Comparative Analysis of Assessment in the IB Middle Years Programme and the GCSE

Submitted to the International Baccalaureate by UK NARIC

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Contents

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List of acronyms

AO	Assessment objective
AQA	Assessment and Qualifications Alliance
CCEA	Council for the Curriculum, Examinations and Assessment
GCSE	General Certificate of Secondary Education
IB	International Baccalaureate
MYP	Middle Years Programme
OCR	Oxford Cambridge and RSA

Executive summary

The International Baccalaureate (IB) Middle Years Programme (MYP) is a baccalaureate-style programme offered across 108 countries worldwide.[1] Designed for learners aged 11-16, the IB MYP aims to prepare students for upper secondary or further education study and as such has a shared purpose with the General Certificate of Secondary Education (GCSE) offered in England, a two-year single subject qualification for students aged 14-16.

A 2012 independent study found the MYP to cover similar content to GCSE[2] but had no external examination – a finding now addressed by the introduction of the IB MYP eAssessment in the 2015-2016 academic year for students wishing to achieve the IB MYP Certificate[3]. Against a backdrop of recent educational reforms to the GCSE designed to "provide evidence of students' achievement against more demanding and fulfilling content"[4], the IB has commissioned an independent study into the comparability of assessment in the IB MYP with the GCSE with a focus on three subjects: English, mathematics and science.

The study focussed on two principal research questions:

Research Question 1: How do the assessment frameworks (objectives, methods, weighting, etc.) compare between the two qualifications, in English, mathematics and science?

Research Question 2: How do the demands placed on candidates by the specifications, mark schemes and specimen papers in the IB MYP English, mathematics and science exams compare against those in similarly-focussed subjects at GCSE? If different, in what areas do the levels of demands differ between the two qualifications?

The study began with a review of the IB MYP documentation to understand the programme as a whole and on a subject level, to support the selection of similarly-focussed qualifications in the UK. The documentation reviewed included subject guides, e-assessments[5] and mark schemes for 2017 and 18, and supporting documentation.

For each of the IB MYP subjects selected for this study, similarly-focussed subjects were identified within the GCSEs. For English, the study compared the IB MYP English Language and Literature with the GCSE English Language. This comparison focussed on the summative assessments, but nonetheless sought to contextualise this analysis by first reviewing the overall aims and structure of each course. Whilst there are some key

[1] International Baccalaureate Organization (Accessed 2018)
[2] Sizmur, J., Cunningham, R. (2012). *International Baccalaureate Middle Years Programme (MYP) in the UK*, Slough: NFER.
[3] Students must take an on-screen examination in five subjects, e-Portfolio coursework, a personal project and community service.
[4] Ofqual (2017). *The Ofqual blog – Why 9 to 1?*
[5] In this report, the term "examination" is used to reflect both the paper-based tests (as included in the GCSEs) and the on-screen assessments of the IB MYP, with both taken under timed conditions.

differences in the aims and scope of these courses[6], GCSE English Language was chosen as the reference point since it is commonly required for access to higher education. For mathematics, the study reviewed the IB MYP Mathematics (Standard and Extended) course with the GCSE Mathematics course. When reviewing assessment in science, UK NARIC compared the IB MYP Integrated Sciences with the GCSE Combined Science: Synergy and the IB MYP Physics course with GCSE Physics course. Materials reviewed for both qualifications included subject specifications, past or specimen examinations and their associated mark schemes.

To explore the two principal research questions, UK NARIC undertook an in-depth review of examination materials. This looked at the GCSE and IB MYP examinations as a whole to establish the number and type of questions in conjunction with the time available for each; the breadth and depth of content and assessment objective coverage; and the resources available to students in the exam. The accompanying mark schemes were also reviewed to establish any key similarities and differences in the marking approaches.

Additionally, the study involved an analysis of item demand informed by the CRAS (Complexity-Resources-Abstractness- and Strategy) framework [7]. The analysis was conducted by panels comprising of both UK NARIC analysts, experienced in benchmarking international secondary qualifications and UK secondary school teachers, experienced in teaching at secondary level in their respective subject. The guiding principle of the study was that it should provide an independent evaluation. As such, it was felt appropriate to engage external teachers who may be unfamiliar with the IB MYP programme and to provide anonymised GCSE and IB MYP examinations. This allowed the analysis to be less influenced by familiarity with the philosophical underpinnings of the IB education, and to focus instead on how to rate the assessment presented to them in terms of demand. Nevertheless using teachers familiar with only one of the programmes (the GCSE) posed some limitations to the study. As UK teachers, they would be much more accustomed to the assessment found in GCSEs which are curriculum-related, 'compensatory' qualifications[8]; whilst unfamiliar with inquiry-based, conceptual learning and criterion-based assessment which characterises the IB MYP.

Overall findings

Overall the study found some clear similarities in the level, range and type of skills assessed by the IB MYP and the reformed GCSE. Similarities are most evident when looking at GCSE Higher tier examinations, where available. Comparing the weighting of those skills proved difficult due to the differing constructs and categorisation of skills within the assessment objectives. The mark schemes – whilst applying generally similar approaches – differ in how they categorise marks.

[6] The IB MYP provides combined study of language and literature whereas the GCSE offers two distinct courses, one focussing on language and the other on literature.
[7] The CRAS framework was developed in the 1990s by UCLES (now Cambridge Assessment) to provide a qualitative measure of cognitive demand in individual examination questions.
[8] Ofqual uses the term 'compensatory' to describe where "better performance in one area can compensate for poorer performance in another". Ofqual (2017), *Mythbusting: 3 Common Misconceptions.* Available at: https://ofqual.blog.gov.uk/2017/03/17/mythbusting-3-common-misconceptions/.

Differences where they exist, primarily relate to the volume of assessment per subject. This is a reflection, in part, of the differing structure of the qualifications: the IB MYP is a composite baccalaureate-style award where students take additional and inter-disciplinary assessments, and the GCSE is a single-subject qualification.

Some minor differences can be seen in the breadth and depth of content assessed, with the GCSE placing slightly more emphasis on breadth, and the IB MYP on depth however the content studied overall is comparable.

In terms of cognitive demand, the IB MYP and reformed GCSEs can be considered comparable although the ways in which they place demand on students differ in places. To explore this further, it is important to consider the subject-level findings, as detailed below.

English

Some clear similarities and differences can be seen in terms of the overall assessment framework for English in the IB MYP and GCSE. Both the IB MYP and the GCSE courses use externally assessed examinations, albeit of differing duration. The IB MYP examination for Language and Literature takes 2 hours whilst the GCSE has two English examinations which, combined, are double the duration of the IB MYP examination. Accordingly the mark allocation also varies, with double the number of marks available on the GCSE programme reviewed: 160 marks compared to 80 marks for IB MYP. Review of the examinations found similarities in the number and type of questions, relative to the amount of time available for assessing each course.

The construct of the assessment objectives varies considerably, with the IB MYP expressed across four different skills (Analysing, Organising, Producing Text, and Using Language, all weighted equally) and the GCSE across nine different areas divided into Reading and Writing (weighted at 50% each) and Spoken Language, which is unweighted. Nevertheless review and mapping of the assessment objectives found that the IB MYP and GCSE English courses are designed to assess a comparable range of knowledge and skills. In particular, the courses both aim to assess students' ability to:

- Identify explicit and implicit information
- Summarise and synthesise, drawing across multiple texts
- Analyse texts for content, language, technique and the author's perspective
- Organise ideas and opinions in a coherent manner
- Produce creative and/or insightful texts
- Employ appropriate vocabulary, style, register and techniques to convey meaning to the intended audience
- Use English appropriately (vocabulary, linguistic conventions, grammatical terminology).

This review also found similarities across question types used, with both courses using short answer and extended answer questions designed to test comprehension, evaluate author purpose, and produce both transactional (or other non-fiction) and creative writing responses based on stimuli. Both the IB MYP and GCSE assessments employ a range of unseen input texts, drawn from fiction and non-fiction texts, with a greater emphasis on the latter. The

complexity of the input texts was found to be similarly high between the two qualifications although the topics were very different, with the IB MYP containing more abstract topics. Scaffolding through rubric was evidenced in both qualifications, although it was considered that more specific support was provided in the GCSE, for example in terms of highlighting key content elements students should include in their response.

Review of items found a typically high level of consensus among external consultants' ratings for the GCSE, as might be expected given that all are experienced in teaching GCSE English, though there were some discrepancies in their findings on a high mark extended question. There was generally less consensus in external consultants' ratings for the IB MYP, which may be in part attributable to the differing level of familiarity with the two qualifications. Overall the GCSE examinations were found to have questions across all five levels of cognitive demand[9] with questions situated early in the examination seen to be low or low-medium demand. Questions towards the end of each examination were considered to be high or medium-high demand. This scaffolding through question progression was seen in the IB MYP too: no questions were considered to be low demand and the later questions were primarily considered high demand. Where questions were identified as high demand in the IB, this was typically a reflection of the level of abstractness found in these, with the level of complexity (synthesis and evaluation) also a key factor.

Across both courses an increase in demand correlated to an increase in allocated marks. The mark schemes for both the IB MYP and GCSE provide sample responses and use a levels-of-response approach, designed to assess a similar level of skill. A key difference in the approach is the IB MYP's use of a cap, limiting the number of marks awarded where a particular aspect of the task is missing in the student's response – such as commenting on one source, where a question presents two. This is linked to task response and is not an explicit feature of the GCSE mark scheme, reflecting the 'compensatory' approach to marking[10].

Mathematics

The IB MYP and GCSE Mathematics courses reviewed have many shared aims, seeking to develop knowledge and understanding of mathematical concepts, principles and methods as well as problem-solving, reasoning and communication skills; whilst the IB MYP also aims to develop reflection skills, specifically students' ability to reflect on their own work and on the work of others.

When considering how these aims translate into assessment objectives, there are clear lines of comparability with both intending to assess students' ability to:

- Select appropriate mathematical techniques to solve problems
- Apply and perform routine and complex procedures in different contexts
- Construct chains of logical reasoning and arguments (including proofs)
- Use appropriate mathematical language (notation, symbols and terminology) appropriate forms of mathematical representation to present information

[9] Low, low-medium, medium, medium-high, high.
[10] Ofqual (2017).

- Translate problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes and solve these problems
- Assess and justify the validity and accuracy of arguments, assumptions and solutions.

The differing structure and construct of the assessment objectives makes comparison of the weighting afforded to each skill more difficult. For example, the IB MYP places a significant focus (25%) on assessing students' ability to apply mathematics in real-life contexts with problem-solving also encompassed under a separate objective (Investigating Patterns); whilst the GCSE has a similarly-weighted assessment objective (25% for the Foundation tier, 30% for the Higher tier) on solving problems in maths and other contexts.

Both the IB MYP and GCSE employ external summative assessment, although the overall duration differs: the IB MYP comprises a single examination of 2 hours, whilst the GCSE comprises three examinations, with a combined duration of 4 hours 30 minutes. The GCSE has both a calculator and non-calculator examination and students can also be entered for either the Foundation or Higher tier examinations, whereas there are no tiers within the two levels of mathematics of the IB MYP examination and a calculator may be used for all questions.

In terms of question type, the GCSE and IB MYP examinations comprise a mixture of short answer, and structured multi-part questions which typically increase in difficulty throughout the examination. In the GCSE, the structured questions are generally shorter and there are more standalone questions, allowing for a greater breath of topic coverage. In the examinations reviewed, the IB MYP typically covered a slightly narrower breadth of topics but assessed certain topics in more depth than the GCSE. Across the examinations, the IB MYP placed emphasis on investigative maths, particularly in the Extended examination which involved longer mathematical arguments, placing demands on strategy and mathematical reasoning. The longer investigative questions did not feature in the GCSE examinations reviewed. Questions in the IB also involve the ability to analyse mathematical information and produce a written response: these extended response analytical questions are not evident in the GCSE examinations.

When considering cognitive demand, there was not a strong consensus among external consultants' for either qualification. Ratings often spanned three, and in some cases four, levels of demand on a five-point scale of low / low-medium / medium / medium-high / high demand. Consultants rated many of the GCSE Foundation questions to be of low, low-medium and medium demand, and the GCSE Higher questions to be of medium, medium-high or high demand. In the IB MYP Mathematics, both Standard and Extended questions were generally considered to be medium, medium-high or high-demand. More in-depth analysis of selected questions found that in geometry for example, the IB MYP and GCSE questions reviewed were considered high demand in terms of complexity, resources, abstractness and strategy. Differences could be seen in questions for probability and algebra, with the IB MYP algebra question considered high demand across all aspects of the CRAS framework, and medium demand for the probability questions. The selected GCSE questions in these two topics were considered medium-high demand across four of the five aspects of cognitive demand.

Review of the mark schemes found these to employ similar approaches to marking with marks available for accuracy and workings, where both the IB MYP and GCSE award some accuracy marks which are independent, and others which are dependent on students showing their workings (method marks). The categorisation of marks is nonetheless more difficult to compare: the GCSE has marks clearly denoted as method, process, accuracy, unconditional accuracy and communication making it clear the percentage of marks available for each; whilst the IB MYP does not differentiate marks so explicitly.

Science

The IB MYP and GCSE assessment frameworks are similar for Science with both qualifications assessing knowledge and understanding, and the ability to apply it, particularly in designing and conducting experiments. The ability to collect and interpret data, using scientific reasoning to explain results and draw conclusions, is also an integral component of the IB MYP and GCSE assessment objectives for science.

Both employ external summative assessments comprising a combination of multiple-choice, short answer, and extended response questions. The overall volume of external assessment is higher in the GCSE though it should be noted that the GCSE Combined Science is a double award. There are considerably fewer questions in the IB MYP but this is because the IB MYP utilises extended response questions which attract almost 40% of the marks. The assessment duration is also higher in the GCSE Physics, with two examinations of 1 hour 45 minutes each, compared with a 2 hour examination in the IB MYP Physics.

For Integrated/Combined Science, the GCSE assesses a larger number of topics than the IB MYP, reflecting the fact that the GCSE is a double award. Review of examinations found the IB MYP to cover a slightly narrower range of topics, but with some assessed in more depth. There were a number of topics awarded a proportionally similar range of marks in both qualifications such as forces, motion and energy; and electricity and magnetism. Observations on content breadth/depth similarly hold true when reviewing the assessment of Physics in the IB MYP and GCSE. In the examinations reviewed, the IB MYP tested mechanics, force and energy in depth, with remaining questions also focussing on two or so overarching topic areas in depth. The GCSE assigned comparatively fewer marks to these topics but assessed a broader range of topics.

When looking at the question types, the study found that the IB MYP and GCSE examinations similarly present questions in real-world and experimental contexts and include a significant proportion of questions assessing knowledge and application of experimental skills (planning, interpretational, analysis and evaluation).

Some differences were nonetheless evident. Whilst both the IB MYP and GCSE Integrated/Combined Science assess knowledge and understanding of topic areas, the longer duration of the examinations allows the GCSE to include more “describe” and “explain” type questions which rely heavily on recall and understanding of topic-specific knowledge. There are also fewer calculation problems in the IB MYP examination than in the GCSE Combined Science, particularly in comparison with Chemistry and Physics examinations.

Extended questions in IB MYP typically involve a longer response and are worth more marks than the six-mark extended GCSE questions. These six-mark questions involve – in the Higher tier GCSE – analysis and evaluation as well as precise use of knowledge and understanding. Extended calculation problems in Physics and Chemistry may involve multiple stages and complex strategies. Extended questions in IB are either experimental (plan or design an experiment) or questions that explore cross-disciplinary socio-environmental impact of scientific ideas / technology. The cross-disciplinary IB questions involve integrating information presented in source material in the question whilst placing emphasis on the skills of evaluation and synthesis to produce a well-reasoned argument.

Analysis of external consultants' item rating analysis proved complex for both Integrated/Combined Science and Physics: there was considerable variation in the external consultants' perception of cognitive demand when reviewing short answer questions and this was true both for the GCSE and the IB MYP. There was greater consensus in the rating of extended response questions, which for IB MYP Physics were considered to be high demand, and medium-high demand in the GCSE. Further analysis of selected extended questions from the IB MYP and GCSE Higher tier examination were similarly demanding: with the resources, task strategy and answer strategy all scoring high, with abstractness medium-high and the complexity medium-high in the IB MYP and high in the GCSE Higher tier. Analysis of selected structured questions using the CRAS framework found the IB MYP and GCSE Integrated/Combined Science to be similarly pitched.

The resources made available to students are similar in both qualifications, with students able to access a formulae/equation sheet or calculator. The GCSE and IB MYP examinations both include data tables, graphs and diagrams, upon which questions are based on. The IB MYP examination additionally includes videos, animations and simulations, which assess the ability of students to interpret the scenario described, to answer the questions. Marks schemes allow for errors carried forward, penalising only the first incorrect answer. Review found these to place a comparable level of demand on students with marks available for each point made, and awarded for acceptable alternative answer, examples for which are given in the mark scheme.

Conclusion

Independent comparative analysis of assessment of the IB MYP to the reformed GCSE has found the two qualifications to be comparable.

This conclusion is based on a holistic review of assessment for English, maths and science, taking into consideration the assessment objectives, assessment methods, the number, type and weighting of questions, content breadth and depth, and marking approaches. This review found that whilst there are some notable differences in the qualifications, these principally relate to the duration and volume of assessment. Overall, the awards can be considered of comparable demand, but the specific ways in which they place demand on students differ.

1. Introduction

Today there is an increasing need among international students, applying for higher education study in the UK, to demonstrate a level of achievement comparable to the General Certificate of Secondary Education (GCSE) in key subjects[11]. It is in this context, that the International Baccalaureate (IB) has commissioned an independent study into the comparability of the IB Middle Years Programme (MYP) with the GCSE.

The IB MYP is a baccalaureate-style programme designed for learners aged 11-16. Offered in over 1400 schools across 108 countries worldwide[12], the IB MYP intends to prepare students for upper secondary or further education study. An earlier study conducted by NFER investigated the implementation of the IB MYP in the UK, using the then GCSE (now legacy GCSE) as the principal reference point. The study found that the IB MYP "covers similar content to GCSE…but has: more international mindedness, more thinking skills [and] more integrated curriculum"[13].

In light of substantial educational reform to the GCSEs in the UK during the intervening period, as well as the introduction of the IB MYP eAssessment, a new study to establish the comparability of the IB MYP and the GCSE is now required. The focus of this study however is on the assessment of three subjects – English, mathematics and science; specifically, through examination of two principal research questions:

> **Research Question 1:** How do the assessment frameworks (objectives, methods, weighting, etc.) compare between the two qualifications, in English, mathematics and science?
>
> **Research Question 2:** How do the demands placed on candidates by the specifications, mark schemes and specimen papers in the IB MYP English, mathematics and science exams compare against those in similarly-focussed subjects at GCSE? If different, in what areas do the levels of demands differ between the two qualifications?

In order to address these two questions, the study must first undertake two key tasks: the first is to contextualise the assessment of the selected subjects by ensuring a thorough understanding of the two qualifications through review of their core components. A summary table is provided below; whilst more detailed qualification profiles can be found in Appendix 1.

[11] In some cases universities may specify a requirement for GCSE, typically at Grade C/4 or above in English (first language), English and Mathematics, or for those looking to enter initial teacher training, English, Maths and Science.
[12] International Baccalaureate Organization (Accessed 2018).
[13] Sizmur, J and Cunningham, R (2012). *International Baccalaureate Middle Years Programme (MYP) in the UK*.

At a glance: the IB MYP and GCSE

Table 1: Comparison of IB MYP and GCSE core features

	IB MYP	GCSE
Qualification purpose	To prepare for further academic (upper secondary) or vocational study or employment.	To prepare for further academic (upper secondary) or vocational study or employment.
Entry requirements (and typical age range of students)	Open Students aged 11-16/14-16	Open Students aged 14-16
Duration	Two to five years	Two years
Structure and content		
Type of award	Baccalaureate / composite	Single subject qualification
No. of subjects studied	Six typically, plus a project and interdisciplinary unit	Eight to 10 typically
Compulsory subjects	None. In Years 4 and 5, students take one course from six of the following subject groups: • Language acquisition • Language and literature • Individuals and societies • Sciences • Mathematics • Arts • Physical and health education • Design.	• English • Mathematics • Science.
Guided learning hours	Minimum 50 hours' teaching per subject per year; up to 70 hours per subject in the last two years	Typically a total of 120 hours for single awards and 240 hours for double awards, taught over two academic years.
Assessment methods	**eAssessment** To achieve the IB MYP certificate, students are expected to take on-screen examinations in five subjects, e-Portfolio coursework, a personal project and community service.	**External examinations typically.** Non-exam assessment methods are used only where needed, to assess skills which cannot be assessed via exam.
Associated outcomes (intended progression)	Access to further education / upper secondary studies.	Access to further education / upper secondary studies.

The next task was to define the term *demand* used in the context of this study. The definitions of demand and its contributory factors, as presented in extant literature, are discussed in the Methodology, found in Section 2.

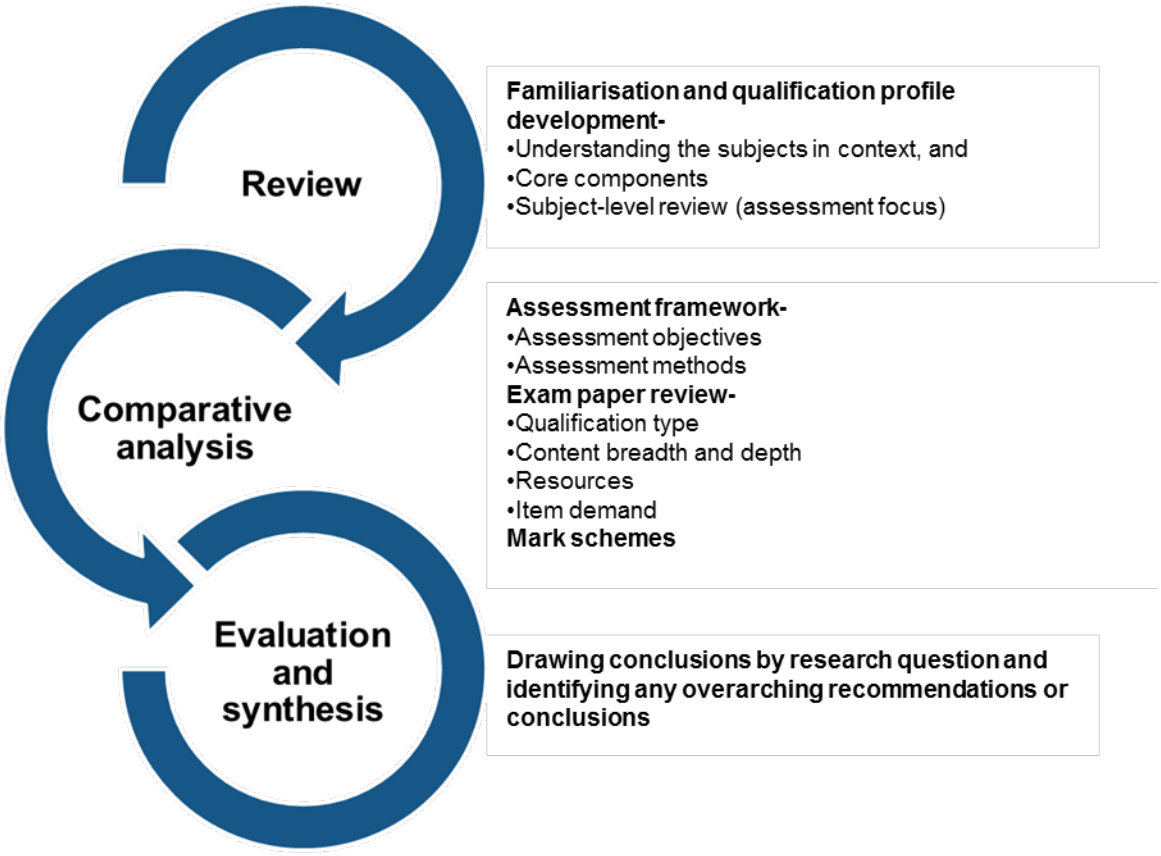
The key findings of the analysis can be found in Section 3, reviewing each subject in turn before summarising the findings by research question.

2. Methodology

2.1 Overview of the methodological process

The methodology employed by UK NARIC in this study was designed to draw both on UK NARIC's methodology for credential evaluation and established good practice in analysing assessment demand. It comprised three key stages:

Figure 1: Methodological process



2.2 Programme review

The study began with a review of the IB MYP documentation to understand the programme as a whole and on a subject level, to support the selection of similarly-focussed qualifications in the UK. The documentation reviewed included subject guides, e-examinations and mark schemes for 2017 and 18, and supporting documentation.

For each of the IB MYP subjects selected for this study, similarly-focussed subjects were identified within the GCSEs as follows:

Table 2: Subjects selected for analysis

IB MYP	GCSE
English Language and Literature	English Language
Mathematics (standard and extended)	Mathematics
Integrated Sciences	Combined Science: Synergy
Physics	Physics

It is important to highlight that there are some differences in subject scope of the IB MYP and GCSE. For example, in the IB MYP, English is a combined language and literature course, whilst in the GCSE, there are two distinct courses; one on English language and another on literature. In this study, the analysis focussed on GCSE English language, as the subject typically required for progression to further study. The IB MYP integrated science has equal weighting with all other subject groups in the IB MYP, whereas the GCSE combined science is a double award worth two GCSEs.

For each of the above GCSE subjects, relevant documentation was collated from the selected awarding body[14] and review included:

- Subject specifications
- Past or specimen examination papers[15]
- Associated mark schemes.

In addition to the above, assessment objectives and weightings were drawn from Ofqual documentation.

2.3 Comparative analysis

Having gained a thorough understanding of each programme and subject, the comparative analysis focussed on comparing IB MYP and GCSE English, mathematics and science in terms of i) their assessment frameworks and ii) their demand.

2.3.1 Assessment frameworks

This involved a document review, firstly to compare the aims of the relevant IB MYP and GCSE subjects, noting that the aims of a programme should inform its assessment objectives and methods.

Next, the project team undertook a comparative review of the assessment objectives in each subject. Assessment objectives set out the key skills and competencies to be evaluated in the assessment of a course, which may include coursework and examinations. This involved a review to identify and code the key knowledge and skills covered by the different

[14] There are several awarding bodies for the GCSE. Materials from two of these bodies – Pearson Edexcel and AQA – were used in this study; however since all GCSE awarding bodies must reflect centrally defined requirements, the selection should not have a material impact on the findings of the study.
[15] Past papers were used wherever possible for reformed GCSEs. For GCSE Mathematics, 2017 past papers were reviewed while for GCSE Combined Science, Physics and English Language specimen papers were examined.

specifications; while at the same time acknowledging inevitable differences in the wording or expression of similar skills and objectives across qualifications.

Assessment methods were also examined to understand the type(s) of assessments used, their relative weighting, marks and time allocated to them. This information is presented in comparative tables by subject to enable similarities and differences between the IB MYP and GCSE to be more clearly identified. Where used, internal assessment is noted, however the comparative analysis centres on the external assessment; using the examinations publically available in the case of the GCSE papers and the eAssessments for the MYP. For ease, 'examination' is used from this point on to refer to both the GCSE paper-based tests and the IB MYP on-screen test.

2.3.2 Defining terms, approach and impact on methodology

2.3.2.1 Defining terms: Assessment demand

There are inherent complexities in demand analysis. For any study attempting to focus on examination demand, it is imperative to specify the parameters in which 'demand' is understood, how it can be measured, and what the implications of it are.

Review of current literature on demand highlights terminological overlap and how this impacts on methodological approaches. Pollitt *et al* in particular emphasises how 'demand' and 'difficulty' are often conflated. For the purposes of this study, demand is understood as representing the cognitive processes required in order to engage with an examination question successfully, and it follows the distinctions made by Pollitt *et al*[16]. Thus, demand is understood as 'separable, but not wholly discrete skills or skill sets that are presumed to determine the relative difficulty of examination tasks and are intentionally included in examinations.'[17]

Difficulty, on the other hand, relates more to the post-examination stage, and more precisely to the performance of specific cohorts. Thus, 'the difficulty measure is therefore a property of a question or test that is defined for a particular group of students.'[18] For example, two different cohorts may take the same question (at the same level of demand) but perform very differently, as the property of difficulty is dependent on a number of contextual aspects (e.g. one cohort may have had poorer instruction or reduced training in examination technique). This study also follows the understanding of 'intended demand' as a concept wherein an examination or item writer intends an examination question to be of a certain demand level that the writer might reasonably expect; although some misjudgements may ultimately impact on its difficulty such as the use of a topic for which candidates have very little background knowledge.[19]

[16] Pollitt, Ahmed, Crisp (2007).
[17] Ibid 196.
[18] Ibid 196.
[19] Ibid 195.

2.3.2.2 Measuring demand

In the absence of fixed and standardised objective scales to measure examination demand, a number of theoretical models have been established with the intent to measure or understand cognitive demand, which may have relevance to an examination context. The section below outlines some of the more well-known models; Bloom's taxonomy, first established in 1956, although later revised,[20] is perhaps the best known:

Table 3: Bloom's Taxonomy (revised)

Create	Produce new or original work
Evaluate	Justify a stand or decision
Analyse	Draw connections among ideas
Apply	Use information in new situations
Understand	Explain ideas or concepts
Remember	Recall facts and basic concepts.

According to Bloom, various cognitive activities are placed in a hierarchical framework from lowest demand (remember), to highest (create). In terms of examination demand, this may imply that examination questions requiring evaluation or creation are more demanding than those requiring the ability to remember or recall basic facts. Course and examination learning objectives continue to be informed by Bloom's, or the revised Bloom's, taxonomy.[21],[22]

Jean Piaget's *Theory of Cognitive Development* has also informed work on demand analysis. Broadly, his theory outlined the differences in cognitive development depending on the age of a child; this has implications for the inclusion of abstract or deductive style questions in examinations, which may not be accessible at a younger age.

Edward de Bono, perhaps most famous for his 'six thinking hats' encouraging thought approaches from different angles, posited the concepts of 'lateral thinking' as an opposition to 'vertical thinking.' Lateral thinking involves approaching a problem or situation from different angles; including/considering more creative or 'out of the box' solutions. Whereas vertical thinking is more closely aligned to the traditional and logical thought process. Lateral knowledge would have less application to fixed knowledge or 'single answer' questions, but may apply more to abstract problems or creative solutions. The implications of this theory can be seen in examination contexts: a candidate may need to utilise different 'thinking' approaches, depending on the question type and it is easy to see how these might be perceived as being aligned to relative demand.

As can be seen from just this brief overview, the concept of thought, complexity of thought and cognitive demand is widely open to interpretation and inherently abstract. There is no singular accepted model and a study focusing on cognitive demand in examination contexts

[20] Anderson, L, Kratwohl, D & Bloom B (2001). *A Taxonomy for Learning, Teaching, and Assessing : a revision of Bloom's taxonomy of educational objectives (Complete ed.)*
[21] See e.g. https://tips.uark.edu/using-blooms-taxonomy/.
[22] Ahmed et al. (2014) *Bloom's Taxonomy Based Proportionate Curriculum Development Model.*

has no specific 'standard' to draw upon, and established process to follow. As Pollitt et al state when discussing a number of studies into examination demand, 'no fully satisfactory system has been developed so far.'[23] The burden of deciding a framework therefore falls upon those undertaking the study, taking into consideration the context of the work to be done.

This study was informed by the CRAS scales, which is a qualitative framework aimed at conceptualising examination question demand, developed by Pollitt, Hughes, Ahmed, Fisher-Hoch and Bramley who were researchers at UCLES in 1998.[24] With its origins in the 'Scale of Cognitive Demand' developed by Edwards and Dall'Alba in the 1980s, it is informed by a number of the cognitive demand frameworks and theories outlined above. The CRAS framework orients around five key aspects: complexity, resources, abstractedness, task strategy and response strategy. The table below outlines the framework as outlined in Pollitt *et al*:[25] [26]

Table 4: The CRAS framework

	1	2	3	4	5
Complexity The complexity of each component operation or ideas and the links between them.		Mostly single ideas and simple steps. Little comprehension, except that required for natural language. Few links between operations.		Synthesis or evaluation is required. Need for technical comprehension. Makes links between cognitive operations.	
Resources The use of data and information.		More or less all and only the data / information needed is given.		Student must generate or select the necessary data / information.	
Abstractedness The extent to which the student deals with ideas rather than concrete objects or phenomena.		Mostly deals with concrete objects.		Mostly abstract.	
Task Strategy The extent to which the student devises (or selects) and maintains a strategy for tackling the question.		Strategy is given. Little need to monitor strategy. Little selection of information required.		Students need to devise their own strategy. Students must monitor the application of their strategy.	
Response Strategy The extent to which students have to organise their own response		Organisation of response hardly required.		Must select answer content from a large pool of possibilities. Must organise how to communicate response.	

[23] Pollitt et al (2007). *The Demands of Examination Syllabuses and Question Papers.*
[24] See further e.g. https://www.cambridgeassessment.org.uk/insights/using-the-cras-framework/ : UCLES is now Cambridge Assessment.
[25] Pollitt et al (2007).
[26] See also: Johnson, M. and Mehta, S (2011) *Evaluating the CRAS Framework: Development and Recommendations.*

As can be seen, scales are provided at levels 2 and 4 and move left to right from less demanding to more demanding. The impact of cognitive theories in its construct can be seen: thus for example, concrete objects are regarded as less demanding than abstract, which aligns well to Piaget's *Theory of Cognitive Development* and 'Strategy is given' reflects well to the lower levels of Bloom's taxonomy (application). On the other hand, the requirement that 'Students need to devise their own strategy…students must monitor the application of their strategy' reflects closely the cognitive activities of evaluation, creation and analysis, nearer the top of Bloom's taxonomy.

Pollitt outlined each aspect of the framework more specifically:

- **Complexity** refers to 'the hurdles students have to get over in order to produce an answer to a question'[27], with complexity being measured according to the number of 'hurdles', the 'height' of the hurdles, and the interdependence of the hurdles within a single question or task (e.g. if failure at one hurdle impacts on the success of the next hurdle). The more complex a question is, the more concepts or cognitive processes are involved. [28] This impacts on demand in two ways: firstly, the quantity increases the chance that something may be done wrong, and the depth or breadth of the complexity affects likelihood of success. Complexity may be at question input level (e.g. rubric / stimulus) as well as question output level (e.g. processes required, final product necessary).

- **Resources** are both internal and external. External resources broadly include the information provided within the examination paper, question or task. For example, in an open book examination, the candidate is able to access the original text. Although he or she would need a fundamental understanding of the text as time demands would impact on how much he or she could review the text, it reduces the cognitive burden of remembering e.g. quotations or thematic development (although not the burden on interpretation or literary criticism). In a mathematics context, being allowed to use a calculator may reduce some of the cognitive processing burden (although not the burden of knowing what to calculate, and why). A language examination may provide a glossary to elucidate some less familiar vocabulary terms to support understanding; the content and breadth of this may impact on demand. Internal resources relate more closely to the individual candidate: what knowledge they have of the subject, what have they memorised, what connections they are able to draw upon, and their ability to know which resources to draw upon and in what order.[29]

- **Abstraction/Abstractedness** relates to the degree to which a concept is 'concrete' and definable in nature, or, on the other hand, less concrete and / or within a hypothetical, scenario-based or imaginary context. Abstract concepts may require higher level thinking skills, as the thinker needs to create and conceptualise, and not rely on an established or universally understood idea[30].

[27] Ahmed, A. and Pollitt, A. (1999). *Curriculum Demands and Question Difficulty*.
[28] Ibid.
[29] Ibid.
[30] Ibid.

- **Strategy** is divided into question strategy and response strategy. If we take the multiple choice question format as an example, the response strategy will be a more simple process than the question strategy. For example, the response strategy requires the student only to choose from (e.g.) option A, B, C or D; the question strategy, however, may require sophisticated and abstract skills in order to ascertain which answer is correct. In an extended essay question, on the other hand, the response strategy may require a greater level of thought (e.g. how to structure an essay, paragraphing, use of topic sentences), although the question strategy may be easier (e.g. 'write about a day in your life). This interaction between question and response strategy is the reason it is reductionist to assume that a multiple choice question or short answer question is immediately less demanding than an extended answer question; the demand of the question strategy may be high, even where the response strategy demand is low, and vice versa. Rubric also impacts on strategy demand; if the rubric provides support in aspects (such as how to structure an answer, or use of bold to emphasise an approach e.g. **compare** and **contrast**), this may help support the cognitive processing[31]. Pollitt also emphasises that approaches have different meanings in different subjects, 'Explain' in Geography means something different from 'explain' in History or Mathematics.'[32]

In addition to its construct being based in a number of cognitive theories, the decision to use the CRAS framework also arose from its previous application to a similar context (the GCSE, AS and A2 examinations) and its flexibility in application across subjects, where it can be tailored according to the specifics of the subject content and skills involved. For example, Pollitt *et al* outline how it has been tailored to the modern foreign language context, where 'resources' as an aspect has been interpreted as 'the amount and kind of language required from the students in relation to the language they are given in the stimulus material, or to the amount of support they are given for the task.'[33]

For the subject specific analysis, the CRAS framework was extended due to its general construct. Therefore, key activities, strategies and approaches relevant to the specific subject were discussed by the research team in order to assimilate subject specific skills and competences with the overall CRAS demand framework.

Beyond the item-level analysis which uses CRAS, this study seeks to answer a wider question on the comparability of assessment in the MYP and GCSE. A number of other factors beyond cognitive processes have been thought to impact on overall demand, though it is acknowledged that the concepts of difficulty and demand are often conflated. Below are several areas or factors which can potentially impact demand[34]:

- **Time / Duration**
  The relationship between time and demand is unclear at a task/item level[35]: If a student has a longer period of time available, he or she may feel that the answer required should be in more detail or of higher quality. On the other hand, a longer time period reduces time pressure on cognitive processing.

[31] Ibid.
[32] Ibid.
[33] Pollitt et al (2007).
[34] The points above are informed by discussion in Pollitt et al, although at times the views may diverge.
[35] Pollitt et al (2007).

At a whole examination-level though, it is a useful consideration in conjunction with the number, type and demand of individual items – it allows comparison of the demands placed on a student by two different qualifications.

- **Question type (e.g. multiple choice, short answer, extended answer)**
  Although question type clearly impacts demand, the way in which this interacts is less clear. For example, it is an oversimplification to assert that a multiple choice question is lower demand; simply because a question requires less written production this does not mean that the cognitive processes themselves are low level.

  Similarly, an extended answer may not require the degree of succinctness or synthesis required in a short answer, even though at first sight the extended answer would appear to be more demanding. Length is not a clearly co-related marker of demand. Within the CRAS framework, this interaction is best conceptualised in 'Task Strategy', and 'Response Strategy' – the response strategy may be very simple e.g. a multiple choice, but the strategy used in order to reach that answer (task strategy) may be quite sophisticated (e.g. elimination of distractors, engagement with complex or abstract text or input). Question type may also be a feature of difficulty as it may relate more to an individual student preference.

  As stated above, when reviewing a whole examination it can be useful to consider the number and type of questions in conjunction with the time available to complete them.

- **Question choice**
  Although it may be thought that an increased choice in question options within an examination may lower demand, in that the student may be able to choose the question which is more suited to him or her, in fact this is difficult to quantify – if three questions are at the same level of demand, incorporation of choice may not impact demand so much as difficulty.

  Across a whole examination, question choice may also negatively impact in terms of time, as a student without clear examination strategy may start one question and then stop and change to another, or may spend too long deliberating over which question to choose.

- **Use of memory (working / recall)**
  Use of memory may mean a higher cognitive demand: for example, if the candidate needs to recall factual information or quotations this may be more demanding than an 'open book' examination. However, as Pollitt *et al* state, certain question types such as the essay format may allow examination candidates to 'work round' or circumvent items they have forgotten. Similarly, tasks requiring a higher degree of working memory may be more demanding than similar tasks where the rubric provides more resources.

- **Level of reading / writing difficulty**
  For some candidates, the reading or writing burden may heavily impact on their ability to succeed on a particular question. This is relevant even in subjects which are seen as being less related to language (such as science / mathematics). Similarly, pressure of processing a larger quantity of input may be significant.

  This is likely to have a more significant impact across a whole examination than on one or two single items that have a heavier reading / writing burden. It may impact on time, level of engagement with text, and understanding of question requirements.

- **Rubric / Instructions**
  Poorly worded rubric or instructions may negatively raise demand. This relates to 'unintentional demand', e.g. where an examiner has unintentionally increased demand through poor item construct (e.g. an unclear command word, or a suggested answer framework which is too restrictive). When considering in this study, the research team have aimed to consider intentional demand, but flag issues where unintentional demand may impact on test validity.

  Again, if rubric issues are confined to one or two less well worded questions the impact on overall demand is probably relatively low. However, if this is a consistent issue across the examination then (unintentional) demand may be significantly increased.

- **Specification – content depth / breadth**
  Across a whole examination the impact of a more in-depth or broader curriculum may be quite significant on demand: candidates will need more knowledge, a wider range of skills, a better understanding of inter-curriculum or conceptual links.

  When reviewing the breadth and depth of topic coverage in the mathematics and science examinations, UK NARIC first sought to code the key topics from the GCSE and IB MYP examinations separately before considering the allocation of marks, in one assessment sitting, to each of the identified topics. The findings are illustrated in colour-coded figures, designed to highlight the depth of topic coverage and the breadth of topics covered by each qualification. The intensity of the colour increases with percentage of marks, as shown in the example below:

Figure 2: Correlation of colour intensity and mark distribution for content comparison heat maps

Mark distribution	Rating
0-10%	
11-25%	
26-50%	
51-100%	

- **Marks allocated and weighting**
  The overlap between demand and difficulty is highlighted here; although different scoring questions may have more or less the same level of cognitive demand (e.g. solving of an equation requires the same processes) for most subjects marks allocated impact on the depth to which candidates attempt to answer. Thus, for example, an extended essay question worth 40 marks is likely to be more demanding than one worth 15 marks.

  The decision was made to also consider mark schemes. This is strictly an aspect related to 'performance' more than 'demand', however as Pollitt notes 'the distinction becomes difficult to maintain when the demand of mark schemes is considered….a student has two kinds of judgement to make with regard to the mark scheme,…what kind of things the examiners are looking for and how good the answer must be to get (say) five marks.'[36] Thus, on the one hand the marks themselves are related to difficulty, yet how to obtain those marks relate to demand. As a result, the research team also engaged with mark scheme analysis and focussed on weighting of tasks within the examinations as another indicator of demand.

2.3.2.3 Reviewing item demand

The analysis was conducted by a team of analysts at UK NARIC experienced in benchmarking international secondary qualifications, together with four external consultants per subject, all holding qualified teacher status with multiple years' experience as a teacher and/or examiner of their respective subject. Each external consultant was provided with anonymised copies of the relevant IB MYP and GCSE examinations so that they were not made aware which items came from the IB MYP and which were drawn from the GCSE.

Working remotely and individually in the case of mathematics and science, external consultants were provided with instructions to rate questions individually for demand; they were able to select Low, Medium or High, or on occasion as borderline between these two (Low-Medium; Medium-High. These ratings were based on a scale of cognitive demand adapted from the CRAS framework[37] and developed for use with science and mathematics assessment items by Clesham, (2013). Questions were organised and presented to the external consultants by topic area. For the GCSEs, questions were drawn from both Foundation and Higher examinations.

In the case of English, external consultants were similarly asked to rate individual questions from Low to High using a scale adapted from CRAS. For each judgement, external consultants were asked to provide reasoning and a final panel discussion took place between consultants to discuss the overall judgements made.

[36] Pollitt et al (2007).
[37] Pollitt et al (2007).

The data from this item level analysis was initially recorded by UK NARIC in the following table:

Table 5: Template for consolidated item ratings

Task no.	Question type	Topic [Category]	Expert	Rating					CRAS aspect(s) and related comments
				Low	Low-Medium	Medium	Medium-High	High	
1.1 ( )			Expert 1						
			Expert 2						
			Expert 3						
			Expert 4						
1.2			Expert 1						
			Expert 2						
			Expert 3						
			Expert 4						
1.3			Expert 1						
			Expert 2						
			Expert 3						
			Expert 4						

This allowed for conclusions to be drawn both at a topic level (linking back to specification), where possible and by question type. When presenting this in the final report, heat maps were created to show the distribution of ratings. This helped to highlight clear areas of consensus among the external consultants as well as those items that divided the panel. Item rating is by its very nature subjective and whilst the CRAS framework is designed to provide some consistency and guidelines to item rating, there were nonetheless some cases where a question was considered low-medium demand by some, and high demand by others. The figure below provides an example of the heat maps used in the analysis:

Figure 3: Exemplar heat map for consolidated item ratings

Topic [Category]	Question type	Rating				
		Low	Low-Medium	Medium	Medium-High	High
Ecosystems and biodiversity	Extended response					
Forces and motion	Short answer					
Energy	Extended response					

This was calculated based on the number of ratings for each level of demand divided by the total number of ratings for that topic and question type. The heat maps represent the extent of agreement / consensus between the four external consultants per topic and question type. For example, where over half of the ratings suggested questions were of high demand, the project team considered this a good consensus, reflected by the darkest shading. A percentage approach was used to distinguish the colour categories because the total number of questions reviewed varied by subject and by examination.

Figure 4: Correlation of colour intensity and percentage of external consultant rating

Percentage of rating	Rating
0-10%	
11-25%	
26-50%	
51-100%	

The assessment item analysis by external consultants was supplemented by in-house analysis of some items as a cross-check to the external consultants' findings and to attempt to further draw out comparisons across similar question types in the two qualifications. In order to undertake these two processes, the team designed a subject specific framework, oriented around the more generally applicable CRAS framework across the key demand aspects of complexity, resources, abstractness and strategy (encompassing both task strategy and answer strategy).

Analysis subsequently considered the mark schemes put in place by the IB MYP and GCSE. Whilst linked primarily to difficulty, it was nonetheless useful to consider the relative approaches: for example, how marks are allocated in terms of accuracy and method for mathematics programmes; and the skills recognised in the English mark schemes.

2.4 Evaluation and synthesis

The purpose of this stage was to collate and synthesise the findings of the review from the qualification specifications, assessment objectives, assessment methods, item analysis and mark scheme comparisons to provide a consolidated yet concise and reasoned response to the research questions.

In doing so, the project team was mindful of the inherent challenges in trying to compare qualifications which differ considerably in their underpinning philosophy and aims, since these will inevitably inform the approaches to teaching and learning, and assessment design. The GCSE's breadth of topic coverage and larger number of questions indicate that there is a strong focus on a topic- or skill-based approach, with emphasis on the application, analysis, and evaluation of knowledge: in that respect, the topics, facts and skills themselves form the prominent aspect informing design. The IB MYP, on the other hand, is based on a concept-based model with a greater emphasis on principles, patterns or extrapolations, with the topics, facts and skills as a way into these aspects.

3. Findings

3.1 English

As highlighted in the methodology, the focus of the IB MYP and GCSE programmes in English differ. The IB MYP combines studies of language and literature, whilst in the GCSE, the study of language and literature are distinct – encompassed within the GCSE English Language and GCSE English Literature respectively.

As such the GCSE has a more explicit focus in the course aims on developing students' vocabulary and ability to use Standard English. This is nonetheless an integral element of the IB MYP assessment criteria. Both qualifications aim to develop students' ability to read a wide range of texts, both literary and non-literary. In the case of the MYP, the course should develop students' ability to engage with text from "different historical periods and a variety of cultures". Review of GCSE curriculum documents found that the GCSE similarly aims to expose students to texts drawn from different periods in the 19th, 20th and 21st century. Reflecting its combined focus on language and literature; the emphasis on creativity is a recurrent theme for the IB MYP and while also found to some extent in the high level aims of the GCSE regarding the deployment of figurative language, the focus is more on demonstrating control of Standard English and writing grammatically correct sentences.

These aims are reflected in the assessment objectives of each programme, as described below.

3.1.1 Assessment objectives

As can be seen in the table below, GCSE English Language has nine prescribed assessment objectives – four for reading (AO1-AO4, collectively counting for 50%), two for writing (AO5 and AO6 counting for the remaining 50%), and three for spoken language (AO7-AO9), however the latter three are unweighted in the GCSE. The IB MYP Language and Literature course has four assessment objectives: Analysing (A), Organising (B), Producing Text (C) and Using Language (D), all of which are equally weighted.

To highlight the similarities, the project team colour-coded the knowledge and skills included in both. For example, the ability to organise information and arguments effectively appears in both the IB MYP and GCSE (shaded in purple for each programme), as is the ability to use English correctly (shaded in green for both programmes). Not every assessment objective has been colour-coded. In such cases this is because the particular objective was only observed in one programme.

Table 6: Assessment objectives and weightings for IB MYP and GCSE English

IB MYP Language and Literature	GCSE English Language	
Criterion A: Analysing (25%) At the end of Year 5, students should be able to: • Analyse the content, context, language, structure, technique and style of text(s) and the relationship among texts • Analyse the effects of the creator's choices on an audience • Justify opinions and ideas, using examples, explanations and terminology • Evaluate similarities and differences by connecting features across and within genres and texts. **Criterion B: Organizing (25%)** At the end of Year 5, students should be able to: • Employ organizational structures that serve the context and intention • Organize opinions and ideas in a sustained, coherent and logical manner • Use referencing and formatting tools to create a presentation style suitable to the context and intention. **Criterion C: Producing text (25%)** At the end of Year 5, students should be able to: • Produce texts that demonstrate insight, imagination and sensitivity while exploring and reflecting critically on new perspectives and ideas arising from personal engagement with the creative process • Make stylistic choices in terms of linguistic, literary and visual devices, demonstrating awareness of impact on an audience • Select relevant details and examples to develop ideas. **Criterion D: Using language (25%)** At the end of Year 5, students should be able to: • Use appropriate and varied vocabulary, sentence structures and forms of expression • Write and speak in a register and style that serve the context and intention • Use correct grammar, syntax and punctuation • Spell (alphabetic languages), write (character languages) and pronounce with accuracy • Use appropriate non-verbal communication techniques.	**Reading (50%)** **Read and understand a range of texts to:**	
	AO1	Identify and interpret explicit and implicit information and ideas Select and synthesise evidence from different texts (9.4%)
	AO2	Explain, comment on and analyse how writers use language and structure to achieve effects and influence readers, using relevant subject terminology to support their views (13.1)%
	AO3	Compare writers' ideas and perspectives, as well as how these are conveyed, across two or more texts (8.8%)
	AO4	Evaluate texts critically and support this with appropriate textual references. (18.8%)
	Writing (50%)	
	AO5	Communicate clearly, effectively and imaginatively, selecting and adapting tone, style and register for different forms, purposes and audiences Organise information and ideas, using structural and grammatical features to support coherence and cohesion of texts (30%)
	AO6	Candidates must use a range of vocabulary and sentence structures for clarity, purpose and effect, with accurate spelling and punctuation. (This requirement must constitute 20% of the marks for each specification as a whole).
	Spoken Language (unweighted)	
	AO7	Demonstrate presentation skills in a formal setting
	AO8	Listen and respond appropriately to spoken language, including to questions and feedback to presentations
	AO9	Use spoken Standard English effectively in speeches and presentations.

Similar objectives are set in the IB MYP and GCSE for what students are expected to be able to do on completion of the course. Reading and writing skills are both emphasised; the GCSE ensures these are evenly assessed (50% each) whereas the IB MYP assesses these under four different skills (i.e. analysing and organising, in addition to producing text and using language) each weighted at 25% of the overall mark.

The GCSE places more emphasis on reading skills (50% of the overall mark) than the IB MYP (20% of the overall Year 5 mark). Nonetheless, both courses require that students are able to critically analyse texts including an author's language, structure and writing style and to compare these across texts. It is also important to note that the GCSE objective although focussed on the students' ability to read and understand texts, implies that some of this critical analysis may be completed in written form. In particular, the objectives to select and synthesise evidence from texts and to use textual references to support evaluations of texts are broadly similar to the IB MYP writing focussed criteria to use details and examples to develop ideas and to use appropriate referencing tools.

Additionally, both courses place similar emphasis on a student's ability to write and produce texts. The IB MYP criterion D (Using Language) prescribes broadly similar skills to those found in the GCSE AO6; both expect students to use correct vocabulary, sentence structures, spelling and punctuation. The IB MYP additionally expects students to ensure the language is appropriate to the context and intention.

Furthermore, the IB MYP criteria for organising and producing text set similar and more in-depth objectives to those in the GCSE AO5; both expect students to demonstrate imagination in their writing and to adapt their writing style to the audience and the purpose of the text. Although both of the courses imply that critical analysis of texts should occur as part of the reading process, the IB MYP also emphasises that students should be able to critically reflect on perspectives and ideas that arise from the creative writing process.

3.1.2 Assessment methods

The table below presents the assessment methods in both the IB MYP English Language and Literature course and the GCSE English language course[38].

[38] Pearson Edexcel (2018). GCSE (9-1) English Language: Specification.

Table 7: English assessment methods and weighting

	IB MYP English Language and Literature	GCSE English Language
Number and type of assessments each examination series	One externally assessed on-screen examination (taken under test conditions)	Two externally assessed written examinations (taken under test conditions)
Duration	2 hrs	Paper 1: 1 hr 45 minutes Paper 2: 2 hrs 5 minutes
Type(s) of question	Short and extended response	Short, long and extended response
Total marks available	80 marks	Paper 1: 64 Paper 2: 96
Weighting toward overall subject grade	100%	Paper 1: 40% Paper 2: 60%

Both the IB MYP and GCSE courses have external assessments taken under test conditions with similar free-response question types. As the table shows, the GCSE has two assessments worth 50% each, taken over a total of three and a half hours while the IB MYP has one assessment worth 100% of the subject mark and is taken over two hours.

3.1.3 Exam paper review

3.1.3.1 Question types and duration

The IB MYP has a single on-screen examination comprising three overarching tasks, and a series of sub-questions. All questions are compulsory:

- **Task 1** Analysing – comprising short response questions based on two unseen extracts, one written and one multimedia (video or audio).

  For instance, in the example reviewed, students were presented with a series of excerpts from an essay on cultural heritage plus a video excerpt and transcript from a documentary on generations.

- **Task 2** Producing literary text – extended creative written response based on a stimulus (two images).

  For example, in one examination reviewed this included two images respectively showing a silhouetted couple in a storm drain and the lights of a single car illuminating the trees surrounding a remote snow covered road. Both are colour images. Students were asked to create a screenplay for a movie based on these images, taking into consideration a number of literary features such as: point of view, characterisation, mood, audience and/or purpose.

- **Task 3** Producing non-literary text – extended written response on a global context.

  For example, in one of the past examinations reviewed, students were provided with a text on a competition for students to share their vision for an innovating, outdoor learning space. They were then asked to write a proposal for the chief architect outlining the importance of such a space and its potential impact.

GCSE English Language comprises two written examinations: Paper 1: Fiction and Imaginative Writing and Paper 2: Non-fiction and Transactional Writing. Each examination is divided into two parts as listed below:

- **Paper 1: Fiction and Imaginative Writing – Section A Reading**
  Four questions: two short answer, one long answer and an extended response. These are based on an unseen text; in one example revised, this was a 19th century fiction text by Edgar Allan Poe.

- **Paper 1: Fiction and Imaginative Writing – Section B Writing**
  An extended response question, on which students are advised to spend around 45 minutes. Students are directed to answer one question from a choice of two, both of which enable students to write about a real or imagined situation.

- **Paper 2: Non-fiction and Transactional Writing – Section A Reading**
  A combination of short and long answer questions based on two unseen non-fiction texts. For example, one examination reviewed included a newspaper article about a recruitment drive for MI6 and an extract from a memoir by a World War 2 intelligence officer.

  There are two short answer questions and one long answer/extended response question per text, designed to assess the students' comprehension and ability to interpret and evaluate the texts individually. A final task requires students to select and integrate relevant information and ideas from both texts.

- **Paper 2: Non-fiction and Transactional Writing – Section B**
  A single extended response question testing students' transactional writing skills. Students are given two options, from which they must select one. In one examination reviewed, students were able to either write a letter to MI6 applying to be an intelligence officer, or write a newspaper article on how technology tracks movements.

The table below provides a summary of the question numbers, types and overall:

Table 8: Comparison of question types in the IB MYP and GCSE English language examinations

Qualification	Exam duration	Types of question			Total no: questions
		Short answer	Long answer	Extended response	
IB MYP	2 hrs	4	0	3[39]	7
GCSE	1hr 45	2	1	2	5
	2hr 5	4	1	4	9

In total, the GCSE has nearly double the number of overall questions compared to the IB MYP; although there is also nearly double the amount of time to complete these questions (2hrs in the IB MYP and 3hr 50 in the GCSE).

IB MYP students are recommended to spend fifteen minutes on the four short answer questions, thirty-five minutes on the reading analysis extended essay task, and one hour ten minutes on the final two extended writing tasks.

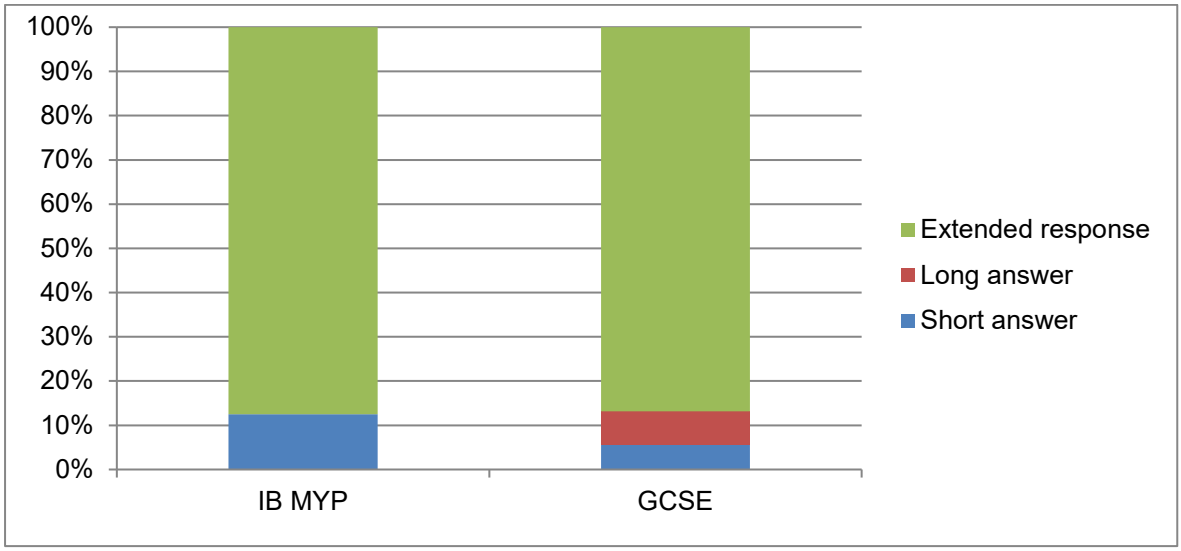
In the GCSE, students are recommended to spend a total of 90 minutes (45 minutes each) on the final two extended writing tasks, and therefore have a slightly shorter duration to complete these tasks than the IB MYP students.

When considering the remaining questions however, GCSE students have 2hrs 20 to do the remaining 12 questions (six short answer, two long answer and four extended response) while the IB MYP students have a total of 50 minutes to do the remaining five questions.

The graph below shows the distribution of marks for different question types[40] in each examination.

[39] One each for Tasks 1, 2 and 3.
[40] Question types are defined in Appendix 2.

Figure 5: IB MYP and GCSE English-Mark distribution (%) per question type



3.1.3.2 Content breadth and depth

In the context of English language, consideration was given to the breadth and depth of skills assessed, coding some of the questions in order to draw out similarities and differences in terms of expectations of student abilities in English skills. The table below shows the skills assessed in the IB MYP.

Table 9: Questions, topics and marks in the IB MYP

Question Number	Topic(s) / Skills assessed	Question Type	Marks Available	Time Available[41]
Task 1, Question 1a	Identification of literary technique and rationale of use of technique in essay text	Short	2	15 mins
Task 1, Question 1b	Evaluation of how argument is developed in same essay text	Short	3	
Task 1, Question 1c	Analysis question on abstract topic within a poem documentary text	Short	2	
Task 1, Question 1d	Analysis question on visual literacy and authorial decision behind image choice in same poem documentary text	Short	3	
Task 1, Question 1e	Compare and contrast approach taken by both authors of input texts to explore their shared topic	Extended	20	35 mins
Task 2	Creative piece covering literary features including perspective, characterisation, mood, audience, purpose based on stimulus image [choice of two images]	Extended	20	35 mins
Task 3	Transactional writing piece: a proposal regarding a creative or innovative idea related to a specific topic	Extended	30	35 mins

[41] As recommended to students on the examination paper.

The following table shows skills assessed across the GCSE English Language examinations:

Table 10: Questions, topics and marks in GCSE English Language examinations

Question Number	Topic(s) / Skills assessed	Question Type	Marks Available	Time Available [42]
Paper 1 (40% of total GCSE)				
1	Identification of phrase in 19th C fictional text / comprehension question.	Short	1	60 mins
2i	Analysis of one way in which author conveys character behaviour in (same) 19th C fictional text.	Short	2	
2ii	Analysis of second way in which author conveys character behaviour in (same) 19th C fictional text.			
3	Analysis of same 19th C fictional text including commentary of authorial use of language and structure to demonstrate mood of narrator.	Long answer	6	
4	Critical analysis and evaluation of how author builds tension.	Extended	15	
5 Or 6	Creative writing on topic related to input text.	Extended	40	45 mins
	Creative writing on topic related to input text.			
Paper 2 (60% of total GCSE)				
1i	Identification / comprehension question in a newspaper article	Short	2	80 mins
1ii	Identification / comprehension question in the same newspaper article	Short		
2	Identification / comprehension question in the same newspaper article	Short	2	
3	Analysis of same newspaper article to discuss authorial use of language and structure to interest and engage readers.	Extended	15	
4	Identification / comprehension question in biographical text	Short	1	
5	Identification / comprehension question in biographical text	Short	1	
6	Evaluation question on how author engages reader through description of relationship with key characters in biographical text.	Extended	15	
7a	Synthesis of the two input texts and evaluation question on similarities between characters portrayed within the texts. (newspaper article and biographical text).	Long answer	6	
7b	Compare / Contrast question of authorial perspectives and views across the two input texts (newspaper article and biographical text).	Extended answer	14	
8 Or 9	Transactional writing (application letter) related to topic of input texts	Extended	40	45 mins
	Non-fiction writing (newspaper article) on technology topic	Extended		

[42] As recommended to students in the examination.

The figure below outlines the skills covered across the two qualifications:

Figure 6: Skills and question type coverage across IB MYP and GCSE based on question coding

	IB MYP	GCSE
Comprehension / identification questions	✔	✔
Evaluation of author purpose and /or success in literary or communicative choices	✔	✔
Compare and contrast / synthesis of multiple texts	✔	✔
Non-fiction writing (based on stimuli) e.g. transactional / newspaper report	✔	✔
Creative writing (based on stimuli or otherwise linked to input texts)	✔	✔

As the figure above indicates, the content is largely comparable: both have short answer questions focussing on basic comprehension or identification. More complex questions covering author intention, purpose or success are also covered across both examinations, as are questions which require students to be able to comment and evaluate across more than one text. Finally, both examinations include questions where the students need to produce language, both through fictional and non-fictional writing.

To better understand the demand across the examination, the analysis also looked at the text types required across both qualifications. These were divided into 'input' texts and 'output' texts: input texts were considered to be the stimuli texts which students need to respond to, generally in terms of understanding literary devices, use of language, and concepts. Output texts were defined as the expected response forms that students would need to create in the (longer) production sections of the examinations. The figure below shows the spread of text types across the two qualifications. The input texts are coloured in green, and output texts in blue. Where both green and blue occur, it represents that particular text type forms both an input and an output question.

As can be seen, both qualifications cover a range of input and output text types. It is worth noting, however, that there were no common text types used across the examinations reviewed. Both examinations cover fiction and non-fiction texts with greater focus on non-fiction texts. Both require formal register output: the IB MYP requires students to write a formal proposal, and the GCSE requires the students to write a formal letter. The GCSE allows more choice on output: for example, the students can write a newspaper article or a formal letter.

Figure 7: Text types covered in IB MYP and GCSE examinations reviewed

	IB MYP	GCSE
Fiction		
Poetry	Input	
Prose e.g. short story, extract from novel		Input / Output
Screenplay	Output	
Non-Fiction		
Newspaper articles		Input / Output
Letters		Output
Essays	Input	
Autobiography / Memoir		Input
Proposal	Output	

Key: Input, Output, Input and Output

The input texts in both examinations are quite complex: the figure below indicates some of the factors contributing to complexity present in the input texts.

It should be noted that each of the input texts are complex in different ways, across the two qualifications. For example, text 1 in the IB MYP is an academic text using some specific lexis related to the topic and consisting of some key conventions of its genre, such as detailed definitions, exemplification, as well as outlining abstract concepts (tangible and intangible). In contrast, text 2 in the IB MYP is a creative poetic text organised in stanzas, full of imagery and abstract concepts. In the GCSE Paper 1, the input text is a 19th Century short story text, full of literary devices to create a sense of drama and suspension, and with a large proportion of low frequency lexis, particularly in terms of descriptive language. In GCSE Paper 2, the first text makes extensive use of imagery, and, at times sarcasm. In particular, it is sited strongly in its cultural context meaning that readers would need to draw on wider contextual knowledge to understand it well. The second text is less demanding in terms of literary language, but has a heavier focus on technical jargon although still within a narration structure.

Figure 8: Factors contributing to text complexity across IB MYP and GCSE English

	IB MYP	GCSE
Personification		✓
Metaphor	✓	✓
Simile	✓	✓
Imagery	✓	✓
Use of expressions, slang, etc.	✓	✓
Abstract concepts / hypothetical situations	✓	✓
Low frequency adjectives	✓	✓
Use of sarcasm or irony		✓
Complex sentence structures (e.g. multiple clauses)	✓	✓
Low frequency or technical vocabulary	✓	✓
Lengthy texts	✓	✓
Persuasive text	✓	
Texts requiring inference	✓	✓
Unfamiliar context (temporal / location / topic)	✓	✓
Formal register	✓	✓

3.1.3.3 Exam paper resources and requirements

Within both the IB MYP and GCSE examinations, students are provided with texts and images that are used as prompts for the writing tasks. The IB MYP on-screen assessment also uses a video and transcript (i.e. multimedia text). GCSE students are then able to handwrite their written responses while IB MYP students are required to type their responses. Each may use text formatting options, within the interface of the on-screen assessment (i.e. italics, underlines, bullet points) for IB MYP, or through the potential use of italics, underlining or capital letters for emphasis for the GCSE.

3.1.3.4 Item demand analysis

This section outlines the findings of the item-level analysis which sought to compare MYP and GCSE questions in terms of the cognitive demand they posed.

The figures below present a visual summary of the panel review findings by item in each qualification, with the shading indicating the distribution of item demand ratings:

Figure 9: Range of external consultants' findings across GCSE English Language Paper 1.

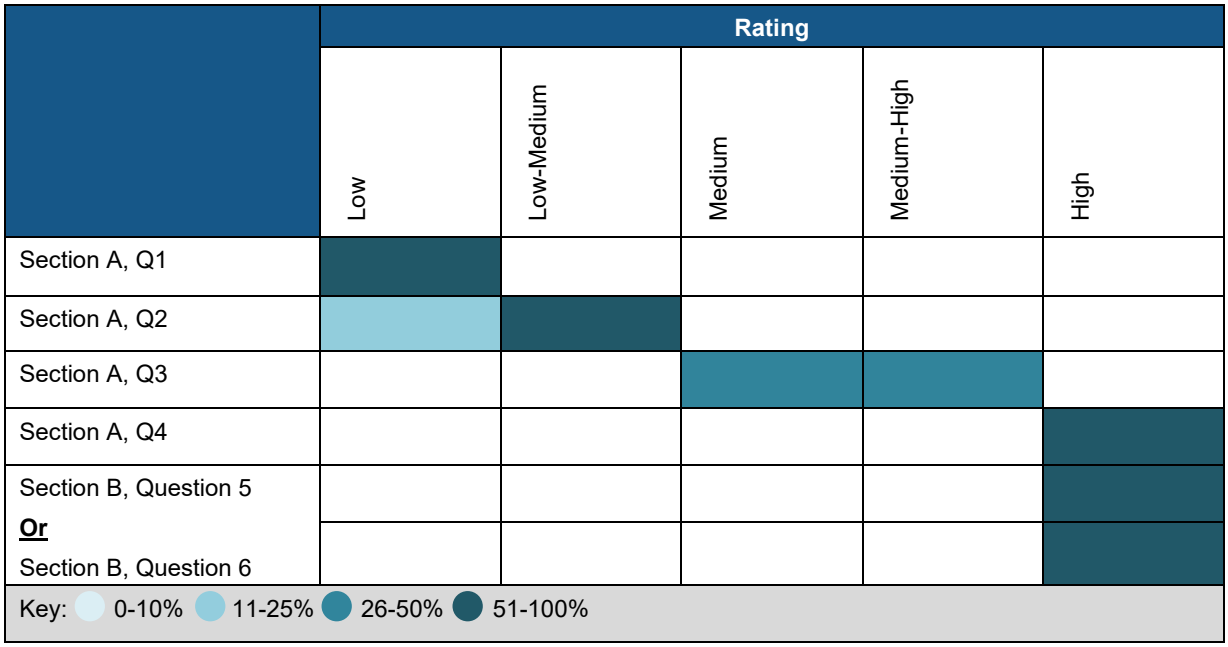


Figure 10: Range of external consultants' findings across GCSE English Language Paper 2

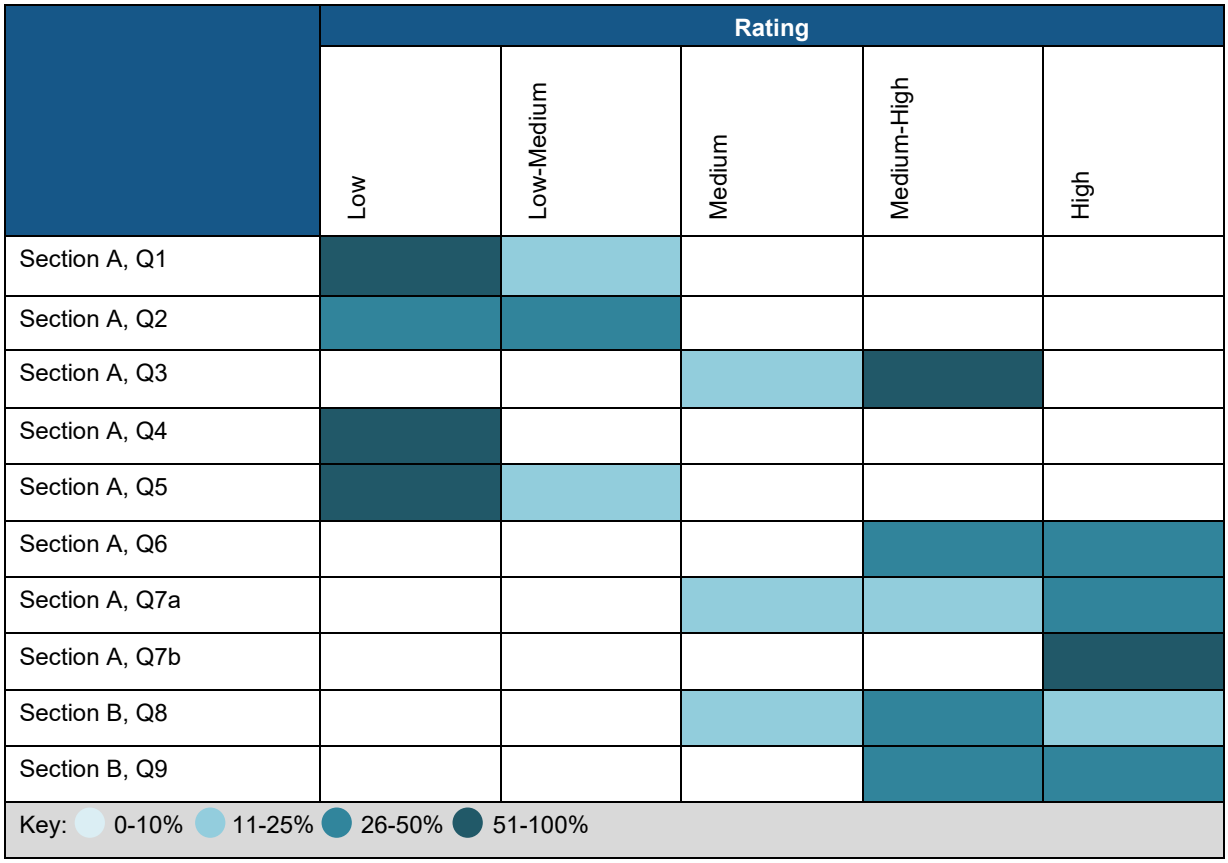
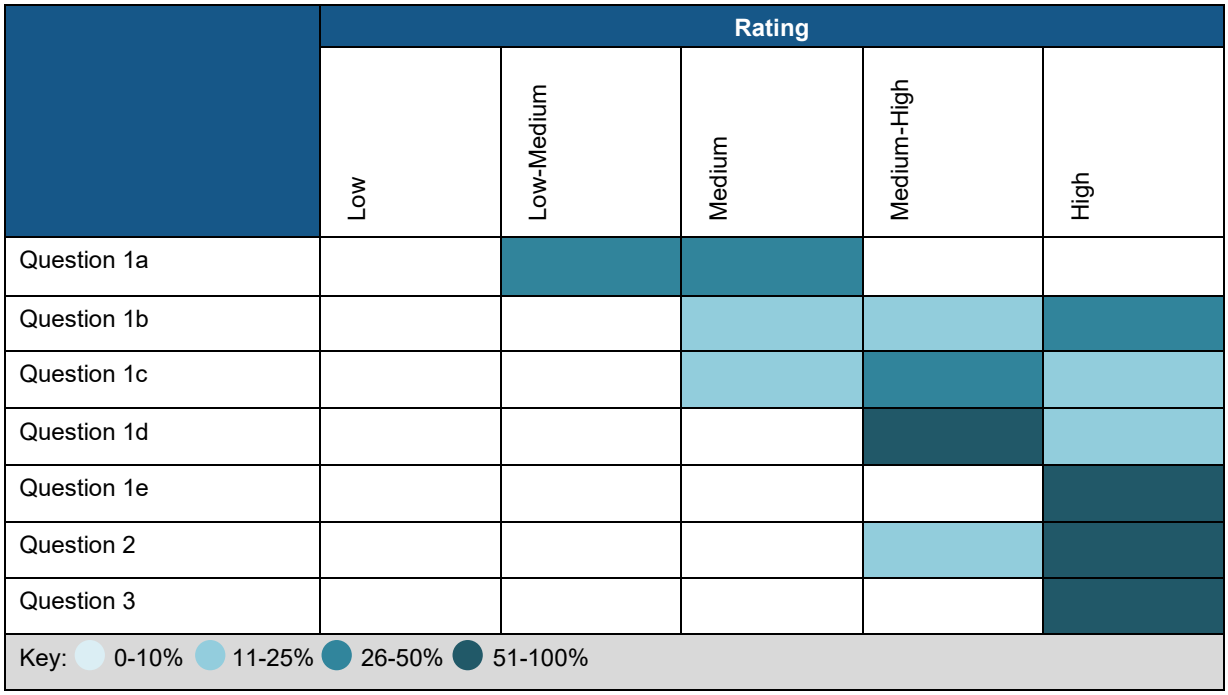


Figure 11: Range of external consultants' findings across IB MYP English Language & Literature



As the figures above show, across GCSE English Language Paper 1 there was a high level of consensus on item demand, with three out of the five tasks unanimously judged to be at the same level of demand. The remaining two tasks also demonstrated a high level of agreement: Task 2 was judged to be either low-medium or low demand by all external consultants. Task 3 was judged to be either medium-high or high.

There was a broad consensus for GCSE Paper 2 too: although there were fewer unanimous agreements on demand, judgements rarely differed more than one level. External consultants were in agreement that Questions 1, 2, 4 and 5 were least demanding, and that Questions 6, 7, 8 and 9 were most demanding. Question 3 was judged to be either 'medium' or 'medium high' in demand, although some external consultants considered demand to be increased due to poor question construct, which would reflect *unintentional* increased demand. The biggest range in external consultants' findings were on Paper 2, specifically on Questions 7a and B8, where findings spread across three levels of demand (in both cases medium - medium high - high). This discrepancy is particularly interesting on Question B8, since this question was worth 40 marks. As a 'medium' demand question it could reasonably be accessible to the majority of students. If, as some external consultants found, it is a 'high' demand question, 40 marks is a considerable percentage of an examination for a question that may be particularly challenging.

For the MYP, the figure indicates that while there was broad agreement on some questions, including 1e and 3 being unanimously considered to be 'high demand'; on questions 1b and 1c, the question judgements ranged from 'medium' to 'high' (e.g. across three demand levels).

In the GCSE, Paper 1 questions requiring basic comprehension skills or very low levels of inference were considered to be of low demand. Higher demand tasks were often linked to the increased demand of task strategy, particularly where students were required to make

creative choices, but also in terms of how this interacted with response strategy. For example, for some questions, students needed to consider not only how to approach a conceptually abstract write-up, but simultaneously structure and organise it well. In some cases, demand was considered particularly high, as when students needed to combine one or more literary element together. Extended responses were generally considered to be the most demanding, and short answer questions requiring identification of features least demanding. Task strategy demand was reduced in some cases through rubric support, such as where students were reminded to use a quotation, providing useful scaffolding.

Paper 2 questions requiring production of text were generally felt to be most demanding, due to the combination of abstractness, task strategy and response strategy aspects. The external consultants argued that demand arose in areas such as students needing to express their own opinions, or needing to undertake a degree of structuring and organisation, or having to unpick abstract concepts such as authorial viewpoints. Abstraction was seen to be a particular barrier in some cases, significantly raising demand in questions where the use of non-literal language may prevent students from understanding the texts. This was of particular interest as abstractness was less commented on in Paper 1. Questions requiring comparing and contrasting were also seen to be particularly challenging in terms of demand, most often expressed in terms relating to complexity; requiring source or text synthesis and evaluation. The lowest demand questions were considered to be short answer 'identification' style questions, such as where the students need to identify a particular phrase, or answer a concrete comprehension question in a short form output (e.g. single word / short sentence).

Resources was one area which was commented on quite frequently by external consultants for Paper 2: this could be in terms of [lack of] internal resources raising demand (e.g. 'students are not familiar with this topic'), which made answering the question complex, as they had little personal background to draw on. Similarly, comments were also made about external resources, primarily in the area of support given by rubric (e.g. 'the bullet points help students to know what to do').

The range of judgements seen for the IB MYP may in some ways be traced to the issues which arose around use of command words, with external consultants often commenting that the command words were not entirely transparent or the expectations unclear, alongside what was perceived as generally less rubric support in comparison to the GCSE. In some cases this reflected increased demand in task strategy, as it would require students to develop their own approach to the question. Such comments, however, may reflect more an issue with external consultants' individual familiarity with qualification types, and different approaches in construct.

These remarks focused primarily around the area of topics and texts and the concepts covered within the texts. External consultants suggested that this raised the demand considerably at times, although in some cases this was framed more negatively, suggesting that students may have limited experience with the topic which may impact on accessibility. Text type was also flagged in particular for the poem-documentary which included a visual aspect as increasing demand. Questions concerned with textual production, e.g. Questions 2 and 3, were also seen as inherently complex due to the output texts required – in some cases external consultants believed that the text type would limit students, whilst other

comments reflected a higher demand in terms of internal resources, whereby the students may need a wider context of knowledge to engage successfully.

As such the item analysis, whilst ensuring an independent and unbiased approach, also revealed a limitation in the methodology. Consultants' increased familiarity with the GCSE may lead them to prefer active verbs rather than questions based on a conceptual construct, such as a question oriented around processes, strategies or skills. This, in turn, may lead to a perception that the GCSE questions were 'fairer' due to a higher degree of transparency in terms of requirements rather than an understanding of the approach implied in IB MYP questions which the students should be familiar with, due to embedded approaches in the curriculum.

Below is a more detailed comparison of the GCSE and MYP items in terms of Complexity, Resources, Abstraction and Strategy.

Comparison of extended compare and contrast questions[43]

Both questions require the students to compare and contrast two input texts of different genres. The questions are relatively heavily weighted in their respective examinations: the IB MYP question is worth 20 marks (25% of the examination), and the GCSE question is worth 14 marks (15% of the examination (one paper), 9% of the total GCSE). The rubric in both questions requires students to specifically reference the texts and engage in detailed analysis across both texts.

Complexity

In both qualifications the compare and contrast question types require synthesis and evaluation of their two different input texts of different genres. The IB MYP input texts consist of an abstract fiction text and an academic text. Question construct requires students to identify the intention behind author decisions and choices and students must provide evidence for their comments. The stages are highly linked: students must first understand the overall concept; then the abstract presentation of the topic in the texts. Students then need to identify choices made by the authors; following this, they need to attempt to understand the rationale behind these choices. Finally they need to compare and contrast this through synthesis of the two texts. Students will need to undertake a multistage process with each step dependent on success at the preceding step.

The first GCSE text is a newspaper article involving some quite complex linguistic techniques including a hint of irony, light humour, literary devices such as imagery, personification, which are quite culturally sited (such as references to class background). Some careful selection of words raises demand in the text, requiring a wide vocabulary range. Text 2 is less complex in terms of literary devices, but the context is likely to be less familiar to students as it is historical and more technical in nature, although related to the same topic as Text 1. Vocabulary is specific and technical in places. This task is also linked in terms of processes: students first must understand the texts; then identify author ideas and perspectives; then explain how they are presented, and then draw out the similarities and differences between the presentations.

[43] IB MYP Question 1e and GCSE Paper 2, Question 7b

Resources

Some internal resourcing is provided in the IB MYP through careful scaffolding of previous questions: this is the fifth question based on these texts and topic and previous questions have supported students to understand some key implications. For example, in Question 1 the idea that text 1 includes some non-literal meaning and that the author's point is developed throughout the text is raised. In Question 1c the students need to engage with some of the literary imagery (simile) of text 2. In Question 1d, the student focuses on a single aspect of how the topic has been developed in text 2, before in Question 1e the candidate is required to bring these elements together across the two texts.

In the GCSE, Some basic support provided in a glossary for very specific terms unlikely to be familiar to students. Students would need some contextual knowledge of the topic to support understanding. As with the IB MYP question, previous questions provide an entry into this question through scaffolding at comprehension question level and literary analysis. In particular the preceding question is a shorter answer comparison question which will allow students to generate some ideas and begin to synthesise the two texts before engaging in this longer compare / contrast question.

Abstraction

The IB MYP topic is highly abstract in nature. Text 1 is a complex academic text on a highly abstract topic, establishing a working definition of a term: structured according to thematic development of argument. Text 2 is a poetic documentary text with abstract language (e.g. similes; imagery; conceptually removed ideas) and is a particularly challenging input text due to its unusual genre and treatment of the subject matter.

The topic in the GCSE is relatively concrete and largely accessible. Text 2 in particular is a more concrete text, which outlines a situation that occurred and the events that happened, with some language used to create literary effect. Text 1 has greater abstractness in that it does cover some less concrete areas such as class, identity, and this increases demand as it may be removed from students' general experience, but overall abstractness is a little lower in demand in the GCSE.

Strategy

Students would need to develop their own strategy for the IB MYP task, and ensure that they are addressing all parts of the question, (compare / contrast / identify author choices / references to text), across various themes. Response requires an extended answer (350 words) which indicates that students will also need to consider aspects of organisation, e.g. paragraphing, structuring, topic sentences etc. within the wider structural framework of a compare and contrast response.

Similarly, in the GCSE, students primarily need to develop their own task strategy: some support is given through rubric (e.g. bullet points which need to be covered and a reminder to refer to the text) but the approach must be constructed by the individual. As an extended answer, students would need to organise and structure their response (e.g. paragraphing) including appropriately signposting the use of quotations and establishing an appropriate structure to compare the two texts over a number of areas.

Comparison of extended response transactional writing questions[44]

Both transactional writing questions are highly weighted: the IB MYP question is worth 30 marks (38%), and the GCSE question is worth 40 marks (42% of Paper 2, 25% over the two GCSE examinations). As transactional writing questions, the students need to communicate a purpose or aim to an audience: in both cases the writing output required is formal. The timing recommendations are slightly different: the IB MYP recommends that students spend 35 minutes on the question, the GCSE recommends 45 minutes. Clearly, both questions are substantial parts of their respective examinations. Both questions require a degree of 'creativity' as the students are unlikely to be able to draw upon their own life experiences.

Complexity

In the IB MYP question, students need to consider a range of different ideas and concepts and connect them into an overall persuasive 'vision'. They will need to give examples and develop their ideas, giving rationales for their approach. Within the task a number of stages are closely linked and connected, and dependent on each other, making this a highly demanding question in terms of complexity.

The task for the GCSE is also complex in design: although it draws upon a real life concrete situation, and there are very specific and clear elements to it, the hypothetical nature of it and the lack of students' own experience in this area make it more complex. Linguistically, complexity arises from the need to use persuasive language and to structure the response in a persuasive way. Within the task a number of stages are closely linked and connected, and dependent on each other.

Resources

No stimulus and no input text are provided in the IB MYP: students need to draw entirely on internal knowledge. The rubric for the GCSE provides some support in terms of areas to cover, and reminds students that they will be assessed on their spelling, punctuation, grammar etc. Moreover, students may be able to draw on input texts from Section A to support content. In the GCSE the question relates to the previous topic and previous questions therefore provide some scaffolding. In the IB MYP the topic is new and unrelated to previous questions in the examination.

Abstraction

Students' likely lack of familiarity with the topic may raise demand in the IB MYP question. The idea of outlining a 'vision' is highly abstract, and based on a hypothetical situation. Furthermore, beyond the hypothetical situation, they also need to consider scenarios of potential impact, linking two levels of abstractness. In the GCSE, some aspects of the question are more abstract than others: for example, students need to outline their reasons for their application and how they may make a difference: both quite abstract concepts. However, in terms of other bullet points, students need to state more concrete aspects. It may be complex for students to create an application letter as it is something they are likely to only have limited experience of in life. This, alongside the hypothetical context of the application, makes demand relatively high in terms of abstractness.

[44] MYP Question 3 – Transactional Writing, Extended Response, 30 marks and GCSE Section B Question 8 – Transactional Writing, Extended Response, 40 marks.

Strategy

The question in the IB MYP requires students to establish a multi staged approach: first to generate creative ideas on the topic, then consider how best to present this persuasively, before looking at organisational / structural ideas. Students need to devise their own strategy from the outset, including creating the content itself. In terms of answer, students then need to reformulate their answer into a formal text written proposal, according to a two-part structure. They will need to consider how best to present their idea within a persuasive context, and carefully organise their response in a structured way, including following key orthographic approaches such as paragraphing, the use of discourse markers, or other signposting techniques.

In the GCSE, to approach the task, the student will need to create relevant ideas and examples within the context which, given its abstract nature, means students will likely be unable to draw on their own life experience. They will need to try to decide which skills or examples are most relevant and useful to draw upon and eliminate others. Finally, this will need structuring persuasively, as per strategy of response. Limited guidance is given, so students will primarily need to establish their own approach.

The students will need to consider appropriate formal letter structure and language in order to address the task successfully. They will need to think about paragraphing, linking their ideas and signposting the points with examples. As the letter is transactional with a communicative aim of persuasion, students will also need to choose language carefully in order to successfully achieve this overall aim.

Comparison of short answer questions[45]

Both questions are low weighted: worth two marks. The IB MYP question is 3% of the examination, and the GCSE question is 3% of the Paper 1 examination, and 1% across the weighted two examinations. In both cases, these questions are at the beginning sections of the examinations and fulfil an 'introductory' function to the input texts to scaffold student engagement with the texts, as well as their purpose in terms of assessment of skills. The questions are not directly comparable in terms of topic or scope, and in this way may be less comparable than the other questions considered in this section, but do nevertheless provide an understanding of the skills and demand aspects associated with the lowest weighted questions.

Complexity

Complexity in the IB MYP question is relatively low: students need to understand author intention and purpose behind linguistic choice, as well as being able to identify the literary device in the text. Nevertheless, whilst the topic itself is quite complex, the specific literary device referred to is a common one, which has a generally standard purpose in texts of engaging a reader. Similarly, in the GCSE, complexity is relatively low. Students need to identify the two examples and recognise in what way they provide information about the character's behaviour.

[45] MYP Question 1a – Short answer, 2 marks and GCSE Paper 1, Section A Question 2i and 2ii, Short answer, 2 marks.

Resources

In the IB MYP, students are told which criterion they are being assessed on. The input text contains the aspects they need to analyse, however they need to consider the purpose of the device based on their own knowledge. There is more rubric support in the GCSE: (e.g. it is clear that they need to identify two ways and support with their own words or direct quotations). Further support is given through the identification of the line numbers which students will need to look at. Irrespective of this support, however, the students will need to draw upon internal understanding of how a specific emotion can be conveyed in literary techniques. Students are told which emotion they need to identify. Both questions are relatively low demand in terms of resources.

Abstraction

The topic itself is abstract in the IB MYP, and that adds an extra level of demand. However, the question construct does not require extensive engagement with the topic. The GCSE is also relatively abstract in the requirement to identify the portrayal of an emotion through behaviour.

Strategy

Students will need to develop their own strategy in terms of identifying the question, and then being able to understand their purpose in the IB MYP question. The required response is quite basic and only requires a short answer. Similarly, in the GCSE, the response strategy is low demand: candidates can either directly quote from the text or, if wanted, can rephrase in their own words. No extensive writing is required. To reach the answer, students need to identify the specific examples in the text, and analyse the paragraph as a whole to understand which aspects relate to the behaviour within the wider context of the text.

The research team's findings across the different aspects of demand are shown in the figure below for the compare / contrast extended questions in the IB MYP and the GCSE:

Figure 12: Overall findings of in-house item analysis

Question type	CRAS	Low → High
Compare/contrast questions	Complexity	◆ ●
	Resources	● ◆
	Abstraction	◆ ●
	Task Strategy	● ◆
	Answer strategy	● ◆
Transactional writing	Complexity	◆ ●
	Resources	◆ ●
	Abstraction	◆ ●
	Task Strategy	● ◆
	Answer strategy	● ◆
Short answer 'identification; questions	Complexity	● ◆
	Resources	● ◆
	Abstraction	● ◆
	Task Strategy	● ◆
	Answer strategy	● ◆
Key: ● MYP ◆ GCSE		

In the extended response questions compared, the IB MYP was found to be mostly high demand in terms of complexity, abstractness and strategy. This was generally the case for the GCSE questions too, although complexity, abstractness and strategy were considered to be of medium-high demand. The level of demand of selected IB MYP and GCSE short answer questions in terms of complexity, resources, abstractness and strategy were found to be similar.

3.1.4 Mark schemes

Similar mark schemes and broad marking approaches are applied in both the IB MYP and the GCSE. Both courses provide a detailed mark scheme and specific guidance to examiners on how to award the marks for each response.

Each question in the GCSE is typically designed to assess a single assessment objective (or AO5 and AO6 for the final extended written response). The mark scheme also indicates what the correct answer will be, or is likely to include and the number of marks to award for each component. Exemplar responses are given, including all possible variations of responses to a question. For all of the long and extended response questions, the marking grid and indicative content are used to determine the marks. The number of levels on the marking grid depends on the total number of marks for the question.

GCSE examiners receive guidance on how to award marks including how to use the marking grids alongside the indicative content (i.e. factual points that could be used in an answer) to determine a 'best-fit' for the mark.

Similar to the indicative content in the GCSE, the IB MYP also provides exemplar responses that represent the top end of each band in the marking grids. Unlike the GCSE, which includes even levels within a marking grid (i.e. 15-13, 12-10, 9-7, 6-4, 3-1), the IB MYP extended response questions have marking grids with uneven levels; the top band for each criterion can be awarded 10-9 marks and the bottom level 2-1 marks, while the middle levels have a range of three possible marks (8-6, 5-3).

Although the IB MYP gives a recommended word count, neither course awards marks based on the number of words or penalises if these are under or over the word count; however, the IB MYP only allows a maximum of two marks to be awarded for Criterion B if a student uses bullet points in their written response.

A key difference in the approach to marking for IB MYP is the inclusion in these criteria of a cap for marks where one or more particular aspect of the student's response is absent (e.g. "a failure to use both of the images should not be awarded more than (5 marks for Criterion C – Producing Text.)" and "responses which use neither the images nor the theme of the prompt should be awarded (0 mark) for Criterion C – Producing Text."

A detailed comparison of the mark schemes for writing tasks revealed a number of close similarities. In the examinations reviewed for example, both mark schemes apply two separate assessment objectives related to writing skills and the use of language. For the highest mark band the IB MYP marks scheme looks for "perceptive stylistic choices in terms of linguistic and literary devices, demonstrating sophisticated awareness of impact on an audience" which matches very closely with the GCSE mark scheme's top mark band where the requirement is for the shaping "audience response with subtlety, with sophisticated and sustained use of tone, style and register."

It should be noted that while the overall approach and generally the level of skills required are similar, the approach to banding levels is different. The IB MYP has fewer bands than the GCSE. This reflects a key difference in marking philosophies: the IB MYP employs a

criterion-based approach where students are assessed against written descriptions of what a student should know and be able to demonstrate for a given mark. By contrast, the GCSE employs a best-fit approach to marking. Therefore, in their respective rubrics, the GCSE explicitly refers to the elements for which the student will receive positive marks while the IB MYP refers to the criteria that the task will be assessed by.

3.2 Mathematics

IB MYP and GCSE Mathematics, both aim to develop students' knowledge and understanding of mathematical concepts, principles and methods to prepare them for further study. Both programmes also aim to develop students' problem-solving, reasoning and communication skills.

The IB MYP additionally intends to develop students' ability to explore mathematics in a broader context, namely that the course enables students to appreciate:

- "How developments in technology and mathematics have influenced each other…
- The moral, social and ethical implications arising from the work of mathematicians and the applications of mathematics…
- The international dimension in mathematics through an awareness of the universality of mathematics and its multicultural and historical perspectives."

Moreover, the IB MYP also aims for students to be able to reflect on their work and the work of others, an element not evident in the prescribed aims for GCSE.

3.2.1 Assessment objectives

The MYP offers Standard and Extended Mathematics. The Extended Mathematics course covers greater depth and breadth of content in comparison to the Standard option. Students intending to study higher level Mathematics (such as the Diploma Programme Maths HL) would typically take the Extended course. The Extended course has more study hours than the Standard course, although the assessment objectives for both options are the same.

For GCSE, students may be entered into either the Foundation or Higher tier, each of which targets a different set of grades[46].

The assessment objectives for the MYP and GCSE Maths courses are presented in the table below, with the indicative weightings for GCSE (including differences between Foundation and Higher tiers); assessment objectives in the MYP are equally weighted.

To highlight the similarities, the project team colour coded the knowledge and skills included in both. For example, the ability to use mathematical notation and terminology appropriate appears in both the IB MYP and GCSE (shaded in orange for each programme). Not every assessment objective has been colour-coded. In such cases this is because the particular objective was only observed in one programme.

[46] The GCSE is graded on a 9-1 scale. Those sitting the Higher tier can typically achieve grades of 9-4 though, with the possibility to achieve a grade 3 when narrowly missing the required marks for a grade 4. The Foundation tier targets grades 5-1.

Table 11: Assessment objectives and weightings of IB MYP and GCSE Mathematics

IB MYP Mathematics	GCSE Mathematics
A: Knowing and understanding (25%): • Select appropriate mathematics when solving problems in both familiar and unfamiliar situations • Apply the selected mathematics successfully when solving problems • Solve problems correctly in a variety of contexts. **B: Investigating patterns (25%)** • Select and apply mathematical problem-solving techniques to discover complex patterns • Describe patterns as general rules consistent with findings • Prove, or verify and justify, general rules. **C: Communicating (25%)** • Use appropriate mathematical language (notation, symbols and terminology) in both oral and written explanations • Use appropriate forms of mathematical representation to present information • Move between different forms of mathematical representation • Communicate complete, coherent and concise mathematical lines of reasoning • Organize information using a logical structure. **D: Applying mathematics in real-life contexts (25%)** • Identify relevant elements of authentic real-life situations • Select appropriate mathematical strategies when solving authentic real-life situations • Apply the selected mathematical strategies successfully to reach a solution • Justify the degree of accuracy of a solution • Justify whether a solution makes sense in the context of the authentic real-life situation.	**AO1: Use and apply standard techniques (Higher 40%, Foundation 50%)** • Accurately recall facts, terminology and definitions • Use and interpret notation correctly • Accurately carry out routine procedures or set tasks requiring multi-step solutions. **AO2: Reason, interpret and communicate mathematically (Higher 30%, Foundation 25%)** • Make deductions, inferences and draw conclusions from mathematical information • Construct chains of reasoning to achieve a given result • Interpret and communicate information accurately • Present arguments and proofs • Assess the validity of an argument and critically evaluate a given way of presenting information. **AO3: Solve problems within mathematics and in other contexts (Higher 30%, Foundation 25%)** • Translate problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes • Make and use connections between different parts of mathematics • Interpret results in the context of the given problem • Evaluate methods used and results obtained • Evaluate solutions to identify how they may have been affected by assumptions made.

Parallels can be drawn between the MYP and GCSE assessment objectives in terms of the expected knowledge and skills, though comparisons of the weighting afforded to these skills is less clear cut because of differences in the structure of the objectives in each programme. For example, the MYP has a dedicated assessment objective for applying mathematics in real life context, worth a quarter of the marks available. GCSE students will be assessed on their ability to apply their knowledge to problems in mathematical and non-mathematical contexts, similarly worth 25/30%; but this could be about applications in maths and in different areas of the curriculum. Communicating, a component of AO2 in the GCSE, is a standalone assessment objective in the MYP with greater weighting allocated to this. AO2 as

a whole is worth 25-30% of the marks and encompasses some of the key skills from objectives B and C in the MYP, collectively weighted at 50%.

A further difference can be seen in the weighting and expectations related to knowledge and understanding, which is attributed 40-50% in the GCSE, and 25% in the MYP. There also appears to be some differences in the focus of these objectives. The GCSE includes knowledge recall of terminology, accurate use of notation. Whilst these may be implicit in the MYP, the emphasis in this assessment objective (A) is on the application of mathematical knowledge to solve problems, therefore demonstrating some correlation with AO3 of the GCSE. Similarly the MYP assessment objective (D) refers to identifying relevant elements of authentic real-life situations, which although not explicitly referenced in the GCSE assessment objectives, may be implicit in the GCSE AO3.

3.2.2 Assessment methods

IB MYP and GCSE Mathematics are both assessed through external examinations at the end of programme, as shown in the table below:

Table 12: Mathematics assessment methods and weightings

	IB MYP Mathematics		GCSE Mathematics	
	Standard	Extended	Foundation	Higher
Number and types of assessments	On-screen examination	On-screen examination	Three examinations	Three examinations
Duration	2 hours	2 hours	1.5 hours each	1.5 hours each
Types of question	Short answer, matching and extended problem	Short answer, matching and extended problem	Short answer, gap-fill and extended problems	Short answer and extended problems
Total marks available	100 marks	100 marks	Paper 1-80 marks Paper 2-80 marks Paper 3-80 marks	Paper 1-80 marks Paper 2-80 marks Paper 3-80 marks
Weighting toward overall subject	100%	100%	Paper 1-33.33% Paper 2-33.33% Paper 3-33.33%	Paper 1-33.33% Paper 2-33.33% Paper 3-33.33%

The GCSE Foundation and Higher are each assessed through three examinations worth 33.33% each, where each examination is to be completed within 1.5 hours. While the IB MYP standard and extended mathematics are each assessed through one examination worth 100% of the subject mark and taken over two hours.

3.2.3 Exam paper review

3.2.3.1 Questions and duration

As detailed in the table above, the MYP examination comprises a range of short answer, matching and extended problem questions. These are organised under three tasks which each address one of three overarching objectives (knowing and understanding; applying mathematics in real-life contexts; and investigating patterns). The fourth objective, Communication, is assessed across all tasks. The on-screen examinations of both the IB MYP standard and extended mathematics consists of eight overarching questions of which seven are multi-part questions and one standalone extended problem. The sub-questions of the multi-part questions are mostly short answer question types with a few extended problems and one matching question. The GCSE examinations contain a mixture of short answer, multi-part and extended problem questions.

The table below summarises the question types found in the IB MYP and GCSE examinations:

Table 13: Comparison of IB MYP and GCSE Mathematic examinations

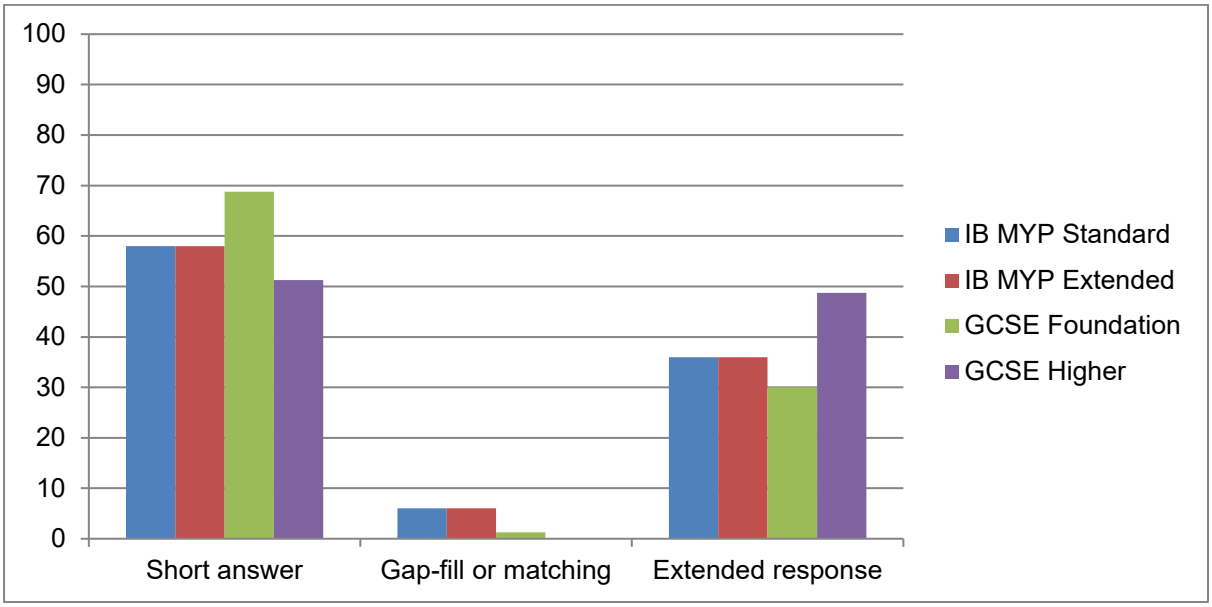
Qualification[47]	Exam duration	Questions			Total no: of questions[48]
		Short answer	Gap-fill or matching	Extended problem	
IB MYP *Standard*	2 hrs	29	2	3	34
IB MYP *Extended*	2 hrs	24	2	3	29
GCSE *Foundation*	1.5 hrs per examination	33	1	6	40
GCSE *Higher*	1.5 hrs	18	0	9	27

As shown in the table above, the GCSE and MYP make similar use of multi-part questions with several component short answer questions. Both include extended problem questions however when comparing the weighting of these to the overall examination, the MYP places more weight on these than the GCSE Foundation.

[47] In total the GCSE Foundation and Higher are assessed through three examinations each. Here a sample of one Foundation and Higher has been reviewed to evaluate the assessment duration in conjunction with the number and types of questions within a whole examination.

[48] Please note that this does not relate to the total number of overarching questions (which for the GCSE Foundation ranges from approximately 24-30, and 21-23 for the GCSE Higher) but rather the total number of component questions allowing for more meaningful analysis.

Figure 13: IB MYP and GCSE Mathematics - mark distribution (%) per question type



Overall, the GCSE examinations have a greater number of questions to be completed in the relative time available, in particular the GCSE Foundation examinations compared to the IB MYP examination. However, the IB MYP examination includes a small number of extended problems that are awarded up to 20 marks each. These extended problems also assess a broader range of skills than the GCSE extended problem questions.

3.2.3.2 Content breadth and depth

In terms of content covered in the examinations, review of whole examinations for the MYP and GCSE found the following:

Figure 14: Content coverage across the MYP and GCSE examinations

	IB MYP		GCSE	
	Standard	Extended	Foundation	Higher
Geometry and Trigonometry	✔	✔	✔	✔
Statistics and Probability	✔	✔	✔	✔
Algebra and Functions	✔	✔	✔	✔
Number	✔	✔	✔	✔
Vectors		✔	✔	✔
Key (mark distribution per topic): 0-10% 11-25% 26-50% 51-100%				

The breadth of topic coverage by both qualifications is shown to be broadly comparable, as shown by the ticks in the figure. A minor difference is that the topic Vectors is only covered in IB MYP Extended Mathematics.

The depth of topic coverage is found to be similar for some topics while differences are encountered for other topics. The figure shows the percentage of total examination marks awarded for each topic, where a darker colour corresponds to higher percentage of total examination marks, as described in the Methodology Section. The GCSE is found to assess the topic Number in greater depth than the IB MYP examinations, particularly the GCSE Foundation examinations, where simple mathematical concepts including fractions, percentages, ratios, proportion, rates of change and number sequences are assessed. The GCSE Higher examination is found to focus on the topics Geometry and Trigonometry and Algebra and Functions, similar to the IB MYP examinations. Both qualifications are found to award less than 10% of the total examination marks on the topic Vectors, which assesses more complex mathematical concepts, compared to the other topics.

3.2.3.3 Exam paper resources

Calculators are not allowed for some of the GCSE examinations, meaning that students have to demonstrate the ability to perform mathematical procedures without the aid of a calculator. The IB MYP examination allows calculators for all questions.

The IB MYP and GCSE examinations both base their questions on graphs, data tables and diagrams. The IB MYP additionally includes videos, static images, animations and simulations, where students have to interpret the information described to answer the question.

3.2.3.4 Item demand

Four external consultants were asked to rate a sample of questions from the MYP Standard and Extended examination, and the GCSE Foundation and Higher tier examinations. The rating was conducted independently and remotely; nevertheless when reviewing their findings for the GCSE Foundation examination items, there is overall a broad consensus across many of the items, with many considered to be of low or low-medium demand, and some moving into the medium or medium-high demand range.

Figure 15: Range of external consultants' findings across GCSE Foundation Mathematics

Topic [Category]	Question type	Rating				
		Low	Low-Medium	Medium	Medium-High	High
Geometry, Trigonometry and vectors	Short answer					
	Extended problem					
Statistics and Probability	Short answer					
	Multi-part Short answer					
Algebra and Functions	Short answer					
	Multi-part Short answer					
	Multi-part Short answer Gap-fill					
	Extended problem					

Key: 0-10% 11-25% 26-50% 51-100%

Generally extended problem questions are considered to be of higher demand than short answer questions for all topics, because of the higher skills assessed and the longer length of answer required. The questions are found to include a large number of information such as tables and diagrams within the question that is found to lower the demand of questions. Questions that assess the ability of students to use a calculator to provide a solution are generally considered to be of low demand. However, the use of trigonometry is found to increase the demand of these types of questions.

The GCSE Higher examination is found to be more demanding than the GCSE Foundation examination, where most items are considered to be of medium to high demand. The consultants found that the extended problems in the GCSE Higher examination provide minimal information to solve the problem, increasing the demand of the question. In the topic Geometry, Trigonometry and Vectors, the lack of diagrams, information such as coordinates and the use of multiple formulae are found to increase the demand of questions. Similarly, for the topic Statistics and Probability, the lack of tree diagrams and scale is found to increase the demand of the question. The GCSE Higher tier expects students to formulate a proof, which is a high demand skill, although, some of the external consultants highlighted that the demand of these questions may not be high, as students could memorise these proofs. Further, algebraic proofs are found to be of lower demand than proofs related to geometry, trigonometry and vectors.

Figure 16: Range of external consultants' findings across GCSE Higher Mathematics

Topic [Category]	Question type	Rating				
		Low	Low-Medium	Medium	Medium-High	High
Geometry, Trigonometry and vectors	Extended problem					
Statistics and Probability	Multi-part Short answer					
Algebra and Functions	Short answer					
	Multi-part Short answer					
	Extended problem					

Key: 0-10% 11-25% 26-50% 51-100%

For the IB MYP standard mathematics items reviewed where most items are found to be of medium to high demand.

Figure 17: Range of external consultants' findings across IB MYP Standard Mathematics

Topic [Category]	Question type	Rating				
		Low	Low-Medium	Medium	Medium-High	High
Geometry, Trigonometry and vectors	Multi-part Short answer Extended problem					
Statistics and Probability	Multi-part Short answer Extended problem					
Algebra and Functions	Multi-part Short answer					
	Multi-part Matching					

Key: 0-10% 11-25% 26-50% 51-100%

Overall, the skills assessed in particular analysing and communicating information in the extended problem questions is found to increase the demand of the question. The longer response and higher proportion of marks allocated for extended problems compared to the GCSE is found to increase the demand of the questions.

Figure 18: Range of external consultants' findings across IB MYP Extended Mathematics

Topic [Category]	Question type	Rating				
		Low	Low-Medium	Medium	Medium-High	High
Geometry, Trigonometry and vectors	Multi-part Short answer					
Statistics and Probability	Multi-part Short answer Extended problem					
Algebra and Functions	Multi-part Short answer					

Key: 0-10% 11-25% 26-50% 51-100%

Most of the IB MYP Extended items are found to be of medium to high demand. The IB MYP Extended questions are found to assess complex concepts such as vectors in unfamiliar contexts, which increase the demand of the question. Further the IB MYP Extended Mathematics assess on transformation of periodic functions that is more demanding than quadratic functions that is assessed in the IB MYP Standard Mathematics.

Below are more detailed comparative analyses of questions from the GCSE and MYP in terms of complexity, abstractness, resources and strategy.

Comparison of Mathematics questions on probability[49]

Complexity

Both selected IB MYP and GCSE questions involve calculating probabilities from a given dataset and scenario. Knowledge of conditional probability and solving associated problems is required in both GCSE and IB MYP questions, indicative of a medium to high level of demand in terms of complexity. The GCSE question includes interpreting and using data provided in the form of statements, whilst the data in the IB MYP question is presented in tabular format and in graphs aiding accessibility. Overall the level of demand is medium in the IB MYP and medium to high in the GCSE, given additional demands placed on strategy and mathematical reasoning in the GCSE question.

Abstractness

The level of abstractness is similarly medium to high in both the IB MYP and GCSE questions. Both present real-world scenarios, in which the candidates are expected to apply their knowledge and conceptual understanding of conditional probability, the mathematical notation for representing probability, and the use of tree diagrams to solve problems.

[49] (Pearson GCSE Sample Paper 3 Higher tier, Question 12 IB MYP 2017 Question 7)

Resources

The information required to answer the questions is provided in the question, along with extraneous information. There is a single extended sub-part in the GCSE worth 4 marks whereas in the IB MYP the question is broken down into a greater number of sub-parts worth 1-2 marks. In the IB MYP sub-part, the tree diagram is provided to the candidate whereas in the GCSE, the candidate needs to apply their knowledge, constructing a tree diagram to solve the problem in a series of logical steps.

Strategy and Answer Strategy

Both IB MYP and GCSE questions require the candidate to identify correct rules for calculating probability and distinguish between different types of probability. The strategy required in the GCSE question standalone question has to be inferred by the student to a greater extent than in the IB MYP question, in which the tree diagram is provided in the question. Understanding of the concepts in probability and logical deduction, demonstrating the links in the required calculations, are nonetheless expected to score full marks in both questions.

Comparison of Mathematics questions on Geometry[50]

Complexity

The reviewed IB MYP and GCSE questions in geometry similarly involve applying knowledge and understanding of trigonometry in solving problems involving vectors and in the case of the GCSE question, scalar quantities. The IB MYP question is split into three sub-parts whereas the GCSE question is a single stand-alone extended problem. The level of complexity from a topic perspective is nevertheless high, with both the GCSE and IB MYP including problems which require mathematical reasoning in multiple steps and application of trigonometric rules.

Abstractness

The topic of vectors and scalar quantities is of high abstractness in both the GCSE and IB MYP. The problems require application of mathematical reasoning and application, contributing to the overall high level of demand of the respective IB MYP and GCSE questions.

Resources

The GCSE question provides a diagram and the known properties of vectors but with relatively few pointers, the candidate is therefore expected to make deductions based on trigonometric rules. The IB MYP question is presented in a real-world context, supported with diagrams. As in the GCSE question, the IB MYP candidate has to select and apply trigonometric rules in a logical sequence to arrive at the correct answer.

Strategy and Answer Strategy

Parts a and b of the IB MYP question involve a relatively straightforward strategy in one or two steps, whilst the part c, carrying the highest number of marks, involves solving a multi-step problem in which the candidate is expected to apply a higher level of mathematical reasoning skills. Similarly in the GCSE question, whilst essential information is provided, the

[50] (Pearson GCSE Sample Paper 3 Higher tier Question 18 and IB MYP Extended Paper Question)

candidate must develop their own strategy, making a series of logical deductions based on the application of trigonometric rules in order to arrive at the correct solution. Part marks can be awarded in both qualification assessments for the working out and clear mathematical communication. The respective strategies can be considered to be of high demand in both the IB MYP and the GCSE.

Comparison of Mathematics questions on Algebra[51]

Complexity

The reviewed IB MYP and GCSE questions focus on understanding the graphs of functions, coordinates and deriving algebraic expressions from graphs and working out values from functions. Two GCSE questions are selected as the basis for comparison, given the shorter length of structured questions in the GCSE. The first GCSE algebra question has three parts in which the candidate must sketch graphs of different functions indicative of medium demand whilst the IB MYP is broken down into seven separate parts involves additional mathematical reasoning in developing, verifying and justifying rules in the later parts of the question. The IB MYP question can be considered of high demand in terms of its complexity. The second selected GCSE algebra question requires some manipulation as well as conceptual understanding of quadratic functions although does not require extended mathematical reasoning, categorising it as medium to high complexity.

The final part of the IB MYP question is an investigative task worth 22 marks, this type of question is not found in the GCSE examinations and can be considered as higher complexity given the emphasis on developing extended mathematical arguments whilst maintaining clear and concise mathematical communication.

Abstractness

The key information required to solve the associated problems is provided in the respective GCSE and IB MYP questions. Both reviewed questions are set in a mathematical rather than a real-world context. There is a relatively high level of abstractness evident in the concepts assessed as well as the context.

Resources

The GCSE question on functions presents two functions and asks the candidate to solve associated problems. The other selected GCSE question involves sketching graphs of equations, based on knowledge and understanding of the type of function. The IB MYP question similarly presents a graph derived from a simulation, the question parts provide the key information whilst extended sub-parts, worth the majority of the marks for the question, place more emphasis on developing a coherent strategy and demonstrating mathematical reasoning given a clearly defined problem.

Strategy and Answer Strategy

The strategies in the GCSE and IB MYP questions involve conceptual understanding of behaviour of functions and applying this knowledge to sketch graphs (GCSE) and provide coordinates (IB MYP). The GCSE questions involve strategies of one or two steps, whilst the

[51] (Pearson GCSE Sample Paper 2 Higher tier Question 19 and Paper 3 Question 10, IB MYP 2017 Question 7a-g)

IB MYP sub-parts also involve rule development and solving problems in multiple steps. The strategy for the final part involves detailed mathematical argumentation, which is not assessed in the GCSE. The ability to plan and communicate mathematically are also assessed in the IB MYP and to some extent in the GCSE, partial marks for correct strategy can be awarded in both assessments.

The findings can be summarised as follows:

Figure 19: Overall findings of in-house item analysis

Question type	CRAS	Low → High
Probability Questions	Complexity	● ◆
	Resources	● ◆
	Abstraction	● ◆
	Task Strategy	● ◆
	Answer strategy	● ◆
Geometry Questions	Complexity	◆ ●
	Resources	◆ ●
	Abstraction	◆
	Task Strategy	● ◆
	Answer strategy	● ◆
Algebra Questions	Complexity	◆ ●
	Resources	◆ ●
	Abstraction	● ◆
	Task Strategy	◆ ●
	Answer strategy	◆ ●

KEY: ● IB MYP ◆ GCSE

In all topics, a high level of demand in terms of abstractness is evident in both qualifications. The questions assess application of mathematical concepts in different contexts and the ability of students to construct mathematical reasoning. The level of demand of questions from both qualifications in terms of complexity, resources, task strategy and answer strategy is found to depend on the topic assessed, where GCSE is found to be more demanding than IB MYP for Probability while IB MYP is more demanding for questions on Algebra. For questions on Geometry, both qualifications have similar level of demand in terms of the CRAS elements.

3.2.4 Mark schemes

Many similarities are observed in the marking approaches by both programmes. For example both programmes award marks for correct workings or method even though the final answer may not be correct. For some questions (mostly single step questions) marks are awarded for the correct answer even if workings are not provided, while for other questions (mostly multi-step questions) workings have to be provided along with the correct answer. Similarly, further or subsequent workings after the correct answer are to be ignored unless the subsequent work contradicts the correct answer.

3.3 Science

As discussed in the methodology, when comparing assessment frameworks and demand in science, this study has considered integrated science courses in each qualification, as well as physics as a standalone science subject.

The MYP and GCSE science programmes have a number of shared aims, with both intending to develop students' knowledge and understanding of science concepts and the ability to apply them in different contexts. A key aim of both programmes is to develop in students, scientific enquiry and investigative skills that enable them to answer scientific questions, including the ability to evaluate evidence and draw conclusions.

The IB MYP additionally intends to develop a number of aims that are not evident in the GCSE. These aims relate to considering science as a human endeavour with benefits and limitations; building an awareness of the need to effectively collaborate, developing sensitivity towards the living and non-living environments, and reflecting on learning experiences and making informed choices.

3.3.1 Assessment objectives

As both the IB MYP and GCSEs prescribe assessment objectives that are applicable across all of the science subjects (i.e. both science and physics), these are examined in the table below.

To highlight the similarities, the project team colour coded the knowledge and skills included in both. For example, the ability to analyse information and make informed judgements appears in both the IB MYP and GCSE (shaded in purple for each programme). Not every assessment objective has been colour-coded. In such cases this is because the particular objective was only observed in one programme.

Table 14: Assessment objectives and weightings of the IB MYP and GCSE Science[52] [53]

IB MYP Science	GCSE Science
Criterion A: Knowing and understanding (25%) At the end of Year 5, students should be able to: • Explain scientific knowledge • Apply scientific knowledge and understanding to solve problems set in familiar and unfamiliar situations • Analyse and evaluate information to make scientifically supported judgments. **Criterion B: Inquiring and designing (25%)** At the end of Year 5, students should be able to: • Explain a problem or question to be tested by a scientific investigation • Formulate a testable hypothesis and explain it using scientific reasoning • Explain how to manipulate the variables, and explain how data will be collected • Design scientific investigations **Criterion C: Processing and evaluating (25%)** At the end of Year 5, students should be able to: • Present collected and transformed data • Interpret data and explain results using scientific reasoning • Evaluate the validity of a hypothesis based on the outcome of the scientific investigation • Evaluate the validity of the method • Explain improvements or extensions to the method. **Criterion D: Reflecting on the impacts of science (25%)** At the end of Year 5, students should be able to: • Explain the ways in which science is applied and used to address a specific problem or issue • Discuss and evaluate the various implications of using science and its application to solve a specific problem or issue • Apply scientific language effectively • Document the work of others and sources of information used.	**AO1 Demonstrate knowledge and understanding of (40%):** • Scientific ideas, • Scientific techniques and procedures. **AO2 Apply knowledge and understanding of (40%):** • Scientific ideas • Scientific enquiry, techniques and procedures. **AO3 Analyse information and ideas to (20%):** • Interpret and evaluate • Make judgements and draw conclusions • Develop and improve experimental procedures

Both programmes aim to test the students' ability to demonstrate and apply knowledge and understanding in familiar and unfamiliar situations.

[52] Department for Education, n.d. (2019). *GCSE AS and A level Assessment Objectives*
[53] International Baccalaureate Organization (2017b). *Middle Years Programme: Science Guide*

In terms of analytical skills, the GCSE expects students to be able to make sense of connections and linkages within data when applying knowledge in AO2; while the ability to draw conclusions and provide scientific judgements is assessed in AO3. Similarly, the IB MYP assesses the ability to analyse and evaluate information to make scientifically supported judgments, albeit within the same assessment criterion.

The GCSE AO3 further expects students to demonstrate the ability to provide reasoning, as well as develop and improve experimental procedures by adapting, modifying and enhancing them and identify limitations of experimental methods. Similarly the IB MYP expects students to be able to provide scientific reasoning, evaluate the validity of experimental methods and explain improvements or extensions to methods.

Minor differences are observed. For example the IB MYP expects students to formulate hypothesis and design scientific investigations including selecting appropriate materials and equipment. In comparison, while the GCSE AO3 expects students to develop and improve experiments, students are not expected to develop their own procedures.

The weighting placed on assessed skills is also found to differ. The GCSE assessment objectives places more emphasis on the ability to demonstrate and apply knowledge and understanding, where the weightings for AO1 and AO2 are 40% each, compared to a weighting of 20% for AO3. The IB MYP, on the hand, places equal emphasis on the different skill areas included in the assessment objectives.

3.3.2 Combined/integrated science

3.3.3.1 Assessment methods

Both the IB MYP and GCSE utilise external examinations at the end of the programme to test all of the content taught throughout the course. In the GCSE Combined Science course, students can also choose to take either Foundation or Higher examinations; these include different sets of questions and allow for different grades to be achieved. In the IB MYP, the assessment is taken on a computer by all students.

The below table sets out the assessment methods used in both programmes, while noting, however, that the GCSE Combined Science course is a double award worth two GCSEs (AQA, 2016a).

Overall, both courses utilise similar external assessment methods under test conditions. The GCSE double award consists of four examinations worth 25% of the overall mark each, while the IB MYP consists of one examination worth 100% of the overall subject mark; however, with the GCSE being a double award, the total volume of assessment is double that of a single GCSE award.

Table 15: Science assessment methods and weighting

	IB MYP Integrated Sciences	GCSE Combined Science (double award)
Number and type of assessments each examination series	Internal assessments One on-screen examination	Foundation- four written examinations OR Higher- four written examinations
Duration	2 hours	1 hr 45 minutes each
Type(s) of question	Multiple-choice, short answer, long answer, extended response and selected response	Multiple-choice, gap-fill, matching, short and long answer and extended response
Total marks available	100 marks	Paper 1: 100 Paper 2: 100 Paper 3: 100 Paper 4: 100
Weighting toward overall subject grade	100%	Paper 1: 25% Paper 2: 25% Paper 3: 25% Paper 4: 25%

3.3.3.2 Exam paper review

Question types

Within the IB MYP examination and the four GCSE examinations, questions tasks are grouped into multi-part questions; these are groups of smaller sub-questions that are joined together and sometimes are all based on a single diagram, figure or graph. Within the IB MYP there are eight overarching questions but a total of 33 sub-questions overall. Similarly, the GCSE examinations typically include 10 overarching questions in each of the Foundation examinations and about eight to 11 in each of the Higher examination papers; however, there are typically 49 to 56 total sub-questions in the GCSEs or 34 to 42 for the Higher examinations.

The IB MYP and GCSE include similar question types that include short answer, long answer, extended response and multiple choice questions. The GCSE additionally include gap-fill and matching questions while the IB MYP includes selected response questions. A summary of the questions types in the IB MYP and GCSE examinations are listed in the figure below.

Figure 20: Question Types in the IB MYP and GCSE Science Examination

Question types	IB MYP	GCSE Foundation	GCSE Higher
Multiple choice	✓	✓	✓
Gap-fill		✓	
Matching		✓	
Selected response	✓		
Short answer	✓	✓	✓
Long answer	✓	✓	✓
Extended response	✓	✓	✓

Given there are only minor variations across the GCSE examinations, a sample of one Foundation and one Higher has been reviewed to evaluate the assessment duration in conjunction with the number and types of questions within a whole examination, as shown in the table below.

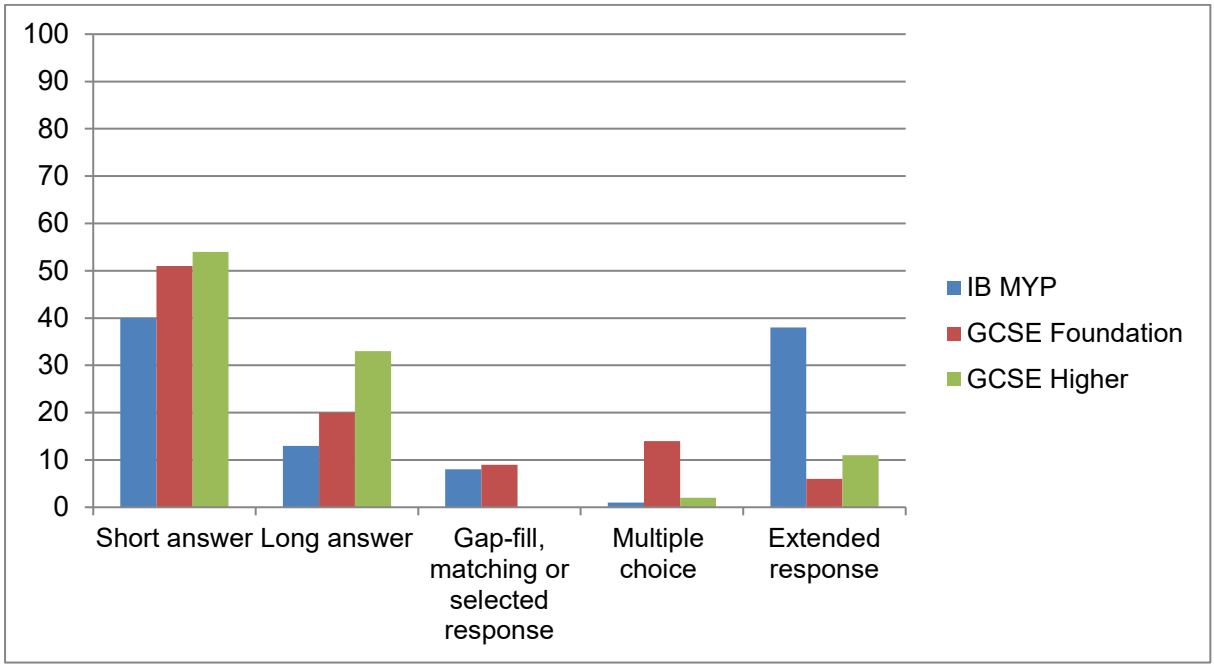
Table 16: Comparison of IB MYP and GCSE Science examinations

Qualification	Exam duration	Questions					Total no: of questions
		Short answer	Long answer	Gap-fill, matching or selected response	Multiple choice	Extended response	
IB MYP	2 hours	24	3	2	1	3	33
GCSE *Foundation*	1 hour and 45 minutes	33	5	4	13	1	56
GCSE *Higher*	1 hour and 45 minutes	30	8	0	2	2	42

The majority of the examination questions in both programmes are short answer questions, which make up about 73%, 59% and 69% of questions of the IB MYP, GCSE Foundation and Higher examinations respectively. The GCSE Foundation examination is found to include a greater proportion of multiple choice questions (23% of the examination) that assess low skills compared to the IB MYP and GCSE Higher examinations, that instead include a greater percentage of long answer and extended response questions (21% and 26% of the IB MYP and GCSE examinations respectively are long or extended response questions compared to 11% of the GCSE Foundation).

The graph below shows the distribution of marks for different question types in each examination.

Figure 21: IB MYP and GCSE Science – mark distribution (%) per question type



In the GCSE Foundation and Higher examinations, more than 50% of the total marks of the examinations are allocated to short answer questions. In comparison, in the IB MYP examination, majority of the total marks are awarded for short answer (40%) and extended response questions (38%).

The total number of marks allocated for extended response questions is much lower for the GCSE examinations compared to the IB MYP.

Overall, the GCSE examinations include a greater number of questions to be completed in a shorter period of time, in particular the GCSE Foundation, compared to the IB MYP examination. Nonetheless as observed in the mark distribution graph, while the IB MYP has a smaller number of questions compared to the GCSE, the IB MYP has extended questions which are worth a greater proportion of marks than in the GCSE examinations. Further the IB MYP extended questions are found to assess higher skills of designing an experiment, comparing and contrasting two sources of energy and discussing and evaluating a concept, compared to the GCSE extended response questions.

Content breadth and depth

In terms of content covered in the examination, review of whole examinations for the MYP and GCSE found the following:

Figure 22: Content coverage across the MYP and GCSE examinations

	IB MYP		GCSE	
	2017	2018	Foundation	Higher
Ecosystems and biodiversity	✔	✔	✔	✔
Inheritance, variance, evolution, cells	✔		✔	✔
Forces, Motion and Energy	✔		✔	✔
Electricity and Magnetism		✔	✔	✔
Waves	✔		✔	✔
Atoms and periodic table		✔	✔	✔
Metabolism and systems	✔		✔	✔
Matter	✔	✔	✔	✔
Chemical reactions and bonding	✔	✔	✔	✔
Organic chemistry		✔	✔	✔
Diseases			✔	✔
Chemistry of the atmosphere	✔		✔	✔
Key (mark distribution per topic): 0- 10% 11-25% 26-50% 51-100%				

The GCSE examinations have a greater breadth of topic coverage than the MYP examinations. The coverage of topics are found to differ between different MYP examination sittings, where some of the topics that are covered in the 2017 examination are not assessed in the 2018 examination and vice versa.

Overall, the GCSE examinations assess topics in comparable depth, with only a small number of topics covered in slightly more depth than other topics. For example, in the GCSE Foundation exam, the percentage of total examination marks for the topics Forces, Motion and Energy, Electricity and Magnetism, Chemical reactions and bonding and Diseases are between 10 to 25% while all the other topics each account for less than 10% of the total examination mark. In the MYP examinations, one topic is found to account for 25 to 50% of

the total examination marks while the other topics contribute to either 10 to 25% or less than 10% of the total examination marks.

Exam paper resources

Both programmes for science and physics allow for calculators to be used throughout the examination and for students to have access to a formulae/equation sheet.

The GCSE and IB MYP examinations both include data tables, graphs and diagrams, upon which questions are based. The IB MYP examination additionally includes videos, animations and simulations, which assess the ability of students to interpret the scenario described, to answer the questions.

Item demand

The figures below present the external consultants' ratings of items in the GCSE and IB MYP:

Figure 23: Range of external consultants' findings across GCSE Foundation Combined Science

Topic [Category]	Question type	Rating				
		Low	Low-Medium	Medium	Medium-High	High
Ecosystems and Biodiversity	Multiple choice questions Short answer					
Inheritance, variance and evolution of cells	Multiple choice questions Matching					
	Matching Short answer					
	Multiple choice questions Matching Gap-fill Short answer					
Energy	Short and Long answer					
	Multiple choice questions Short answer Extended response					
	Matching Gap-fill Short answer Long answer					

Topic [Category]	Question type	Rating				
		Low	Low-Medium	Medium	Medium-High	High
Forces and Motion	Short answer, Multiple choice questions					
	Multiple choice questions Short answer					
	Multiple choice questions Short answer					
Electricity and Magnetism	Multiple choice questions Short answer					

Key: 0-10% 11-25% 26-50% 51-100%

Figure 24: Range of external consultants' findings across GCSE Higher Combined Science

Topic [Category]	Question type	Rating				
		Low	Low-Medium	Medium	Medium-High	High
Ecosystems and Biodiversity	Extended response					
Inheritance, variance and evolution of cells	Short and Long answer					
	Short answer Extended response					
Energy	Short and Long answer					
	Extended response					
Forces and Motion	Short and Long answer					
	Short answer					
	Short answer Extended response					
Electricity and Magnetism	Short and Long answer					
	Short answer					
	Short and Long answer					

Key: 0-10% 11-25% 26-50% 51-100%

Figure 25: Range of external consultants' findings across IB MYP Integrated Science

Topic [Category]	Question type	Rating				
		Low	Low-Medium	Medium	Medium-High	High
Ecosystems and Biodiversity	Extended response					
Inheritance, variance and evolution of cells	Short answer					
Energy	Extended response					
Forces and Motion	Gap-fill, short answer, Extended response					

Key: 0-10% 11-25% 26-50% 51-100%

Overall for most topics, the external consultants found the questions in the GCSE Foundation examination to be of lower demand (low to medium demand) compared to the GCSE Higher and IB MYP examinations, which were mostly considered to be of medium-high demand.

In particular, in terms of task strategy, the greater proportion of multiple choice questions is found to lower the level of demand of the GCSE Foundation examination compared to the IB MYP and GCSE Higher.

In terms of resources and response strategy, there were considerable variations in the perceived level of demand in the IB MYP examinations, particularly for the extended response questions. Some consultants thought that the IB MYP extended response questions provided lots of guidance on how to answer the question whilst other consultants pointed out that the set of requirements provided by IB MYP within the questions made it more difficult for students to respond to such questions.

Comparison of structured questions[54]

Complexity

Question 1 in the IB MYP examination is a 13 mark question that assesses knowledge and skills in biology (digestion) and chemistry (chemical reactions) whilst GCSE questions assess knowledge and skills in biology and chemistry in separate examinations.

The sub-parts to the selected IB MYP example question range from low complexity to a medium level of complexity later in the question. The first two tasks involve listing nutrients required for a healthy diet and explaining why two selected nutrients are of value, indicative of lower complexity. Part C of the IB MYP question, which involves formulating and

[54] Pearson Sample Paper 2 Chemistry Question 4 Higher tier) and IB MYP (Integrated Science 2017 Paper Question 1) Questions.

explaining a hypothesis for an experiment testing the effect of hydrochloric acid on digestion, could be described as of medium to high level of complexity. Whilst the construction and balancing of the chemical equation relies on application of knowledge and understanding, the specific compounds and the neutralisation reaction are described in a familiar context. Overall, the question contains medium with lower demand elements, taking into account all of the requirements of the IB MYP question.

Similarly, the selected question reviewed in GCSE Combined Science chemistry examination asks the candidate to write out and balance chemical equations, in this case the reaction between calcium carbonate (marble chips) and hydrochloric acid. The following sub-parts to the GCSE question ask the candidate to interpret the rate of reaction from a graph and to explain how the rate of reaction changes, the role and action of catalysts in two or three linked statements characteristic of a medium level of demand.

In the Combined Science sample biology examinations do not contain any specific questions on digestion. Nonetheless, a number of reviewed GCSE questions in biology include parts (typically lead-in parts to more extended structured questions) which involve listing or categorisation of biological information or processes similar in scope to parts a and b of the selected IB MYP question. These question sub-parts are also typically of lower demand in the GCSE, rising to medium level of demand in application questions where an additional explanation or relating a biological function to structure is required.

Abstractness

The contexts presented in the IB MYP question are fairly concrete, for example digestion and the effects of hydrochloric acid on the stomach are familiar topic areas. Ingestion, its causes and remedy can also be considered a familiar context, whilst the use of aluminium hydroxide as an antacid and the type of reaction (neutralisation) occurring in its reaction with hydrochloric acid are also fairly concrete.

Similarly, the question in the GCSE focusing on the construction and balancing of equations is fairly concrete with some abstract elements. The context of using marble chips (calcium carbonate) in an experiment to measure reaction rates and the role of a catalyst in the decomposition of hydrogen peroxide is of reasonable familiarity, whilst the final part of the question introduces a more abstract scenario where the candidate is presented with unknown reactants and products in a separate experiment and asked to explain an assertion based on the data.

Resources

The key information required to answer the questions is provided in the IB MYP and GCSE questions. The IB MYP question presents the context using visual diagrams illustrating the set-up of the experiments, whilst a description of the key variables is also provided in the GCSE questions. The chemical compounds involved in the reactions are given, requiring some degree of manipulation by the candidate to balance and demonstrate the reactants and products in the form of an equation. The reviewed GCSE question does not involve formulation of a hypothesis although does ask for an explanation why a prediction cannot be made based on data provided, assessing interpretation of data and understanding of the scientific method.

Strategy

The strategies in the first two parts to the IB MYP questions require recall and listing, both indicative of lower demand whilst the strategy involved in formulating and explaining a hypothesis in part d assesses application and planning to reflect the scope of the suggested investigation.

Strategies involved in the GCSE question similarly vary, requiring an equation based on knowledge of chemical compounds to description or explanation in two or three linked statements.

Comparison of extended questions[55]

Complexity

Both selected questions from the IB MYP and the GCSE can be considered high demand, although the scope of the skills and knowledge covered as well as the format of questions are significantly different. The IB MYP question is a standalone extended question on the construction of desalination plants worth 19 marks which involves writing an essay whilst the structured GCSE question focuses on acids, their composition and behaviour. The GCSE question is broken down into sub-parts with one extended sub-part worth six marks. The GCSE Combined Science examinations do not include interdisciplinary essay based questions so the focus is on drawing comparisons with a selected extended question task.

The requirement to construct an analytical and evaluative response, drawing on scientific arguments whilst considering interdisciplinary economic and environmental factors contributes to the high complexity of the IB MYP question.

The high complexity of the GCSE question is apparent through the requirement for logical explanation and application of conceptual understanding to an unfamiliar situation, with emphasis on precise use of scientific terminology and construction of a series of chemical equations in an experimental plan.

Abstractness

The IB MYP essay based question topic of desalination plants and their construction is not one with which the candidate will likely be familiar, placing demands on the candidate reading and developing a thorough understanding of the issues based on the information provided in the question in order to address its key points.

The selected GCSE question includes some more concrete elements regarding the behaviour and characteristics of acids, whilst the context of the extended part is more abstract, this involves the planning of an experiment to purify magnesium sulphate crystals from an unnamed acid.

[55] IB MYP Integrated Science 2017 Question 9 and Pearson Sample GCSE Question 5 Paper 3: Chemistry 1 Higher tier

Resources

Although the IB MYP question provides much of the key information, the challenge of the IB MYP question is to analyse, identify and extract the relevant information and to deploy this information accurately in addressing the specific issues in the question.

The introduction to the extended part of the GCSE questions states that salts of metals can be made by reacting one of the metal's compounds with the appropriate acid. Limited instruction is given on what should be included in the experimental plan, with the assessment focused on how well the candidate can provide an independent plan, with consideration of variables, equipment and the order of steps in conducting the experiment.

Strategy

The strategy required for the GCSE question draws on a combination of subject knowledge and understanding as well as the ability to analyse and synthesise scientific knowledge to provide a coherent plan. The ability to formulate balanced chemical equations to illustrate the key stages in preparing the chemical compound without direct instruction is reflective of the overall higher demand of the task.

The IB MYP question strategy by contrast involves planning and synthesising a response which fully addresses the question, integrating the most relevant information in support of a balanced argument which reaches a final evaluation. The respective strategies required to score highly in either question can be considered to be of high demand.

Figure 26: Overall findings of in-house item analysis

Question type	CRAS	Low → High
Structured questions in IB MYP Integrated Science and GCSE Combined Science	Complexity	● ◆
	Resources	◆ ●
	Abstraction	● ◆
	Task Strategy	● ◆
	Answer strategy	● ◆
Extended questions (Extended sub-part in the GCSE)	Complexity	◆ ●
	Resources	● ◆
	Abstraction	◆ ●
	Task Strategy	● ◆
	Answer strategy	● ◆
KEY: ● IB MYP ◆ GCSE		

Overall the level of demand in terms of complexity, task and answer strategy is comparable for both the GCSE and MYP examinations. In terms of abstractness, the structured question in the GCSE examination was found to be more demanding than the MYP. In terms of resources, the MYP extended response question was found to be more demanding than the GCSE.

3.3.3 Physics

3.3.3.1 Assessment methods

IB MYP and GCSE Physics are both assessed through external examinations at the end of programme. The IB MYP Physics is assessed through one two hour on-screen examination, that includes short answer and extended response questions. The GCSE has two tiers (Foundation and Higher) where students taking the Foundation tier examinations achieve grades of 1 to 5 while the Higher tier examinations allow students to achieve grades of 5 to 9 (AQA, 2016b). The GCSE Foundation and Higher tiers have two examinations each, where the duration for each examination is 1 hour and 45 minutes. Further each examination contributes to 50% of the overall subject grade.

Table 17: Physics assessment methods and weighting

	IB MYP Physics	GCSE Physics
Number and type of assessments each examination series	Internal assessments On-screen examination	Foundation tier-Paper 1 and 2 OR Higher tier-Paper 1 and 2
Duration	2 hours	Paper 1 and 2- 1 hour and 45 minutes each
Type(s) of question	Multiple choice, short answer, long answer, selected response and extended response	Multiple choice, short answer, long answer, gap-fill, matching and extended response
Total marks available	100 marks	Foundation and Higher Paper 1-100 marks Paper 2-100 marks
Weighting toward overall subject grade	100%	Foundation and Higher Paper 1-50% Paper 2-50%

3.3.3.2 Exam paper review

Question types

Both the IB MYP and GCSE Physics examinations mainly consists of multi-part questions with a few standalone extended response questions. The GCSE Foundation examination is composed of about 12 to 13 multi-part questions with 52 to 56 sub questions and one standalone extended response question. The GCSE Higher examinations include 11 to 12 multi-part questions with 44 to 49 sub questions and up to two standalone extended response questions. Similarly, the IB MYP on-screen examination is composed of six multi-part questions with 36 sub questions and two standalone extended responses.

There are broad similarities in the question types used by both programmes, these include multiple choice, matching, short answer and extended response questions. The GCSE

examinations additionally include long answers and gap-fill questions whilst the IB MYP includes selected response questions. The figure below summarises the question types found in the IB MYP and GCSE examinations.

Figure 27: Question types in the IB MYP and GCSE Physics examinations

Question types[56]	IB MYP	GCSE Foundation	GCSE Higher
Multiple choice	✓	✓	✓
Gap-fill		✓	
Matching	✓	✓	
Selected response	✓		
Short answer	✓	✓	✓
Long answer		✓	✓
Extended response	✓	✓	✓

To evaluate the assessment duration in conjunction with the number and types of questions (including sub questions) within a whole examination, one sample GCSE Foundation and Higher examination are compared to the IB MYP on screen examinations in the table below.

Table 18: Comparison of IB MYP and GCSE Physics examinations

Qualification	Exam duration	Questions					Total no: of questions
		Short answer	Long answer	Gap-fill, matching or selected response	Multiple choice	Extended response	
IB MYP	2 hours	28	0	6	2	2	38
GCSE *Foundation*	1 hour and 45 minutes	34	3	5	10	1	53
GCSE *Higher*	1 hour and 45 minutes	38	3	0	3	2	46

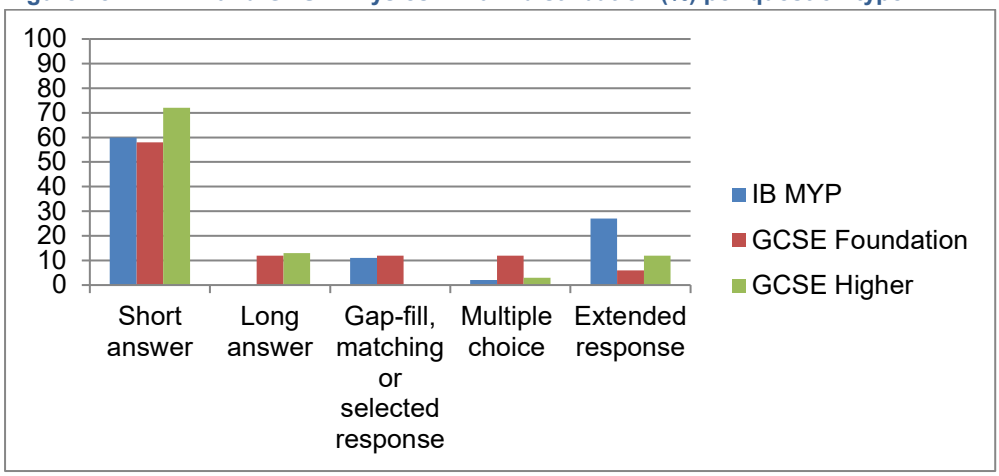
Short answer questions make up the majority of the examinations, where 74%, 64% and 83% of questions of the IB MYP, GCSE Foundation and GCSE Higher examinations respectively are composed of short answer questions. The GCSE Foundation has a greater proportion of questions types (multiple choice, gap-fill, matching or selected response) that assess low skills compared to the GCSE Higher and IB MYP.

The graph below shows the distribution of marks for different question types in each examination. In all three examinations, over 50% of the total marks of the examination are

[56] Question types are defined in Appendix 2.

allocated to short answer questions. The GCSE Foundation is found to allocate a considerably higher proportion of marks to multiple choice questions of low demand compared to the IB MYP and GCSE Higher examinations. The IB MYP is found to allocate a greater proportion of marks to extended response questions compared to the GCSE examinations.

Figure 28: IB MYP and GCSE Physics – mark distribution (%) per question type



Overall, the GCSE examinations have a greater number of questions to be completed in a shorter period of time compared to the IB MYP examinations. However, it is important to note that the IB MYP includes extended response questions that are awarded a higher proportion of marks and assess higher skills compared to the GCSE questions.

Content breadth and depth

In terms of content covered in the examinations, review of whole examinations for the MYP and GCSE found the following:

Figure 29: Content coverage across the MYP and GCSE examinations

	IB MYP		GCSE	
	2017	2018	Foundation	Higher
Mechanics, Force and Energy	✔	✔	✔	✔
Electricity, Magnetism and Electromagnetism		✔	✔	✔
Waves	✔		✔	✔
Astrophysics	✔		✔	✔
Thermal Physics		✔	✔	✔
Atomic physics			✔	✔
Particle models of matter			✔	✔
Key (mark distribution per topic): 0- 10% 11-25% 26-50% 51-100%				

The GCSE examinations have a greater breadth of topic coverage than the MYP examinations. The GCSE examination covers seven topics whilst the MYP examinations assess on about three topics.

The GCSE examinations have more questions and a higher percentage of the total examination marks that assess on topics of Mechanics, Force and Energy and Electricity, Magnetism and Electromagnetism than the other physic topics. The MYP examination has a greater focus on the topic Mechanics, Force and Energy with over 70% of the total examination marks awarded to questions assessing concepts on this topic.

In terms of depth of topics assessed, the MYP has a greater depth of coverage on the topic Mechanics, Force and Energy than the GCSE examinations. However, for all the other GCSE physics topics that are similarly assessed by the MYP, the depth of topic coverage is comparable.

Exam paper resources

Both programmes for science and physics allow for calculators to be used throughout the examinations and for students to have access to a formulae/equation sheet.

The GCSE and IB MYP examinations both include data tables, graphs and diagrams, upon which questions are based on. The IB MYP examination additionally includes videos, animations and simulations, which assess the ability of students to interpret the scenario described, to answer the questions.

Item demand

The figure below summarises the external consultants' ratings of items in the IB MYP and GCSE Physics

Figure 30: Range of external consultants' findings across IB MYP Physics

Topic [Category]	Question type	Rating				
		Low	Low-Medium	Medium	Medium-High	High
Force and Energy	Extended response					
Statistics and Probability	Multi-part Multiple choice Short answers					
Waves	Multi-part Multiple choice Short answers					
Astrophysics	Short answers					
Key: 0-10% 11-25% 26-50% 51-100%						

Figure 31: Range of external consultants' findings across GCSE Foundation Physics

Topic [Category]	Question type	Rating				
		Low	Low-Medium	Medium	Medium-High	High
Force and Energy	Multi-part Short answers Gap Fills					
	Multi-part Multiple Choice Short answers 3 …					
	Multi-part Multiple Choice Gap Fills Short answers					
Electricity and Magnetism	Multi-part Multiple Choice Short answers					
	Multi-part Short answers Gap Fills					
Astrophysics	Multi-part Multiple Choice Short answers					

Key: 0-10% 11-25% 26-50% 51-100%

Figure 32: Range of external consultants' findings across GCSE Higher Physics

Topic [Category]	Question type	Rating				
		Low	Low-Medium	Medium	Medium-High	High
Force and Energy	Short answers					
	Multi-part Short answer Multiple Choice					
Electricity and Magnetism	Short answers					
	Multi-part Multiple Choice Short answer					
	Multi-part Short answer Extended Response					
Waves	Multi-part Short answer Extended Response					

Key: 0-10% 11-25% 26-50% 51-100%

When considering item demand, analysis of Physics items presented a particular challenge – one that impacted both the MYP and GCSE Higher examination analysis. In line with the methodology, ratings were completed independently and remotely; however the review of consultant ratings revealed considerable variations in the perceived level of demand of multiple choice and short answer questions in the MYP examination.

For example, a series of short answer questions for the MYP Physics examination were considered by some to be of medium or medium-high demand based on the complexity of the topic and skills assessed and the strategy students would need to employ. Another of the external consultants however considered those same questions to be low-medium demand based on the resources given to students. Such variation can also be seen in the GCSE where short answer questions on electricity and magnetism were rated as low-medium demand by two external consultants in the panel, and medium-high by the other two panel members. Short answer questions on waves and on force and energy, also divided the panel albeit with some consensus visible for other questions on force and energy.

For both the MYP and GCSE, greater consensus can be seen in the ratings given to long- or extended- response questions. In the case of the MYP, these were considered by three of the four reviewers to be high demand (medium-high for the fourth) based on the task and response strategies needed to respond. In the case of the GCSE Physics course, all raters

considered the question to be medium-high demand on account of the topic and skills assessed, with students also needing to develop an appropriate response strategy.

There is greater consistency in the ratings given to the GCSE Physics tasks drawn from Foundation tier examinations with external consultants considering these to be at a low or medium-low level across all question types and topics reviewed.

Comparison of Structured Questions on Forces and Energy[57]

Complexity

Reviewing the selected questions on energy and forces in the GCSE and the IB MYP, both are multi-part structured questions which present an experimental scenario and ask the candidate to solve a series of interconnected problems and complete tasks related to the described experiments. Whereas the IB MYP question has a greater number of sub-parts and marks allocated to the question, the overall level of complexity of the tasks in both can be considered comparable to a medium level of demand overall. Both GCSE and IB MYP question sub-parts, for instance, involve conducting calculations of two steps, identifying and using the correct formulae for calculating kinetic energy and stating the correct units. Question parts in both the IB MYP and GCSE exemplars also involve providing linked explanations of scientific phenomena. Both questions involve experimental skills, including the ability to define variables and constants in planning as well as interpretation of experimental data.

Both questions involve some elements of higher demand, including in the IB MYP, the formulation of hypotheses linked to experimental modifications. The GCSE final part to the structured question involves planning an experiment with less definition, indicative of medium to higher level of demand.

Abstractness

Both selected GCSE and IB MYP questions involve familiar concepts of distance, time and speed and averages as well as more abstract concepts involving calculations of kinetic and gravitational potential energy. The experimental scenarios presented in the GCSE and IB MYP have elements are likely to be fairly familiar to the candidate, for instance objects sliding down a ramp and exploring and explaining the way in which moving object behave.

Resources

The key information required to conduct the calculations and provide full explanations is provided in the GCSE and IB MYP questions in either diagrammatic form, graphically or described in the question preamble, although the formulae for the calculation problems are not provided in the question.

Some of the question sub-parts provide less direct guidance to the candidate. For example, Part c of the GCSE structured question for example is fairly broadly defined and asks the candidate to devise an experimental plan without explicitly asking for a list of variables or constants. The IB MYP question also involves providing a research question and describing

[57] GCSE Question 7 Higher tier Paper 1 Pearson Sample and IB 2017 Paper Question 5.

data that would be collated, without providing guidance on type of data requiring the candidate to infer the key information.

Strategy

The strategies required involve understanding, using and accurately employing formulae in calculations, interpreting data in graphs and extrapolating from graphs. The ability to construct linked description / explanation, to respond to an experimental scenario, apply scientific method in suggesting objective and planned series of steps. The strategies required are general of medium demand, given the predominantly structured nature of the tasks, with a small number of more open-ended sub-parts in both GCSE questions requiring more independence of thought in devising a strategy specific to the experimental scenario.

Comparison of extended open-ended tasks[58]

Complexity

The GCSE selected question focuses on asking the candidate to provide scientific reasoning for scientific phenomena and processes involving a specific scenario, the behaviour and control of a submarine underwater. The IB MYP question is a standalone extended question, focused on exploring the social and ethical implications of technological advance relating to prosthetics.

Whilst the selected GCSE and IB MYP extended questions involve assessment of different skills and knowledge, the overall complexity level of both can be considered to be reflective of a higher level of demand. The calculations required in the GCSE question involve multiple steps, including selection, rearrangement of a complex formula (pressure, volume of gases formula) as well as substitution and evaluation. Explanations of phenomena presented in the question require precise use of physical terminology and concepts.
The open-ended nature of the selected IB MYP task and the requirement to discuss and evaluate the implications of a specific technological advance for example place demands on the candidate's ability to construct a more extended analytical argument, thereby invoking higher order thinking skills.

Abstractness

A proportion of questions found in the GCSE Higher tier examinations involve solving problems in unfamiliar or less predictable scenarios (referring to the submarine scenario), placing demands on the candidate's reasoning and application skills. Specifically, concepts of pressure and volume of gases and density and associated formulae assessed in the question are indicative of a higher level of abstractness.

The theme of the social and ethical implications of prosthetics use in the IB MYP extended question is also one which the candidate is less likely to have direct familiarity. The requirement to apply general scientific reasoning skills and ability to make cross disciplinary linkages, whilst considering ethical and societal impact contributes to the higher level of demand.

[58] Pearson GCSE Sample Paper 2 Higher tier Question 9 and IB MYP Question Physics Paper 2017

Resources

Although some key information is provided in the GCSE question, few specific guidelines are provided on the formulae, terminology or underpinning concepts to be addressed in the candidate's responses. Similarly, the IB MYP question provides few resources in the question, with the onus on the candidate to be able to plan and synthesise ideas in producing a reasoned response.

Strategy

Although the level and length of response expected is evidently higher in the 11 mark IB MYP question compared to the 6 mark extended GCSE question, both tasks involve a degree of planning and synthesis to produce a coherent and linked response. The GCSE question provides key information in the question and the candidate must apply logical thinking skills and in-depth understanding of the concepts and terminology (for instance, displacement and up-thrust) not explicitly provided in the question to produce a coherent and fully reasoned scientific explanation.

Acknowledging that some broad guidance is provided in the IB MYP extended question, the task can be considered open-ended, requiring the candidate to devise their own plan in constructing an extended argument which should lead to a reasoned concluding appraisal.

The figure below provides a visual representation of this comparison:

Figure 33: Overall findings of in-house item analysis

Question type	CRAS	Low → High
Structured questions on energy and forces	Complexity	● ◆
	Resources	◆ ●
	Abstraction	● ◆
	Task Strategy	● ◆
	Answer strategy	● ◆
Extended questions (structured with an extended sub-part in the GCSE)	Complexity	● ◆
	Resources	◆ ●
	Abstraction	◆ ●
	Task Strategy	● ◆
	Answer strategy	● ◆
Key: ● MYP ◆ GCSE		

Overall the level of demand in terms of abstraction, task and answer strategy of the GCSE and MYP examinations are similar. The MYP structured questions are found to be more demanding than GCSE in terms of resources while the GCSE extended response questions are more demanding than the MYP in terms of complexity.

3.3.4 Mark schemes

Both programmes for science and physics allow for calculators to be used throughout the assessments and for students to have access to a formulae/equation sheet.

The GCSE and IB MYP examinations both include data tables, graphs and diagrams, upon which questions are based. The IB MYP examination additionally includes videos, animations and simulations, which assess the ability of students to interpret the scenario described, to answer the questions.

The demand placed on students by the mark schemes is found to be broadly similar. For example both programmes accept alternative answers or wording. Neither programme deducts marks for incorrect responses; unless it contradicts the correct response. Both courses allow for errors carried forward and only penalise the first incorrect answer.

Similar marks are awarded for demonstrating similar level of skills. For example, in physics, questions related to analysing experimental information and making scientifically supported judgments are allocated two marks. The mark schemes for these questions from both programmes award a mark for each point made and provide examples of acceptable answers.

4. Conclusions

Independent comparative analysis of assessment of the IB MYP to the reformed GCSE has found the two qualifications to be comparable.

This conclusion is based on a holistic review of assessment for English, maths and science, taking into consideration the assessment objectives, assessment methods, the number, type and weighting of questions, content breadth and depth, and marking approaches. This review found that whilst there are some notable differences in the qualifications, these principally relate to the duration and volume of assessment. Overall, the awards can be considered of comparable demand, but the specific ways in which they place demand on students differ.

The similarities and differences observable across all subjects are listed below, supported by subject-specific findings as appropriate:

- **The two qualifications differ in structure and accordingly in the volume of assessment for individual subjects.**
  Differences in the qualification structure – with the IB MYP a composite, diploma-style award and the GCSE a single subject qualification – are reflected in the volume of assessment for individual subjects. IB MYP subjects are each assessed through a single 2-hour examination, whilst the GCSE has multiple examinations. There are two examinations each for English and physics (totalling 3 hours 50 and 3 hours 30 minutes respectively), three for maths (totalling 4 hours 30) and four for GCSE Combined Science which is a double award (totalling 7 hours).

- **The GCSE assesses at two tiers – Foundation and Higher – whilst all IB MYP students will sit the same assessment level.**
  This is important to note since in the GCSE, students expected to perform at the lower achievement levels will be put forward for a Foundation tier examination where available. The questions in these examinations will typically be designed to assess the level of performance associated with the lower grades[59] at GCSE and this accounts for the consultants' findings that items were of low, low-medium and medium demand; whilst the Higher tier is designed to assess performance with questions rated as medium, medium-high or high demand. The IB MYP does not employ tiers and all students will therefore sit examinations where items are of medium to high demand.

[59] It is recommended generally, that students likely to achieve a grade 4 or 5 should be entered to the Foundation tier.

- **Some differences can be seen in the breadth and depth of content assessed, but with similar topics covered overall.**
  The qualifications cover similar topics but review of the examinations revealed some differences in the breadth and depth of the assessment with the GCSE typically covering a broader range of topics than the IB MYP, whilst the IB MYP assessed some topics in more depth.

  For example, in the physics examinations reviewed, the IB MYP assessed mechanics, force and energy in depth as well as some further topics. The GCSE assigned comparatively fewer marks to these areas but assessed a broader range of topics across the examinations. In the case of Integrated/Combined Science though, there were a number of topics awarded a proportionally similar range of marks in both qualifications such as forces, motion and energy; and electricity and magnetism.

- **The qualifications target and assess a comparable range and level of skills.**
  Analysis of the IB MYP and GCSE in three subjects – English, maths and science – found clear lines of comparability in terms of the level and range of skills assessed.

  In English, both programmes seek to assess students' ability to:
  - Analyse texts for content, language, technique and the author's perspective
  - Employ appropriate vocabulary, style, register and techniques to convey meaning to the intended audience
  - Identify explicit and implicit information
  - Organise ideas and opinions in a coherent manner
  - Produce creative texts
  - Summarise and synthesise, drawing across multiple texts
  - Use English appropriately (vocabulary, linguistic conventions, grammatical terminology).

  In maths, both programmes seek to assess students' ability to:
  - Apply and perform routine and complex procedures in different contexts
  - Assess and justify the validity and accuracy of arguments, assumptions and solutions
  - Construct chains of logical reasoning and arguments (including mathematical proofs)
  - Select appropriate mathematical techniques to solve problems
  - Translate problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes and solve these problems
  - Use appropriate mathematical language (notation, symbols and terminology) and appropriate forms of mathematical representation to present information.

  In science, both programmes seek to assess students':
  - Knowledge and understanding of scientific ideas, terminology, techniques and procedures
  - Interpretation and evaluation skills to make judgements and draw conclusions
  - Ability to evaluate the validity of hypotheses and methods and suggest ways to improve methods.

In science, there is a wider, more explicit focus in the IB MYP on the impact of science, where students should be able to discuss how science can be applied to a specific problem and the implications of this; and to document the work of others.

- **It is difficult to compare the specific weighting afforded to these skills across the two qualifications because of the differing constructs in the assessment objectives.**
  For example, in maths, problem solving ability is encompassed under multiple IB MYP assessment objectives (Knowing and Understanding, Investigating Patterns, and Applying Mathematics in Real-Life Contexts), whilst in the GCSE, there is a specific assessment objective on problem solving in maths and other contexts accounting for 25% of the marks.

  In English, the assessment objectives are expressed in terms of four equally weighted skills (Analysing, Organising, Producing Text, and Using Language). The first aims to assess reading and textual analysis skills (25%), whilst the other three focus more explicitly on writing (75% overall). The GCSE assessment objectives assign 50% to reading and the understanding of texts and 50% to writing although there is some overlap, noting that under the reading objectives, students will be expected to be able to support their evaluation with appropriate examples (textual references).

  In science, demonstrating knowledge and applying it are separately defined and weighted assessment objectives in the GCSE (Demonstrate Knowledge and Understanding (AO1) and Apply Knowledge and Understanding (AO2)) attributed 40% each, with the remaining 20% focussed on analysis. In the IB MYP, there is an assessment objective on knowledge and understanding, but application and analysis is included both under this objective and implied across the remaining criteria.

- **The qualifications employ the same assessment methods for English, mathematics and science subjects**
  Both the IB MYP and GCSE assess English, maths and science through external summative examinations accounting for 100% of the final subject grade.

  For science, the resources made available to IB MYP and GCSE students are similar and may include a formulae/equation sheet or calculator. Questions similarly make use of data tables, graphs and diagrams. The IB MYP examination additionally includes videos, animations and simulations, assessing students' ability to interpret the scenario described, in order to answer the questions. One difference evident in mathematics was the inclusion of both calculator and non-calculator examinations in the GCSE whilst the IB MYP maths, comprising one examination, permits a calculator for all questions.

- **Similar question types are also used within the examinations although the number of questions and their individual weighting differs**
  This is particularly apparent in the case of English where both the IB MYP and GCSE use a combination of short answer and extended response questions and attach a

broadly comparable proportion of marks to these question types: extended response questions account for around 87% of the overall marks in both the IB MYP and GCSE, however the weighting of individual questions differed. The GCSE English has more questions but with the allocation of marks ranging from 9-25% on an extended response question. In contrast the IB MYP extended response questions are individually worth 25-38% of the marks meaning that the impact of poor performance or task fulfilment in a single task on a student's overall grade will be higher in the IB MYP.

For maths, the GCSE and IB MYP examinations comprise a mixture of short answer, and structured multi-part questions. In the GCSE, there are more standalone questions than in the IB MYP, although the structured questions are generally shorter. The number and type of questions assess students on a greater breadth of content. The IB MYP, particularly in the Extended examination, instead involves longer investigative questions which place demands on strategy and mathematical reasoning, as well as extended analytical response questions.

Science examinations for the IB MYP and GCSE similarly comprise a mixture of multiple-choice, short answer, and extended response questions. As was observed for English, there are considerably fewer questions in the IB MYP science assessments since the IB MYP tends to use extended response questions which attract a larger proportion of the marks. These extended questions require students to plan/design experiments and explore the impact of science through review and integration of scientific sources. The GCSE also assesses the ability to develop and improve experiments through its extended response questions (worth six marks each) but the examinations also include several short answer questions focussing on recall and understanding. There are also fewer calculation problems in the IB MYP examination than in the GCSE Combined Science, particularly in comparison with chemistry and physics examinations.

Both awards employ questions in real-world and experimental contexts and include a significant proportion of questions assessing knowledge and application of experimental skills (planning, interpretational, analysis and evaluation).

- **Mark schemes display some clear similarities and differences in approaches to marking. Cross-referencing marks with item demand analysis showed that both similarly reflect increases in item demand with a corresponding increase in mark allocation.**
  For maths, both the IB MYP and GCSE reward not only the students' ability to reach the correct answer, but also their ability to demonstrate their workings. There is scope for students to achieve both independent accuracy marks (marks awarded for the correct answer which are not contingent on them showing the correct workings) and conditional marks (where these *are* contingent on students showing the correct method). The mark schemes themselves do not allow for reliable comparison of the GCSE and IB MYP in terms of the emphasis each places on method and accuracy. In the GCSE, the marks are clearly labelled making it possible to easily establish, in any given examination, the percentage of marks available for method, process, accuracy, unconditional accuracy and communication. The IB MYP does not

explicitly categorise marks in this way, instead instructing examiners to cap marks on specific questions where workings are not shown.

In English, the IB MYP employs a cap on marks linked to task response, such as not referencing all sources; a practice not evident in the GCSE mark scheme. Linked with the aforementioned difference in question weighting, this may have a greater impact on the student's overall grade for English,

The science mark schemes were broadly comparable, with guidelines on acceptable and alternative answers, and on errors carried forward.

- **When considering the level of cognitive demand placed on the students, the comparison is more complex, as evidenced by a varying level of consensus among external consultants rating tasks on a five point scale. At a question level, there are differences in the complexity, resources, abstractness and strategy but both have questions considered to be of medium and high demand.**
  The level of consensus among external consultants varied somewhat, both by qualification and by question type. In English, there was a high level of consensus overall. GCSE English examinations had questions spanning across all five levels of cognitive demand (low, low-medium, medium, medium-high, high), with items increasing in demand as the student progresses through the examination. Scaffolding could also be seen in the IB MYP English but there were no questions considered to be of low demand. Questions situated further on in the examination were primarily considered to be of high demand, reflecting the level of abstractness and to an extent complexity (synthesis and evaluation) in the MYP items.

  Notwithstanding the differing focus of the two qualifications, the IB MYP and GCSE English use unseen input texts to assess comprehension, the ability to evaluate author purpose, contrast and synthesise multiple texts and produce creative and transactional texts using the input texts as a stimuli. The input texts may be fiction or non-fiction, with the examinations reviewed showing a greater emphasis on the latter. Review of these texts in IB MYP and GCSE examinations found that these to be of comparable length and overall complexity. Further analysis of extended response questions in the IB MYP and GCSE found these to be similarly demanding in terms of task and answer strategy but with some differences in terms of complexity and abstractness, where the GCSE questions reviewed were found to be medium or medium-high demand, and the IB MYP questions considered to be high demand. Short-answer questions are used in both qualifications, with a similar overall weighting (10-13% of the marks). Where reviewed, these questions were found to be similarly pitched in the IB MYP and GCSE with the level of abstractness the principal factor in demand.

  In Maths, there was somewhat less consensus among consultants – item ratings sometimes spanned three or even four levels of demand on the five point scale. GCSE Foundation questions to were rated as low, low-medium and medium demand. The GCSE Higher questions as well as the IB MYP (Standard and Extended) were generally considered to be of medium, medium-high or high demand. More in-depth

analysis of selected questions found differences by topic. In the case of algebra for example, the IB MYP was considered to be of high demand in terms of complexity, resources, abstractness and strategy; whilst probability questions were considered to medium demand. For both topics, the selected GCSE questions were considered medium-high demand across four of the five aspects of cognitive demand. In geometry, questions reviewed considered high demand in both the IB MYP and GCSE.

For science, consultants' item rating analysis for extended response questions revealed the IB MYP physics to be high demand, and medium-high demand in the GCSE. Further comparative analysis showed selected questions in the IB MYP and GCSE Higher tier to be similarly demanding: medium-high demand in terms of abstractness, and high demand in terms of resources, task strategy and answer strategy. Complexity was considered slightly higher in the GCSE Higher tier, although the IB MYP extended question was still considered to be of medium-high demand.

Greater disparity was found in consultants' rating of short answer questions and this was true both for the GCSE and the IB MYP. Internal analysis of selected structured questions found the IB MYP and GCSE Integrated/Combined Science to be similarly pitched across all aspects of the CRAS framework.

Appendix 1: Qualification profiles

IB MYP

The IB MYP is a two to five year baccalaureate-style qualification offered to students aged 11 to 16 and consists of eight subject groups from which students choose courses.

Table 19: IB MYP subject groups

IB MYP Subject Groups
• Language acquisition • Language and literature • Individuals and societies • Sciences • Mathematics • Arts • Physical and health education • Design.

Up to Year 3, IB World Schools offering the IB MYP must teach at least one subject from each of the eight subject groups. For both Years 4 and 5, students have subject-group flexibility and can choose a minimum of six out of the eight subjects to study. The six must include courses from Language Acquisition, Language and Literature, Mathematics, Sciences, and Individuals and Societies, and one course from the additional subjects (Arts, Design, or Physical and Health Education).

Each subject group has a minimum of 50 hours' teaching time required per programme year. The final two years of the programme are more flexible depending on the requirements set by the school and a student's learning goals (i.e. 70 teaching hours per subject in the last two years of the programme are recommended for those pursuing the IB MYP Certificate award (i.e. eAssessments)).

As well as the above subjects, students take an interdisciplinary unit each year of the programme that combines a minimum of two of the eight subject groups. Additionally, students complete a long-term project. The IB MYP projects aim to develop in students an in depth knowledge and a range of skills, including the ability to create project proposals and plan projects.

Although the IB MYP Guides include a 'framework' for the concepts and skills that should be taught within the curriculum, schools are responsible for developing their own set of documents on what will be taught in each subject at each age group. Therefore, schools are responsible for determining the subject-level content that will be taught, and can do so based on national curriculum requirements.

Further prescribed sections within the IB MYP Guides for each subject include aims, objectives, criteria and strands. These key terms are defined by the IB as follows:

Table 20: Key terms in the IB MYP

Key Terms in the IB MYP	
Aims	The 'general statements about what teachers may expect to teach or do, what students may expect to experience or learn, and how students may be changed by the learning experience'
Objectives	A set of 'statements which describe the skills, knowledge and understanding that will be addressed in the subject group'. These are then addressed through teaching and learning.
Criteria	The assessment criteria align with the objectives and are used by teachers to judge the extent to which students have achieved the unit or course objectives. Teacher assesses the criteria through formative and summative tasks.
Strands	These are 'aspects or elements of subject-group objectives or criteria; or put another way, strands are a detailed breakdown of what each objective or criterion encompasses or entails.' Objective strands must be addressed and criteria strands assessed at least twice a year.[60]

Interdisciplinary teaching and learning is a vital part of the IB MYP programme. Each MYP school is required to engage students in at least one collaboratively planned interdisciplinary unit and all subjects must offer interdisciplinary opportunities.

Assessment

Assessment criteria are prescribed for all subjects and these assessment criteria are aligned to the subject group objectives and the strands underneath, which describe what students should be able to do. Each assessment criterion is further divided into eight possible achievement levels that can be generally grouped into the following four performance bands:

- Limited (1-2)
- Adequate (3-4)
- Substantial (5-6)
- Excellent (7-8).

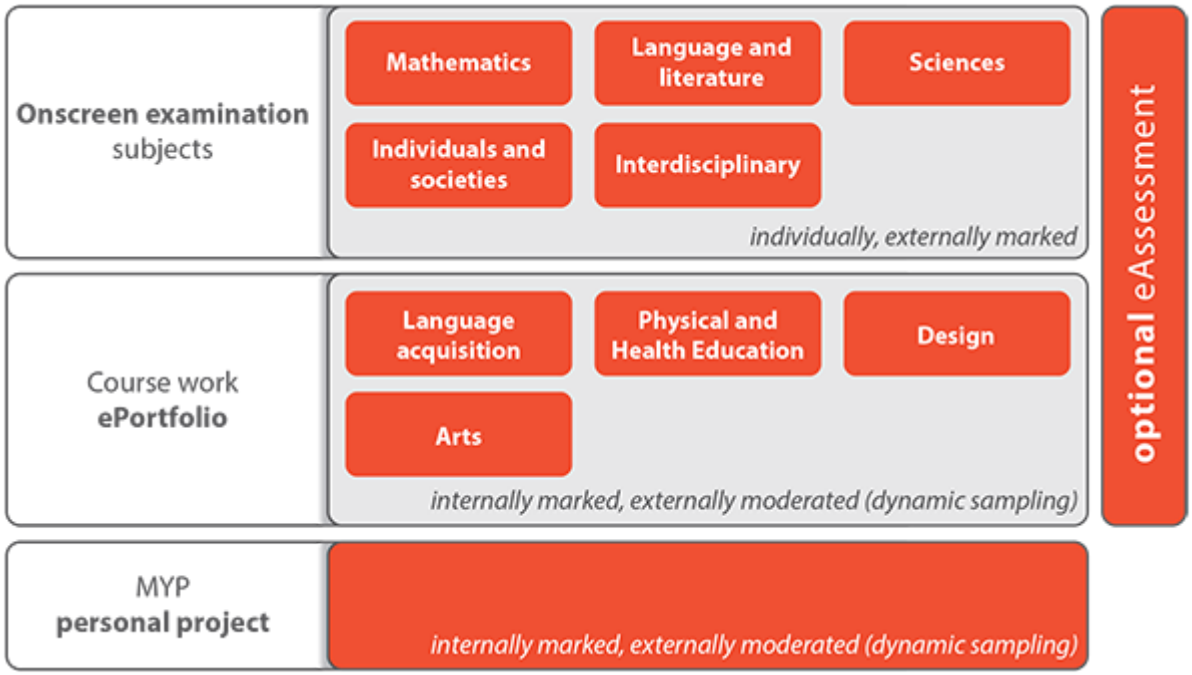
Descriptors are provided for each band, which describes the student performance required for each strand for each assessment criteria. All assessment criteria and strands must be assessed at least twice a year for each year of the IB MYP. Each subject guide provides the required assessment criteria for Years 1, 3 and 5; although schools may add criteria or additional modes of assessment to meet any local or national requirements.

IB MYP e-assessments are available for a variety of subjects for eligible students that have been part of a full year of teaching and learning in an IB World School (however, the IB Organisation recommends at least two years) and have completed all programme requirements in IB MYP Year 5. All e-assessments are optional with the exception of the externally moderated IB MYP Personal Project.

[60] International Baccalaureate Organization (2016)

To achieve the IB MYP Certificate, students must complete ePortfolios of coursework, a personal project and on-screen examinations, as shown in the figure below.

Figure 34: IB MYP assessment methods across the different subject groups [61]



To receive the IB MYP Certificate, students should achieve a minimum total score of 28 out of 56 in all components (on-screen examinations, ePortfolios and personal project), with at least grade 3 or higher in each component (the highest grade for each component is 7).

The IB MYP Bilingual Certificate is awarded to students who have additionally achieved a grade of three or higher in one of the following on-screen examinations:

- Two language and literature subjects
- A course in any IB MYP subject group (other than Language acquisition), or interdisciplinary learning, or the personal project, in a response language that is not the same as that chosen language and literature.

IB MYP students, who either do not aim to or have not attained the required minimum grades to achieve the IB MYP Certificate, will receive an IB MYP Course Result document recording their achievements for subjects, interdisciplinary learning, community service and personal project. Students may also receive an IB MYP record of participation issued by schools for showcasing the following:

- Complete two years of the programme (including requirements in Year 3 and Year 4)
- Study a minimum of six subjects in Year 4, and eight subjects in Year 3
- Complete school-based community project.

[61] International Baccalaureate Organization (2014). *General Regulations: Middle Years Programme.*

Grading, marking and moderation

Examinations (including on-screen examination) are taken at the end of the programme and are marked by examiners. The ePortfolios and projects are marked by teachers and moderated by examiners. Marks are credited against a mark scheme; however, the examiner assigns the final grade by making a judgment against a defined standard. Grade boundaries are set using a combination of judgement, statistical evidence, grade descriptors and feedback from teachers. Schools may use equivalent local, state or national grading scales to report student achievement, or they may adopt the IB MYP 1-7 grading scale. The IB MYP 1-7 grading scale should be used in conjunction with the associated general grade descriptors and grade boundary guidelines.

GCSE

GCSEs are single-subject qualifications normally taken around the age of 16 at the end of 11 years of compulsory schooling in the UK. They are the principal means of assessing the final two years (Year 10 and Year 11) of the National Curriculum at Key Stage 4[62]. Entry to the national curriculum Key Stage 4 is based on successful completion of Key Stage 3; however there is no external assessment at this stage.

As an exit-qualification, separate GCSE qualifications are awarded for each subject. Students typically take an average of eight or nine subjects during the two years. Students are required to take an English, mathematics and science subject, which are considered 'core' subjects. Schools must offer computing, physical education and citizenship, which are 'foundation' subjects, in addition to at least one subject from the following areas:

- Arts: (i.e. art and design, music, dance, drama or media arts)
- Design and technology
- Humanities: (i.e. geography or history)
- Modern foreign languages.

Schools may also offer a range of additional subjects, including, but not limited to: business studies, economics, geology and engineering.

The syllabi for GCSEs are developed by the examining boards, but must conform to criteria set by Ofqual. The GCSE examinations are regulated by Ofqual in England and offered by the following major examining boards: AQA, Edexcel, CCEA and OCR. Additionally the Welsh Joint Education Committee (WJEC) offers Ofqual regulated GCSE examinations in England through the Eduqas brand.

[62] In England and Wales, the Education Reform Act of 1988 introduced a compulsory National Curriculum for most state primary and secondary schools. The existing National Curriculum consists of a variety of subjects which are taught over four Key Stages (Key Stage 1 to 4). At each Key Stage the core skills of English, mathematics and science must be taught.

Modes of Learning and Assessment

At Key Stage 4, the curriculum is classroom based while the GCSEs are typically externally assessed examinations. Each subject has a different number of assessments suitable to the subject or award (i.e. the combined science subject is a double-award and therefore is worth two GCSEs).

Grading and Marking

Proposed in 2014, taught from 2015 and examined from 2017 onwards, a new grading system for GCSE examinations is now in place with a nine point scale from 1-9 with 9 being the highest grade; a fail grade is recorded as a U (unclassified). Most examinations are now un-tiered but in the subjects where they remain so, including science, students taking the Foundation tier assessment can receive a maximum grade 5 (minimum grade of 1); students taking the Higher tier assessment can receive a maximum grade of 9 (minimum grade 4, or a 3 for those who just fail to achieve a 4); those that fail to achieve a 3 receive a U.

Examinations are marked and moderated externally using mark schemes. These include general instructions to examiners (i.e. those who mark the exam) on how to apply the mark scheme and record marks. For each question, where possible, the correct answer and extra information or possible alternative answers are provided. Examiners are also instructed on how to award marks for each answer; for example, if a question requires three separate calculations or words, one mark may be awarded to each correct calculation or word for a total of three marks. More detail on the mark schemes used for English, maths and science is provided in the respective subject comparison sections.

Appendix 2: Glossary of Question Types

Question type	Subject	Description
Multi-part question	Mathematics, Science and English	These are longer question which are broken down into sub-parts
Short answer	Mathematics	This type of question is designed to assess knowledge and correct application of a limited range of mathematical techniques. The demand of such questions often relies on the technique or method being assessed
	Science	This type of question typically requires one or two word responses that could be based on graphs or diagrams provided within the question. Students may be asked to perform a calculation with accompanying explanation or plot and draw graphs and diagrams
	English	A short response (one word to a few sentences) and is typically worth a very low number of marks
Long answer	Science	A longer response of a few sentences or longer calculation
	English	A long response (one or two paragraphs), typically worth 6-8 marks.
Extended problem	Mathematics	These present a substantial problem that is not broken down into sub-parts and are usually presented as a single standalone question. Extended problem questions typically involve multiple steps. However, less guidance is given to the candidate regarding the strategy and techniques required to solve the problem than is typically provided in multi-part structured questions
Extended response	Science and English	Extended- answer question ask students to write an extended piece of text / essay / creative piece to a question or statement
Multiple choice questions	Mathematics, Science and English	Questions in which the candidates are expected to select the best possible answer (or answers) out of a range of possible answers. One of the choices is the correct answers whilst the alternatives are known as distractor items
Gap-fill	Mathematics, Science and English	This is where the candidate has to choose the correct word(s)/numbers to fill in the blanks. Question may provide a selection of possible answers
Matching	Mathematics, Science and English	Correctly match two sets of information or data

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