DESIGN TECHNOLOGY

Overall grade boundaries

Higher Level

Grade:	1	2	3	4	5	6	7
Mark range:	0-15	16-27	28-38	39-51	52-63	64-76	77-100

Standard Level

Grade:	1	2	3	4	5	6	7
Mark range:	0-14	15-26	27-39	40-52	53-62	63-75	76-100

Introduction

The May 2002 examination session is the final May session and penultimate examination session under the existing Guide. In relation to current practice, it is clear that the papers, as one would expect, do not hold any great surprises for candidates who are generally well prepared for the challenge. Teachers, by now, will have received the new Guide and will have been teaching the first cohort of students to be examined under the new Guide for a year. The examining team is very aware of the importance of both examination papers and the subject report in facilitating the preparation of candidates for future examination sessions. A set of specimen papers with an accompanying explanatory commentary has been prepared to enable teachers to assess the significance of the revisions to the Guide.

From the fourteen schools being examined at SL and sixteen schools at HL in this session, four sets of G2 forms were received for HL papers and six sets of G2 forms were received for SL papers. The G2 forms are extremely valuable in providing feedback to the examining team and are always studied carefully during grade award meetings. Comments from the G2s are fed back to other teachers via the subject report. As pointed out in previous subject reports not all schools take this opportunity to feedback comments on the paper and perhaps only feel moved to comment when they have an adverse reaction to an element of the paper. G2s should be viewed as ‘constructive feedback sheets’ rather than ‘complaints sheets’ and as such are welcomed by the examining team. The examining team pleads again for teachers to feedback both positive and negative comments to inform the development of this still small, but growing, subject. Where teacher comments are informed by candidate reaction to the papers after the examination this would be particularly useful.

Grade boundaries are determined by matching the Grade Descriptors for Group Four to the evidence available from marked scripts. Each paper is set in a way that ensures that it provides enough evidence to enable the use of the Grade Descriptors and also to ensure that there is appropriate syllabus coverage and that the papers are appropriately discriminating. Grade award meetings first determine the three/four boundary by inspection of the scripts for each component, moving on to the six/seven boundary and then the two/three boundary. Other grade boundaries are determined by interpolation from these three boundaries. Paper 1 boundaries are set with reference to the Paper 2 boundaries as the Papers 1 and 2 have the same syllabus coverage.

Standard Level Paper 1

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-7	8-11	12-14	15-18	19-21	22-25	26-30

General comments

Six G2s were received. The paper was considered by two G2s to be of similar standard and by two to have been a little more difficult. Five G2s considered the level of difficulty appropriate and one considered the level of difficulty too difficult. Three considered syllabus coverage satisfactory and three considered it good. Four G2s considered clarity of wording satisfactory and two considered it good. The presentation of the paper was considered to be satisfactory by two G2s and good by four. Some G2s commented on specific questions and these are discussed below. Most of the questions stimulated little comment on the G2s.

The table below indicates how difficult questions were perceived to be as determined by candidate performance – the higher the difficulty index, the easier the question! The * shows the correct answer and the numbers represent the number of candidates providing each individual response. A discrimination index comparing the performance of the top 25% of candidates on a particular question with the top 25% of candidates overall is also calculated. With such a small candidacy the discrimination index is a less useful tool than it is in large entry subjects. All questions achieving a negative discrimination index are discussed at the grade award meeting.

Question	A	B	C	D	Blank	Difficulty Index	Discrimination Index
10	84*					100.00	.11
14			79*	5		94.04	.14
8	6		77*	1		91.66	.21
18		76*	5	3		90.47	.14
20	4	8	72*			85.71	.25
15	9	4		71*		84.52	.17
13	2	70*	9	3		83.33	.17
9	5	3	7	69*		82.14	.35
19	69*	5	8	2		82.14	.32
17	67*	7		10		79.76	.14
2	3	6	66*	9		78.57	.39
6	66*	2		16		78.57	.17
27	66*	6	2	10		78.57	.32
24	11	11	62*			73.80	.42
21	14	58*	5	7		69.04	.32
4	57*	7	11	9		67.85	.14
23	2	9	16	57*		67.85	.14
16	5	55*	14	10		65.47	.46
28	8	12	10	54*		64.28	.64
1	17	10	5	52*		61.90	.39
29	13	51*	13	7		60.71	.67
3	49*	20	14	1		58.33	.53
26	16	45*	20	3		53.57	.60
12	4	29	41*	10		48.80	.60
5	10	37*	11	26		44.04	.46
25	8	10	34	32*		38.09	.21
11	10	10	28*	36		33.33	.60
30	27*	33	13	11		32.14	.07
22	21	33	6	24*		28.57	.28
7	6	17*	34	27		20.23	.10

One general comment on a G2 suggested that compared to last year there was too much emphasis on Topic 5. Question setters use a grid to develop the paper and allocate questions to topics according to the time allocations in the Guide. The grid has not changed from year to year throughout the life of the current Guide, although it will obviously change for next year in the light of the new Guide. The examining team has not modified the proportion of questions devoted to individual topics from the previous year so refutes the suggestion that there is more emphasis on Topic 5. The new grid for use 2003 – 2007 is included in Appendix 1 where the number of questions relating to each topic reflects the hour weightings as identified in the Guide.

On reflecting on candidate performance and teacher response via G2s, the examining team will continue to emphasise to question setters the importance of minimising the length of the question stems to ensure accessibility by English as Second/Foreign Language candidates. However, in attempting to define design contexts as unambiguously as possible the word length can increase.

General comments on the G2s for Paper 1s from previous years have suggested that one particular style of the question seems less accessible to candidates, i.e. the three options I, II and II with the answers being I and II, I and III, II and III or I, II and III. This type of question will not be allowed to predominate in future examination papers and where this style of question is used, additional complications such as double negative will **not** be used.

QUESTION 7

One G2 commented that if children are seen in the context of the full population the answer could arguably be 5th percentile. This is a common but incorrect interpretation of what percentile ranges are signifying, i.e. that they refer to specified populations, e.g. adult females, children aged 4 - 6 years.

QUESTION 9

One G2 commented that all are answers of social responsibility in design. This was not a problem for candidates who predominantly agreed that aesthetics are not a social responsibility.

QUESTION 17

One G2 asked what the product was and suggested that the product should have been named. This was found to be an easy question by candidates and was not negatively discriminating.

QUESTION 22

One G2 commented that all these could be considered as one-off or as batch. This was not a problem for candidates.

QUESTION 23

This question did not seem to pose a problem for candidates although one G2 did question the meaning of the word 'value'.

QUESTION 30

One G2 commented that this was not a 'great question' and that 'many teachers would not associate the circuit arrangement in their teaching'. The Guide clearly mentions voltage division as a particular arrangement and so this question was not seen as unfair by the examining team. The candidates perceived the question as more difficult, as indeed questions on Topic 5 often are perceived to be, but was not negatively discriminating.

Standard Level Paper 2

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-3	4-7	8-13	14-18	19-24	25-29	30-40

General comments

Six G2s were received. Two G2s suggested that this year's paper was of a similar standard to last year, two suggested it was a little more difficult and one suggested it was much more difficult. Five suggested that the level of difficulty was appropriate and one that it was too difficult. Syllabus coverage was considered by two G2s to be poor, three to be satisfactory and one to be good. Clarity of wording was rated as satisfactory by five G2s and good by one. Presentation of the paper was considered poor by two G2s, satisfactory by two G2s and good by two. Specific comments on the G2s indicated that some teachers did not think that the data question Question 1 was accessible, mainly

because electronics is perceived to be the most difficult topic by many candidates and this question was perceived to be about electronics. One G2 asked what type of question is Q1b and how it relates to the syllabus. The point about Question 1 is that is requires students to analyse unfamiliar data and design contexts and relate the contexts to the syllabus and make design decisions. The same G2 commented that the diagram to be annotated was poor. One G2 would have liked to see the word range after voltage in 1 (a) ii. Although there were some candidates who were clearly put off by Question 1, equally there were a number of candidates who persevered and achieved good marks.

There was evidence that many candidates had been better prepared for the style and format of the paper than earlier cohorts of candidates. The examining team would wish to reinforce the need for papers to collect evidence for the group 4 level descriptors and to enable grading of scripts into grades 1 to 7. One of the criteria relates to the analysis of quantitative and qualitative data - hence the calculation which became one of the most discriminating elements of question one. The data question may at first glance appear more daunting than it really was, which reinforces the need for candidates to be prepared for this type of question ensuring that they read the components carefully before starting to answer. In doing so they should get an impression of the holistic nature of the data and its assimilation before focusing on the detail of the individual elements. Although teachers cannot 'teach' these questions in relation to content they can use past papers to expose students to this type of question and stress the importance of attention to detail, e.g. always including units with the answer to calculations.

As in previous years there has been some evidence that weaker candidates, having been put off by not being able to answer one element of a question have not persisted and attempted to answer later elements of the question. Again, the examining team pleads that teachers encourage candidates not to be put off and there was evidence that candidates this year are heeding this advice. The labelling of questions and sections of the questions as (a), (b), (c) with sub-sections labelled (i), (ii), etc. should help to signpost questions for candidates. Mark allocations and the action verbs are important indicators of the nature and extent expected in answers. It is worth teachers emphasising this to candidates.

In general candidates made a reasonable attempt at the paper. It was pleasing to see that better candidates had considered how to structure their answers for part 3, the extended response element, of the Section B questions. The dominating discriminating element of the paper was Question 1. Electronics questions continue to elicit no response from candidates at a number of schools and it is clear that candidates are by no means comfortable with electronics, although some schools do particularly well at this element.

Section A

QUESTION 1

It is important that teachers remember that Section A Question 1 is non-syllabus-related which poses its own set of problems in relating unfamiliar context, irrelevant data, the numbers of sections, the time to devote to the area. It is very clear that the first question can put candidates off. If candidates were to turn the page and decide that the question is just on Topic 5 and therefore they could not do it then they were misinterpreting the question. Later parts of the question do require understanding of Topic 5, but not all parts.

Question 1 discriminated well. Again some good candidates failed to achieve high marks not because they lacked knowledge and understanding but because their answers were not precise enough. To gain full marks for questions based on calculations candidates need to ensure that they state the appropriate units with the numerical answer. Where candidates are picking up data from tables they need to ensure they understand the significance of the units stated. They may need to convert units, e.g. mm to metres, to use them in calculations. This exercise is not seen as inappropriate by the examining team but rather, reflects the reality of design. On a

database question of this type some of the data is redundant. Part of the skill shown by better candidates is their ability to sort out the data and achieve the correct answer.

(a) (i) This question required candidates to select the most sensitive model of Passive Infrared Detector (PIR) on the basis of data provided in a data table. This question posed few problems for candidates.

(ii) Again from a table of data, candidates were required to identify an operating voltage that would allow any of the PIRs to operate. Whilst the question could have asked for a range, the markscheme allowed a specific voltage or a voltage range to be acceptable answers. Answers needed to include units. Many candidates did not include units and so lost a mark. Some candidates responded with one voltage and some with a range, 12-14V. Either response was accepted.

(b) This was found remarkably difficult by candidates. The easiest way to calculate the area is as a 30/360 segment of a circle (area = πr^2).

(c) (i) This question posed few problems for candidates.

(ii) The 'diagram' might have been better described as a photograph although this did not affect candidate performance.

(d) (i) Surprisingly, and interestingly, many candidates did not make a good attempt at completing the logic table which seemed the easy task (to the examining team) although they went on to provide good responses to (ii). 0/1 is the preferred notation for truth tables although F/T was accepted.

(ii) Most candidates made a reasonable attempt at designing a logic circuit to allow only the cat to enter.

QUESTION 2

This question posed few problems for candidates who were able generally to identify three strategies used by designers to obtain information. Good candidates used bullet points to note the different strategies. Some candidates provided untidy answers, which did not help them to check that they had, in fact, provided three different strategies.

QUESTION 3

Most candidates achieved the first mark for a balanced combination of the main nutritional food groups and many listed protein, fat, carbohydrate, vitamins, minerals and fibre. Not many candidates mentioned appropriateness to the person and their lifestyle to achieve the second mark.

QUESTION 4

(a) This posed few problems to most candidates.

(b) Thus question was rarely answered well.

QUESTION 5

Answers to this question were often vague and not specific enough to gain both marks.

Section B

The three additional quality marks awarded for questions in Section B are for clarity of argument (1 mark), designer's logic (1 mark) and communication (1 mark). From May 2003 the marks will be contained within the mark scheme and thus the marks indicated to candidates will be 20 rather than 17 as is currently the case.

In section B Questions 7 and 8 were much more popular than Question 6, although those candidates who chose to answer question 6 were able to achieve good marks.

QUESTION 6

Only a few candidates attempted this question.

(a) (i) A straightforward list of two mechanical properties of timber were required. Most of the candidates were able to achieve this.

(ii) This question required candidates to state the relative values of the two properties listed in (i). Most of the candidates were able to do this.

(b) (i) This question required candidates to describe the way in which timber is positioned under the saw using a processing block diagram. Candidates answered this question poorly.

(ii) This question required candidates to state two non-contact sensors that could detect the position of the end of the length of the timber. Light-dependent resistor, photovoltaic cell, proximity sensor, phototransistor and photodiode were all acceptable answers.

(c) None of the answers matched the markscheme since the candidates failed to understand the question.

QUESTION 7

This was the most popular question and generally candidates demonstrated good understanding and provided reasonable responses. Candidates needed to view the question holistically and to plan their answers carefully to differentiate responses for (a) and (b). Part (c) was not answered as well as parts (a) and (b).

(a) (i) This question asked candidates to outline how planned obsolescence influences the design of vacuum cleaners. Good candidates were able to explain how planned obsolescence resulted in designers planning for a limited product life and not designing for ease of repair.

(ii) Good candidates were able to respond that metal are generally difficult to recycle with high energy costs. Thermoplastics, in contrast, although they need identifying before recycling can occur are generally much cheaper and easier to recycle.

(b) (i) This question asked candidates to identify how changes in social values affects the work of the designer. Generally candidates provided good answers.

(ii) This question required candidates to identify three ways in which design can influence the development of the vacuum cleaner to lessen environmental impact. A straightforward but not necessarily easy question.

(c) Candidates needed to establish the link between scale of production and economic use of materials to unlock the answer to this question.

QUESTION 8

This was the second most popular Section B question.

(a) (i) A straightforward definition of thermal expansion.

(ii) This question asked candidates to outline the significance of thermal expansion in design. Weak candidates found this question very difficult.

(b) (i) This question asked candidates to outline the difference between a physical model and a symbolic model. This section was generally answered well.

(ii) This question was straightforward and required candidates to list two uses of physical models in bridge design.

(iii) Similarly, this question was reasonably straightforward and required candidates to list two uses of symbolic models in bridge design.

(c) This question logically follows on from (b) and having listed uses of the two types of model in (b), required candidates to weight up the advantages and disadvantages of each.

Standard Level Paper 3

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-4	5-9	10-15	16-21	22-26	27-32	33-45

General comments

Again the format for each of the Paper 3 options is that question 1 is a database question providing data in the form of a table, bar chart, photograph, flow chart, etc. This will be continued in examinations from 2003–2007 although at SL the marks allocated to this part **may** be cut back, perhaps to 4, and at HL to a maximum of 6 marks. The database acts as a stimulus and context for the question. The last question in each option is an extended response question worth 4 marks and in the examinations from 2003 will be increased to 6 marks to provide a better opportunity for candidates to demonstrate their understanding. It is through the 'sting in the tail' of the database question and the extended response question that the more able candidates are able to demonstrate their ability and weak candidates can be better discriminated from stronger candidates.

Five G2s were received. Four stated that the paper was of a similar standard to last year's. Four G2s thought the level of difficulty was appropriate and one said it was too difficult. Two said that syllabus coverage was appropriate and three said that it was good. Three G2s rated clarity of wording as satisfactory and two said that it was good. Three G2s said that the presentation of the paper was satisfactory and two said it was good.

In popularity order the options are ranked: F, E, B, A, D, G, C. No one attempted to answer Option C reinforcing the decision to scrap it from the new Guide. The inconsistencies of candidates options selected at individual schools suggests that some candidates are tempted to answer options that they have clearly not been taught and this obviously impacts on their performance.

Option A – Raw material to final product

QUESTION A1

The database for this question showed a diagram of a blast furnace.

(a) This question, worth 1 mark on A.3.4, asked candidates for one material added to iron ore in the production of pig iron in a blast furnace. Possible answers are limestone and coke. Wrong answers offered by candidates included: copper, carbon dioxide, maganese [sic]. Most candidates correctly answered the question.

(b) This question on A.3.8 and worth 2 marks, asked candidates to identify two advantages of wrought iron over pig iron as an engineering material. Possible answers included: less brittle [1] and tensile strength rather than compressive strength [1]. Incorrect answers included 'tougher and stronger… contains more impurities', 'wrought iron doesn't produce as much CO_2 as pig iron'. 'Wrought iron has the specific characteristics needed for producing engineering materials'. This question was clearly not as straightforward as might have been expected and few candidates achieved both marks. Candidates identified 'stronger' without distinguishing between tensile and compressive strength.

(c) This question, worth 3 marks, draws on assessment statements A.3.10, A.3.11.and A.3.12. [1] mark was awarded for naming an application and [2] marks for an explanation. Teachers should explain to candidates that a question calling for a named explanation requires them to identify an appropriate application. In this case candidates could have selected car bodies or cutlery directly from the syllabus and then explained how the properties are modified for the application. Many candidates did not name an application losing a mark.

QUESTION A2

This question, worth 2 marks on A.2.7, required candidates to outline the difference between toughened glass and laminated glass with reference to their response to impact. [1] mark was awarded for identifying that toughened glass shatters into tiny fragments on impact and [1] for stating that laminated glass does not, with its plastic layer preventing cracks from growing. Incorrect responses included 'laminated glass is glass that doesn't scratch as easily, it can be useful for eyewear'. Several candidates provided full details of how each type of glass is produced, earning no marks as this was not the point of the question.

QUESTION A3

(a) This question, worth 1 mark on A.1.8, required candidates to define seasoning. Most students were able to achieve 1 mark on this although surprisingly not all.

(b) This question, worth 2 marks, required candidates to outline the potential consequences of using non-seasoned timber for a wooden product. [1] mark was awarded for dimensional instability or cracking and twisting as it dries, [1] mark for resulting in defects in the product. [1] mark was awarded for more susceptible to insect or fungal attraction and [1] for product life being shortened. Most students were able to answer this question appropriately and were able to achieve the full 2 marks.

QUESTION A4

Worth [4] marks, this extended response question on A.5.7 required candidates to discuss the importance of public acceptability of mycoprotein in the commercial success of new food products containing mycoprotein. [1] mark was awarded for each distinct correct point up to a maximum of 4 marks. The major points here relate to consumer suspiciousness of new products and the difficulty of getting people to try the products and thus establish a market and achieve commercial success. Most candidates were able to build up their argument and achieve 3 or 4 marks. The questions did not require a description of the production of mycoprotein which was offered as a response by some candidates.

Option B – Products in context

The database for this question showed an integrated circuit board incorporating copper.

QUESTION B1

(a) This question, worth 1 mark, required candidates to define resource. Surprisingly there were some weak responses to this question, e.g. 'a material that can be obtained from nature and does not need to be made'.

(b) This question, worth 2 marks draws on assessment statement B.2.5 and asked candidates to outline how the market can determine whether copper resources are exploited. Candidates were awarded [1] mark for explaining that market demand drives up price or vice versa and [1] mark for explaining that higher prices increase the likelihood of exploitation. This question was not easy for all candidates some of whom missed the focus on 'the market' and thus only achieved one of the two available marks.

(c) This question required an explanation of how economic issues contribute to the feasibility of recycling copper from the circuit board. The question worth [3] marks, relates to assessment statement B.2.6. [1] mark was awarded for indicating that recycling can be expensive and [1] for that the costs need to be balanced against the cost of non-recycled materials and [1] for if the cost of recycling is high and the cost of virgin materials low that recycling is unlikely.

QUESTION B2

This question worth two marks and based on assessment statement B.7.1, asked candidates to outline how the purpose of evaluation of a motor car, e.g. a safety test, influences the nature of the evaluation. [1] mark was awarded for identifying that a safety test focuses on particular features relevant to the safety of the car, [1] for identifying that non-safety relevant issues such as price, running costs, comfort and appearance are not considered and [1] for identifying that safety tests are quantitative/objective in nature. Candidates did not identify that the nature of the test results in the selection of relevant criteria and ignores other criteria. Responses to this question were often vague.

QUESTION B3

(a) This question asked for a definition of a literature search (assessment statement B.8.1). The question was not a problem to most candidates.

(b) This question, on assessment statement B.8.2 and worth 2 marks, asked candidates to outline one disadvantage of a literature search to collect data to evaluate a product. The question was answered reasonably by most candidates.

QUESTION B4

This question, worth 4 marks on assessment statement B.4.2, invited candidates to discuss the issues surrounding the need to conserve the resources of the planet. [1] mark was awarded for each distinct correct point. This was clearly a topic close to the heart of some candidates who provided excellent answers on sustainability, the finite nature of most resources and the urgent need for changes in behaviour in relation to resource utilisation and recycling.

Option C - Mechatronics

No candidates attempted this option and so there are no comments to add to the examination paper and the markscheme.

Option D – Food technology

This option is extremely popular and should be readily accessible to candidates, impinging on their everyday lives. However, it is notable from session to session that the science and technology underpinnings of the food technology option are poorly understood by candidates. Thus, reasonable candidates tend to gain marks well on D1 and D4 - then on D2 and D3, which require solid knowledge of the syllabus, it is only the better candidates that get really good marks. Candidates need to be encouraged to learn and understand the definitions. In the new Guide the definitions are much reduced and relate to the contexts selected.

QUESTION D1

(a) This question, worth 1 mark, required candidates to identify one ice cream product designed for children from a graph with two bipolar axes. Most candidates answered the question correctly.

(b) This question, worth 2 marks and based on assessment statement D.2.1, required candidates to outline the role of tasting panels in developing the specification of new products. A wide range of quality of answer was given by candidates.

(c) This question, worth 3 marks, required candidates to explain the importance of being able to compare new food products with existing products. It is important that products are either good copies of existing products – similar but better! Or that they are distinctly different. Comparison of new products with existing products enables a manufacturer to predict a likely market for a product. Most candidates were able to achieve one or two marks from their responses although there were also some very good responses.

QUESTION D2

This question worth 2 marks and based on assessment statement D.5.5, asked candidates to outline one factor that determines a need for primary food processing. Candidates generally answered this question poorly suggesting lack of syllabus knowledge.

QUESTION D3

(a) Asked candidates, for 1 mark and based on D.4.3, to define coagulation of protein. Few candidates gave definitions suggesting that they had any idea of what this was.

(b) Based on D.4.8 and worth 2 marks, this question asked candidates to outline how coagulation of protein affects the physical properties of bread. Most candidates answered the question very badly, again suggesting lack of syllabus knowledge.

QUESTION D4

This question, worth 4 marks and based on D.1.3 and D.1.5, required candidates to explain how health consciousness has led to the design of new food products. One mark was awarded for each distinct correct point. This question, surprisingly, was extremely differentiating.

Option E – Computer aided design and manufacturing

QUESTION E1

This data-based question showed a product developed using CAD/CAM. The question discriminated well between weaker and stronger candidates. Part (a), worth 1 mark and drawing on assessment statement E.1.13, required the identification of an input device. Part (b), worth 2 marks and based on E.3.5, required candidates to outline the impact of CAD/CAM in working conditions for the workforce. Most candidates were able to generate reasonable answers to this question although some candidates failed to focus on working conditions and concentrated on employment issues – job losses. Part (c), worth 3 marks and based on E.1.17, invited candidates to explain how the application of virtual reality in the marketing of consumer products can help conserve resources. Some candidates produced good answers to this question.

QUESTION E2

Based on E.4.2 and worth 2 marks this question asked candidates to explain how CAD/CAM has improved choice for consumers. Some candidates answered this question extremely well.

QUESTION E3

Part (a) required a straightforward definition of patent and posed problems for a surprisingly large number of candidates. Part (b) required candidates to outline the implications of computerised manufacture on the infringement of copyright and patent laws and was reasonably straightforward.

QUESTION E4

Candidates were required to discuss the advantages and disadvantages of CIM to manufacturers. Whilst reasonably discriminating there were no particular problems observed although some candidates failed to relate advantages and disadvantages specifically to manufacturers.

Option F – Invention, innovation and design

This option was by far the most popular.

QUESTION F1

In part (a) there was some confusion between invention and innovation which also affected question F3(a). In part (b) many candidates failed to explicitly outline the meaning of technology push and market pull to achieve maximum marks yet were able to go on in part (c) to relate the concepts well to the given context.

QUESTION F2

Although this question is straightforward and is straight from the syllabus it was rarely answered well enough to gain both marks.

QUESTION F3

Confusion in F1(a) affected answers here to part (a). Part (b) produced very varied responses. Most candidates knew enough to gain one mark.

QUESTION F4

Good candidates balanced their answers equally between the two issues of market pull and technology push Some candidates failed to focus specifically on social demands but in general the question was answered well.

Option G – Health by design

QUESTION G1

Part (a) – state one advantage of using diabetic testing sticks over earlier methods of testing - posed no problems for candidates. Part (b) – outline how diabetic sticks work - similarly was reasonably straightforward and answered well by most candidates. Part (c) – explain how the availability of diabetic sticks has impacted on the lives of diabetics – posed a problem for some candidates and not many answers were sufficiently detailed to gain the full three marks. The action verb 'explain' requires a deeper response than 'outline'.

QUESTION G2

A straightforward question asking candidates to outline the advantage of the 'one day' disposable contact lens. This question was answered well by some candidates.

QUESTION G3

Part (a) of this question required candidates to draw a conventional liquid-in-glass thermometer. The action verb 'draw' means: *represent by means of pencil lines. Add labels unless told not to do so.* Some candidates did not show the liquid in the scale either by the use of clear diagram or annotation. Part (b) – state one disadvantage of a liquid-in-glass thermometer for measuring a patient's temperature - was reasonably well answered by most candidates.

QUESTION G4

This question required candidates to explain why Magnetic Resonance Imaging (MRI) is superior to CT scanning. The question was poorly answered although straightforward due to poor planning.

Higher Level Paper 1

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-9	10-14	15-20	21-24	25-27	28-31	32-38

General comments

Four G2s were received for this component. All four stated that the paper was a little more difficult than last year. All four rated the level of difficulty as appropriate. Three G2s said that syllabus coverage was good and one said it was satisfactory. Clarity of wording was rated satisfactory by three G2s and good by one. Three rated the presentation of the paper as good and one as satisfactory. Some of the questions elicited specific G2 comments as discussed below.

The table below indicates the difficulty index of each question. A lower difficulty index indicates a harder question. The * indicates the correct response and the values represent the number of candidates providing each individual response. A discrimination index comparing the performance of the top 25% of candidates on a particular question with the top 25% of candidates overall is also calculated. With such a small candidacy the discrimination index is a less useful tool than it is in large entry subjects. All questions achieving a negative discrimination index are discussed at the grade award meeting.

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21	79*	9	2			87.77	.26
37	2	1	79*	8		87.77	.20
15	3	7	78*	2		86.66	.20
6	76*	1	4	9		84.44	.14
9	5	2	8	75*		83.33	.33
12		2	74*	14		82.22	.30
23		74*	6	10		82.22	.13-
17	8	7	73*	2		81.11	.40
4	2	5	72*	11		80.00	.23
19	72*	2	4	12		80.00	.23
29	6	68*	13	3		75.55	.30
40	10	67*	5	8		74.44	.33
24	10	11	65*	4		72.22	.30
14	64*	15		11		71.11	.46
22	3	19	4	64*		71.11	.50
36	64*	5	13	8		71.11	.66
1	17	4	8	61*		67.77	.33
11	8	18	3	61*		67.77	.60
30	5	4	60*	21		66.66	.50
20	14	58*	11	7		64.44	.50
3	57*	24	5	4		63.33	.20
39	12	8	56*	14		62.22	.40
28	24	11	2	53*		58.88	.53
18	6	2	30	52*		57.77	.46
34	30	3	12	45*		50.00	.60
5	8	43*	12	27		47.77	.40
25	11	6	33	40*		44.44	.06
33	36	40*	3	11		44.44	.53
16	24	25	4	37*		41.11	.40
10	10	8	33*	39		36.66	.40
35	16	33*	8	33		36.66	.53
7	5	30*	25	30		33.33	.10
31	24*	19	46	1		26.66	.26-
27	21*	37	24	8		23.33	.06-
13	74	6	1	9			.00
32	68	6	12	4			.00

The general comments on Paper 1s for the Standard Level paper apply equally to the Higher Level paper and will not be repeated here.

QUESTION 7

One G2 commented that if children are seen in the context of the full population the answer could arguably be 5th percentile. This is a common but incorrect interpretation of what percentile ranges are signifying.

QUESTION 9

One G2 commented that all are answers of social responsibility in design. This was not a problem for candidates who predominantly agreed that aesthetics are not a social responsibility.

QUESTION 13

No adverse G2 comments were received for this question but in consideration of its negative discrimination index, the question was removed from the examination.

QUESTION 14

One G2 asked what the product was and suggested that the product should have been named. This was found to be an easy question by candidates and was not negatively discriminating.

QUESTION 16

One G2 commented that all these could be considered as one-off or as batch. This was not a problem for candidates.

QUESTION 18

One G2 commented that some teachers may not have dealt with logic gates with more than two inputs and this may have misled some candidates. Candidates in fact found this a relatively easy question and it was not negatively discriminating.

QUESTION 32

This question was removed from the examination. The question highlights a contradiction in the Guide between assessment statements 12.1.12, 12.2.2 and the definition of velocity ratio in the glossary, a contradiction pointed out in one G2. Interestingly, candidates were overwhelmingly (74 out of 90) convinced that the right answer was A.

Higher Level Paper 2

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-4	5-9	10-14	15-22	23-30	31-38	39-52

General comments

Five G2s were received. Three suggested that the paper was a little more difficult than last year and one suggested that it was much more difficult. All five stated that the level of difficulty was appropriate. Two G2s suggested that syllabus coverage was poor, two said it was satisfactory and one said it was good. Four G2s suggested that the clarity of wording was satisfactory and one said it was good. One G2 said the presentation of the paper was poor, two said it was satisfactory and two said it was good.

Section A

Overall the examining team is trying to ask different questions from various parts of the syllabus in different ways in a range of familiar, or unfamiliar but not inaccessible, contexts. One G2 commented that questions 2, 3 and 4 are all about materials. True Questions 2 and 3 are about materials. Question 4 is about a material property (ductility) and a manufacturing context where it is an important consideration.

Throughout Question 1 and the rest of Section A, the examining team tries to use the design context to explore different parts of the syllabus. Each question within Section A should cover a different section of the syllabus and not lead on from previous sections causing issues of double jeopardy. The use of parts (a), (b), (c) and sub-sections (i) and (ii) should provide some sign-posting to candidates about the structure of the question and the shift from one focus to the next. It is by no means clear that all candidates understand the significance of this. Teachers must continue to emphasise this to candidates and encourage them that if they falter on one part of Section A for whatever reason they should carry on with other parts which will explore different issues.

QUESTION 1

One G2 commented on the poor quality of the photograph. Another commented that the pictures were very grainy. The team strives for all illustrations to be of the highest quality. One G2 said that this was: 'A good question, suitably discriminating - starts straightforward and soon getting students thinking!' One G2 asked 'What type of question is No 1b? Completely inappropriate – not in syllabus at all – very unfair in my view.' The question is supposed to be off syllabus. One G2 commented that the question is much more accessible for HL candidates that SL candidates due to the extra teaching time for electronics. This must relate to how comfortable HL candidates feel about electronics due to the extra exposure. The examining team would argue that the context is not just on Topic 5 but this may not have been obvious to the candidates.

(a) (i) Required candidates to state the preferred location of PIR40 reading the data from a data table. This was achieved by all candidates.

(ii) Required candidates to identify the least sensitive model of PIR. Again this question posed few problems.

(iii) Required candidates to identify the operating voltage range that would allow any of the detectors to operate. Most candidates were able to identify 12-14 V and write in the units to achieve the mark.

(b) (i) The calculation! This calculation seemed relatively straightforward to the examining team but was extremely discriminating and few candidates achieved both marks. Some candidates did not even attempt this question.

(ii) This section was attempted well by most candidates.

(iii) This similarly was attempted well.

(iv) Weak candidates found this a problem but most candidates were able to annotate the diagram to show suitable positions for the sensors.

(c) (i) The truth table was reasonably straightforward for most candidates.

(ii) A pleasing number of candidates were able to go on to (ii) and design a logic circuit to satisfy the conditions of the truth table.

(d) (i) This question was answered well by candidates.

(ii) This question was answered poorly and there seemed to be a lack of knowledge about the structure and bonding of thermosets.

(iii) This was answered well with candidates using knowledge gained from Topic 2.

QUESTION 2

(a) Most candidates were able to outline the need to season natural timber.

(b) Candidates rarely gained both marks recognising the high melting point but not recognising that this is due to the strong chemical bonds.

(c) This was answered well by most candidates.

QUESTION 3

(a) A straightforward definition of an alloy was required.

(b) Generally answered well.

QUESTION 4

(a) A straightforward definition of ductility was required.

(b) Most candidates were able to outline manufacturing contexts where ductility is an important consideration.

Section B

Parity of Section B questions and syllabus coverage remain conflicting constraints. In the Section B questions for the new Guide the examiners will adopt a more formulaic approach to ensuring appropriate syllabus coverage. The three quality marks are awarded for clarity of argument (1 mark), designer's logic (1 mark) and communication (1 mark) as for Standard Level Paper 2. As for Standard Level these quality marks will be drawn explicitly into the markscheme and the question will identify 20 marks on the paper rather than the 17, which is the current practice.

QUESTION 5

One G2 stated that Question 5 was good. Part (a) (i) – list two criteria for the specification of a material for the head - and (ii) – identify suitable materials for the head - were reasonably straightforward. Part (b) (i) calculate the mechanical advantage and percentage efficiency for the lamp was also reasonably straightforward and most candidates attempting the question were able to calculate these appropriately. Part (b) (ii) was poorly answered and candidates were not able to outline two reasons for the efficiency of the head as required. Part (c) produced some varied responses which were generally good.

QUESTION 6

Part (a) (i) produced some vague responses. Part (a) (ii) was reasonably straightforward. One G2 commented that Q6 b (i) and (ii) could be argued as almost off the syllabus 'since study of robots only appears in Option E' – the examining team would draw attention to assessment statement 4.1.9 on which this question was based. Undoubtedly there could be an advantage for candidates studying Option E. Answers to Part (b) (i) were vague with candidates

achieving one or two marks but rarely three. Part (b) (ii) produced some reasonable but varied answers. Part (c) elicited some poor responses. Candidates did not focus on a specification for a control system in relation to how the system should operate. Most interpreted the question in relation to the hardware and software.

QUESTION 7

One G2 commented that Question 7 was good. This was the most popular question. Part (a) (i) was answered by by candidates. Part (a) (ii) similarly was relatively straightforward for candidates. Part (b) (i) should have been relatively straightforward with candidates relating syllabus content to design context. Candidates perform best on this type of question when they use a structure, e.g. bullet points, to help them clearly identify three different responses. Those who provide free unstructured text often repeat themselves and do not get three clearly different responses. Part (b) (ii) produced a variety of appropriate responses. Part (c) was answered well by the majority of candidates. Good answers demonstrated good balance between the advantages and disadvantages of the two systems.

Higher Level Paper 3

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-5	6-10	11-12	13-18	19-25	26-31	32-40

General comments

The paper appears to have been well received by both candidates and teachers. Four G2s were received. Three G2s commented that the paper was of a similar standard to the previous year. All four G2s suggested that the level of difficulty was appropriate and syllabus coverage, clarity of wording and presentation of the paper were satisfactory or good.

Good discrimination was achieved throughout the paper with the best candidates scoring almost full marks and the weakest very low marks. Again, a general criticism of candidates is that the use of specific technical terms was rather limited except by the better candidates and lack of precision in answers was fairly widespread, especially with higher order questions. As new schools come on line there is a better balance in the options selected by schools. Some candidates dilute their effort by ignoring the instruction to select two of the Options. Where candidates do not indicate which two options they are answering on the front page of the answer booklet the examiners will mark the first two options selected. In such cases, which generally involve weaker candidates, it is difficult to tell whether candidates have studied more than one option or whether they were not clear about which options they were studying. It is the feeling of the examining team that the data-based question in each section should provide a context in which the syllabus can be explored rather than being another opportunity for data handling.

The double page for the extended response question was not deliberate but it did seem to encourage candidates to respond more fully. Candidates seemed better prepared for the extended response questions and provided much more balanced answers than often previously and teachers are to be congratulated for this. There seemed to be good parity between the options in terms of the challenge offered by the extended response questions as evidenced by candidate performance.

Option D – Food technology

This option is extremely popular and should be readily accessible to candidates impinging on their everyday lives. However, it is notable from session to session that the science and technology underpinnings of the food technology option are poorly understood by candidates. Thus, reasonable candidates tend to gain marks well on D1 and D4 - then on D2 and D3, which require solid knowledge of the syllabus, it is only the better candidates that get really good marks. Candidates need to be encouraged to learn and understand the definitions. In the new Guide the definitions are much reduced and relate to the contexts selected.

QUESTION D1

(a) This question, worth 1 mark, required candidates to identify one ice cream product designed for children from a graph with two bipolar axes. Most candidates answered the question correctly.

(b) This question, worth 2 marks and based on assessment statement D.2.1, required candidates to outline the role of tasting panels in developing the specification of new products. A wide range of quality of answer was given by candidates.

(c) This question, worth 3 marks, required candidates to explain the importance of being able to compare new food products with existing products. It is important that products are either good copies of existing products – similar but better! Or that they are distinctly different. Comparison of new products with existing products enables a manufacturer to predict a likely market for a product. Most candidates were able to achieve one or two marks from their responses although there were also some very good responses albeit it in a minority.

QUESTION D2

This question worth 2 marks and based on assessment statement D.5.5, asked candidates to outline one factor that determines a need for primary food processing. Candidates generally answered this question poorly suggesting lack of syllabus knowledge.

QUESTION D3

(a) Asked candidates, for 1 mark and based on D.4.2, to define aeration. Few candidates gave definitions suggesting that they had any idea of what this was.

(b) Based on D.4.8 and worth 2 marks, this question asked candidates to outline how aeration affects the physical properties of bread. Most candidates answered the question very badly, again suggesting lack of syllabus knowledge.

QUESTION D4

This question required candidates to discuss the acceptance by the general public of foods produced by novel techniques. The major weakness in answering this question was in not identifying specific foods as required in the markscheme. Candidates were not just vague in communicating understanding but they failed to relate novel techniques to issues of public acceptability. In planning their answers, candidates could have built a balanced discussion. It was relatively easy for candidates to achieve half the marks but without a structure it was very difficult to gain full marks. Thus this question discriminated well.

Option E – Computer aided design and manufacturing

QUESTION E1

This data-based question showed a product developed using CAD/CAM. The question discriminated well between weaker and stronger candidates. Part (a), worth 1 mark and drawing on assessment statement E.1.13, required the identification of an input device. Part (b), worth 2 marks and based on E.3.5, required candidates to outline the impact of CAD/CAM in working conditions for the workforce. Most candidates were able to generate reasonable answers to this question although some candidates failed to focus on working conditions and concentrated on employment issues – job losses. Part (c), worth 3 marks and based on E.1.17, invited candidates to explain how the application of virtual reality in the marketing of consumer products can help conserve resources. Some candidates produced good answers to this question.

QUESTION E2

Based on E.3.3 and worth 2 marks this question asked candidates to outline one disadvantage of JIT (Just-in-Time) to manufacturers. Some candidates answered this question extremely well.

QUESTION E3

Part (a) required a straightforward definition of patent and posed problems for a surprisingly large number of candidates. Part (b) required candidates to outline the implications of computerised manufacture on the infringement of copyright and patent laws and was reasonably straightforward.

QUESTION E4

Candidates were required to explain how multinational companies may utilise modern communications technology to enhance the efficiency of their operation. There was no need to name a multinational company. The question was looking for examples of the specific ways that modern communications technologies are typically used by multinational companies. The sting in the tail was the requirement to focus on the efficiency of operation.

Option F – Invention, innovation and design

This option was by far the most popular.

QUESTION F1

In part (a) there was some confusion between invention and innovation which also affected question F3(a). In part (b) many candidates failed to explicitly outline the meaning of technology push and market pull to achieve maximum marks yet were able to go on in part (c) to relate the concepts well to the given context.

QUESTION F2

Although this question is straightforward and is straight from the syllabus it was rarely answered well enough to gain both marks.

QUESTION F3

Confusion in F1(a) affected answers here to part (a). Part (b) produced very varied responses. Most candidates were able to gain at least one mark.

QUESTION F4

This question required candidates to discuss how technological development have had positive and negative impacts on physically-impaired people. Candidates needed to identify specific technological developments related to physical impairment. The discriminator was the balance between positive and negative issues. Many candidates did not achieve this balance with a typical overemphasis being on positive benefits. Also to get full marks the candidates needed to communicate the context in which the physically-impaired person is operating – i.e. the home. Thought was needed to identify issues and plan the answer before launching into a response. Many candidates gave lengthy responses gaining 4 or 5 marks in the first few paragraphs and then repeating the issues by identifying another physical impairment but not adding to the discussion.

Option G – Health by design

QUESTION G1

Part (a) – state one advantage of using diabetic testing sticks over earlier methods of testing - posed no problems for candidates. Part (b) – outline how diabetic sticks work - similarly was reasonably straightforward and answered well by most candidates. Part (c) – explain how the availability of diabetic sticks has impacted on the lives of diabetics – posed a problem for some candidates and not many answers were sufficiently detailed to gain the full three marks. The action verb ‘explain’ requires a deeper response than ‘outline’.

QUESTION G2

A straightforward question asking candidates to outline how development in manufacturing techniques have led to the widespread use of disposable syringes. This question was answered well by most candidates.

QUESTION G3

Part (a) of this question required candidates to draw a conventional liquid-in-glass thermometer. The action verb ‘draw’ means: *represent by means of pencil lines. Add labels unless told not to do so.* Some candidates did not show the liquid in the scale either by the use of clear diagram or annotation. Part (b) – state one disadvantage of a liquid-in-glass thermometer for measuring a patient’s temperature - was well answered by most candidates.

QUESTION G4

This question required candidates to explain how exhaust gases from motor vehicles affects air quality. Most candidates had good subject knowledge. To gain full marks candidates needs to explain different level of effect – local/global, also sustainability – present/future issues.

Internal Assessment (IA)

Higher and Standard Level

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-4	5-7	8-10	11-13	14-15	16-18	19-24

As the number of centres preparing candidates for the Design Technology examination continues to grow it is pleasing to be able to report the increase in efficiency and accuracy of IA assessment. The vast majority of teachers are very familiar with the assessment criteria and obviously use it to plan a practical scheme of work, which provides sufficient evidence of how the criteria have been addressed. A few centres did not "flag" the aspects of folio work sent for moderation, which makes a rather tedious task for the moderator to sift through all the evidence.

To satisfy planning (a) criteria candidates must be given the opportunity to formulate their own hypothesis (brief) and identify variables (specifications). The new Guide (for examination 2003-2007) sets out more precisely the differences and value of the brief and specifications for design projects (Topic 1). Evidence for planning (b) criteria should not be a retrospective account of the investigation but demonstrate clarity of thinking for planning the practical work, clearly identifying materials and equipment to be used and setting out the methodology for doing the practical work with a strategy for controlling variables. The evaluation stage will reflect upon how astute were the judgements at the planning (a) and (b) stages and recommend modifications if appropriate.

When group projects are used as evidence of formative assessment, as is often the case with the Group Four Project the individual input of each candidate must be identifiable. In a number of instances exactly the same evidence was presented to all members of the group with no differentiation made in applying the assessment criteria. It would be appropriate for each candidate to keep a project diary or log which shows clearly the work they have undertaken to contribute to the success of the project. If such work is used as evidence for planning (a) and planning (b) the candidates must have had the opportunity to develop their own hypothesis and plan the practical work as with an assignment tackled individually. Group Four Projects, which allow each candidate to identify their own experimental work, although satisfying a common aim were more appropriate for use against the formative criteria.

The modification made by the IBO to the marking matrix has been effective in differentiating more accurately between candidates. Teachers seem more confident in applying the scale and weaker candidates have great opportunity for gaining at least one mark for attempting a task compared to those candidates who do nothing or very little.

Design Technology is a diverse subject, which is represented by the wide range of practical programmes undertaken. In a few centres it was clear that candidates had not been given adequate preparation for the compulsory design project by having to apply the design process in previous tasks. It is not necessary to undertake 'mock' or mini design projects following the entire design process, but candidates should have focused on each aspect of the process by applying it to a practical task.

The majority of centres are to be congratulated on managing a demanding course well, providing their students with an invaluable Design Technology experience.

Conclusion

The shift in understanding by teachers of the IA criteria and its impact on the moderation of IA is perhaps the single most pleasing feature of this examination session. Overall a higher proportion of the candidature achieved higher grades and the coveted '7' than in previous years. Congratulations to all candidates on this success.

There was good understanding this year of the action verbs (e.g. state, outline, describe, explain) and more evidence to suggest that candidates recognise the significance of the mark weighting in relation to the expectations of the answer.

Good candidates took the advice from previous reports of 'sign-posting' answers with headings and bullet points or using tables to identify distinct points. Teachers should continue to stress this to candidates and encourage candidates to confirm their understanding of the extent of the answer required by checking the mark allocation for the question. Answers from better candidates were notably more succinct, used appropriate terminology, provided clear and well-annotated diagrams where appropriate and structured their answers demonstrating a 'designer's logic'.

Teachers should continue to familiarise themselves with the Group 4 Grade Descriptors. The examining team continues to strive to:

- ensure appropriate syllabus coverage;
- use accessible design contexts understandable around the globe;
- ensure parity between optional questions;
- make the expression of questions as straightforward as possible (particularly for second language candidates);
- ensure that the various examination elements discriminate appropriately between stronger and weaker candidates
- ensure that there are opportunities for candidates to provide evidence for the different aspects of the Group 4 Grade Descriptors within the examination papers to enable the Grade Descriptors to be used in the setting of the grade boundaries at the Grade Award meeting.

With more new schools participating each year the subject continues to grow. The overall evidence of the May 2002 session is that candidates were well prepared for the examinations, presumably benefiting from this being the ultimate May session and the ninth and penultimate set of examination papers for this Guide.

The single most significant change in the new Guide (for examination 2003–2007) is the shift towards 'greenness'. This will be reflected throughout the various assessment elements of the programme. The examining team has produced a set of specimen papers for teachers. Paper 2 will hopefully become even more of an opportunity for candidates to apply science in demonstrating their ability to make and justify design decisions.

APPENDIX 1

Standard Level (SL) Paper 1

This comprises 30 multiple choice questions (MCQs) across the 6 topics comprising the SL core. To ensure appropriate coverage of the syllabus the number of MCQs on each topic should reflect the teaching hours for each topic, as identified in the Design Technology Guide and indicated in the table below:

Topic	Teaching hours	Number of MCQs
1	15	7
2	11	5
3	6	3
4	8	4
5	9	4
6	16	7
Total	**65**	**30**

An exemplar SL paper is shown in Appendix 2.

Higher Level (HL) Paper 1

This comprises 40 MCQs across the 9 topics comprising the HL core. Again, to ensure appropriate coverage of the syllabus the number of MCQs on each topic should reflect the teaching hours for each topic, as identified in the Design Technology Guide and indicated in the table below:

Topic	Teaching hours	Number of MCQs
1	15	4
2	11	3
3	6	2
4	8	3
5	9	3
6	16	5
7	15	6
8	19	8
9	15	6
Total	**114**	**40**

15 of the questions on topics 1 – 6 are common to SL and HL papers to enable comparison of achievement by SL and HL candidates.

