May 2017 subject reports

Design Technology

Overall grade boundaries

Higher level

Grade:	1	2	3	4	5	6	7
Mark range:	0-14	15-27	28-38	39-49	50-59	60-70	71-100

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0-16	17-29	30-42	43-51	52-62	63-72	73-100

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

The majority of candidates submitted work within the page limit, but where this was not the case it was due to poor presentation and layout, a lack of synthesised research and excessively descriptive work. Further teacher guidance is required at the point of starting project work to ensure candidates have the best opportunities to stay within page limit. Font size and style is still a problem for some centres. Where work is reduced in size it still needs to meet the minimum requirements of Arial 11. Handwritten text also needs to be legible and submitted at a resolution which is readable on smaller screens. Pencil drawings need to be clearly visible; some work was not readable. It is advisable to check electronic versions of the work for such issues before submission.

Many teachers provided evidence of how marks had been awarded. However, some teachers only suggested where each criterion had been achieved across bands. Although this aided the moderation process, it did not always allow for detailed feedback to schools as the rationale for the awarding of marks had not been made clear.

Some candidates explored open-ended projects which met a real need for a specified client, but far too many projects started from personal experience leading to assumptions about market need and incomplete/inaccurate specifications. Some schools approached project work via a set theme, which in most cases 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 through discontent of existing products, user interviews, expert appraisal etc.

In general, a wide range of suitable tasks were presented for moderation, which included packaging solutions, upcycling, furniture, fashion garments and electronic products. Prototypes that allowed for the testing of functionality generally performed better in evaluation. Scale models often lacked a critical approach to evaluation due to limitations for testing. Teachers need to guide candidates towards projects that can address all the level descriptors of the assessment criteria. A tick box approach and restricting projects to themed tasks often meant candidates were not able to achieve marks above the middle bands. Evidence and use of CAD and CAM was mostly good, but some candidates need further guidance and exposure to such software if they are to utilise its benefits during development and detailing of ideas.

Candidate performance against each criterion

Criterion A

Many candidates struggled to identify a problem with enough scope for creativity or it addressed a personal need where there was fixation on one idea. The best work identified a problem from objective evidence and offered the opportunity to develop a solution attainable within the constraints of time, resources and skills. In most cases, this also enabled candidates to recognise a clear market from which they could start to develop specifications. There is still some confusion as to how to differentiate between a marketing specification and a design specification. Reference to the clarifications for the assessment criteria indicates that candidates should explain and justify each point linking back to research as appropriate. For example, where weight is a consideration minimum and maximum weight constraints need to be included as generic terms such as large, big, small, heavy and light are not detailed enough. Further guidance is needed to ensure candidates are able to write focused, measurable and justified specifications.

There is considerable reliance upon the results of questionnaires to justify a 'need'. Often these questionnaires are given to peers at school but the reliability of the data gathered is not questioned either in terms of how the sample was chosen and why it is representative of the target market. The issue of bias is a problem in these circumstances. Few candidates seem to consider use of focus groups for user research. Although this can be time-consuming it offers the opportunity to use the group at different stages of the design cycle to gain feedback.

Many candidates use internet searches to analyse competing products in their market. This strategy may be a useful starting point but is limited in scope. Often the candidate repeats information gleaned from the website or makes a subjective evaluation of the degree of success of the product just from looking at images. If the context is a chair, for example, the candidate does not explore key features of the design such as weight, comfort, construction and texture.

Re-design of existing products is obviously a popular approach and reflects normal design practice. However, for high marks candidates need to focus on an area of novelty for their proposed redesign i.e. a 'unique selling point' (USP), especially for a crowded market. Many candidates decide that their USP will be to design a cheaper version and so widening the market. Although it is incorrect to say that this is a doomed strategy it rarely works out at this level. Candidates fail to appreciate the costs involved and the amount of market research and promotion undertaken by companies selling the existing products. Candidates usually realize by the evaluation stage that it has not been possible to achieve their goal given time and resources but then try and rectify the situation with design modifications which merely reinforce the fallibility of the concept.

It is obvious from the outset that many candidates are constrained by available resources usually within the school context. This is quite understandable and so candidates should not waste time producing theoretical research into a range of materials and associated manufacturing techniques when they know they have to work with what is available to them for the prototyping. This does not mean that the design work cannot reflect other materials/techniques which would be preferable but that the prototype is, in effect, a model and will be evaluated on that basis. It may be that DfM is the driving force when choosing what to

design so specific materials/techniques are identified as part of the brief. At Standard Level alternative materials and processes which may be more appropriate can be explored for design modifications (Criterion D) and HL candidates may take this into more detail when explaining modifications for commercial production.

Higher level candidates need to take into account the requirements of Criterion E when considering the scope of the proposed design for scaling up production and the potential market thereafter. Often candidates focus on a 'one-off' prototype for the brief and specifications and then tag on modifications for commercial production when they needed to appreciate that commercial production is the goal and the prototype is to be designed in order to make this achievable.

Criterion B

There continues to be a significant difference in the quality of work presented for this criterion. The very best work displayed a wide range of original ideas, presented using appropriate techniques with detailed annotations. Reference to specifications was considered throughout and concept modelling refined ideas to develop ergonomics, function, aesthetics, etc. However, a considerable number of candidates work for ideas and developing concepts was well below the level and quality to achieve more than the middle band. This work was either a copy of existing ideas or a photo of a product suggesting basic changes to improve its function. This section provides an opportunity for candidates to demonstrate their creative ability but they need considerable guidance to develop an iterative design approach. The best work included the refinement and testing of models to make a sequence of alterations to ideas. The weakest work either omitted this section or simply showed different views of the same CAD visuals. Few candidates conducted a series of tests e.g. methods of joining components, structural integrity, surface finishes etc. Descriptive, storytelling is to be avoided as candidates need to be more analytical in their approach to design – for example, changing the design to improve aesthetics may lead to a reduction in functionality, increased cost, more complex manufacture, etc. and they need to understand how to balance requirements.

HL candidates should appreciate that they need to take into account that the goal is to produce a design suitable for commercial manufacture eventually. Many candidates overlook this aspect and find that the prototype does not lend itself to a commercially successful outcome.

Criterion C

The very best work made clear justifications for different choices of materials, fixings, construction and manufacture through the testing of models, comparison of results and literature based research. Characteristics and properties of materials should be considered, as well as cost, availability, stock form, and manufacturing limitations. Links between material choice and manufacturing processes should be evident – this was a major defect in many projects. Communicating the details of the final design was not done effectively by many candidates and further focus should be given to addressing this through the use of TDA time. Rough sketches and poorly scaled drawings are unsuitable. There was some improvement in the quality of work for planning for manufacture, with far more focus given to timings, dates, processes, tools, quality control, part lists and risk assessment. However, some schools still

feel the need to show this work as an ongoing diary. Such work is retrospective and fails to address the assessment criteria.

Many candidates fail to appreciate that this stage is crucial to producing a prototype suitable for gaining feedback from users and experts in the market. Although there are no separate assessment criteria relating to skilful manufacture of the prototype a crude outcome will impact on the feasibility of gaining appropriate feedback.

Criterion D

In general, there is a lack of direction and time allowed to complete a successful evaluation.

Strategies for testing and evaluation are recommended to ensure all aspects of the criteria are addressed. The use of client feedback, expert opinion and evidence of testing is highly recommended if students are to aim for marks in highest band and critically analyse their own work. Testing, especially for scale models, was often superficial and was mostly based on personal opinion.

The very best work demonstrated objective, rigorous testing and evaluation from potential users and experts along with a range of detailed drawings to address significant weaknesses identified through testing. Suggestions for just making outcomes lighter, smaller, bigger, etc. were insufficient for high marks. Recommendations should be based on improving the outcome not addressing weaknesses in poor manufacture. This is a difficult section for many candidates and there is a tendency to use a personal perspective even though user research has been conducted as the parameters for the interviews are based on the candidate's viewpoint. Many candidates are reluctant to admit that the design outcome does not succeed or is just unlikely to make much impact on the market, given the competition.

HL candidates should focus on how to proceed with the prototype to commercial production and launch to the marketplace. Evaluation strategies should support this transition by providing information on areas of the design which need improvement and revision of at least some of the specifications and even a revised design brief may be necessary. Testing is based on the prototype so potential users are limited in the feedback they can provide for taking the design to the next stage but experts such as engineers, retailers etc. can usually see beyond the limits of the prototype and offer advice to make suitable modifications.

Criterion E

Although there has been a general improvement in work for this category since last year many candidates still give a relatively small amount of time to it compared to core criteria. Lack of suitable research into appropriate commercial production is the main issue. Most candidates focussed on a specific process such as injection moulding but did not consider the full sequence of production from the input of raw materials/components to final product and packaging. The original specifications tended to be overlooked so suggestions for modifications to the design conflicted with the original brief and specifications. Many candidates did not appreciate the cost implications of their suggestions and incorrectly identified 'mass production' as a suitable scale of production but this was not appropriate for the market. Some candidates stated that mass

customisation and JIT production would be suitable with no reference to the costs involved or evidence of a mass market.

Selection of materials tended to be more accurate with better candidates identifying properties required from the selection and suitability of materials for associated manufacturing techniques.

Criterion F

It is difficult for candidates to provide details for every conceivable cost which would underpin a selling price for their product but they need to be realistic about the major and minor costs. Many candidates just focused on costs they could quantify for the production of their prototype and then assumed that scaling up production would reduce costs by a fixed percentage and hence create an early break-even point. These candidates then went on to suggest many possible promotion strategies without any assessment of the cost implications. A significant number of candidates decided that the price would need to undercut the competition to be successful but there was no evidence from the previous sections to show that the product could be produced and marketed cheaply enough to justify the price.

Astute candidates stated in Criterion E if the product would be self-manufactured or produced by license and who would bear the costs for promotion and launch to market. These candidates went on to gather research from manufacturers or retailers about how they would recommend promoting the product and whether it would form part of a range. In this way evidence for Criterion E and Criterion F is linked as the volume of production is decided and the market segment(s) identified for the initial launch phase.

Recommendations for the teaching of future candidates

- Further teaching is needed to encourage students to recognise problems that have scope to meet a marketable goal. Simply asking students to find a problem at home or school is not sufficient if they are to address the full assessment criteria.
- Further teaching of presentation techniques for ideas, development and use of modelling strategies need to be explored. These should include isometric, 2-point perspective, exploded views and orthographic drawing.
- Candidates need to be more analytical in their approach to work. Further use of product analysis and developing physical models is encouraged to support this.
- Greater use of tests to justify choice of manufacturing processes and material selection e.g. testing properties of materials or suitable joining techniques.
- Higher level candidates should appreciate that the design will potentially be commercially viable and this is reflected in the brief and a theme throughout the design cycle.
- Interim deadlines need to be built in to planning of the course to leave sufficient time to address each criterion.

Standard level internal assessment

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-5	6-10	11-15	16-19	20-23	24-27	28-36

The range and suitability of the work submitted

The majority of student's submitted work was within the limit of 38 pages, but where candidates did not meet the requirement this was mainly due to poor presentation and layout, a lack of synthesised research and excessively descriptive work. Further teacher guidance is required at the point of starting project work to ensure candidates have the best opportunities to stay within the parameters outlined. Font size and style is still a problem in some schools. Where work is reduced in size it still needs to meet the minimum requirements of Arial 11. Hand written text also needs to be legible and submitted at a resolution, which is scalable on smaller screens. Pencil drawings also need to visible; some work was faint work and not assessable. It is advisable to check electronic copies of work for such issues before submission.

Many teachers provided evidence of how marks had been awarded. However, some teachers only suggested where each criterion had been achieved across bands. Although this aided the moderation process, it did not always allow for detailed feedback to schools as the rationale for the awarding of marks had not been made clear.

Some candidates explored open-ended projects which met a real need for a specified client, but far too many projects started from personal experience and as result of these often-constrained marks awarded later in the project. Some schools approached project work through a set theme, but in most cases, this 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 through discontent of existing products, user interviews and news based articles. It was at this stage students should have considered the potential market, but this was often omitted.

In general, a wide range of suitable tasks were evident across the sample, which included packaging solutions, upcycling, furniture, fashion garments and electronic products. Prototypes that allowed for the testing of functionality generally performed led to a better evaluation in Criterion D. Scale models often led to a less thorough evaluation due to a lack of testing. These results were often superficial. Teachers need to guide candidates towards projects that can access all the level descriptors of the assessment criteria. A tick box approach and restricting projects to themed tasks often meant candidates were not able to achieve marks above the middle bands. Evidence and use of CAD and CAM was mostly good, but some candidates need further guidance and exposure to such software if they are utilise its benefits during

development and detailing of ideas. Its use for detailing outcomes for manufacture indicated further teaching is needed to improve work in this area.

Candidate performance against each criterion

Criterion A

Suitable problems included designing items for the elderly, disabled, children, schools and charities. Inappropriate problems were often too narrow offering limited scope for creativity or addressed a personal need where there was fixation on one idea. The best work included evidence of problems by analysing existing products, news articles, health journals interviews with clients. In most cases, this also enabled candidates to recognise a clear market from which they could start to develop specifications. There is still some confusion between what constitutes a marketing specification and what constitutes a design specification. Teachers should refer to the clarifications for this assessment criterion

Precise information such as minimum, maximum size and weight constraints need to be included as generic terms such as large, big, small, heavy and light offer no detail. Further guidance is needed to ensure candidates are able to write focused, measurable and justifiable specifications.

A good example of a marketing specification for a device to dry wet sailing kit could be as follows:

Target market

The item to be designed should consider the wider needs of water sports users, to include the drying of clothing and kit for sailors, canoeist, rowers, scuba- divers tri-athletes and wild swimmers. The identified market is sailing, but other market segments should not be discounted if a viable product is to be made with batch manufacture in mind, as by widening the market economies of scale will help to drive down costs. The RYA has 2500 training centres based across 46 countries, indicating the sport continues to be well supported. Having the product endorsed by the RYA would help to increase sales.

Target audience

The target audience is wide, with many water-based activities requiring kit to be dried fast, before taking wet kit home or within the school or home environment. In the case of this product I will concentrate addressing the needs of sailors in the UK, and those who do it for mostly for leisure. Such a product is unlikely to be used by young children so my aim is to market the product at adults.

Market analysis

In a survey of 15 sailors all agreed that it was difficult and time consuming to dry kit. All felt that existing products used for drying laundry were impractical, and although aided the drying of kit and quicker easier device was required. In 2010 over 1.8 million people were actively involved in sailing and powerboat activities. Although not all users would require such an item, if a market

potential of 0.1% of active respondents could be considered I could have a potential market of 18000 users.

Table 47 Grouped Watersports Combination 2010

	Also do					
People who do	Sail		Power		Manual	
	No.	%	No.	%	No.	%
Sail	846,889	100%	128,987	13%	249,617	18%
Power	128,987	15%	973,427	100%	173,399	12%
Manual	249,617	29%	173,399	18%	1,404,100	100%

Source: Watersports Omnibus Survey 2010 (Base: all respondents who participate in the respective activities)

The cost of existing laundry drying solutions range in price between £15 to £50. For a new device to enter the market at the same sales figures, its use must be flexible, but must also address the needs of sailors if it is to compete within this market sector. The retail cost of my solution should be <£30 with manufacture cost to include distribution <£10. If this were the case items could be sold to retailers at £15 per item, potentially giving a pre-tax profit of £90000 for the sale of all items.

The production of 18000 units would require batch manufacture. Common components would help to reduce costs of manufacture.

User need

The product needs to be lightweight, less than 5kg, intuitive and easy to use. It must dry items at a much faster rate than current methods (preferably less than 1 hour), be easily stored and flexible in its use of drying other items. It must be able to dry and support garments that weigh in the region of 20 kg. (please note other user needs would be evident in the PDS)

Competition

Competing designs are mainly used for drying laundry although a few specific products do exist for drying of sailing shoes. All items are ineffective in drying sailing clothing fast without taking up valuable space in the home. The cost of such items ranges from £15 - £50 and are available from the following retailers, John Lewis, Argos, Wilkos and Coastal Water Sports Direct. Most items are collapsible for easy storage.

Criterion B

There continues to be a significant difference in the quality of work presented for this criterion. The very best work displayed a wide range of original ideas, presented using appropriate techniques with detailed annotations. Reference to specifications was considered throughout and concept modelling refined ideas to develop ergonomics, function, aesthetics, etc. However, a considerable number of candidates work for ideas and developing concepts was well below the level and quality to achieve more than the middle band. This work was either a copy of existing ideas or a photo of a product suggesting basic changes to improve its function. This is usually an area of the project students enjoy but it would appear there is a lack of sufficient teaching in this area to develop an iterative design approach. The best work included the refinement and testing of models to make a sequence of alterations to ideas. The weakest work

either omitted this section or simply showed different views of the same CAD visuals. Descriptive, storytelling is to be avoided as candidates need to be more analytical in their approach to design – For example changing the design to improve aesthetics may lead to a reduction in functionality, increased cost, more complex manufacture, etc. and they need to understand where balance is needed.

Criterion C

The very best work made clear justifications for different choices of materials, fixings, construction and manufacture through the testing of models, comparison of results and literature based research. Working and physical properties of materials should be considered, as well as cost, availability, stock form, and manufacturing limitations in school. Links between material choice and manufacturing processes should be evident, but in there was limited evidence of this in samples moderated. Detailing for making in the form of orthographic drawings or suitable alternatives is still a weakness in some schools and further focus should be given to addressing this through the use of TDA time. Rough sketches and poorly scaled drawings are unsuitable. There was some improvement in the quality of work for planning for manufacture, with far more detail given to timings, dates, processes, tools, quality control, part lists and risk assessment. However, some schools still feel the need to show this work as an ongoing diary. Such work is retrospective and fails to address the lowest mark band for this criterion.

Criterion D

In general, there is a lack of direction and time allowed to complete a successful evaluation. This is where students who were over the allocated page constraint lost marks as some of the work was not assessed.

Strategies for testing and evaluation are recommended to ensure all aspects of the criteria are addressed. The use of client feedback, expert opinion and evidence of testing is highly recommended if students are to aim for marks in highest band and critically analyse their own work. Testing, especially for scale models, was often superficial and was mostly based on personal opinion.

The very best work did include all of this and a range of detailed drawings to address significant weaknesses identified through testing. Suggesting making outcomes, lighter, smaller, bigger, etc. was deemed to have lacked detail when making recommendations. Recommendations are to be based on improving the outcome not addressing weaknesses in poor manufacture. Interim deadlines for each criterion should be considered to ensure candidates have 10 hours of study time to complete Criterion D to an appropriate standard.

Recommendations for the teaching of future candidates

- Further teaching is needed on how to recognise problems that have scope to meet a marketable goal. Simply asking students to find a problem at home or school is not sufficient is pupils are to access the full assessment criteria.
- Further teaching of presentation techniques for ideas, development and use of modelling strategies need to be explored. These should include isometric, 2-point perspective, exploded views and orthographic drawing.
- Candidates need to be more analytical in their approach to work. Further use of product analysis and refining models is encouraged to support this.
- Use models and testing to justify choice of manufacturing processes and material selection.
- Ensure candidates make use of and evidence with photographs client and expert evaluation.
- Interim deadlines need to be built in to planning of the course to leave sufficient time to address each criterion.

Higher level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-10	11-15	16-20	21-24	25-27	28-31	32-40

General Comments

Many thanks to the teachers who provided comments for the Grade Award meeting on the G2 Form. Every comment was studied by the participants at the meeting and many have replies below. This information is a vital part of the triangulation that takes place in the Grade Award meeting.

The Grade Award team agree with many of the comments in the G2 forms and agreed that the paper was more difficult than in May 2016. This increase in difficulty has been accommodated in a downward shift of the grade boundaries so that candidates in May 2017 were not disadvantaged compared to those in May 2016. This also accommodated the increase in the number of questions with multiple answers (I, II, III) which may have been problematic for some candidates.

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

DESIGN TECH. HL PAPER 1 (MCQ) MAY 2017 in Question order

Question	A	B	C	D	Blank	Difficulty Index	Discrimination Index
1	832	151	97	20		75.64	0.26
2	29	59	477	534	1	91.91	0.12
3	688	147	170	93	2	62.55	0.20
4	7	342	300	451		27.27	0.21
5	98	857	68	77		77.91	0.38
6	784	57	94	163	2	71.27	0.34
7	215	651	59	174	1	78.73	0.28
8	326	3	528	243		48.00	0.43
9	856	102	44	98		77.82	0.36
10	33	255	754	58		68.55	0.39
11	20	939	20	120	1	85.36	0.30
12	301	222	401	176		27.36	0.31
13	288	60	707	44	1	64.27	0.36
14	71	849	153	27		77.18	0.28
15	553	153	161	233		50.27	0.26
16	21	22	1030	27		93.64	0.12
17	347	166	236	351		31.91	0.27
18	218	59	130	692	1	19.82	0.14
19	52	174	861	13		78.27	0.23
20	928	15	118	38	1	84.36	0.15
21	59	24	939	78		85.36	0.20
22	716	114	169	101		65.09	0.41
23	172	96	622	208	2	56.55	0.38
24	62	225	281	532		20.45	0.11
25	15	35	672	378		61.09	0.29
26	899	64	7	130		81.73	0.18
27	201	235	27	637		57.91	0.39
28	163	61	754	122		68.55	0.41
29	988	55	13	44		89.82	0.17
30	18	727	185	170		66.09	0.19
31	78	12	14	996		90.55	0.17
32	117	836	87	60		76.00	0.26
33	43	40	1005	12		91.36	0.16
34	64	27	980	29		89.09	0.12
35	693	127	223	53	4	63.00	0.16
36	54	984	42	20		89.45	0.16
37	62	166	763	109		69.36	0.31
38	128	574	206	190	2	11.64	-0.01
39	6	98	559	436	1	39.64	0.01
40	48	173	163	716		65.09	0.17

Number of candidates : 1100

Question 2 (common with SL Q2)

A number of comments were received about this question and the Grade Award team recognised that the answer would be dependent on the product. The Grade Award team decided that either C or D were acceptable responses and the markscheme was amended to accommodate this and give the candidates the benefit of doubt.

Question 3 (common with SL Q4)

The “busy diagram” comment was accepted and the issue that this may have caused. It should be noted that the question was largely answered correctly by the candidates.

Question 5 (common with SL Q5)

A concern was raised by teachers, who commented that they would have struggled to understand the question. The Grade Award team believe that this question is not an issue as the definition has been taken from the Glossary (on the OCC).

Question 7

Although no comments were received by teachers on the G2 Form, the Grade Award team considered that either A or B could be accepted. The markscheme was adapted to accommodate this and to give the candidates benefit of doubt.

Question 11 (common with SL Q14)

“Could this not have been worded better? Probably a lot of students wouldn’t choose hard as it seems too easy”. The comment was noted by the Grade Award team who also wondered if candidates may end up second guessing themselves as the answer seemed so easy.

Question 12 (common with SL Q15)

One teacher commented that “Robot generations are not mentioned in the syllabus”. This is not the case as they are mentioned in Topic 4.6.

The Grade Award team also noted that the answer is the same as in the Glossary.

Question 15

It was noted that, “characteristics of polyester. Polyester kitchen products? Fibres? Fabrics? Polyester has low elasticity, High durability, Low absorbency (hydrophobic), leaving (ii) as the only correct answer. Unless of course the question refers to textiles only where elasticated polyester fabric is available, probably due to the weave rather than the material itself.” This was a fair point and the question could have been worded better by including the word “textile”. Most candidates identified that answer III was incorrect and therefore obtained the correct response.

Question 18 (common with SL 22)

The possible answers were discussed by the Grade Award team and although D may have been selected, the definition in the Glossary is clearly A.

Question 21 (common with SL 24)

It was observed that the stem had little to do with the question. The Grade Award team agreed with this observation. Although being imitated may not be given as part of the definition of classic design, the first possible answer (no longer produced) is clearly wrong and by a process of elimination only C is possible.

Question 22 (common with SL 26)

Although there were concerns with the context of the question, the Grade Award team believed it was an appropriate question and the image was helpful to the candidates.

Question 30

A number of concerns were raised about this question, and on reflection the Grade Award team accepted that they may have substance. However, in light of the fact that a large majority of candidates got the correct answer and the question was a good discriminator, the question was retained.

Question 34

Some teachers commented that they were unable to select an answer. The Grade Award team disagreed with this assertion, as did the candidates (89% obtaining the correct answer).

Question 35

Some comments stated that the wording is confusing and believe it should read “role of design”. The Grade Award team agreed with their comment about the wording. However, most candidates correctly identified the correct response.

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.

Standard level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-7	8-11	12-16	17-18	19-21	22-23	24-30

General comments

Many thanks to the teachers who provided comments for the Grade Award meeting on the G2 Form. Every comment was studied by the participants at the meeting and many have replies below. This information is a vital part of the triangulation that takes place in the Grade Award meeting.

The Grade Award team agree with many of the comments in the G2 forms and agreed that the paper was more difficult than in May 2016. This increase in difficulty has been accommodated in a downward shift of the grade boundaries so that candidates in May 2017 were not disadvantaged compared to those in May 2016. This also accommodated the increase in the number of questions with multiple answers (I, II, III) which may have been problematic for some candidates.

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

DESIGN TECH. SL PAPER 1 (MCQ) MAY 2017 in Question order

Question	A	B	C	D	Blank	Difficulty Index	Discrimination Index
1	791	126	141	28	2	72.70	0.30
2	37	73	514	463	1	89.80	0.13
3	177	221	326	364		63.42	0.22
4	708	134	118	128		65.07	0.15
5	10	363	273	442		25.09	0.23
6	102	767	113	105	1	70.50	0.49
7	423	30	81	553	1	50.83	0.23
8	44	470	424	149	1	82.17	0.07
9	780	114	112	82		71.69	0.43
10	712	148	58	170		65.44	0.42
11	32	227	663	166		60.94	0.43
12	62	220	451	355		32.63	0.31
13	441	95	313	237	2	40.53	0.33
14	28	850	24	186		78.13	0.41
15	221	254	422	191		20.31	0.29
16	355	67	609	57		55.97	0.42
17	77	785	198	28		72.15	0.38
18	518	191	158	220	1	47.61	0.33
19	267	735	31	55		67.56	0.26
20	118	471	207	292		43.29	0.36
21	40	40	963	44	1	88.51	0.20
22	173	48	108	758	1	15.90	0.12
23	57	210	777	44		71.42	0.26
24	96	34	867	91		79.69	0.29
25	187	112	323	465	1	72.43	0.11
26	641	152	220	74	1	58.92	0.40
27	359	665	37	27		61.12	0.33
28	441	401	176	69	1	36.86	0.36
29	759	35	135	158	1	69.76	0.30
30	242	301	526	18	1	76.01	0.21

Number of candidates : 1088

Question 2 (common with HL Q2)

A number of comments were received about this question and the Grade Award team recognised that the answer would be dependent on the product. The Grade Award team decided that either C or D were acceptable responses and the markscheme was amended to accommodate this and give the candidates the benefit of doubt.

Question 3

The Grade Award team accepted both C and D as the diagram included both nominal and ordinal scales.

Question 4 (common with HL Q3)

The “busy diagram” comment was accepted and the issue that this may have caused. It should be noted that the question was largely answered correctly by the candidates.

Question 5 (common with HL Q5)

A concern was raised by teachers, who commented that they would have struggled to understand the question. The Grade Award team believe that this question is not an issue as the definition has been taken from the Glossary (on the OCC).

Question 8

It was noted that button coin is not mentioned as a type of battery in the specification, nor are the views of governments on hazards. The Grade Award team agreed with this comment and accepted that there is potential ambiguity in the question. Lithium batteries are less harmful to the environment than button coin batteries (which use NiCd), but can have harmful environmental impacts. Therefore, as candidates may not realise the chemical composition of button coin batteries is harmful, they may assume as Lithium batteries can cause harm to the environment and that button coin batteries may be less harmful. As a consequence of this apparent contradiction, that both lead acid and NiCd are harmful to the environment, the Grade Award team felt that either B or C was acceptable. The markscheme was changed to accommodate this and give the candidates the benefit of doubt.

Question 11

The Grade Award team agreed with the comment that the use of “Button presses” was potentially confusing for English as a second language (ESL) candidates. The Grade Award team agreed that “the number of times a button is pressed” would have been much clearer.

Question 13

The Grade Award team agreed that some of the language used in this question could be challenging for ESL candidates. This refers to language or terms such as 'adversely' and 'product geometry'.

Question 14 (common with HL Q11)

"Could this not have been worded better? Probably a lot of students wouldn't choose hard as it seems too easy". The comment was noted by the Grade Award team who also wondered if candidates may end up second guessing themselves as the answer seemed so easy.

Question 15 (common with HL Q12)

One teacher commented that "Robot generations are not mentioned in the syllabus". This is not the case as they are mentioned in Topic 4.6.

The Grade Award team also noted that the answer is the same as in the Glossary.

Question 16

The Grade Award team disagreed that there was more than one acceptable answer.

Question 20

It was noted in the G2 comments that fused deposition modelling is a form of CNC machining which caused confusion between B and D. The Grade Award team disagreed as FDM is an additive manufacturing technique whereas machining, for example milling or turning, is a subtractive technique.

Question 22 (common with HL 18)

The possible answers were discussed by the Grade Award team and although D may have been selected, the definition in the Glossary is clearly A.

Question 24 (common with HL 21)

It was observed that the stem had little to do with the question. The Grade Award team agreed with this observation. Although being imitated may not be given as part of the definition of classic design, the first possible answer (no longer produced) is clearly wrong and by a process of elimination only C is possible.

Question 25

This question was discussed at length by the Grade Award team and it was decided that either C or D were acceptable. The adoption of this map may be a result either of it being dominant, or because it is functional.

Question 26 (common with HL 22)

Although there were concerns with the context of the question, the Grade Award team believed it was an appropriate question and the image was helpful to the candidates.

Question 27

There were concerns with the use of the term ‘electric assist’. The Grade Award team agreed that this may be a potential issue, but by the inclusion of further explanation in the stem it would make the question too straight forward. In a way, a bit of a ‘catch 22’.

Question 28

“For question 28, it was totally unnecessary to ask that in the context of the case study. You could just as well have asked "what is not a composite" anywhere else in the test”. The Grade Award team agreed with this comment.

“What is not? Why is this still happening?”. This comment was noted, and acknowledged as a reasonable observation.

Question 29

A number of comments referred to the idea of the design being ‘radical’. The Grade Award team accepted the comments, but as the majority of candidates gave the correct response, plus the image of the bicycle showed that neither the frame, chain or carrier were radically different to what is seen on current bicycles, the question was deemed appropriate.

Question 30

This question was discussed at length by the Grade Award team, and it was decided to give the candidates the benefit of doubt, both B and C were acceptable responses

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 / Standard level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-5	6-11	12-15	16-20	21-26	27-31	32-50

General comments

The exam rewarded candidates who were well prepared with a good knowledge of the six core topics and there was a fair and equitable representation of all core topics distributed throughout the paper. Classic design was a strong element in this paper and was a popular choice in Section B. There was also a good covering of materials and manufacturing processes related questions.

The battery context was relevant in relation to a number of topics although the amount of theory in the guide relating directly to batteries is limited to Topic 2.3 only. All Section B contexts/products were classic designs and the Section A contexts/products led themselves to providing questions relating to material choices and properties – (the safety pin could also be regarded as a further classic design)

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

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

- Knowledge of batteries.
- Strategies for innovation (categories were able to be named as opposed to strategies being explained)
- Material (metals) properties, in particular grain size, hardening and tempering in relation to the context of a given product (safety pin)
- Cradle to cradle and cradle to grave in relation to the circular economy (although general explanations of the two concepts were adequate)
- The concept of adaptation in relation to the development of the Ray Ban sunglasses
- Six mark questions that require candidate to discuss/explain the issues concerning two distinct aspects of a given product (form vs function, function vs psychological factors and anthropometrics vs psychological factors). It appears that a number of candidates find it difficult to structure answers well for these questions. Candidates understand the concepts but are unsure whether to make a judgement/find a balance or simply list a number of distinct points for each concept.
- Roger's characteristics (of observability)

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

Overall, the paper was well balanced and contained a good number of questions in both Section A and Section B that were accessible enough to allow the candidates to access a range of marks. There were a number of good responses to extended answer questions for all three Section B questions.

Other areas in which candidates appeared well prepared included:

- Human factors design
- Market pull and technology push
- Modelling
- Material properties and characteristics relating to glass and plywood and the manufacturing processes of casting metals

Classic design was quite prominent in this exam and was a topic many candidates felt confident answering. Q5 (Ray Ban sunglasses) was a very popular choice for Section B.

More candidates this year were concise with their answers, making good use of short structured statements in distinct paragraphs rather than long sentences and large mass of text which often tend to become repetitive and tend to go off course.

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

STRENGTHS

Section A

Q1 (a) (i)	The majority of candidates answered this question well however many mistook the term ‘accessibility’ to infer availability through acquisition of purchase.
Q1 (a) (ii)	A good understanding of eco design was shown.
Q1 (b) (i)	A good understanding of the difference between renewable and non-renewable energy in very straightforward question.
Q1 (d) (ii)	Many candidates demonstrated a good basic understanding of patents.
Q2 (a&b)	Many candidates showed a good understanding of the properties of toughened glass and were able to give good reasons why the pool table was made from this material.
Q3	Almost all candidates achieved at least 1 mark in this question for listing an ergonomic characteristic of the controller. A good number achieved a second mark for indicating that physical modeling provides feedback and a few

achieved all three marks for going on to mention product development and improvement.

Section B

Q5 (d) Almost all candidates achieved marks for listing attributes of a design classic. A good number were able to develop explanations around these attributes to gain a good range of marks for this question.

Q6 (d) The majority of candidates who answered this question did so quite well and were able to provide good explanations around why casting was an appropriate manufacturing process for this product.

Q7 (d) The majority of candidates who answered this question did so quite well showing a good understanding of the properties of plywood.

WEAKNESSES

Section A

Q1 (b) (ii) Many candidates lost marks because they did not have a good understanding of the use of lithium ion batteries.

Q1 (d) (i) Many candidates lost marks because they confused innovation categories with strategies for innovation.

Q4 Many candidates lost marks because they did not fully understand the implications of a cradle to grave or cradle to cradle philosophy although a general basic understanding was evident. Very few candidates were able to achieve 2-3 marks as they were unable to develop a well-rounded comparison or explanation of the advantages of one over the other.

Section B

Q5 (b) Very few candidates managed to obtain 2 or 3 marks for this question.

Q5 (c) Very few candidates managed to obtain 4 or more marks for this question. Candidates wrote in vague/general terms and subjectively about the form and function of the juicer.

Q6 (b) A poorly answered question with very few students understanding the meaning of the concept of observability in relation to Roger's characteristics.

Q6 (c) Very few candidates managed to obtain 4 or more marks for this question. Answers were general/vague. Students needed to be more concise and list 3 clear points for each aspect. Some common answers appeared such as 'good

conversation starter' (which came from the stem) and 'more ornamental than functional'. Most students only achieved 2-3 marks.

Q7 (a) Quite a straight forward question but generally not well answered. Many candidates simply stated 'easy to take apart/disassemble' or talked about screws.

Q7 (b) Only a few candidates used the term ‘obsolescence’ at all. Most discussed functional or technological aspects for 1-2 marks only. Very few candidates achieved 3 marks.

Q7 (c) Many candidates showed a good understanding of structural force but were lacking the correct technical vocabulary to clearly explain stress in relation to the bar of the stool.

Recommendations and guidance for the teaching of future candidates

- Cover all the new concepts in the DT syllabus.
- Remind candidates to make use of all the stem information, diagrams, graphs and photographs in the examination paper.
- Do not answer in lengthy repetitive sentences but use clear concise sentences and key points.
- Do not repeat the question in the answer.
- Underline key words in the question.
- Do not write outside the box provided.
- Avoid where possible using extra pages to answer the questions.
- Do not answer more than one Section B question

Higher level paper three

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-4	5-8	9-11	12-16	17-20	21-25	26-40

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

Majority of candidates did not demonstrate an understanding of:

- Sustainable innovation
- The economic aspect of Triple Bottom Line sustainability

Many candidates did not demonstrate a good understanding of:

- Principles of lean production
- Personae
- Attitude
- Product family
- CSR

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

Majority of candidates demonstrated a good understanding of:

- Learnability
- Suitability of lean production for larger companies

Many candidates demonstrated a good understanding of:

- QA and QC
- The environmental aspect of Triple Bottom Line sustainability

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

SECTION A

Q1 (a) The majority of candidates scored 1 mark for relating UCD to understanding the users, tasks and environments. Few scored a second mark. Many candidates simply repeated information from the question, for example: "designed for users with problems in finger mobility".

Q1 (b) Many candidates scored 1 mark but few scored a second mark. Many thought designers could actually give personae the Cimzia System to test and give feedback. Some candidates left this question blank.

Q1 (c) Most scored at least 1 mark. However, many also confused psycho-pleasure with physio-pleasure and/or ergonomics.

Q1 (d) The learnability part of this question was well answered, with the majority of candidates scoring at least 1 mark. However, the majority of candidates did not demonstrate a good understanding of attitude.

Q2 (a) The easiest question in P3, with the majority of candidates scoring at least 1 mark.

Q2 (b) Most candidates demonstrated a good understanding of Kaizen. However, many left this question blank

Q2 (c) Many candidates confused the principles of lean production with the 7 wastes and/or the characteristics of lean production. Very few candidates scored 2 marks.

Q2 (d) Many candidates showed a good understanding of QA and QC.

SECTION B

Q3 (a) The majority of candidates scored at least 1 mark.

Q3 (b) Many candidates did not demonstrate a clear understanding of a product family. Instead of listing how the Mode: Flex e-bike may be developed into a product family, they outlined how it is part of the Ford's family of vehicles. Strong candidates earned 2 marks.

Q3 (c) Most responses tackled environmental issues (especially the reduction in pollution and fuel consumption) but not social issues.

Q3 (d) The majority of candidates scored one mark or less.

Q3 (e) The majority earned marks from the environmental cluster, followed by the social cluster. However, the majority linked the economic aspect to users and/or governments instead of Ford. Strong candidates with well-structured responses scored 5 and over.

Recommendations and guidance for the teaching of future candidates

- Cover all the new concepts in the DT syllabus.
- Guide candidates to relate and link their responses to the case studies in the paper.
- Encourage candidates to fully analyze the specific product/context/environment/user that the question revolves around; this may be achieved by practicing examination techniques and exposing candidates to past papers.
- Candidates are not penalized for wrong answers, so encourage students to answer all the questions.
- Connect the guide's "Concepts and Principles" to their correct "Guidance", for example Topic 7.2 Usability objectives (concepts and principles) include: usefulness, effectiveness, learnability and attitude (Guidance). Topic 10.2 Principles of lean production (concepts and principles) include: eliminating waste, minimizing inventory, maximizing flow, pulling production from customer demand, meeting customer requirements, doing it right first time, empowering workers, designing for rapid changeover, partnering with suppliers, creating a culture of continuous improvement (Guidance).
- Guide candidates not to spend time repeating the question in their answers, for example answers to the 9 mark questions do not need unnecessary introductions and/or conclusions.