DESIGN TECHNOLOGY

Overall grade boundaries

Higher level

Grade:	1	2	3	4	5	6	7
Mark range:	0-15	16-28	29-39	40-51	52-63	64-76	77-100

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0-14	15-29	30-43	44-55	56-66	67-78	79-100

Introduction

The May 2004 examination session is the second May session for the new Guide and the third set of examinations for this subject. Specimen papers have been available for some time. 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 be familiar with the new Guide. 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.

This session has seen twenty three schools (10 new) and 94 candidates being examined at SL, an 8% increase over May 2003; and thirty schools (13 new) and 206 candidates at HL, a 27% increase over May 2003.

Teachers have three options for submitting the G2 forms – through either IBNET or the OCC, or in hard copy form. However disappointingly, only one school commented on the SL papers, and whilst six schools commented on the HL paper 1, the comments for P2 and P3 were less.

G2 Comments		
	HL	SL
P1	6	1
P2	5	1
P3	4	1

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.

Internal Assessment

Higher level

Grade:	1	2	3	4	5	6	7
Mark range:	0-5	6-11	12-15	16-19	20-23	24-27	28-36

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0-5	6-11	12-15	16-19	20-23	24-27	28-36

The range and suitability of the work submitted

With the increase of new schools taking up the subject a wider range of work is evident. Most schools submitted work of a suitable nature, but closer examination of the assessment criteria is required if candidates are to obtain higher marks. Work ranged from complex design and make activities through to smaller laboratory based experiments. The schools that adopted to use the design and make route do seem to have faired better when addressing the assessment criteria. Some of those new to the subject did not use the Design Project in their own assessment. Not all schools realised that they were required to use the Design Project as evidence for each set of assessment criteria on the 4/PSOW. As marks need to be highlighted on the form for each assessment heading, one of the marks must be for the design project and the other for any of the other investigations. Fortunately in schools where the design project had not been highlighted on the 4/PSOW form moderators were able to highlight the mark themselves, as projects had been included in the sample material. Hence, the necessity of asking for a remark by centres was avoided. In quite a large number of schools there is still some confusion over what should be contained within the project report and logbook. In some instances candidates had wasted valuable time repeating the work in both documents or there were so many gaps in the work it was difficult to make a good holistic judgement as to what had taken place. The logbook is not formally assessed, but reference should be made to pages throughout the report. Work was submitted in different formats, and where the reports are clearly labelled to address the assessment criteria candidates have generally scored well. Some of the work submitted was disorganised and not bound.

Candidate performance against each criterion

Pl(a): Most candidates seem to fare well in this section, but candidates had lost marks where all of the criteria had not been addressed under each heading. Common errors included a repetition of a problem set by the class teacher and the omission of any reference to built in constraints.

Pl(b): Candidates did not always display evidence of planning, apparatus, diagrams and methods in the investigations which were highlighted for moderation. When considering the design project some candidates omitted a detailed plan of action and material list. Those who had written their plan in retrospect failed to address some of the assessment criteria.

DC: Smaller investigations where candidates had to collect raw quantitative data offered ample opportunity to address the assessment criteria. Where candidates had completed a literature search, the data allowed insufficient identification of uncertainties and errors. The design project allowed candidates to address most research issues, but some marks were lost where candidates had omitted essential data to solve the problem.

DPP: Most candidates addressed the majority of the assessment criteria. A good range of ideas was presented by most, but detailed annotation and careful presentation was not always considered. Ideas were not always supported by an evaluation against the design specification. Some candidates developed their chosen idea by using a range of sketches and modelling, but in most cases the quality of working drawings did not offer sufficient detail for the product to be realized.

CE: In most instances insufficient time had been allocated to this aspect of the investigations. Insufficient time had been devoted to completing a thorough evaluation/conclusion. Some candidates only offered personal evaluations with no consideration being made to address the specification and suggest improvements. The more organised candidates did leave adequate time to address the criteria to a satisfactory standard.

Paper 1

Higher Level

Grade:	1	2	3	4	5	6	7
Mark range:	0-10	11-14	15-19	20-24	25-28	29-33	34-40

General Comments

Six G2s were received for this component. One suggested it was too easy, five suggested it was an appropriate level of difficulty, one said syllabus coverage was satisfactory, four said it was good, two said clarity of wording was satisfactory and four said it was good, two said the presentation of the paper was satisfactory and four said it was good.

One G2 suggested using more pictures, one said there were too many questions on the environment, one said that too many of the questions required recall rather than application and one commented on the lack of questions related to ergonomics.

In defense of the comment related to the syllabus coverage, the examining team would point out that the number of questions related to each topic is determined by the hour allocations identified in the guide and number of questions on the environment reflects the emphasis of the new guide through topics 6 and 9.

Question 34 elicited specific G2 mention., ie, that two of the forces (shear and torsion) are not specifically mentioned in the guide. This is a fair comment, however it did not adversely impact on candidate performance and the question was not removed from the analysis. In the next revision of the guide the teachers notes will be expanded to include these references.

The table below indicates, in question order, 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. The International Baccalaureate computer also calculates a discrimination index comparing the performance of the top 25% of candidates on a particular question with the top 25% of candidates overall and can vary between 0.00 and 1.00. With such a small candidacy the discrimination index is a less useful tool than it is in large entry subjects. Although the discrimination indices are not published as part of the subject report, all questions achieving a negative discrimination index are discussed at the grade award meeting.

Question	A	B	C	D	Difficulty Index
1	9	3	6	187*	91.21
2	24	137*	24	20	66.82
3	86	8	103*	8	50.24
4	6	187*	9	3	91.21
5	28	116*	3	58	56.58
6	148*	40	13	4	72.19
7	180*	5	2	18	87.80
8	164*	34	2	5	80.00
9	7	2	6	190*	92.68
10	1	167*	36	1	81.46
11	202*	1	2	0	98.53
12	54*	44	70	37	26.34
13	162*	17	5	21	79.02
14	10	116	57*	22	27.80
15	140*	18	16	31	68.29
16	55	35	10	105*	51.21
17	34	7	10	154*	75.12
18	142*	2	40	21	69.26
19	8	4	187*	6	91.21
20	14	36	3	152*	74.14
21	43	37	3	122*	59.51
22	8	192*	0	5	93.65
23	6	8	168*	23	81.95
24	25	20	47	113*	55.12
25	176*	11	5	12	85.85
26	11	8	3	183*	89.26
27	7	2	177*	19	86.34
28	89*	36	74	6	43.41
29	13	132*	38	21	64.39
30	31	17	32	124*	60.48
31	51	108*	30	16	52.68
32	63	117*	12	13	57.07
33	54	119*	10	21	58.04
34	12	172*	8	13	83.90
35	9	118	78*	0	38.04
36	19	3	131*	52	63.90
37	38	19	36	112*	54.63
38	28	4	167*	6	81.46
39	3	4	197*	0	96.09
40	6	15	170*	13	82.92

Standard Level

Grade:	1	2	3	4	5	6	7
Mark range:	0-7	8-12	13-17	18-20	21-22	23-25	26-28

General comments

One G2 was received. It suggested that the level of difficulty was appropriate, and that syllabus coverage, clarity of wording and presentation of paper was satisfactory. It specifically commented on four questions.

Question 3

The G2 commented that the answer B is also relevant to the simple design cycle model. However, market research is not explicitly mentioned in the simple design cycle model, so the question was retained.

Question 6

The comment was that the wording of the question was poor. Whilst the question was very discriminating and of moderate difficulty, there was no evidence to suggest that it should be removed from the analysis.

Question 20

The G2 questioned whether a product could encourage extra sales and whether A is a correct answer. A is not a correct answer, but because the specific wording of C may have misled some candidates, it was deleted from the analysis.

Question 21

The G2 asked if the question was comparing mechanization with craft production. This is a valid question and implicitly the guide does make this comparison. However the statistics would suggest that the candidates shared this understanding and were not adversely effected. The question was retained in the analysis.

Question 30

The G2 questioned the lack of specificity in using the word 'often', which could be misleading. A reading of the question in this light indicates that this could be the reason why some candidates selected option A. In addition the question generated a negative discrimination index and so it was deleted from the analysis.

The table below indicates in question order 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.

Question	A	B	C	D	Difficulty Index
1	8	5	3	59*	78.66
2	15	1	11	48*	64.00
3	11	36*	16	12	48.00
4	1	70*	2	2	93.33
5	42	2	27*	4	36.00
6	1	14	49*	11	65.33
7	3	66*	6	0	88.00
8	1	16	56*	1	74.66
9	9	40*	0	26	53.33
10	8	4	63*	0	84.00
11	66*	2	1	6	88.00
12	1	2	5	67*	89.33
13	54*	17	1	3	72.00
14	62*	6	0	7	82.66
15	2	2	1	70*	93.33
16	70*	1	3	1	93.33
17	7	54*	14	0	72.00
18	15*	21	26	13	20.00
19	1	51*	17	6	68.00
20	deleted				
21	48*	14	5	8	64.00
22	13	0	57*	5	76.00
23	52*	13	3	7	69.33
24	26*	2	5	42	34.66
25	26	14	4	31*	41.33
26	0	5	63*	7	84.00
27	16	5	2	52*	69.33
28	3	5	9	58*	77.33
29	10	3	57*	5	76.00
30	deleted				

Two questions had a negative discrimination index, Question 28 and Question 30. Question 28 seems a reasonable question and with low candidate numbers, a negative discrimination index is less reliable and so the question was retained in the analysis. Question 30 however, is ambiguous and so a decision was made to delete it from the analysis.

Paper 2

Higher level

Grade:	1	2	3	4	5	6	7
Mark range:	0-8	0-16	17-19	20-27	28-36	37-44	45-60

General comments

Five G2s were received. Four suggested that the paper was of a similar standard to last years. All five stated that the level of difficulty was appropriate. One G2 suggested that syllabus coverage was poor, two said it was satisfactory and two said it was good. Four G2s suggested that the clarity of wording was good, and one said it was satisfactory. Two G2's said the presentation of the paper was satisfactory and three said it was good.

Section A

Each question within Section A should be separate and not build on from previous sections to cause issues of double jeopardy. The use of parts (a), (b), (c) and sub-sections (i) and (ii) should provide some signposting 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

Question 1 is a data question and is the hub of Paper 2, Section A. The question was a good discriminator and poor candidates achieved very low marks and good candidates very high marks so using the full range of the scale. 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 to use them in calculations. One G2 commented on the requirement to convert units. The ability to do this is seen as essential by the examining team to reflect the reality of design. The paper proved highly accessible. Whilst in previous year the examining team would defend the appropriateness and fairness of the questions set, it would not have been as easy to defend the accessibility of some of the contexts. Removal of electronics from the syllabus core has had a major impact on the accessibility of the paper. In papers based on the previous version of the Guide, an electronics section or sub-section, e.g. using digital logic, would not be attempted even by very good candidates so higher marks were not easily achieved.

In terms of particular problems encountered, some candidates attempted to find a very hard way to answer question (a) (ii) by calculating from the dimensions of the barrier rather than the density of the water and the empty and filled masses of the barrier.

Questions 2, 3, 4, 5 and 6

These provided syllabus coverage. The questions provided highly discriminating assessment. The question on lamination produced answers about veneering. Question 4 on the conversion of iron to steel proved more difficult than would have been expected suggesting that some candidates had not revised well for the paper. Questions 5(b) and 6(b) also were poorly answered.

Section B

Parity of Section B questions and syllabus coverage remain conflicting constraints. In this year's Section B questions the examining team had tried very hard to produce equally difficult questions whilst achieving syllabus coverage. The fairly well-balanced numbers of responses for each of the questions is a good indicator that candidates did not perceive any one question to be any more or less difficult or accessible than any other.

The three quality marks, awarded for clarity of argument (1 mark), designer's logic (1 mark) and communication (1 mark), have gone and all marks are included explicitly into the mark scheme which identifies 20 marks rather than the 17 + 3, which was the previous practice.

Again the questions in Section (c) related to green issues. The examining team sees the 'greening' of the Guide as a major change in the development of this version. Whilst Section (c) may be 'green' or 'appropriate' in future sessions, it may not be. Please do not take this year as a signal that it will always be 'green' or 'appropriate'.

The extended response question is a major challenge to candidates and some preparation is needed for this. A framework for answers helps guide candidates towards a balanced answer and the achievement of a good mark. Planning helps and, for candidates who clearly thought about their answer and jotted down some notes which were crossed out afterwards, there was the reward of a well-structured answer. Good candidates were able to provide a clear structure to their answers, especially the extended response in section (c) (ii). With a framework candidates are able to ensure that they provide a balanced response. Where there is evidence of candidates planning their answers, perhaps in pencil and crossed out afterwards, there was also evidence that the planning benefited the coherence of the answer. Some candidates did not answer the question asked and did not achieve marks. Where candidates respond in a 'stream of consciousness' and just waffle on rather than answering the questions as set and coherently there is often a large volume of answer but in not addressing the points in the question candidates do not achieve marks. Quantity is no indicator of quality! Whilst examiners search hard for anything relevant, it is often very difficult to find anything that corresponds to the material required by the question as identified in the mark scheme. A table or bullet points helps organise a response and candidates using such devices generally achieve higher marks by being able to identify clearly different points in their responses and they can see for themselves whether they have gone into sufficient depth.

Standard Level

Grade:	1	2	3	4	5	6	7
Mark range:	0-4	5-8	9-16	17-21	22-26	27-31	32-40

General comments

The examination paper was highly accessible and proved extremely discriminating so candidates were spread across the entire range of marks with poor candidates getting only 2 or 3 marks and some excellent candidates achieving very high marks. The examining team designs the paper in order to achieve syllabus coverage as well as being able to collect evidence for the group 4 level descriptors and to enable grading of scripts into grades 1 to 7. Although teachers cannot 'teach' the contexts covered in Section A Question 1, they can use past papers to expose candidates to this type of question and the importance of attention to detail, e.g. always including units with the answer to calculations. This should be reinforced through the IA work..

Candidates were generally well prepared for the style and format of the paper. There was no evidence from this small candidature that weaker candidates had been put off by not being able to answer one element of a question and had not persisted to attempt later elements of the question. However, teachers should continue to encourage candidates not to be put off. 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 action verbs are important indicators of the nature and extent of response expected for answers. It is worth teachers continuing to emphasise this to candidates and ensuring that candidates are familiar with the action verbs listed in the Guide.

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 (c), the extended response element, of the Section B questions.

Section A

Question 1

Question 1 discriminated well. 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. 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 through the data and achieve the correct answer.

Questions 2 and 3

These posed no particular problems for candidates and were good discriminators.

Section B

Questions 4, 5 and 6

Parity of Section B questions and syllabus coverage remain conflicting constraints. In this year's Section B questions the examining team had tried very hard to produce equally difficult questions whilst achieving syllabus coverage. The fairly well-balanced numbers of responses for each of the questions is a good indicator that candidates did not perceive any one question to be any more or less difficult or accessible than any other.

The three quality marks, awarded for clarity of argument (1 mark), designer's logic (1 mark) and communication (1 mark), have gone and all marks are included explicitly into the mark scheme which identifies 20 marks rather than the 17 + 3, which was the previous practice.

Again the questions in Section (c) related to green issues. The examining team sees the 'greening' of the Guide as a major change in the development of this version. Whilst Section (c) may be 'green' or 'appropriate' in future sessions, it may not be. Please do not take this year as a signal that it will always be 'green' or 'appropriate'.

The extended response question is a major challenge to candidates and some preparation is needed for this. A framework for answers helps guide candidates towards a balanced answer and the achievement of a good mark. Planning helps and, for candidates who clearly thought about their answer and jotted down some notes which were crossed out afterwards, there was the reward of a well-structured answer. Good candidates were able to provide a clear structure to their answers, especially the extended response in section (c) (ii). With a framework candidates are able to ensure that they provide a balanced response. Where there is evidence of candidates planning their answers, perhaps in pencil and crossed out afterwards, there was also evidence that the planning benefited the coherence of the answer. Some candidates did not answer the question asked and did not achieve marks. Where candidates respond in a 'stream of consciousness' and just waffle on rather than answering the questions as set and coherently there is often a large volume of answer but in not addressing the points in the question candidates do not achieve marks. Quantity is no indicator of quality! Whilst examiners search hard for anything relevant, it is often very difficult to find anything that corresponds to the material required by the question as identified in the mark scheme. A table or bullet points helps organise a response and candidates using such devices generally achieve higher marks by being able to identify clearly different points in their responses and they can see for themselves whether they have gone into sufficient depth.

Paper 3

Higher Level

Grade:	1	2	3	4	5	6	7
Mark range:	0-4	5-8	9-13	14-19	20-24	25-30	31-40

General comments

The paper appears to have been well received by both candidates and teachers. Four G2s were received. Two 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. Two G2's suggested that syllabus coverage was satisfactory and two said it was good. All four G2's suggested that clarity of wording and presentation of the paper were good.

One G2 welcomed the specification of how many issues candidates should discuss in their responses. "This is good and it allows candidates to focus on and discuss in depth a few issues rather than worry about how many they are expected to raise given the marks allocated. This is a positive development and I would hope this style would also be adopted in future sessions." The examining team notes this comment.

One G2 stated that this is a great step forward with regard to the content of the questions, the philosophies being applied (industrial and product design), the subject topics used and the overall appeal to candidates and staff. It only lacks now an actual DESIGNING element …" The Paper 3 is designed to test candidate knowledge of the options, and not to test designing which is an element of Paper 2 and the Internal Assessment, which should reflect core topics as well as optional material. Within the constrains of the mark allocation, it would be difficult to provide parity of opportunities across all topic areas for designing.

Candidates are generally well prepared for the extended response questions and provided much more balanced answers than previously and teachers are to be congratulated for this.

The low take up options B,G and H will be addressed in the guide review that will take place over the next few years.

Option D: Food Technology

This option was less popular than last year. Ice cream was taken as the theme and the various questions explored different aspects of product development, manufacture and packaging. Again it is notable that the science and technology underpinnings of the food technology option are poorly understood by candidates, and this impacts on their overall performance.

Candidates must learn and understand the definitions, and relate these to the context selected.

Question 1

(a) This question, worth 2 marks, required candidates to list two organoleptic properties of food. Most candidates made a reasonable attempt at this question.

(b) This question, worth 3 marks and based on assessment statement D.2.4, required candidates to outline the role of tasting panels in developing the specification of an ice cream. A wide range of quality of answer was given by candidates.

Question 2

This question worth 2 marks and based on assessment statement D.3.12, asked candidates to outline how freezing extends the safe storage life of ice cream. Syllabus knowledge would have enhanced candidates ability to answer this question.

Question 3

This question asked candidates for 2 marks and based on D.4.5, to outline how aeration effects the physical properties of ice cream. Again, the ability to apply syllabus knowledge to this design context is critical to success.

Question 4

This question required candidates to list two ways in which food packaging is used as a promotional tool. Most candidates coped well with this question.

Question 5

This question required candidates to explain three ways in which food poisoning can be avoided and was based on D.8.9-16. One mark was awarded for identifying a way and two marks were awarded for an in depth explanation. Candidates who did not provide depth to their answer did not achieve the second mark for each way. Some candidates provided very thorough answers. This question discriminated well between weak and strong candidates.

Option E: Computer-Aided Design and Manufacturing

This option was framed in the context of the mass customization of sport shoes.

Question 1

(a) This question required candidates to provide a definition of mass customization. Most candidates were able to do this.

(b) This required candidates to state one input device used by customers to customize the design to their own requirements. Keyboard and mouse were acceptable answers, however a scanner was not.

(c) This required candidates to outline how mass customization transforms the relationship between the manufacturer and the customer. Most candidates provided reasonable answers to this question.

Question 2

This question required an explanation of an advantage of JIC to manufacturers. Picking up the second mark of explanation posed a problem for some weaker candidates.

Question 3

This required candidates to list two types of computer software that can be used for modelling. Some candidates offered the names of specific software packages rather than type of software..

Question 4

This required candidates to list two strategies that designers could employ for ease of disassembly at the end of the products useful life. Weaker candidates offered reuse, recycling and repair as responses rather than specific design suggestions for ease of disassembly.

Question 5

This question required candidates to explain three ways in which the internet can assist designers with design development. Strong candidates offered well structured answers, often in point form, with the use of bullet points; weaker candidates wrote with repetitive, unstructured and irrelevant material.

Option F: Invention, Innovation and Design

This option continues to be by far the most popular.

Question 1

Part (a) required candidates to outline one reason why Dyson's bagless vacuum cleaner is an example of radical design. Most candidates were able to identify that the radical aspect of the answer is its lack of a bag.

In part (b) candidates were required to outline why the cleaning robot exemplifies incremental and radical design. Surprisingly this proved quite difficult for all but the strongest candidates.

Part (c) required candidates to outline why inventor/entrepreneurs often have difficulty in obtaining financial support for an invention. This was fairly straight forward to most candidates.

Question 2

This required candidates to discuss the implications of adopting a pioneering strategy and was worth 3 marks. Again, weaker candidates did not go into sufficient detail to achieve the third mark. However, there were some strong responses to this question.

Question 3

This question required candidates to outline one reason why the majority of inventions failed to become innovations. Most candidates handled this question reasonably well.

Question 4

This question required candidates to discuss three ways in which global consumerism impacts on local cultures and or communities. This proved quite challenging for all but the stronger candidates. This candidates who developed structured answers were able to address the required points.

Option G: Health by Design

Very few candidates selected to do this option.

Question 1

Part (a) required candidates to outline how the hearing of the person whose audiogram was shown would be effected. This was answered well by most candidates.

Part (b) required candidates to explain the advantage of a digital hearing aid for the person whose audiogram was shown. Again this was well answered.

Question 2

This question required candidates to describe the function of a catalytic converter on a motor car. Surprisingly this question was not answered well and indeed many candidates left a lank space

Question 3

This required candidates to describe one advantage of one day disposable contact lenses. The responses to this were variable although strong candidates provided good answers.

Question 4

This question required candidates to outline one advantage of user-centred design. Most candidates provided adequate responses to this question and earned the two marks.

Question 5

This question required candidates to explain three ways in which money spent on ergonomic considerations can prevent RSI in the workplace and make a return on investment. Again well structured answers clearly demonstrated a depth of response and earned good marks.

Option H: Electronic Products

No candidates responded to this option so we have no additional information to supplement and question paper and the marks scheme.

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0-3	4-7	8-10	11-14	15-18	19-22	23-30

General comments

Again the format for each of the Paper 3 options is that question 1 is a data based question providing stimulus and context in the form of a table, photograph, flow chart, etc. The last question in each option is an extended response question worth 6 marks to provide a better opportunity for candidates to demonstrate their understanding. It is through this question and its extended response that the more able candidates are able to demonstrate their ability and weak candidates can be better discriminated from stronger candidates. It is important to reinforce with candidates that a question worth 6 marks is generally looking for 6 specific points in the answer, and that these can be presented as a lists of points.

One G2 was received, which stated that the paper was of a similar standard to last year's, and that the level of difficulty was appropriate, that syllabus coverage was satisfactory, and clarity of wording and presentation of the paper were satisfactory.

In popularity order the options are ranked: F, E, D, C, G, A, B, H. The inconsistencies of candidates options selected at individual schools (candidates from some schools selected 3 different options) 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 1

The database for this question showed a diagram of a mycoprotein fermenter.

(a) This question, worth 1 mark on A.5.1, asked candidates for one raw material that can be used for mycoprotein production. Possible answers are grain waste and paper flour. Most candidates correctly answered the question.

(b) This question on A.5.3 and worth 2 marks, asked candidates to outline one characteristic of a raw material used in commercial mycoprotein production. Possible answers included: cheap substrate, safe to eat, easily processed, no technological effects and no residues or contaminants from substrates. Candidates tended to either achieve both marks for this question or no marks, few received just 1 mark..

(c) This question, worth 1 mark, draws on assessment statement A.5.2. and asked for 1 nutritional advantage of mycoprotein. A mark was given for low cholesterol or fat, high protein, low salt, high fibre. Most candidates achieved the 1 mark.

(d) This question asked for a description of how mycoprotein is processed, based on A.5.4 and worth 2 marks. The answer was mix the dough with a binding agent and flavouring agent and colouring agent [1] then form the mix to the required shape [1]. This question was not successfully answered by the majority of candidates.

Question 2

This question, worth 3 marks on A.2.7, required candidates to explain why stainless steel is an appropriate material to use in Mycoprotein production equipment. A mark was given for points including corrosion resistant, does not need finishing, can be sterilized with steam, can be shaped into large vessels, easy to clean, strong, hard wearing and low maintenance.

Question 3

This question asked candidates to explain why timber needs to be seasoned and the consequences of using unseasoned timber. For 6 marks it should be clear to candidates that 3 marks, and so 3 points, would be expected for each part of the question. The stronger candidates recognized this and organized their answer appropriately. Acceptable reasons included natural timber has a high moisture content, not easily workable, shrinks unevenly and needs to have stabilized dimensions. The consequences include distortion due to uneven shrinkage, not straight, change in length and breadth and joints may come apart.

Option B: Microstructures and Macrostructures

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

Question 1

(a) This question, worth 2 marks, required candidates to list 2 design contexts in which wire is used. Most of the few candidates who attempted this option received 2 marks. Acceptable answers included electrical telephone wiring, fencing, cabling, suspension bridges and wheel spokes.

(b) This question, worth 2 marks draws on assessment statement B.4.7 and asked candidates to outline one effect of alloying on ductility. The effect that was required was that ductility is reduced by alloying [1] as the presence of foreign atoms interferes with the movement of atoms in the crystal during plastic deformation [1].

Question 2

(a) This question worth two marks and based on assessment statement B.2.1, asked candidates to describe a metallic bond. The 2 points required were that it is a positively charged metal atom nuclei [1] in a negatively charged cloud.sea of electrons [1]. Responses to this question were often vague, and generally candidates did not do well.

(b) This question based on assessment statement B.3.2 and worth 3 marks asked candidates to explain why metals have very high electrical and thermal conductivity. Marks were awarded for distinct points about electrical conductivity requires the movement of electrons through material [1], the free electroncs in the sea of electrons are extremely mobile [1], the more free the electrons, the more easily heat or electricity can be conducted through the material [1].

Question 3

This question asked candidates to explain the stress/strain graph and its relevance to the manufacture of wire. It is based on assessment statement B.7.4. Three marks were awarded for explaining the graph, and 3 for its relevance to the manufacture of wire. The explanation points included: the graph identifies the way a material responds to a load; the straight line section is the elastic region [1]; the cured line section is the plastic region [1]; the point at which the elastic deformation ends and the plastic deformation begins is called the yield stress [1]. The relevance of the graph to the manufacture of wire included: enough force has to be

exerted to put the material into the plastic region so the wire will then retain its size and shape when the force is removed [1]; if not enough force is applied to material will remain in the elastic region and will return to its original size and shape when the force is removed [1]; if too much force is applied the material will fracture [1].

Option C: Appropriate Technologies

Question 1

(a) This question, worth 1 mark, required candidates to define renewable resources. One mark was given for stating that they are naturally replenished in a short period of time/less than one human lifetime. Most candidates achieved this mark.

(b) This 1 mark question required candidates to state one renewable energy resource. A mark was given for wind, wave, water, solar, biomass, hydroelectric, tidal, geothermal.

(c) This question required candidates to outline how planned obsolescence of TV's and other products can help shift consumers towards more energy efficient products. Answers required were that it determines the effective life of the product and determines that it has to be replaced [1] and that the replacement of a later version is more energy efficient [1].

Question 2

This question related to the energy star stimulus to Option C, and asked candidates to explain why market pull has been created for energy efficient products, from assessment statement C.5.12. One mark was given for the answers: consumer attitudes have shifted and they now want less polluting more energy efficient products; conservation of energy resources makes products cheaper to run; there is now a growing number of green consumers.

Question 3

This question required candidates to list 2 proposals agreed by participants as part of the Agenda 21 conference. One mark was given for each of 2 points; most candidates received the two marks for this question.

Question 4

This question required candidates to explain 2 ways in which energy utilization in manufacturing is consistent with sustainable development. Candidates were given 3 marks for each of 2 explanations from: minimizing waste of energy; optimizing energy efficiency of systems; and maximizing the use of renewable energy resources. The majority of candidates who attempted this question scored 3-5 marks.

Option D: Food Technology

This option was less popular than last year. Ice cream was taken as the theme and the various questions explored different aspects of product development, manufacture and packaging. Again it is notable that the science and technology underpinnings of the food technology option are poorly understood by candidates, and this impacts on their overall performance.

Candidates must learn and understand the definitions, and relate these to the context selected.

Question 1

(e) This question, worth 2 marks, required candidates to list two organoleptic properties of food. Most candidates made a reasonable attempt at this question.

(f) This question, worth 3 marks and based on assessment statement D.2.4, required candidates to outline the role of tasting panels in developing the specification of an ice cream. A wide range of quality of answer was given by candidates.

Question 2

This question worth 2 marks and based on assessment statement D.3.12, asked candidates to outline how freezing extends the safe storage life of ice cream. Syllabus knowledge would have enhanced candidates ability to answer this question.

Question 3

This question asked candidates for 2 marks and based on D.4.5, to outline how aeration effects the physical properties of ice cream. Again, the ability to apply syllabus knowledge to this design context is critical to success.

Question 4

This question required candidates to explain two ways in which food packaging can contribute to the development of brands. Most candidates coped well with this question.

Option E: Computer-Aided Design and Manufacturing

This option took the context of mass customization of sport shoes.

Question 1

(a) This question required candidates to provide a definition of mass customization. Most candidates were able to do this.

(b) This required candidates to state one input device used by customers to customize the design to their own requirements. Keyboard and mouse were acceptable answers, however a scanner was not.

(c) This required candidates to outline how mass customization transforms the relationship between the manufacturer and the customer. Most candidates provided reasonable answers to this question.

Question 2

This question required an explanation of an advantage of JIC to manufacturers. Picking up the second mark of explanation posed a problem for some weaker candidates.

Question 3

This required candidates to list two types of computer software that can be used for modelling. Some candidates offered the names of specific software packages rather than type of software..

Question 4

This question required candidates to discuss one advantage and one disadvantage of mass customization for manufacturers, with 3 marks for an advantage and 3 for a disadvantage. Some candidates discussed advantages and disadvantages without relating it to the manufacturers' perspective.

Option F: Invention, Innovation and Design

This option continues to be by far the most popular.

Question 1

Part (a) required candidates to outline one reason why Dyson's bagless vacuum cleaner is an example of radical design. Most candidates were able to identify that the radical aspect of the answer is its lack of a bag.

In part (b) candidates were required to outline why the cleaning robot exemplifies incremental and radical design. Surprisingly this proved quite difficult for all but the strongest candidates.

Part (c) required candidates to outline why inventor/entrepreneurs often have difficulty in obtaining financial support for an invention. This was fairly straight forward to most candidates.

Question 2

This required candidates to discuss the implications of adopting a pioneering strategy and was worth 3 marks. Again, weaker candidates did not go into sufficient detail to achieve the third mark. However, there were some strong response to this question.

Question 3

This question required candidates to explain two reasons why the majority of inventions fail to become innovations. Most candidates handled this question reasonably well.

Option G: Health by Design

Very few candidates selected to do this option.

Question 1

Part (a) required candidates to outline how the hearing of the person whose audiogram was shown would be effected. This was answered well by most candidates.

Part (b) required candidates to explain the advantage of a digital hearing aid for the person whose audiogram was shown. Again this was well answered.

Question 2

This question required candidates to describe the function of a catalytic converter on a motor car. Surprisingly this question was not answered well and indeed many candidates left a blank space

Question 3

This required candidates to describe one advantage of one day disposable contact lenses. The responses to this were variable although strong candidates provided good answers.

Question 4

This question required candidates to discuss the properties of vascular prostheses produced by weaving and knitting. Weaving properties, for 3 marks included high dimensional stability, low water permeability and suitable for larger vessels. Knitting properties included low dimensional stability, high water permeability and suitable for smaller vessels.

Option H: Electronic Products

No candidates responded to this option so we have no additional information to supplement the question paper and the marks scheme.

Conclusion

The good understanding of the action verbs (e.g. state, outline, describe, explain) seen in the past continued to be evident, as did 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. Very few tables were used and more use could be made of this type of answer structure. 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.

Appendix

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.

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.