Environmental systems & societies

Overall grade boundaries

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0-12	13-25	26-34	35-45	46-57	58-68	69-100

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

The range and suitability of the work submitted

The May 2016 IA moderation exercise is the last of the current model for May session school, and so it might seem that the following comments are necessarily dated. However, the skills do not change in the "new model" and these are perhaps the areas where students still need help. Having said that, there are obviously many schools that have really perfected their programs under the current model, and will have to make some adjustments for the new model.

In general, the types of activities that schools are carrying out are ideal for teaching the skills that students should acquire through a course of this nature. Students are given opportunities to engage in serious laboratory work as well as in fieldwork and perhaps most difficult, work involving the exploration of attitudes and beliefs in their communities.

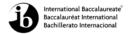# Candidate performance against each criterion

Planning

In this criterion the problems centre on being able to focus a [research] question that is suitable for exploration in a high school context. The lack of a good question invariably leads to problems identifying the relevant variables and this of course has a knock-on effect on the methods designed by students. This will have greater significance in the new model, as students engage in a single activity rather than a number under the current one. It is crucial that teachers invest time in helping students acquire these skills. There are some problems also with methods that can gather sufficient relevant data. The key words here are sufficient, and relevant. There are still schools whose students are using one plant each for three different treatments to determine the effect of acid rain on growth, for example. This is a topic that has been addressed in these reports practically every year. The concept of relevance on the other hand, becomes especially important when designing surveys. Often the types of questions being asked lead the responder, or are ambiguous or are very difficult to score/quantify the outcomes. This is an area that will definitely require direct instruction for most students.

Data processing and presentation (DCP)

Candidates continue to lose marks in Aspect One of DCP for really simply mistakes, and because the teacher does not penalize them, the students do not receive the feedback necessary to drive the changes they need to make. The three most common mistakes are the absence of a good explanatory title, the inclusion of units in individual cells, and the reporting of data to a variety of decimal places. These are simple to correct and given that students are allowed to turn in a first draft, it is surprising that practicals are sent for moderation that include these mistakes.

In Aspect Two of DCP the most common mistakes are the lack of sufficient depth in processing, the lack of correctly worked sample calculations and the reporting of results to inappropriate numbers of decimal places. The first of these problems requires significant work on the part of the teacher. Students may not necessarily know or be familiar with the various analytical techniques available to them for processing data. For example, simple statistics such as the median and the mode can be really powerful methods for analyzing survey data. Cumulative frequency curves are also useful and hardly ever used. Perhaps the issue is with teacher's level of comfort with alternative analytical techniques. What is clear is that candidates are required to go further than the calculation of a simple average for full marks. The lack of correctly calculated examples and the use of significant figures are simple enough to fix, and require good feedback from teachers.

The third aspect of DCP requires the presentation of processed data. Students continue to lose marks on this aspect for presenting unprocessed data and for the lack of titles and labels on their graphs. All three of these problems should be caught early in the program and corrected. Another problem that teachers should correct is the drawing of spurious lines of best fit. Excel will draw any line of best fit when instructed to do so, without regard to the degree of correlation of the two variables. Consequently, if students are not taught how to interpret this information they may comment on a trend line when the correlation coefficient is close to 0.
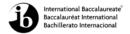
Discussion, Evaluation and Conclusion (DCE)

There were some examples of really excellent discussion of data in this exercise. These students were able to successfully discuss the data they had gathered, identifying patterns and trends, and commenting on how meaningful these were. They also placed their work in a suitable context. Weaker candidates tended to restate their findings but were unable to comment on trends and patterns and in many cases made no reference to context or theory. This first aspect of this criterion is challenging and requires considerable thought to gain full marks. Teachers should consider reading scientific papers or material available on the OCC with their students to improve their understanding of what is required. These skills will be necessary in the new model, although in different criteria.

The second aspect of DEC requires a thorough evaluation of the work carried out, including an analysis of strengths and weaknesses and how to best address the latter. Unfortunately, weaker students tend to focus on their weaknesses, be these organizational or attitudinal. Typically, this sort of evaluation will receive few if any marks. What is expected is an analysis of the shortcomings of the method employed. For example, when using a kick net, even if well used, there are inevitable questions of repeatability, the representativeness of the sample, and the influence of seasonality. When using quadrats, the same questions apply. Students need to be aware of these issues because they are directly related to the quality of their data. All of these problems can be dealt with to a greater or lesser extent, and this is what is required for the improvements. Again, these skills will also be addressed in the new model.

Finally, students need to come to some conclusion about their work. The most common errors in this aspect are the failure to cite data in support of the conclusion and the lack of a correct explanation. It is a pity to see students come to a reasonable conclusion and lose a mark for not citing their data or not providing an explanation when both of these are clearly within their capabilities.

In preparing candidates for the new [assessment] model, all of the comments above are valid. The skills that will be measured are very similar, although there are some important organizational differences. In addition, there are a few new skills, although many programs already address these. For example, it is quite typical for practicals to include some sort of introduction or theoretical context and of course the new model assesses this directly. Many students already include safety concerns in their reports, and this will now be formally assessed. So although there are new skills included in the new model, few if any of the old skills have been set aside. Probably the most significant change will be the requirement for students to produce a complete, integral practical in which all skills are assessed simultaneously. Material is already available on the OCC and teachers are strongly advised to read it.

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Standard level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-6	7-13	14-18	19-23	24-28	29-33	34-45

General comments

The majority of respondents (over 90%) to the G2 questionnaires confirmed that the level of difficulty of Paper 1 was 'appropriate' for an SL paper, although 5% of respondents considered it to be 'too difficult'. When compared to May 2015 paper, 51.8% of respondents considered the May 2015 to be of a similar standard whereas 14.36% respondents thought it was easier and 25.18% believed it to be more difficult.

Most respondents considered the clarity and presentation of the paper to be fair or better. The majority of respondents also agreed that questions were accessible to all candidates with learning support and irrespective of religion/belief system, gender or ethnicity.

Other salient points from the G2 respondents include:
- Coverage of syllabus was appropriate.
- Paper was well balanced and clear.
- Figures used could be clearer.
- Figure 4 was an unusual and potentially difficult graph to interpret although in general students answered the associated questions well.
- There were two questions with 5 marks rather than a maximum of 4 marks as in previous papers (e.g. there were two questions each allocated 4 marks in the May 2014 paper). Hence these questions required a more extensive response, traditionally typical of Paper 2 questions.

 Candidates performed significantly better on Paper 1 this session than in May 2015. The provisional mean mark for May 2016 was 20.26 (standard deviation 8.03) compared to the mean for May 2015 of 15.74 (standard deviation 6.26). However, it was slightly lower than the mean for May 2014 of 22.60 (standard deviation of 6.88).

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

- The carbon cycle.
- Explaining the concept of natural income and explaining how maximum sustainable yield could be calculated.
- Understanding the significance of measuring ecological footprints in global hectares per capita and how the ecological footprint can be used to try and achieve sustainability.
- Calculating percentage increase.
- Distinguishing between stratospheric and tropospheric ozone and understanding of human activities that affect these levels.
- With evaluation questions students often only listed the strengths and weaknesses and did not offer an appraisal supported by evidence.

The areas of the programme and examination in which candidates appeared well prepared
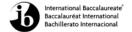
- Describing a method to estimate population size.
- Identifying relationships between species and trophic levels of species.
- Defining an open system and identifying outputs from a system.
- Interpreting data from figures.
- Identifying greenhouse gases.
- Application of positive feedback mechanisms to global warming.

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

1a		Many students were able to clearly define the term species. A common error was to give a generalised definition e.g. species that have common characteristics.

1b(i)		Responses varied widely. Common mistakes included not giving 'paired contrasting features' but describing two different features or using generalised terms such as 'thin' or 'fat'.

1b(ii)		Many students correctly stated a limitation to using keys

1c		This question was generally answered well. Most candidates achieved some marks for this question with many attaining full marks.

1d		Most candidates correctly identified 'competition' as the relationship between oystercatchers and avocets.

1e(i)		The majority of candidates answered this question correctly.

1e(ii)		Response to this question was variable. Common error was not to directly answer the question or ensure the response referred to flows or stores within the carbon cycle.

2a(i)		The majority of candidates correctly answered this question.

2a(ii)		Most candidates were able to clearly identify two outputs from the lake.

2a(iii)   Responses varied widely. A common error included referring to natural income as monetary income. In some cases, no reference was made to the lake as requested.

2a(iv)   Few candidates explained how maximum sustainable yield (MSY) could be calculated. Many candidates confused MSY with carrying capacity.

2a(v)   Responses varied widely with some candidates clearly identifying 3 correct strategies, however many responses lacked sufficient detail e.g. answers just stated 'legislation' or 'clean up'.

3a(i)   The majority of candidates correctly answered this question.

3a(ii)   The majority of candidates correctly answered this question.

3a(iii)   Many candidates correctly answered this question.

3b   Responses varied widely with some very good answers. A common error was to compare incineration to landfill rather than to recycling.

4a(i)   Few candidates correctly answered this question. Many candidates did not check difference in scale between the two graphs and incorrectly thought that China had a greater ecological footprint.

4a(ii)   Many responses gave generalised responses. E.g. increase in industry without reference to how this impacts on the ecological footprint such as through use of greater resources or production of more waste.

4a(iii)   Candidates often incorrectly explained what ecological footprint is rather than giving an advantage of its use.

5a(i)   A significant number of candidates incorrectly carried out this calculation for percentage increase resulting in a wrong answer.

5a(ii)   Most candidates answered this question well.

5b   Responses varied widely for this question. Although there were some very good responses, some candidates had a poor understanding of positive or negative feedback mechanisms. Some answers were too generalised and did not refer to global temperature.

6a   Responses varied. A common error was to confuse stratospheric ozone with tropospheric ozone.

6b   Responses varied widely. Very good responses were able to correctly apply their knowledge of the Montreal Protocol and ozone depleting substances to the trends observed within the data. Poor responses did not relate changes within the data to the year of the Montreal Protocol or confused Montreal with the Kyoto Protocol and greenhouse gas emissions.

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Recommendations and guidance for the teaching of future candidates

- Ensure students understand key terms and concepts and are able to apply this to different situations and scenarios.
- Ensure students understand the requirements of each command term.
- Emphasize the importance of reading questions carefully and train students on how to answer directly.
- Ensure students practice interpreting graphs and charts.
- Ensure students practice calculations based on data from figures.
- Advice students not to write outside the box or leave responses blank.
- Cover the whole syllabus in sufficient detail. This includes ensuring students:
  - are able to construct a dichotomous key and understand its limitations
  - understand the carbon cycle
  - understand concept of natural income and sustainable yield
  - understand the use and implications of ecological footprints
  - understand the difference between stratospheric and tropospheric ozone; the role of human activity on these ozone levels and associated impact on humans
  - understand the strengths and weaknesses of the Montreal Protocol.

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Standard level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-6	7-13	14-17	18-24	25-32	33-39	40-65

General comments

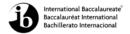## The areas of the programme and examination which appeared difficult for the candidates

139 schools completed the online G2 form. 130 in English and 9 in Spanish. This is an improvement on previous years. Overall 70% found the difficulty level of the paper appropriate and 30% found it too difficult. In comparison to last year's paper 40% found the paper to be of a similar level, 30% a little more difficult and 19% much more difficult. The suitability of the wording of the paper had 90% of the responses as fine and 96% had the presentation of the paper being at an acceptable level. Generally, the responses found the paper to be accessible. With 84% indicating learning support students would find this accessible; 96% for beliefs; 98% for gender and 93% for ethnicity.

There were many more comments than normally seen. These were mainly looking at a variety of concerns with the paper, though a significant minority expressed positive comments about the paper. In reading the comments many important points are noted, however please give details as comments that say "the content was not in the syllabus" do not give enough information for the grade award team to consider.

The positive comments liked the range of the questions and felt the students knew what expected of them in an answer. The longer introduction section before the question was praised for being a guide for the students. Many comments appreciated the resource booklet and the case study questions.

The concerns raised were mainly on the essay questions. The images in the resource booklet could have been clearer for some, and there were queries about the case study being in colour in the future. The new Case Study for Paper 1 in 2017 will have images in colour.

The extended length of the essay questions was the part of the paper most queried. The comments mentioned the "convoluted questions", "awkward phrasing", "the closed nature" and the extended reading for bilingual or learning support students was unfair and not consistent with previous papers. The style of the essay questions over the last few years has been without introduction sections, but the guidance in the introduction section was to help the candidates understand where to focus their answers. The students seemed to be able to stick more closely to what the question asked as they used the guidance given in the introduction to base their answers upon. This led to fewer candidates wandering off the topic of the question.

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Another comment mentions how the students are "asked to link concepts in an unfamiliar and complex manner". This should have clarification on which essay question in particular but please remember the whole course is holistic and so the separate topics can be brought together in a question to highlight the interdependence of the topics within the course. The essays do require higher level thinking skills, especially the part c of the questions. The use of case studies and examples was not explicitly asked for but the students are encouraged to use examples to illustrate the points they are making.

A number of comments enquired about the use of terms/phrases in the resource booklet and section A. The terms "plantations" and "Game" were mainly mentioned, in the candidate answers a wide interpretation of both words was allowed in the candidate answers. The specific words for areas/places in the case study, like Miombo, have been used in previous examination sessions. The candidates extract these new words from the case study with little difficulty.

The use of a question in section A worth 5 marks was queried, most other past paper 2s had at least one 4 mark question, so this was not outside the norm for these examinations.

This year the popularity of the essay questions was more evenly spread across all of the available questions.

The standardizing team considered how the candidates answered questions as the final markscheme was prepared. When students approached questions in a different way from the original exam writers expected interpretation then the markscheme is reviewed. Generally, both the original interpretation and the post-exam interpretation are included, as long as the concepts are correct.

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

In Section A the straightforward syllabus based questions proved more difficult for the candidates than the questions requiring the processing of information from the resource booklet. The factors affecting primary productivity proved difficult to answer. Also distinguishing between a biome and an ecosystem. The final evaluation question was difficult as the candidates often failed to evaluate, so focused on the positive or negative elements of the options.

In section B the candidates found it easier to write about weaknesses rather than strengths and differences rather than similarities. The discuss command term seldom produces the overall conclusion part for the question.

Some students are still trying to incorporate the three parts of the essay into a continuous prose. This can mean they focus mainly on one part only, not always the part with the most marks available. Very few candidates gave no response to parts of questions.

Question 2c which combined economic development and food production proved difficult for most students to gain more than a few marks on. Question 4b also proved problematic for students understanding that the focus was how data is collected for reliability and validity.

Candidates found it difficult to stick to discussing the managing the impacts in 4c. In 5c linking the influences to a value system and an energy decision was hard for the candidates.
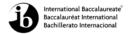
Evaluate and discuss are the command terms that are most often misunderstood. Only strong candidates gave the balancing/arguments and a conclusion. Assessment objective 4 stresses the need to make reasoned and balanced judgments using appropriate economic, historical, cultural, socio-political and scientific sources. Only the very best candidates were able to demonstrate this balance.

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

Section A

Question 1

a(i)   Only a very small minority gave an incorrect answer here. Having both sides as 0.8 million and not adding them up was accepted as an answer.

a(ii)   Most answers managed to gain one mark. The answers commonly did not really address the shape of the pyramid and how that linked to future growth, so the second mark was seldom met.

b(i)   The candidates understood the concept of the question and most gained the 2 marks. But in a significant minority they did not describe but listed impacts with no link to the mining activity

b(ii)   Most candidates mentioned a clear link between a mining activity and a specific human health impact. Some candidates were too vague on the health impact. A wide range of health impacts was accepted.

c(i)   The candidates generally had no problems with identifying the two land changes

c(ii)   The markscheme allowed for any reasonable changes in land use to be mentioned, even the ones not stated in c i). Most candidates managed 2 or 3 marks here.

c(iii)   Many candidates tried to only use the resource booklet to obtain the answer, so they missed mentioning straightforward limiting factors for photosynthesis like water and light

d(i)   Most candidates gave Miombo as the ecosystem but a significant minority incorrectly mentioned only the woodland biome for the answer.

d(ii)   The distinguish command term was not addressed by most candidates who instead defined the two terms only. Most gained one mark for mentioning how a biome is made up of many ecosystems.

e(i)   Most candidates gave two clear factors for the factors, generally population size and some link to their habitat.

d(ii)   Most candidates gained at least one mark here. But many described the distribution of the parks without explaining how this makes for more effective conservation. No marks were awarded if weaknesses of the distribution were mentioned.

(f)   Most students recognized that this question could be broken down into looking at ecotourism and forestry plantations separately. Most candidates mentioned the strengths and weaknesses with enough detail to gain most of the marks. The final appraisal of the evaluate command term was generally missed.
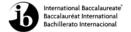
Section B

Question 2
a) Generally, the candidates knew what the Gaia hypothesis was and could link it to the global ecosystem. Gaining all four marks was more difficult and many students repeated their initial comments.

b) Most candidates defined the two terms before trying to describe the similarities and differences. Many gained a similarity mark from mentioning maintaining equilibrium or both relying on natural capital. The most common difference was how sustainable development looked at services as well as goods.

c) The candidates struggled with the discussion aspect of the question and also with the relationship between the two aspects of economic development and sustainable food production. Instead they often described and explained how economic development could help produce food. As a result, the sustainability element was hardly mentioned in this approach to the answer. Even those candidates who successfully answered the question often missed out a conclusion.

Question 3
a) The candidates could generally describe S and J curves, however outlining how limiting factors influenced the shape was more difficult. A number of candidates incorrectly stated that J curves had no limiting factors at all influencing the population curve. Many students gained 2 or 3 marks for the S curve part of the answer. The stronger candidates did show an understanding of the J curve.

b) A wide range of definitions was accepted for fertility and crude birth rate. The students found it harder to mention the strengths of these indicators than the weaknesses. Many students only wrote 4 to 5 sentences and so there was limited scope for achieving the maximum marks. Weaker candidates generally described the population factors involved in growth.

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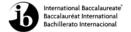Baccalauréat International
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c) Having the development policies for indirect influence mentioned in the question introduction helped guide the students to address these in their answers. This often led to the awarding of at least one mark to each policy. There was a tendency for the weaker candidates to give long detailed answers about one policy, usually the one child policy, this amount of detail for one policy was not required. Candidates should read the question carefully to ensure they remain focused on the question asked.

Question 4

a) The candidates clearly understood the differences between clay and sand soils. Stronger candidates outlined four distinct ways the soils differed and linked these clearly to productivity. However, there were also good answers that only mentioned productivity at the start or the end of the answer. As long as the link to productivity unambiguously evident from the context then marks were awarded.

b) Many candidates answered this question using an EIA. So they described how an EIA is carried out. This was not appropriate for answering the question asked. The information given is asking for the impacts to be investigated so a method for collecting data about the environment around the landfill is required. This question looks at how biotic and abiotic data are collected. Credit was given for candidates who recognized having an EIA would provide data as a baseline for comparison. Some candidates gave very strong answers for this question, detailing how data can be collected reliably in the field.

c) Most candidates gained 2 or 3 marks for the management of the impacts of acid rain and/or global warming. The discussion on the comparison of the relative difficulty of management was not as strong. The conclusion mark was attained by many candidates as they recognized the complexity/inter-relationships of the impacts. Weaker candidates tended to write descriptive answers that seldom allowed a mark to be awarded.

Question 5

a) Many candidates focused their answer on the last few hundred years and stated that extinction rates are increasing, usually outlining a reasonable cause. Stronger answers also mentioned historic mass extinctions with a variety of causes.

b) The candidates found gaining 2 or 3 marks relatively straightforward. The understanding of intrinsic value was generally well understood. Most candidates could link the concept of intrinsic value to conservation and development. But finding more than one strength and weakness proved to be tough for everyone except the very strong candidates.

c) The candidates approached this answer with the concept of the dynamic nature of resources. A few did not mention energy sources at all but generally they did. Once the candidate had determined the energy source/s they then related to MEDC. The majority of candidates elected to name a specific country to help guide their answer. The mark scheme was flexible enough to allow the candidates to focus on only two stages of change or they could mention more. Most candidates gave points on the changes from a fossil fuel energy hungry country to renewable energy sources.

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Recommendations and guidance for the teaching of future candidates

The following is a summary of the advice for teaching future candidates:

- Review the meanings of command terms so students know what is required in each question. Especially for level 3 command terms.

- Encourage students to make annotated diagrams large and clear if they are using them.

- Make sure students pay attention to the "point value" for each question to gauge how many different and distinct statements they need to address to earn full marks. Encourage candidates to give clear, diverse and discreet marking points, rather than a single vague, limited, and repetitive discourse.

- Encourage students to break up their answers into the relevant sub sections to make it easier for the examiner to identify which part of the question they are answering. The answers are not expected to be one long essay.

- Ensure sufficient time is dedicated to the teaching of the systems and values elements of the course. To enable the holistic nature of the course to be recognized and used in the answers.

- Reinforce the importance of learning key definitions and terminology.

- Clarify how expression of ideas marks are allocated and perhaps use them in your own marking so students get used to developing their answers, including examples and structuring their ideas.

- Candidates should be encouraged to write within the space provided within the exam paper.

- Please encourage students to print specific examples as these are often hard to interpret when the handwriting is bad.

Detailed examples/case studies are needed for all areas of the syllabus. Local ecosystems should be used and then the inter-relationships can be explicitly noted.