little attention to safety issues and shows little regard for the environmental consequences of his or her actions and academic integrity.

Planning

It is essential in order to assess this criterion that you **are given an open-ended problem to investigate**, involving a number of variables to manipulate. Although the teacher may provide a general aim or context, you must individually identify a problem or research question for yourselves. **Identify variables that may be responsible for a pattern, and design a method for collecting data.**

Aspect 1: defining the problem and selecting variables

The problem or research question must be clearly stated by the student. You must also **clearly state the relevant variables** in the investigation, including those to be measured and those to be controlled.

Aspect 2: controlling variables

It is recognized that, in fieldwork in particular, not all variables can be controlled, but the student should nevertheless **clearly identify such variables and attempt to minimize their influence** where possible.

Aspect 3: developing a method for collection of data

The method should allow for the collection of sufficient relevant data to answer the research question. However, what is considered "sufficient" will depend upon the nature of the investigation and the time available to the student.

Data collection and processing

The collection, recording and processing of primary and secondary environmental data is an integral part of the investigation. Investigations based on either primary or secondary data can be assessed here.

Aspect 1: recording data

- When data collection is carried out in groups, the actual recording and processing of data should be independently undertaken if this criterion is to be assessed.
- **Data may be quantitative or qualitative and may consist of numerical measurements, observations, drawings, maps, photographs, results of questionnaires or interviews.**
- **Primary data may be generated through fieldwork, laboratory investigations or surveys.** Use of secondary data may be the only way to investigate some topics effectively, but in this situation it is essential that students select the relevant data for themselves from a range of secondary sources, which may or may not be provided by the teacher.
- A student who systematically collects relevant data and records it clearly (for example, a well-designed table with correct units and consistent significant figures) would have fulfilled this aspect completely.
- A student who collects relevant data, but uses incorrect units, omits units or uses inconsistent or inappropriate significant figures, would have partially fulfilled this aspect.
- A student who collects little or no data, and whose results are difficult or impossible to comprehend because of the way in which they are laid out, would not have fulfilled this aspect at all.

Aspect 2: processing data

- Processing data refers to the **manipulation of raw data** before it is finally presented. In order to assess this criterion, **it is important to use an investigation that requires data processing.** This might include grouping elements from raw data, calculation of mean values, percentages, indices or statistical tests. For example, you may collect raw data from communities along a transect and process this data to provide diversity indices for each point, which can subsequently be presented on a graph. Alternatively, the results of an open-ended questionnaire on perceptions of global warming may be grouped into common elements so that percentages for each group can be calculated.
- It is important in assessing this criterion that students are given the opportunity to select their own methods of processing the data. **The written account must include evidence of this processing, for example, calculations for a diversity index, or tabulation of open-ended questionnaire data ready for graphical presentation.**

Aspect 3: presenting processed data

- **The emphasis is on selection of a method of presentation that displays the processed data to best effect and aids interpretation.** Presentation of data may take many forms, including graphical models such as kite diagrams, maps, charts, flow diagrams or annotated drawings.
- **A high level of neatness and precision, use of scientific conventions and inclusion of unambiguous headings and labels contribute to effective presentation.**
- **Unnecessary repetitive presentation of the same data set in a variety of formats is deemed inappropriate.**

Discussion, evaluation and conclusion

Once the data has been processed and presented in a suitable form, the results are discussed and reviewed, procedures are evaluated and conclusions are drawn. It is intended that this criterion should reflect the holistic approach that is central to the ethos of this course. Thus in the process of reviewing, evaluating and concluding, **you should demonstrate an ability to coherently discuss the broader significance of your findings.** Although teachers may lead class discussions on group projects for example, you must be able to produce independent discussions, evaluation and conclusions for assessment purposes.

Aspect 1: discussing and reviewing

In the discussion, you should review and analyze results and consider them in the context of relevant literature, accepted scientific understanding/models and class discussions as appropriate. This could include identification of trends, patterns and/or anomalies that may or may not agree with established theory. The assessment of this aspect requires an investigation that allows for discussion within such contexts.

Aspect 2: evaluating procedure(s) and suggesting improvements

You should evaluate your investigation in a constructive and reflective way, **recognizing strengths but also using weaknesses and limitations to suggest realistic improvements.** You may consider procedures, limitations of equipment, use of equipment, management of time, investigation timing, data quality (accuracy and precision) and relevance of data.

Aspect 3: concluding

You are expected to **provide a concise and clear conclusion** that is supported by the evidence from your data and your discussion.

Personal skills

This criterion is assessed summatively once only at the end of the course.

Aspect 1: carrying out techniques

The effective student should **be able to carry out a range of techniques competently**, follow instructions, and assemble and use equipment with precision and accuracy.

Aspect 2: working in a team

Working in a team is when two or more students work on a task collaboratively. Effective teamwork includes recognizing the contribution of others. There is an expectation that all team members contribute and are encouraged to contribute by the rest of the team. This will be demonstrated in the exchange of ideas, and an ability to integrate ideas into decision-making.

Aspect 3: working safely and ethically

Students should adhere to safe and ethical working practices, demonstrating academic integrity, for example, properly citing secondary sources, not falsifying data and avoiding plagiarism. Due attention to environmental impact may be demonstrated in various ways, including avoidance of wastage, using safe waste disposal, and minimizing damage to local environments while undertaking an investigation.

Primary Productivity Lab

(sample lab)

Teacher's instruction sheet

Primary Productivity

1. Measuring primary productivity in Elodea and Algae

The rate of oxygen production and photosynthesis can be estimated by measuring the amount of dissolved oxygen and how it changes over time.

To do this a technique called the "dark/light bottle" is used. Here the oxygen concentrations are measured and compared before and after incubation in light and darkness. The usual incubation time is 5 days.

The differences between the measurements of dissolved oxygen (DO) give an indication of:

1. Respiration: Initialbottle–darkbottle
2. NetProductivity: lightbottle–initialbottle
3. GrossProductivity: lightbottle–darkbottle

Design an experiment to look at an abiotic factor that should alter the primary productivity. All criteria will be assessed for this investigation.

STUDENT SAMPLE WORK: SEE STUDENTS SAMPLE WORK

Assessment of Sample Lab and Feedback

Criterion	PI	DCP	DEC
Achievement level awarded	6	5	5
Achievement of aspects	c, c, c	c, c, p	p, c, c

Planning

Defining the problem and selecting variables

Complete

The aim is focused, the organism used is correctly identified and a prediction is given. Although this is not a requirement for the assessment of the planning criterion, it does help to identify the independent and dependent variables. No background information is included as some is given in the teacher's instructions. The variables are specifically identified.

Controlling variables

Complete

The student attempts to keep the conditions the same in each test. The *Elodea* length and type of bottle used, how the samples will be placed under the light, and the method used to attach the overhead projector sheets are all stated.

Developing a method for the collection of data

Complete

The samples of pond water are all from the same pond. Although the data collection is automated using a data logger, the student is responsible for the settings in the data collection. This is sufficient for aspect 3 of the planning criterion. Three replicates are performed for each light level and two samples at each light level are tested. The subjective nature of the stirring probe is offset by the six results recorded for each light level.

Data collection and processing

Recording data

Complete

The raw data from the two samples is recorded three times in a clear table. The units are given. The uncertainty of the probe is not given—this is not necessary as the probe reading is given three times for each sample.

Processing data

Complete

The averages of each dissolved oxygen (DO) level are calculated correctly and tabulated. The calculations for respiration, gross primary productivity (GPP) and net primary productivity (NPP) are correctly calculated and tabulated.

Presenting processed data

Partial

The calculations are presented as bar charts, which allow for effective analysis to support or disprove the prediction. The x-axes on the graphs, however, are not a continuous scale and so the relationships shown are misleading. This is a typical error when students use spreadsheets to plot graphs.

Discussion, evaluation and conclusion

Discussing and reviewing

Partial

The student is expected to include some explanation as to **why** light decreases with increased depth, and to mention some of the ecological implications of this (for example, decreased productivity in benthic areas, or plants that absorb at different wavelengths).

There is no reference to research literature.

Evaluating procedure(s) and suggesting improvements

Complete

The main weaknesses of the investigation, as revealed by the data that is collected, are identified. Realistic improvements are proposed for these weaknesses.

Concluding

Complete

A reasonable conclusion is stated based on the data obtained. The student makes an attempt to explain what has occurred.