

ENVIRONMENTAL SYSTEMS AND SOCIETIES

Overall grade boundaries

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 13	14 - 26	27 - 37	38 - 50	51 - 61	62 - 73	74 - 100

Standard level internal assessment

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 7	8 - 14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 42

General comments

This was the first November session of this course.

There were some wonderful practicals, two of which are mentioned below. One looked at the effect of salinity on germination and later plant growth. While this has been done in the past, this practical was different in that the candidate was trying to establish the threshold at which salt in the soil started to impact growth measurably. This is a nice departure from previous practicals. Too often when looking at the effect of pH of salinity or some other abiotic parameter, candidates use a control and then an amount of acid or concentration of acid, or amount of fertilizer that is so extreme that there is very little useful data gathered. Using the example of pH, very often the results for the seeds that are treated with acid is 0% germination and 100% for the control. Candidates will gain much more information from using concentrations that are similar to those found in the field. Another very ambitious practical looked at the impact of the number of blades on a model windmill, and the best arrangement for a group of windmills with respect to changing wind direction. These model fans were connected to a multimeter and recorded changes in current with the varying conditions. Beautiful work and well carried out.

The use of local ecosystems when doing fieldwork is highly recommended as it allows the linking together of topics in the syllabus, giving candidates a holistic view of their area and the application of the theory in a practical way. Commonly used simulations that have been altered to match the local conditions are to be encouraged, for example, Simpson's diversity simulations from Europe converted to use local Australian flora.

Candidate performance against each criterion

Planning (PI)

Although the formulation of a hypothesis is no longer strictly necessary, many centres continue to require it of their candidates. One of the strengths of this approach is that a well-written hypothesis clearly sets out the dependent and independent variables, and the identification of these is an area of relative weakness among candidates. Being able to select relevant variables for Aspect 1 of the planning criterion is a skill that may require direct instruction for weaker candidates. Teachers should consider having candidates read hypotheses and/or research questions and identify the dependent/independent and controlled variables.

Aspect 2 requires candidates to develop a method for the effective control of variables. Some centres are misinterpreting this to mean that a candidate needs to identify the control in the experiment. A broader approach is required. Candidates need to be able to develop a method that results in a “fair” test or one in which reasonable attempts have been made to remove bias. For example, a practical that includes sampling of quadrats should include some description of how these are to be selected. For the candidate to indicate that quadrats were selected randomly is not sufficient - the method to ensure randomness should be stipulated. If a candidate is comparing germination of plants under different salinity conditions, the method should indicate how temperature, moisture, and other variables are being controlled in order to ensure that the results are comparable.

Aspect 3 involves the collection of sufficient relevant data. There were too many practicals in which candidates used one plant for each treatment in their design. This is troublesome because it may imply that candidates have not had sufficient instruction in designing practicals. As this particular problem is so easy to correct, it would seem that over the course of two years even weaker candidates ought to be able to design a practical in which, for example, 10 plants were used for each concentration of pH as opposed to one. It is frustrating to see candidates lose marks for a concept that ought to be easy to understand.

Data collection and processing (DCP)

Most centres are carrying out practicals where candidates have an opportunity to collect data that is then organized in good tables. However, many candidates lost marks in Aspects 2 and 3 of this criterion. Aspect 2 requires candidates to process data, and Aspect 3 to present this processed data. These aspects are closely linked, and a candidate that graphs raw data and does nothing else (for example, taking one temperature reading at ten different sites on a river and then graphing these) will receive zero marks for processing, and zero marks for presenting processed data. In this situation the error carried forward does not apply. Teachers should provide candidates with opportunities in which the data collected lends itself to some form of processing, i.e. calculation of averages, standard deviations, cumulative frequencies, diversity indices. It is discouraging to see candidates collect ten samples of a given parameter, calculate the average and not find the standard deviation, which provides such rich information. When a candidate who has received very high marks by their teacher, measures the length of a plant on 15 successive days and then averages these fifteen readings, it is evident that the candidate has not received a lot of instruction regarding the meaning of an average. The use of simple statistics such as these is expected of Environmental systems and societies candidates. When data lends itself to these sorts of analyses and the candidate has not carried them out, Aspect 2 of the criterion may be penalized.

Aspect 2 is often penalized for accuracy levels once the processing has been done. If plant lengths are being measured with a ruler that reports millimeters, the average of these data should not be reported to 8 decimal places. The processing should be checked by the teacher for accuracy before being awarded a complete as candidates often make calculation errors that are not picked up.

Discussion, evaluation and conclusion (DEC)

DEC continues to be the most challenging criterion to assess, particularly Aspect 1 and Aspect 3. The discussion requires candidates to take a critical look at their data and place it in some sort of context. For example, when comparing two different averages, a candidate should comment on the standard deviations of their data. If the data departs significantly from what was expected, the candidate should make some comment about the reliability of their data, and what factors should be considered when interpreting the data.

Aspect 2 of DEC requires candidates to look at their method critically and offer improvements. To take up a thought introduced in the planning section, by the time candidates are carrying out practicals that will be used for moderation, they should be able to recognize that one plant in each of two different treatments may or may not be representative of what might happen with a larger sample. It is always surprising that candidates do not suggest the collecting of more data as an improvement. It is rare that there is enough data to make a strong statement about what is being observed, and collecting more data is usually one of the most important improvements a candidate can make. When in the evaluation section of a practical on the greenhouse effect, a candidate makes recommendations about how humans can avoid planetary climate change, it is clear that this candidate has not received a lot of instruction regarding what is expected to fulfill this criterion.

Finally, Aspect 3 of DEC requires that candidates provide a conclusion that refers back to their data. Often candidates miss a mark because their conclusion does not refer back to their findings in any meaningful way.

Recommendations and guidance for the teaching of future candidates

On a clerical note, some centres used the 4/PSOW form and group 4 assessment criteria, and this differs significantly in this last criterion. The correct assessment criteria for Environmental systems and societies as well as the ES&S/PSOW form must be used.

It is recommended that candidates are directly taught some of the necessary skills. For example, how many samples are reasonable? What are the variables that might affect the outcome of this experiment, and how can they be controlled? Candidates should be provided with data tables and asked to process the data.

Starting the course with guided investigations showing good practice in PI, DCP and DEC is useful. Less guidance can be given as the course progresses, until the candidates can confidently and successfully complete an investigation that can be assessed using the IB criteria.

The teacher support material and teacher resource exchange and forums have a number of ideas to help with guiding candidates to success in the investigations to be assessed. These can all be found on the OCC homepage for the subject.

Standard level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 5	6 - 11	12 - 17	18 - 23	24 - 28	29 - 34	35 - 45

General comments

As in previous sessions, very few teachers completed the G2 form. The information is valuable as feedback and we encourage teachers to submit G2 forms.

Only one centre felt that the exam was harder than previous years. The majority deemed the examination of the same difficulty as previous years and the level of difficulty as appropriate. One centre felt the syllabus coverage was poor. All deemed the paper suitably presented and satisfactorily clear in its wording.

The areas of the programme and examination that appeared difficult for the candidates

In general, candidates were quite weak at being able to think laterally or to apply their knowledge to novel questions. For example, many candidates did not think about the plant as an organism which respire. Candidates struggled when asked to think about the interplay of different societal sectors with regards to sustainable development (Question 3). Environmental value systems were poorly understood to the extent that many candidates could not even provide a definition for the term 'environmental value system' (Question 3 (a)).

Candidates seem to struggle with responding to the command term used in the question. For example, in Question 1 (a)(ii) some candidates explained why water is scarce, rather than describing a pattern.

Overall this paper seemed to be slightly harder for candidates than in previous sessions. The questions addressed a number of areas that candidates struggled with, such as system diagrams and feedback systems.

The area of the programme and examination in which candidates appeared well prepared

Candidates did well on the topic of biodiversity and were able to describe a case study, define biodiversity in multiple ways and describe some of the factors which impact the conservation status of an organism. The case studies were varied and showed that candidates had studied local issues related to biodiversity. Candidates did well on being able to give basic responses to questions that were factual in nature and requiring basic responses, for example Question 2 (a). Similarly, candidates were able to identify the priority for different sectors of society with regards to sustainable development (Question 3 (b)(i)).

The levels of knowledge, understanding and skill demonstrated

There was a wide range of ability and knowledge shown but in general, candidates demonstrated an adequate level of knowledge. Candidates who answered questions well seemed to be drawing on direct experience with topics. However, in some cases, candidates referenced work they had done rather than addressing the question being asked.

The strengths and weaknesses of the candidates in the treatment of individual questions

Question 1

- a) (i) Candidates did well on this question. One G2 response commented that the term 'water scarcity' is not in the syllabus. The aim of this question was for candidates to use Figure 1 to determine the meaning.
- (ii) As mentioned previously, some candidates explained why water is scarce instead of describing a pattern. The majority of candidates mentioned MEDCs/LEDCs and the distribution of physical water scarcity along the equator.
- b) (i) Almost all candidates earned some marks for this question. Some candidates failed to label stores and processes. One centre commented that the question (overall) had a heavy emphasis on assessment statement 2.5.4. However, it also encompassed elements of 1.1.7, 1.1.8, and 1.1.9.
- (ii) Some candidates struggled with this question. Responses were poor as candidates did not annotate the diagram and instead made a list for showing what humans withdraw (e.g. groundwater) or where they withdraw it, but not *how* it is withdrawn.

Question 2

- a) Many candidates missed that plants respire and so only received one mark of a possible two.
- b) Transformations were very well understood by candidates. Transfers were confused with transformations - candidates often provided four transformations and no transfers. A few candidates stated that carbon dioxide is transformed to oxygen during photosynthesis. Although little chemistry is required for this course, it is important that the candidates have accurate conceptions about the chemistry they do need to learn.

Question 3

- a) A number of candidates were unable to answer this question.
- b) (i) This question was done very well by candidates.
- (ii) Examples of the type of activity a banker or a conservation biologist does to help sustainable development were weak for various reasons. Some candidates did not give an example that related to sustainable development while others did not give an example which applied to that sector. One comment on the G2 form was that 'banker' could be very differently defined by candidates and that clarification (e.g. green banker) would have made it clearer.

- c) Candidates did very well, providing a wide range of responses. Several candidates provided more than two good answers.

Question 4

- a) Most candidates responded adequately but other responses were too general in their description (“the water content increases”).
- b) This was largely well done by candidates, demonstrating that they were able to interpret the graph and apply their knowledge of soils.
- c) Many candidates did not mention the units (per unit area per unit time), and therefore did not receive the mark for this question.
- d) Candidates did very well on this part question.

Question 5

- a) and b) Candidates did well in defining biodiversity and in providing some reasons for how plate tectonics contributes to biodiversity.
- c) (i) Candidates did very poorly on this question and very few achieved two marks. Some factors were not ones that are used for the Red List criteria though they may be criteria that are used locally or regionally.

(ii) This was generally well done, though a few candidates named a species that is not endangered or critically endangered.

Question 6

- a) The candidates who struggled with this question either provided an indirect method (such as BOD) or misread the question, responding with methods for *controlling* pollution.
- b) Surprisingly, around half of candidates provided an incorrect answer to this question.
- c) This was answered very well by the majority of candidates.
- d) Some candidates demonstrated their misconceptions about global warming and ozone depletion by describing the Kyoto Protocol. However, for many candidates this question was answered well enough for two or three marks.
- e) Very few candidates achieved three marks and it therefore served to discriminate stronger candidates. Candidates who responded throughout with global warming related issues, were credited if positive feedback was correctly described.

Recommendations and guidance for the teaching of future candidates

Although Topic 7 (Environmental value systems) is not a large topic in itself, it underscores many of the overall aims and objectives of the course. Topic 7 should not be taught as an isolated topic, but should be taught early in the programme of study and instilled into most of the topics candidates explore.

With topics that candidates struggle most (such as negative and positive feedback), encourage candidates to start answering such questions with basic definitions. This may earn them at least a mark, even if they are unable to apply their knowledge to the question for full marks.

Common and difficult misconceptions exist between global warming and ozone depletion, and the idea that plants don't respire. These misconceptions are quite resistant to instruction, though research shows that giving candidates hands on experience that disprove their misconceptions will help them learn such concepts correctly.

Candidates sometimes made elaborate diagrams, particularly of the water cycle to the point of even colouring their image. Many candidates ran out of time and so it is important that part of their examination strategy is to keep diagrams simple. Encourage candidates to draw diagrams as labelled boxes rather than actual pictures. Similarly, in Question 3 (b)(ii), some candidates wrote lengthy descriptions for priorities rather than using the single word provided in Figure 2.

Standard level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 8	9 - 16	17 - 22	23 - 30	31 - 37	38 - 45	46 - 65

General comments

The number of G2 forms received was disappointing. The paper was considered to be at an appropriate standard. The level of difficulty was mostly appropriate, though two centres thought the paper was too difficult. The syllabus coverage, clarity of wording and the presentation of the paper was rated as satisfactory or good.

The resource booklet and Section A questions were considered challenging and there was a concern about the time needed to go through the information. The term 'eluviation' was used in Figure 5 (b) of the resource booklet. Candidates were not expected to necessarily know this term. The use of a general soil profile and then the specific one for the prairie system was intended to be complementary.

Comments on the G2 forms indicated that the Section B essay questions "were particularly good with a broad range for the candidates to choose from to best show their abilities", an "interesting paper that should have enabled candidates to show their understanding".

There was a clear preference for Questions 3 and 5 in Section B. However, approximately a quarter of candidates attempted Question 2 and Question 4. This indicated that candidates were prepared for the first November session of this course.

There was some concern about the use of command terms in the questions. The assessment statement command term does not have to be the one used in the examination. A command term used in an examination question will either be the same as that in the assessment statement (at a particular objective level) or a less demanding command term (at a lower objective level). Alternatively, another command term at the same objective level can be used. For example, if the assessment statement is at objective 3, then a question can be set using a command term at objective 1, 2 or 3. Candidates should be familiar with the command terms to understand the depth of treatment required in examination questions.

The areas of the programme and examination that appeared difficult for the candidates

Time management seems to be a problem with candidates spending time, and writing far too much for questions worth only a few marks. This usually means responses were not sufficient to allow the candidates to gain maximum marks on questions worth several marks. The compound nature of many of the questions meant that candidates often left some aspects unanswered.

Section A (Question 1), which requires the use of the resource booklet, proved problematic to the weaker candidates. Many gave simplistic, non-analytical answers and seemed to answer some of the question parts using quotes from the resource booklet.

In Section B, many of the part (c) answers wandered off topic and so gained few marks. The 'evaluate' or 'justify' command terms were generally not effectively addressed. There was a tendency for the candidates to focus on the content in the question rather than the command term. This meant that they wrote about the concept, endangered species or population growth or global warming, but they did not link their answer to the command term and so gained few, if any, marks. The use of specific named examples also proved to be an issue. Candidates gave very general examples that were not appropriate. Fish in lakes and fish in the oceans or forests for a biome or climate change for an historical influence – all of these are not detailed enough for the question asked.

Continuous prose can be problematic as in some cases it was very difficult to see where one part of the question ended and the next started.

The areas of the programme and examination in which candidates appeared well prepared

Candidates showed a solid understanding of the basic content of the course. Many showed that they could use the case study and extract relevant information. The drawing of the diagram in Question 1(b) was attempted by the majority and did gain marks for most. Though a typical systems diagram was not usually drawn, candidates need to be able to apply the systems approach to all other areas of the courses.

When clear examples were used they were detailed and supported the answer. When questions were misinterpreted but good examples were used then expression of ideas marks were often awarded.

In terms of content, candidates showed good understanding of global warming, succession and population strategies, application of value systems and population growth. Many candidates could draw and label the survivorship curve (Question 5 (a)).

The strengths and weaknesses of the candidates in the treatment of individual questions

Section A

Question 1

- a) (i) The majority of candidates gave two correct answers. Others were too general stating grasslands or forests. The question should be read carefully as a number gave only one answer and so did not gain the mark.

(ii) This question proved to be problematic for candidates. They generally gave answers that were not in the resource booklet and from their own knowledge of what can potentially interrupt succession. Habitat destruction and hunting were common answers that were incorrect.

(iii) Candidates showed good knowledge of mutualism and predation and used the examples from the case study. A few gave answers from their own knowledge. A minority did not understand the terms mutualism and predation.

- b) Few candidates actually attempted a typical systems diagram for the soil system. Many responses were too vague. However, many drew elaborate cycles showing inputs and outputs from the soil, gaining some marks. The time spent on the drawings could have been saved with simpler representations. Construction of systems diagrams is an essential part of the course and is mentioned in the assessment statements and teachers notes in most topics of the course.

The candidates found the inputs easier than the outputs in the system.

- c) (i) Candidates gave detailed answers. Most mentioned the large bison population and the small numbers taken, how all the bison parts were used and how the American Indians used fire to maintain the grassland habitat. In some cases, only one point was made and repeated. Candidates should take care to ensure that they differentiate their answers to gain all the available marks.

(ii) Answers to this question were often quotes from the resource booklet. This did not allow the question to be answered effectively, as the quotes did not explain the change in the resource status over time. Candidates found the application of resource status to an animal hard to interpret. The most common answers revolved round the change in use from food source to tourist resource.

- d) (i) The majority of candidates gave correct answers for this question. A few mentioned population changes rather than range size changes. Candidates did not need to explain the answer as this is not part of the question asked.

(ii) Candidates showed clear understanding of the knock on impacts to a foodweb and could state how the rabbit population would change. Candidates should clearly mention how the rabbit population would increase or decrease as this important point was often left out of the answer, though the change was implied.

- e) The long stem to the question seems to have confused candidates. Many focused on the ecological factors and not the economic and cultural factors specifically mentioned in the question. This was another question where quotes were often used, and these did not answer the question.

- f) (i) Candidates generally gained marks here; a few used the quotes from the resource booklet. Many only gave one point and repeated it in a number of sentences.

(ii) For most candidates, this question proved to be difficult to gain full marks. The environmental philosophical terms 'deep ecologist' and 'environmental manager' seemed to be difficult to apply to the conservation of the bison. The candidates are expected to be able to apply the philosophies in Topic 7 (Environmental value systems) to other areas of the course.

Section B**Question 2**

- a) The named food production systems were generally poorly done. This meant that maximum marks could not be gained, even if the environmental impacts were fine. When candidates gave detailed examples they generally answered this question very well.
- b) The knowledge of international policies was poor. Candidates could discuss the factors influencing population growth in LEDCs but gave very general policies. Most candidates did try to make the link however and it was pleasing to note that few answers were just lists of ways to reduce population growth.
- c) This question requires careful reading and a plan of how to answer in order to ensure all the parts were mentioned. Most answers did mention contrasting countries but the links to the factors social, food and population were weak. Very few examples gave specific examples to the country mentioned. The relationship between food and population was generally done well but the link to social systems proved difficult for the candidates.

Question 3

- a) This question gave a variety of answers. Many answered this very well for the example, the distribution and productivity. The structure of the biome was often the aspect that gave the most difficulty. Many answers were detailed on the vegetation and animal adaptations but not on the structure. The global warming link was not done as well. Candidates found the linking the specific parts of the biome to global warming difficult. Some answers gave icesheets, which is not a biome.
- b) Most candidates could attempt an answer here that gained marks. Some did wander off the topic of the question and described global warming in general. Many candidates showed a wide knowledge of the issues of uncertainty and answered this question well. Few candidates gave a really critical discussion.
- c) Most candidates wrote a long answer here that did not always address the question. The justification for each change suggested was often missing and many answers were a list of ways individuals could reduce their use of resources, mainly linked to reducing their carbon emissions. Candidates often went off point with ecological and carbon footprint discussions.

Very few candidates justified their answers using a persuasive argument.

Question 4

- a) Many candidates wrote long answers for this question, though only three marks are available. Many gave very interesting historical influences. Most candidates gave historical influences that were rather vague. Many mentioned environmental philosophies or global warming – possibly using other questions to give them ideas? Despite this, most could at least describe the role of their chosen influence to gain some marks.
- b) Most candidates made a good attempt at answering this question. They mainly commented on both quotes with the Gandhi quote usually in more detail. The discussion on carrying capacity was generally fine but some candidates showed confusion with ecological footprints. When candidates mentioned the environmental value system they usually did this well. However, a significant minority did not include a reference to the environmental value system.

- c) The description of ecocentric and technocentric responses to eutrophication was done well. Only the stronger candidates tended to do well on the evaluation part of this question. The weaker candidates often left out the evaluation altogether or gave simplistic answers involving costs only. The candidates showed that they understood the concepts involved in this question.

Question 5

- a) This question gave rise to a wide variety of answers. Some drew clear, well labeled diagrams with examples and others confused survivorship curves with J and S curves or predator/prey graphs. The labeling of the y-axes presented the most problems for the candidates who drew the correct shaped graphs. A few candidates confused r and K species.
- b) This was generally well done, showing a clear understanding of succession. Linking the r and K strategies to a specific part of succession proved more difficult for the weaker candidates. These candidates tended to list the characteristics of r and K strategy species. A few candidates confused r and K strategies and also where they appear in relation to succession.
- c) This part of the question was mainly misinterpreted. Most candidates discussed endangered species and conservation techniques rather than population dynamics. The answers were generally long and so touched on aspects of population dynamics. Common answers were the size of the conservation area for meeting mates, time to mature and breed and fragmentation. However, these correct answers appeared in the middle of answers that focused on humans and the destruction of habitats. The use of examples was rare, but when they were done it usually gained the candidate marks.

The question requires application of population concepts in Topic 2 to Topic 4. Most candidates failed to do this. The candidates need to read the question carefully before starting to answer – the question is asking why is the study of population dynamics important when trying to conserve a species.

Recommendations and guidance for the teaching of future candidates

Please complete the G2 form after the examination as this helps with the development of the examinations for future sessions.

The resource booklet and the Section A questions are design to follow a format. The case study can be set anywhere in the world and basic information on location and characteristics are given in the booklet. The answers will be able to be taken from the resource booklet and then the content learnt during the course will be applied to this case study situation. Candidates should be exposed to the resource booklet and questions. This will allow them to become familiar with the timing and the style of this section of paper 2.

Candidates should be shown how to interpret the question carefully, paying attention to bold words indicating the numbers of answers to gain a mark or where the answer should be taken form, for example the resource booklet.

Encourage candidates to draw large, clear diagrams when required and to include them in answers when it would help with an explanation. Diagrams should be simple box/arrow types rather than pictorial. Intricate pictures take time and often lead to ambiguity. The flow diagrams style is often clearer.

Candidates should be encouraged to give precise answers rather than vague ones. The use of clear examples could also be used to illustrate this.

Candidates should be familiar with the command terms and be aware that a question may contain more than one command term. To gain full marks both command terms must be addressed in the answer.

Remind candidates that the final part question for each essay is likely to require more evaluative/discursive/higher-order thinking, so simple descriptions will not score highly. Candidates need to read these carefully and make a simple plan before starting to write.

Candidates should use their own case studies to answer the essay questions rather than taking ideas from the case study. They should have greater knowledge of the ecosystems they have studied.