

November 2016 subject reports

Design Technology

Overall grade boundaries

Higher level

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 14	15 - 26	27 - 37	38 - 48	49 - 59	60 - 71	72 - 100

Higher level internal assessment

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 7	8 - 15	16 - 22	23 - 28	29 - 34	35 - 40	41 - 54

The range and suitability of the work submitted

Teachers should note that moderators do not need to see evidence of the full Practical Programme other than the Design Project and the summative report of the Group Four Project. Moderators are not in a position, therefore, to provide feedback on the Practical Programme and how it supports the execution of the Design Project.

Moderators are instructed to ignore work contained on pages beyond the maximum allowed. The Subject Guide states on page 97 that the page limit refers to A4 size (or its equivalent) so candidates who worked on A3 size paper needed to appreciate that each A3 page was equivalent to two A4 pages. Candidates were not penalised for exceeding recommended page limits related to individual assessment criteria provided the maximum page limit was not exceeded.

Appendices must not be used. In this [November 2016] examination session candidates were not penalised if content contained in the appendices was within the page limit specified in the

Guide as this information had not been provided by the IB in a timely fashion. However, in May 2017 and future examination sessions appendices will not be permitted.

It was clear that some or all pages within some Design Projects pages had been reduced in size to conform to the A4 page limit. This resulted in a font size which was very small and in some cases unreadable, especially text linked to annotations. Guidance has been provided in the eCoursework documentation to inform schools that should candidates submit work in a font size smaller than 11 from May 2017 onwards, the work will not be moderated. Teachers should ensure that white space is used appropriately. [Examples](#) of good practices can be seen in the Computer Science Teacher Support Material.

Teachers were asked to provide notes to moderators justifying the marks awarded. It is important that the rationale for the awarding of the mark is provided rather than just a descriptive comment such as the quality of the work is appropriate for the mark awarded. Teachers are advised to see [this thread](#) on the OCC that discusses the appropriate annotation of work. Many teachers did this by highlighting assessment criteria they deemed appropriate within the mark bands and by making references to key evidence in the Design Project. This practice was very helpful to moderators especially if they disagreed with the teacher assessment and appropriate feedback could then be provided. Not all teachers provided appropriate notes to assist moderators, which was a pity.

Page 13 of the Subject Guide shows the iterative nature of the DT Design Cycle clearly illustrated including links between the four 'core' aspects and the two HL only aspects. Page 96 of the Guide states 'award the marks for the upper level if the work demonstrates the qualities to a great extent OR the lower level if it demonstrates qualities to a less extent.' It is not uncommon for evidence relating to one aspect to straddle two (or even three) level descriptors. Judgment is needed to decide how much of the evidence fitted the criteria for the different mark bands and what summative mark to apply for that particular aspect.

On Page 97 of the Guide teachers are advised that 'the task produced should be complex and commensurate with the level of the course.' Teachers need to ensure that candidates embark on a design project appropriate to the level of study and which has scope for a fresh approach to the problem".

Candidate performance against each criterion

Criterion A

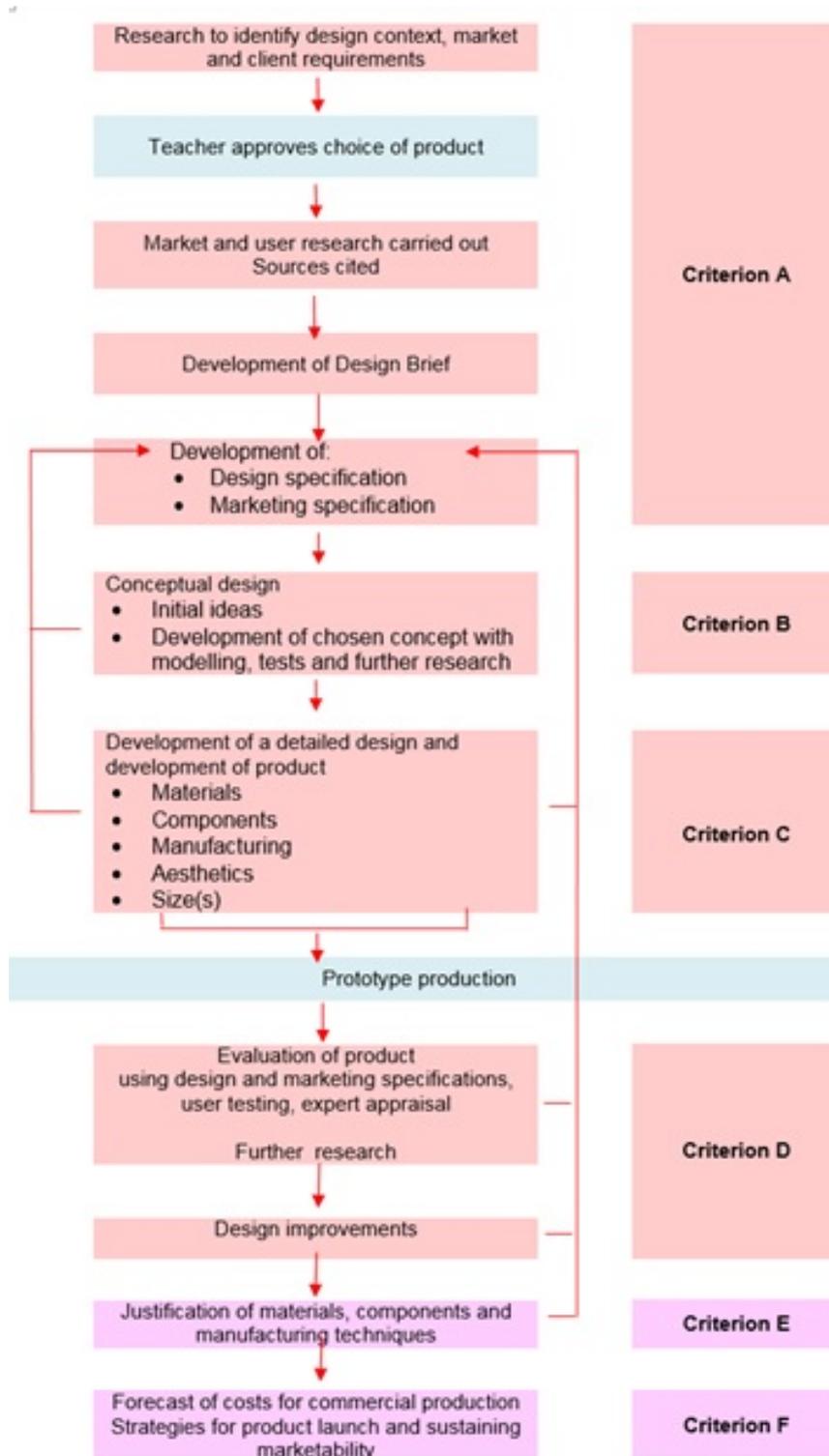
Prior to stating the design brief candidates should provide evidence of exploration into the design problem or opportunity in a chosen or given context. Teachers who set a common theme for candidates to explore need to ensure that each candidate carries out individual research and is able to identify a unique problem, leading to a design brief which normally takes the form of a set of instructions or 'needs' from a client. In practice, projects constrained to themes or set problems often limited access to the full mark range. The best work was from candidates who had fully analysed a problem, found data to back up its feasibility and considered the market opportunity appropriately.

The specifications should not be just a list of requirements but an explanation of the relative importance of the requirements in order to satisfy the design brief. Sometimes teachers provide candidates with a generic list of specifications e.g. safety; aesthetics etc. but many candidates did not use this starting point to relate the categories to their particular design context in order to compile a detailed set of specifications containing 'all of the requirements, constraints and considerations' which were 'specific, feasible and measurable.' For the "design specification" nine 'requirements, constraints and considerations' are listed in the Subject Guide and the level of 'specificity, feasibility and measurability' will depend on the nature of the proposal. In many instances it was clear that further guidance was needed to ensure candidates were able to compile suitable specifications.

The "marketing specification" requires candidates to summarize information obtained about potential users and markets, competing or comparable products along with the general characteristics of an appropriate target market requiring a new or improved design. 'An appraisal of economic viability of the proposed design from a market perspective is important taking into account fixed and variable costs and pricing.' Fixed and variable costs and pricing relate to a proposed scale of production (commercial production) so even though the intended outcome may be a prototype manufactured in a school workshop by craft production it will be used to evaluate marketability via commercial production and the "brief" needs to reflect that. More detail of concerning cost breakdown and marketing of the final design will be shown for Criterion E and Criterion F. Evidence should be clear to justify the chosen market sector or segment.

It has been noted that many Design Projects have inconsistencies between the design and marketing specifications in Criterion A and the evaluation of them in Criterion D. This suggests that teachers are using a linear (waterfall) approach to the Design Project. In the vast majority of cases it is likely that there will some iterative (agile) development of the product that occurs and this needs to be reflected in the Design Project. Figure 1, on page 4, indicates the iterative nature of the Design Project at Higher Level although a similar diagram could be used for Standard Level.

Figure 1: An example of an iterative approach to the Design Project



Criterion B

Marks for Criterion B are differentiated by the extent to which candidates have explored, evaluated and refined ideas. For high marks genuinely alternative ideas need to be generated, not just a rehash of existing solutions. Annotations should show how the ideas impact on users, manufacturing and other important criteria stated in the brief and specifications e.g. the environment. The chosen design context should provide enough information about shape/form, size etc. but more precise information will be included at the “detailed design” stage as a result of further development.

There was quite a large amount of evidence in sample project work of conceptual modelling both graphical and physical but not that much evidence of the use of tests/experiments e.g. tests to explore construction aspects, types of finishes. Not enough candidates revisited the validity of the specifications as they attempted to put them into action and in many instances it was obvious that further research was required but candidates were too engaged in a linear approach to oscillate successfully between research and development. The best work displayed a wide range of original ideas, presented using appropriate techniques and detailed annotations.

Criterion C

Most candidates manufactured their own prototype and by doing so were able to identify potential weaknesses and have the chance to rectify them via more development. If the prototype is outsourced for manufacture it is important that documentation clearly shows that the candidate has retained “ownership” of the design and the prototype has been manufactured to their instructions/drawings. There is a danger that the design may have been taken over by a third party who has modified it based on their expertise and experience in order to make it more feasible. Teachers need to ensure that the Design Project remains the work of the candidate and that collaboration with others falls within the normal parameters of research/guidance. There was plenty of evidence of effective use of CAD and CAM but some candidates clearly needed more guidance and exposure to such software to gain benefit during development and detailing of the chosen solution. The very best work made clear justifications for different choices of materials, fixings, construction and manufacture. Candidates had weighed up the alternatives and made judgements when considering cost, availability, stock availability and manufacturing limitations for the prototype. Unfortunately, many candidates only listed their choices and detailing for manufacture, in the form of orthographic drawings or suitable alternatives, was lacking. Far too many candidates did not plan effectively for manufacture taking into account sequencing, quality control and risk assessment but merely provided a retrospective “diary” of prototype manufacture which was inappropriate.

Criterion D

Candidates have been instructed to ‘evaluate the success of the solution against the marketing specifications’ which includes market analysis, competition and target market. For high marks the evidence needs to be objective e.g. from user trials, expert appraisal etc. Higher level candidate should consider the extent to which the outcome has potential for success in the marketplace and therefore what further development is required for

commercial production at an appropriate scale forming the basis for modifications (Criterion E). When evaluating the success of the solution against the design specification technical feasibility is the key issue and able candidates are likely to suggest areas of uncertainty with the design and what else should be done though this would probably be beyond the scope of their project in terms of time and resources. Some candidates did this well, except that in the process they lost sight of the requirements of the marketing specifications. Physical prototypes that could be tested for functionality generally performed better in this section. The very best work showed evidence of a strategy for testing which included client feedback, expert appraisal and user research/observations with detailed drawings to address weaknesses identified through the testing.

Criterion E

This section proved quite problematic for many candidates. Much of the evidence seen during the moderation process was hypothetical in nature and unrealistic in practice. Although some candidates identified a scale of production they considered suitable for commercial production they did not relate this to the type of product and how to launch it to market. For example, “batch production” was often identified but no specific batch size such as 10,000 for the first production run followed by larger batch sizes if the product sold well. Evidence for Criterion E is linked to evidence for Criterion F therefore, as the analysis of costs will be based on production volume and promotion strategies will ensure feedback and control of costs. Some candidates identified “mass production” for the commercial scale without appreciating that this entailed continuous flow and that this did not correspond with the marketing specifications. Some candidates went even further and suggested that “mass customisation” would be appropriate without demonstrating any appreciation of the costs involved. In this way, many candidates suggested modifications for commercial production which were theoretically possible but would not make commercial sense given market conditions. If candidates did not consider the holistic nature of the design cycle when compiling the “brief” and “specifications” then evidence for Criterion E and Criterion F tended to be ‘tagged on’ and poorly researched.

Criterion F

Many candidates seemed to focus on a sales price without much justification except competitor pricing. Unfortunately, in many cases the nature of the final product and associated commercial production resulted in an unrealistic price. Evidence is required of a logical process using realistic data relating to aspects of economic viability such as likely unit costs, sales volume, selling price and financial returns. Moderators are looking to credit candidates who have made a genuine attempt to quantify the costs which will contribute to the final cost of the product. It was common for figures to be almost ‘plucked from the ether’ which made a meaningful discussion of the appropriateness of the sales price impossible.

The example below, which was also in the May 2016 Subject Report, shows how a particular framework can be used to determine an appropriate sale price though there are many alternatives. It should be noted that there are many alternatives to this approach and candidates must be aware that theory related to price setting can be applied to their individual circumstances. It should also be noted that a number of assumptions need to be made about the nature of production and costs etc.

“The production of the compost tea collector is outsourced to a factory. The compost tea collector is initially produced in a one-off batch of 1200 units (*assumption based on evidence of potential initial market size*).

For simplicity energy costs are subsumed into the cost of using the machinery (*assumption made to simplify calculations*).

As the labour cost is a one-off payment it is included as a fixed cost. The batch takes one week to produce and requires 5 employees (*assumption made to enable calculations of break-even*).

All figures are in \$

Fixed costs (FC)

Machinery	30 000
Labour	2 500
Total	32 500

Variable costs (VC)

Cost of materials for each compost tea collector - \$265.70

In this scenario these variable costs will be considered as a one-off fixed cost as the materials are purchased prior to the manufacture of the compost tea collector.

Total costs (TC) of producing batch of 1200 units.

$$TC = 32\,500 + (1200 * 265.70)$$

$$TC = 351340$$

If the sale price is \$350 (as proposed by the candidate)

Total revenue (TR) if all units sold

$$TR = 350 * 1200$$

$$TR = 420\,000$$

$$\text{Profit if all 1200 units sold} = 68660 (420\,000 - 351\,400)$$

Break-even (BE) can be achieved by using the following calculation:

$$BE = TC / 350$$

$$BE = 351\,340 / 350$$

BE = 1003.8, so 1004 units (approximately 80% of the batch needs to be sold).

This gives a margin of safety of 196 units.”

Note:

If the break-even point of the compost tea collector is calculated using the variable cost of each unit of \$265.70, the break-even point will be at 386 units.

BE = FC/Contribution

BE = 32500/84.3

BE = 385.53

BE = 386 units.

In this example minor costs such as storage and distribution are not considered as they would not impact significantly on the calculation for break-even but for other design contexts they may not be so minor and would need to be taken into account. Candidates should show that they are aware of all relevant costs even though they may not include minor ones in their calculation of bringing the product to market.

In the discussion about strategies for marketing the product candidates need to avoid making assumptions based on existing products in the marketplace or just stating “theory” from course topics in the Subject Guide. These topics may be a useful reference point as long as candidates apply the strategies specifically to their type of product and the identified market. The discussion should take into account the original market research and subsequent research to justify the market, pricing and competition e.g. even though the research indicates a potentially large market the initial production run may be quite limited and promotion targeted at a small sector (local/national) in order to test the market and gain feedback. Candidates need to provide evidence to back up their strategies. Many candidates merely provided a list of promotion strategies with comments relating to potential effectiveness but with no consideration of the impact on costs. Not many candidates linked promotion strategies to volume production so they discussed tapping into a very large, often international, market but without considering how demand would be satisfied in terms of the rate of production, storage, distribution etc.

Recommendations for the teaching of future candidates

Now that all work for moderation is submitted electronically it is important that candidates are made aware of the eCoursework requirements. These requirements have been stipulated to ensure that the work can be easily assessed by moderators. Teachers may want to build in sufficient time in their Design Project schedule to be able their students to review the format and clarity of the work especially annotations as often these cannot be read by moderators after scanning.

There is a temptation for candidates to include all the research undertaken for the Design Project and let the moderator sort out what is relevant. It is usual that some research will not be directly relevant to solving the problem though possibly useful to the candidate in considering how to solve it. The analysis of the market research should be an objectively structured document relating to how the design cycle has been used to identify and solve the problem to the stage of launching the product on the market. Candidates should include only analysis of research material which was important to the process. In many November 2016 projects candidates included tables of data for anthropometrics, material properties, manufacturing techniques etc. with little analysis of their relevance or usefulness. Sometimes, it was obvious which type of materials would be used because of what was stated in the brief/specifications but then pages of textbook research material were also included relating to a wide range of materials, none of which were applicable to the context. Some candidates stated that they were constrained by the availability of materials at school which was understandable as long as they realised that the materials may not be ideally suited to the final solution and at the evaluation stage put this into perspective and the most appropriate material(s) identified. As with all IB DP academic work, research sources should be cited (footnotes), and the requirements are the same for Des Tech as they are for other subjects.

Moderation for the May 2016 and November 2016 sessions has shown that the structure of the Design Project tends to be more formulaic than in previous years. The nature of the assessment criteria set out under headings and reinforced by the “clarifications” leads to a systematic formatting of the report using the headings. This may be a good starting point for candidates but as the Design Project develops they need to adapt the process to suit the nature of the design context being explored. Each Design Project will have different priorities in relation to the amount and type of research and development required. The assessment criteria are a useful framework for teachers, candidates and moderators but can lead to a linear approach to using the design cycle rather than reflecting the iterative nature of the cycle as shown in Figure 1.

Probably the most important guidance provided by teachers is for the selection of an appropriate project. By the time the Design Project is undertaken teachers will know their candidates well and be aware of their capabilities and style of working. Able candidates undertook considerable research to identify an appropriate design context to explore which was interesting but did not always lead to a specific ‘USP’ so candidates spent a great deal of time and effort trying to justify the ‘need’ and commercial potential when there was none. It is recognized that candidates undertaking an examination course want to do well by ensuring that they cover all the requirements of the assessment but for a high grade they need to demonstrate a reasonable amount of flair and ingenuity. Able candidates with a good grasp of the course should focus on a design problem which allows their talent to flow through the process. Many candidates decided to focus on an already crowded market stating that they would achieve a competitive edge by designing a solution which undercut the competition but this was rarely an astute strategy as the competition was already well established, selling in high volume and priced accordingly.

At the top of the marking range there was often a mismatch between the marks awarded by the teacher and the notes which explained the marking. Teachers are advised to refer to the Grade Descriptors in order to ensure that the marks awarded reflect the anticipated grades.

Higher level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 10	11 - 14	15 - 20	21 - 24	25 - 28	29 - 32	33 - 40

General comments

There were very few responses from teachers about this paper, and no comments were received. Consequently, it was assumed that the standard of the paper was of an equivalent standard to those in previous examination sessions.

Figure 2 below shows the difficult index of each question. This is a slightly counter intuitive label as it refers to the percentage of candidates who achieved the correct answer. The discrimination index indicates how well the question discriminated the different candidates based on their responses to the question compared to their performance on the paper as a whole. The higher the Discrimination Index, the better the question has performed. For example, analysis of Question 2 shows that the more able candidates tended to get the correct responses, whereas Question 3 was a less effective discriminator, perhaps as it was relatively easy.

Figure 2: HL Paper 1 (MCQ) in Question order

Question Index	A	B	C	D	Difficulty Index	Discrimination
1	29	92	17	4	64.79	0.06
2	21	31	19	71	50.00	0.53
3	20	5	1	116	81.69	-0.04
4	69	16	55	2	48.59	0.51
5	9	31	84	18	59.15	0.06
6	26	13	8	95	66.90	0.23
7	5	95	15	27	66.90	0.49
8	28	8	45	61	42.96	0.57
9	10	68	24	40	76.06	0.13
10	76	38	25	3	53.52	0.47
11	86	19	33	4	60.56	0.38
12	41	41	56	4	28.87	0.19
13	9	10	108	15	76.06	0.32
14	6	2	3	131	92.25	0.15
15	30	87	15	10	61.27	0.23
16	68	8	60	6	47.89	0.17
17	72	23	46	1	50.70	0.40
18	33	32	45	32	22.54	0.19
19	20	5	115	2	80.99	0.34
20	6	18	46	72	83.10	0.30
21	39	14	86	3	60.56	0.11
22	107	19	4	12	75.35	0.26
23	0	65	60	17	45.77	0.47
24	1	131	6	4	92.25	0.21
25	19	3	11	109	76.76	0.45
26	26	17	29	70	49.30	0.57
27	15	61	59	7	42.96	0.45
28	13	15	19	95	66.90	0.40
29	15	13	9	105	73.94	0.45
30	84	23	11	24	59.15	0.40
31	80	22	34	6	56.34	0.51
32	8	40	75	19	28.17	0.19
33	6	26	102	8	71.83	0.19
34	12	70	55	5	38.73	0.09
35	11	12	41	78	28.87	0.15
36	45	51	28	18	19.72	0.11
37	14	13	90	25	63.38	0.47
38	4	37	100	1	70.42	0.49
39	22	35	79	6	55.63	0.17
40	107	12	10	13	75.35	0.34

Comments about individual questions

In the Grade Award meeting any question where a teacher has commented on is discussed, or where the Grade Award Team believe that the original answer suggested may be incorrect, or there is a negative Discrimination Index. The information in Figure 3 shows the final decision of the Grade Award Team. At all times the candidate is given the benefit of doubt which is why there may be more than one possible answer if on reflection the question is perceived to be ambiguous.

Figure 3: Decisions about individual questions discussed in the Grade Award meeting

Q3	Negative discrimination index (-0.11)	The answer was correct (D), but there was a suspicion of the use of the word “not” in the question may have confused some candidates. No further action.
Q9	Negative discrimination index (-0.02)	Definitely B, some discussion about whether D was acceptable. Split decision, but in the spirit of giving the benefit of the doubt to the candidates both were accepted. Both B and D accepted.
Q12	Specimen Paper had a similar question with the answer electro-rheostatic	B is the correct answer, but in the Specimen Paper magneto-rheostatic was not provided as an option. This is an area where the understanding of the context of the scenario is critical. No further action.
Q16	Use of the word “not”	This did not cause a problem. No further action.
Q20	Larger number of candidates (72) chose D rather than C (46)	Both C and D were seen as acceptable responses. Although A was suggested, it was less likely to ‘best describe’ the reason why the Coca Cola bottle is a design classic. Both C and D accepted.
Q34	Larger number of candidates (70) chose B rather than C (55)	The question is clearly more about Quality Assurance (QA) than Quality Control (QC). Answer changed to C.
Q36	Negative discrimination index (-0.06)	It was decided that the innovation was configurational rather than architectural. Answer changed to C.

Recommendations and guidance for the teaching of future candidates

Teachers should ensure they use the Glossary, published on the OCC in 2016 as these definitions are the ones used by the paper authoring teams.

Higher level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 5	6 - 11	12 - 15	16 - 20	21 - 25	26 - 30	31 - 50

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

Candidates did not demonstrate a good understanding of some of the following concepts in the DT guide, including:

- Dematerialization
- Patents
- Form follows function in a specific design context
- Sustainable production issues relating to corporate social responsibility and good environmental practice (Topic 2)
- Drivers for green design (what are the other potential drivers beyond consumer pressure and legislation)
- Some candidates struggled with the idea of the growth phase of a new product to market
- Of the few candidates who chose Q7, the answer for question (7d) was difficult given that the manufacturing method was more likely to be an alternate method to what was listed in the mark scheme.
- Candidates did not perform well in some questions relating to Topics 2 and 5

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

Overall, many questions particularly from Section A, Q1 were accessible enough to allow the candidates to access a range of marks. There were some good responses to extended answer questions particularly the extended response question for (6d) Selfie stick and to some extent (5d) Plan wooden toys.

Many candidates this session were concise with their answers, making good use of sub-headings and short statements rather than long sentences in which the question is repeated in the answer – which should be avoided.

- The calculation question was simpler than previous questions of this type as it did not require any complicated conversion of units
- Candidates performed particularly well in questions relating to Topics 1, 4 and 6.
- *There were no questions that linked directly to content from topic 3
- Questions 1ci, 1cii and 6c don't relate to any specific topic but are more general design knowledge or related to design project

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

Strengths

Section A

- 1a(i) The majority of candidates answered this question well.
- 1a(ii) Provision of a good product illustration helped candidates with this question.
- 1c(ii) Many candidates answered from the 'glass tend to mark easily' or 'glass can scratch easily' clusters well although only a few got 3 marks
- 1d(i) Easy calculation question which most candidates answered correctly
- 1d(ii) Many number of candidates understood the concept of 'static data' in the context of the question
- 1e(i) A good understanding of ordinal scales
- 1e(ii) A good understanding of biomechanics from Topic 1
- 2a Almost all candidates achieved 2 marks from the list of classic design descriptors
- 3 Almost all candidates understood how market segments are used by designers to determine user needs and for creating variations of a design.

Section B

- 5a Most candidates achieved at least 1 mark for identifying a mechanical property of rubber wood
- 6a/b The majority of candidates answered both these questions well. Good understanding of market pull and human factors design was shown by candidates who were all mostly familiar with the product.
- 6c Many answer clusters provided candidates ample opportunity for marks however some varied and jumped between clusters
- 6d The best candidate responses of all the 9 mark questions was for this one. Candidates did better with their responses relating to planned obsolescence and further development than they did with the growth phase however
- 7a/b The majority of candidates answered both these questions well. Good understanding of thermoset plastic properties and environmental impact during product disposal was demonstrated by candidates

Weaknesses

Section A

Many candidates lost marks because they:

- 1c(i) Only considered the edge shape of the shelf and its potential to cause injury.
- 1d(i) A small number of candidates forgot to add the unit to the final answer.
- 2b Candidates did not know how to effectively apply their understanding of form and (follows) function to the context of the Swiss Army Knife.
- 4 Candidates still don't seem to have a good understanding of dematerialization. Most will only discuss the idea of reducing materials but do not address or make connections to wider issues of efficiency, environmental impact, sustainability or circular economy.

Section B

- 5b Very few candidates managed to obtain a full 3 marks for this question showing a limited understanding of the concept of corporate environmental responsibility from topic 2.
- 5c Some good responses however many candidates only presented one side of the argument.
- 5d Candidates found it difficult to get 9 marks as the guide only listed two drivers for green design (consumer pressure and legislation). Question may have been better suited as a 6-mark question.
- 7c Very few candidates managed to obtain 2 or more marks for this question. There seemed to be a poor understanding of the knowledge of patents in the context of protection of product sales, marketing, ownership and technology.
- 7d This seems to be an inappropriate question as the product components would most likely not be produced by a subtractive CNC method. Also, being a very open question some candidates did not focus on the process of CNC in a production sense and focused on a discussion about eco-friendly aspects of CNC manufacture and general advantages.

Recommendations and guidance for the teaching of future candidates

- Ensure all the new concepts in the DT syllabus are taught, the examination papers will ask questions from across all of the topics in the Guide.
- Remind candidates to make use and refer to the diagrams, graphs and photographs in the examination paper.
- Do not repeat the question in the answer.
- Avoid the use of extra paper to extend the answer if it is not necessary.

- Underline key words in the question.
- Use clear concise sentences and structure answers in clusters when addressing the extended response questions - in particular the 6 and 9 mark questions.
- Understand the correlation between the command term objective, the depth of the response and the marks allocated to that response. For example, a question that uses an Objective 3 command term such as 'explain' is worth 3 marks and requires greater depth in the response than a question that uses an Objective 2 command term, such as 'outline' is worth 2 marks.

Figure 4, on page 17, shows a table that was developed at a workshop where teachers attempted to make connections between the command term used and the depth of response expected from candidates. This may be useful in assisting teachers understand the requirements of each command term.

Figure 4: The correlation between the assessment objective, command term and number of marks for a question.

Command Term	Objective	No. of Marks	IB definition	Ask the candidate to:
Define	1	1	Give the precise meaning of a word, phrase, concept or physical quantity.	Give the exact meaning
List	1	1 per item	Give a sequence of brief answers with no explanation.	Give a number of possible answers using bullet points
State	1	1	Give a specific name, value or other brief answer without explanation or calculation	Give the only possible answer
Calculate	2	2	Obtain a numerical answer showing the relevant stages in the working.	Answer sum and show workings and ensure units are included where needed
Describe	2	2	Give a detailed account.	Using the information in the paper as a starting point, make two clear points (one mark per clear point)
Estimate	2	2	Obtain an approximate value.	Show working to achieve an approximate answer
Identify	2	2	Provide an answer from a number of possibilities.	Select the correct answers from a range of options (1 per item).
Outline	2	2	Give a brief account or summary.	Take an idea and develop it with a brief explanation
Discuss	3	3 or more	Offer a considered and balanced review that includes a range of arguments, factors or hypotheses. Opinions or conclusions should be presented clearly and supported by appropriate evidence.	Make the point, develop the point and justify the point (could include advantages and disadvantages).
Evaluate	3	3 or more	Make an appraisal by weighing up the strengths and limitations.	Make the point, develop the point and develop/justify the point (must include advantages and disadvantages).
Explain	3	3 or more	Give a detailed account including reasons or causes.	Make the point, develop the point and develop it again with reasoning
Suggest	3	3 or more	Propose a solution, hypothesis or other possible answer.	Give a feasible idea, develop the idea and develop it again with reasoning
Compare	3	3 or more	Give an account of a similarities and differences between two or more items or situations referring to both brackets all of them throughout	Pick a similarity or difference, develop it and develop it again with reasoning

The breakdown of questions in Objective 3 is usually (except for some questions in HL Paper 3) based on 3 mark clusters. Examples of how they are addressed can be seen in the markschemes of past papers and specimen papers.

Each 3 mark cluster is linked to **one** idea or possible solution.

Each cluster requires depth; the ideas are developed twice rather than listing a number of different unrelated ideas. The use of 'point-explanation-link' is a good approach to structuring an answer to the 3 mark question.

Objective 3 questions require:

- One cluster for 3 marks
- Two clusters for 6 marks
- Three clusters for 9 marks

For questions that are not multiples of 3 marks candidates should keep developing the point until the number of marks for the question is reached (usually 4 or 5 on HL Paper 3).

Higher level paper three

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 3	4 - 7	8 - 9	10 - 15	16 - 20	21 - 26	27 - 40

General comments

HL Paper 3 for November 2016 focused on Topics 7 UCD (27.5%) and Topic 8 Sustainability (25%), Topic 9 Innovation and Markets (25%) and topic 10.4 Quality Management (22.5%). There were 4 mark questions on Topic 9, a 5 mark question on Topic 7, a 6 mark question on Topic 8 and the 9 mark question on Topic 10.

Candidates in general performed better on Topic 8, and showed some lack of knowledge with UCD theory (Topic 7) and quality management (Topic 10). Weaker candidates struggled to achieve good marks in the extended response questions. Candidates who planned their responses tended to do better as did those who used headings to separate their clusters.

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

Candidates did not demonstrate a good understanding of some of the following concepts in the DT guide, including:

- Topic 7.1: UCD strategies.
- Topic 7.4: Focus groups
- Topic 8.2: Sustainability particularly implications of take-back legislation.
- Topic 9.2: Market segmentation
- Topic 10.4: Quality management: Quality Control / Quality Assurance / Statistical Process Control

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

In general, most candidates were able to answer Question 1 well, although the responses to the implications of take-back legislation varied and few managed to get the full 6 marks.

Candidates that planned their extended responses with headings tended to score higher. Many candidates tended to repeat the question which preventing them from answering the question given the time constraints of the examination.

In general, most candidates did better in the short response questions, in particular Q1a and Q2a.

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

Strengths

Section A

- 1a The majority of candidates identified no battery, take back legislation and recyclability.
- 1b Most candidates identified brand loyalty, promotion, attracting clients and competitive advantage as reasons for sustainability reporting.
- 1c Most candidates discussed recyclability of materials, design for disassembly, the phone's packaging and the need for a take-back system.
- 2a Most candidates identified loyalty amongst existing customers and standing out amongst competitors as a benefit of brand loyalty.
- 2b The majority of candidates identified creating products that better relate to consumers wants and needs. A few related similar tastes to create products that better relate to customer needs.
- 2c A few candidates mentioned that a family of products would share common parts and assemblies only some mentioned economies of scale.
- 2d Most candidates realised that product development would increase a market share, a few realised that diversification would lead to new customers, because of the brand quality.

Section B

- 3a A few candidates were able to identify research, design and user trials as elements of UCD. More candidates would have answered this question had the question been worded differently.
- 3b Most candidates correctly identified that a usability lab did not replicate the outdoor environment, fewer actually stated which environmental conditions might affect the performance.
- 3c Most candidates realised that focus groups could enhance the development of a product.
- 3d Most candidates related the colours of Brazil in the football as emotional design. Most discussed the prestige of the World cup and the association of ADIDAS with it as emotional design. A few mentioned the panel design.

Weaknesses

Section A

- 2c There appeared to be differences at times in the performance of the candidates in the different languages. For the Spanish scripts, not many candidates mentioned ease of disassembly or temporary joining techniques. For the English scripts, few discussed temporary joining techniques and reduced variety of materials. In both English and Spanish scripts, some argued that recycling and take-back policy would reduce costs instead of incurring costs. Not many recognised that policies vary from country to country.
- 2d Few candidates mentioned the risk aspect of product development and diversification. Candidates who planned their answers with headings and sub-headings tended to do better at this question. Few candidates recognised that diversification brought the greatest rewards.

Section B

- 3a Few candidates demonstrated a good understanding of UCD elements. The DT guide refers to the Five Stage of UCD and not five elements (Topic 7.1). The MS was adapted to accept a larger variety of responses and candidates could have scored max points by simply listing two elements, two UCD principles, or two UCD strategies. After initial marking, the MS was amended to include a broader range of responses.
- 3c Few candidates recognised that the use of focus group leads to high quality qualitative data or that the data is based on open ended research.
- 3d Few candidates appreciated that Adidas had minimal influence on the design of a football but could alter the colour / panel design.

- 3e Candidates struggled to score high in this 9 mark question. Those that structured their response with headings did better. Very few mentioned automated machinery or tolerances with respect to quality control. A very small number of candidates gained marks for the concept of statistical process control. The majority did not demonstrate an understanding of this concept in relation to quality management. Few appreciated that quality assurance is about providing confidence that quality requirements will be fulfilled.

Recommendations and guidance for the teaching of future candidates

All of the recommendations made in Paper 2 apply to this paper, so teachers should refer to the recommendations made in that part of the report.