DESIGN TECHNOLOGY

Overall grade boundaries

Higher level

Grade:	1	2	3	4	5	6	7
Mark range:	0-16	17-31	32-42	43-53	54-65	66-76	77-100

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0-17	18-34	35-46	47-58	59-68	69-80	81-100

Introduction

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. We trust this continues to be a useful form of review and assistance in planning to teach DT. We would welcome feedback about the usefulness of the report and any suggestions about how to make it more effective. The most obvious way to ensure usefulness is through the submission of G2 Forms.

Teachers have three options for submitting the G2 forms – through either IBNET or the OCC, or in hard copy form. Disappointingly, the number of G2 Forms submitted was significantly less than last year. The numbers of forms received were as follows:

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

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.

PLEASE COMPLETE A G2 FORM AFTER EACH EXAMINATION EVEN IF IT TO PROVIDE NO COMMENTS BUT JUST TO LET THE EXAMINING TEAM KNOW THAT THERE WERE NO PROBLEMS

This session has seen 40 schools (14 new) and 202 candidates being examined at SL, a 24% increase over May 2005; and 43 schools (11 new) and 315 candidates at HL, an 11% increase over May 2005.

The new schools offering SL were from seven different countries and the new HL schools were from six different countries. The maximum number of candidates from any one school is 32 and the minimum is one. The majority of schools have less than 10 candidates.

These numbers represent continued significant growth in DT, and while not as dramatic as last year, nevertheless gratifying.

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

Component grade boundaries

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

The number of schools opting to take Design Technology in the May session continues to grow to the benefit of the subject. Most of the new schools submitted work of a suitable nature, but closer examination of the assessment criteria and better guidance is required if candidates are to obtain higher marks. Work ranged from design and make activities through to smaller laboratory based experiments. Those schools that are established in the teaching of IB Design Technology continue to make some improvements to their own schemes of work to the benefit of student outcomes. The schools that adopted to use the design and make route do seem to have faired better when addressing the assessment criteria, but not all areas were always done well. It is advised to use coursework as a support exercise in order to help students understand the theoretical nature of the subject. The topics covered by coursework should be entered on the form 4PSOW along with the time taken for each investigation. Teachers support materials that are given to students to enable them to carry out investigations should be included with the sample.

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. All work that has been highlighted, along with evidence of the group 4 project, should be sent for moderation. Other elements of the coursework are not required for moderation. Where moderation could not happen more evidence of work was requested from the schools. In a number of schools there is still some confusion over what should be contained within the project report and logbook. The logbook is not formally assessed, but reference should be made to pages throughout the report. Work continues to be

submitted in a wide range of formats, but most are presented in an organized structure. Photocopied work should be easy to read and sketches should be easily identifiable. Colour photocopies would be preferred where this is deemed important to clarify the assessment mark. Some teachers use labels to indicate which work is to be assessed, this is to be in encouraged as it aids the process of moderation. Where the reports are clearly labeled to address the assessment criteria candidates have generally scored well. Some of the work submitted was disorganized and in an inappropriate format. To avoid this teachers are encouraged to send an individual student sample per folder/folio with the form 4 PSOW attached.

Candidate performance against each criterion

P1(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 aspect. Common errors included a repetition of a problem set by the class teacher and the omission of any reference to built in constraints. When using the design project assessment criteria, students should consider the feasibility of the study and produce a detailed specification.

P1(b): Most candidates displayed evidence of planning, but methods did not always control the variables. Those who included annotated diagrams did seem to fare better. When considering the design project some candidates omitted a detailed plan of action and material list. Materials and processes must be included if students are to achieve a high mark under this heading. Gantt charts are to be encouraged, but time intervals must be realistic. Those who had written their plan in retrospect failed to address some of the assessment criteria. Evidence of ongoing work could be in the form of photographs and annotation.

DC: Smaller investigations where candidates had to collect ‘raw’ quantitative data offered ample opportunity to address the assessment criteria, however not all students had entered the correct units. 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. Students should fully analyze the brief in Pl(a) if they are to prioritize strategies in which to collect focused data. Those that achieved a high mark in this section displayed evidence of focused research that had been annotated to indicate its relevance in order to solve the design problem and answer the analysis. Not all candidates design ideas were supported by an initial evaluation.

DPP: Most candidates addressed the majority of the assessment criteria, but detailed annotation and careful presentation of improvements was not always considered. Drawings and evidence of modelling should be presented in an appropriate format. CAD should be encouraged as it not only offers visualization, but also allows students to explore how parts link and move against one another. 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. Modelling using a wide range of materials and orthographic projection drawings are to be encouraged. Most candidates omitted the need to state ‘final specifications’.

CE: In most instances insufficient time had been allocated to completing a thorough evaluation/conclusion. Some candidates only offered superficial personal evaluations with no consideration being made to address the specification and suggest realistic improvements. Students should be encouraged to test their outcomes in the area for which they had been designed and suggest improvements in sketches. The more organised candidates did leave adequate time to address the criteria to a satisfactory standard. Most candidates omitted the need to state ‘modified specifications’.

Recommendations for the teaching of future candidates

Teachers should consider how best to use IA when covering topics in the syllabus. Small investigations that test material properties and products are to be encouraged as these allow students to gain more experience of assessment procedures and improve the overall quality of their work.

Design and make activities require more time, but are necessary if students are to develop the necessary skills to undertake the design project. The teaching of skills required to improve the marks of DPP is to be encouraged. Only a few students currently seem to understand the importance of modelling to overcome the constraints of the user, manufacture, materials, ergonomics and costs.

The use of the OCC is to be encouraged if teachers and students are to become more confident in the teaching of design technology.

Higher level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-10	11-15	16-21	22-25	26-30	31-34	35-40

General comments

The average score for HL Paper 1 was 27.8, slightly higher than the average for May 2005 which was 26.2. An examination of the papers and the statistics may indicate that the candidates are better prepared for the examination this year, with fewer new schools than in 2005, allowing for some consolidation of teaching. An alternative explanation could be an easier paper, but the G2 responses indicate that the paper is of a similar standard to last year, a position reinforced by the examining team.

Five G2s were received for this component, all of whom responded to the item judged it was a similar standard to last year. All five suggested it was an appropriate level of difficulty, one said syllabus coverage was satisfactory and four said it was good; two said clarity of wording was satisfactory and three said it was good; two said the presentation of the paper was satisfactory and three said it was good.

Two G2's made general comments, that it was a true fair exam with good coverage. One comment, from a new school for this paper, felt it was generally a bit lenient.

Only one specific comment was made, and that was related to Question 5. The comment was that most DT textbooks refer to an ergonome as a 2-dimensional model, and the IB DT glossary defines it as 3-dimensional, thus creating confusion for students. This is a fair comment and has been addressed in the DT new guide. The statistics for Q5 indicated the item was a fair discriminator with a reasonable Difficulty Index.

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 marking software 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	6	37	14	257*	81.84
2	284*	10	19	1	90.44
3	41	13	12	248*	78.98
4	11	74	212*	16	67.51
5	28	243*	19	24	77.38
6	17	266*	12	19	84.71
7	15	245*	6	48	78.02
8	274*	27	1	12	87.26
9	53	11	23	227*	72.29
10	59	46	192*	17	61.14
11	238*	73	2	1	75.79
12	38	20	14	242*	77.07
13	211*	33	38	31	67.19
14	28	269*	16	1	85.66
15	173	13	114*	14	36.30
16	25	31	258*		82.16
17	36	246*	8	24	78.34
18	39	22	239*	14	76.11
19	286*	1	6	21	91.08
20	39	238*	15	20	75.79
21	27	34	225*	26	71.65
22	41	129*	91	53	41.08
23	154*	60	54	44	49.04
24	8	5	54	247*	78.66
25	17	34	172*	91	54.77
26	106*	37	84	87	33.75
27	10	14	109	181*	57.64
28	41	21	222*	30	70.70
29	150*	82	39	43	47.77
30	12	77	216*	9	68.78
31	14	69	77	152*	48.40
32	83	201*	11	17	64.01
33	24	222*	17	50	70.70
34	27	12	103	171*	54.45
35	15	58	19	221*	70.38
36	268*	23	10	11	85.35
37	11	25	269*	7	85.66
38	6	250*	6	50	79.61
39	83	37	26	167	53.18
40	232*	6	67	8	73.88

The examining team analysed the statistics on all the questions, and while none had a negative discrimination index, those questions where a significant number of candidates selected an incorrect option were more closely scrutinized.

Many candidates found Question 15 confusing, selecting option A rather than the correct answer, C. It seems that candidates considered increased flexibility to be a characteristic of automation, which is not the case.

In Question 22 a high number of candidates incorrectly selected option C, but recycling is not the "primary reason" for adding scrap glass, even though it could be a reason.

A number of candidates incorrectly selected option D in Question 25. While fermenting is part of the mycoprotein development process it is not the process that provides the required shape of the food product.

In Question 27, Option C was selected by many of the candidates, but this simply seems to be because of confusion with the correct option D.

Question 34 related to the calculation of stiffness and it seems that many students incorrectly selected option C because of their familiarity with the formula for Young's Modulus: stress/strain.

Higher level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-8	9-17	18-21	22-28	29-35	36-42	43-60

General comments

The format of the Paper 2 followed the Higher Level standard Paper 2 format with the paper divided into two sections: Section A and Section B. Section A is worth 40 marks and comprises six questions – a data-based question (question 1) worth 20 marks and five questions worth 4 marks each and providing syllabus coverage. Students are required to answer all six questions in Section A. Section B comprises three questions each worth 20 marks, of which students are required to answer one question. Each question in Section B comprises three parts with each part divided into two or three sub-sections. The questions are contextualized by the provision of stimulus material – generally a photograph reflecting a particular design scenario and the questions posed explore different aspects of the design scenario to provide syllabus coverage. Through the paper the examining team tries to ensure that evidence will be available to enable the determination of the grade boundaries through the application of the Group 4 Grade Descriptors.

Of the four G2 comments three were from new schools and so only one could comment about the standard of the paper compared to the previous year. That one G2 comment suggested that the paper was of a similar standard to last year. The mean mark for this paper (M2006) was 33.1 which compared with 36.3 for May 2005, 34.5 for May 2004 and 33.3 for May 2003 suggesting that although the paper was indeed a little more difficult than in 2005 it was fairly comparable with earlier years. All four G2s suggested that the paper of an appropriate difficulty. One said syllabus coverage was satisfactory and three said it was good. Two suggested that clarity of wording was satisfactory and two that it was good. Two said the presentation of the paper was satisfactory and two said it was good.

Specific G2 comments suggested that in relation to Question 1a students may need specific knowledge of this type of cycle. This is not a view shared by the examining team and perhaps it is worth reminding teachers that the point of Question 1 is that it is to provide the opportunity for students to demonstrate data analysis and problem-solving skills and should be something that is off syllabus and providing an unfamiliar context for the demonstration of these skills. Most of the average and above students coped well with the question and there were no obvious problems. One final G2 comment suggested that the paper was a: 'Very good paper, a bit lenient'.

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

Section A

Question 1 (a) (i) required students to read data from a table and to state the dimensions (in metres) of the smallest rectangular box that the folded bicycle shown in Figure 3 could be delivered in. Question 1 (a) (ii) required students to list two actions, apart from the actual folding, required to fold the bicycle as shown in Figure 3. Analysing the two photographs of the bicycle in its unfolded and folded states led most students to the right answer. Question 1 (a) (iii) proved more problematic for candidates and required students to consider the folded bicycle and work out if it could be laid flat in the storage area of the Mini and/or the Smart Car. Only about half the candidates were able to do this. The ability to think in three dimensions is an important aspect of designing.

Question 1 (b) (i) asked students to describe the importance of stiffness in the design of the frame of the bicycle shown in Figure 2. This was quite difficult and few candidates achieved 2 marks for their responses. Question 1 (b) (ii) was meant to be more difficult and indeed was proven to be so by most candidates! The rounded rectangular cross-section of the cross bar acts like an I-beam and puts more material in the line of the applied force. Few candidates achieved 2 marks and many did not even achieve 1 mark on this question.

Question 1 (c) (i) required candidates to list two advantage of using extrusion for the manufacture of the metal tubing for the frame of the bicycle. This was fairly straightforward for most students. Question 1 (c) (ii) asked for a description of why the design of the folding bike is an example of incremental design. Many students provided very good responses to this question.

Some new data was then introduced and Question 1 (d) (i) went on to explore this data asking candidates to state how many frame sizes Manufacturer A needed to produce to cover the full range of rider heights. Clearly many candidates did not read the question properly or the table and started adding up all the frame sizes. Question 1 (d) (ii) required students to explain the disadvantage to Manufacturer B of producing an increased number of frame sizes to cover the range of rider heights. Many students achieved 2 marks for their responses with a few providing sufficiently detailed answers to gain 3 marks.

Question 1 (e) (i) required students to list two ways in which manufacturers might ensure that for any given frame size that the bicycle safely and comfortably accommodates its rider. Two types of responses were accepted – one type talked about user trials, the other about adjustability of seat height and handlebars. Question 1 (e) (ii) asked for the advantage and disadvantage of a user trial in collecting ergonomic data.

Question 2 (a) required students to define lamination and posed problems for many candidates who defined lamination as providing a plastic cover for a sheet of paper or something similar rather than the glossary definition. Many students were able to gain one or two marks on Question 2 (b) which asked students to discuss the advantage of using lamination as a manufacturing technique. Only the best students provided sufficiently detailed responses to earn the full three marks.

Question 3 (a) required students to state one way in which mild steel can be treated to prevent rusting and posed few problems to students. Question 3 (b) asked students to explain why cotton is treated to make it suitable for use in various applications. The question was reasonably well tackled by students.

Question 4 (a) required a definition of electrical resistivity. Few students provided the glossary definition but many were able to provide a definition which earned them the mark allocated to the question. Question 4 (b) required students to explain why an electrical wall socket uses materials with different electrical resistivities. This question posed few problems for candidates.

Question 5 (a) asked for a description of how designers use brainstorming in the development of a design. Most but by no means all students were able to answer what had appeared to be a reasonably straightforward question. Question 5 (b) required a comparison of divergent and convergent thinking. Only about half the students were able to make an appropriate comparison.

Question 6 (a) asked for a definition of planned obsolescence. This was achieved satisfactorily by most students. The second part of the questions - Question 6 (b) – however was more problematic and whilst there were some very good answers there were also some very poor ones.

Section B

The design context for Question 7 focused on a hairdryer. Question 7 (a) (i) asked students to list two advantages of 2-D and 3-D freehand drawings to designers. The question posed few problems for most candidates. Question 7 (a) (ii) went on to ask why designers use a variety of drawing and modeling techniques to represent ideas. This was more problematic for candidates with some candidates reading the question as if it focused just on drawing techniques. The question then went on to explore the thermoplastic used to manufacture the body of the hairdryer. Question 7 (b) (i) asked for two reasons for why a thermoplastic would be selected for the manufacture of the hairdryer and posed few problems for candidates. Question 7 (b) (ii) asked for a description of the structure and bonding of a thermoplastic and proved more problematic with few candidates providing lucid descriptions. Question 7 (c) (i) asked for an outline of one way in which injection moulding can be considered as an example of a clean technology and was fairly well answered. Question 7 (c) (ii) asked for a discussion of three ways in which the design of a hairdryer can be modified to minimise its environmental impact – one relating to production, one to utilization and one to disposal. This was surprisingly poorly answered by many candidates mainly due to lack of structure of answers, repetition and insufficient depth of response although there were some superb answers from good candidates.

The focus for Question 8 was a renewable energy project featuring wind generators. Question 8 (a) (i) asked students to outline one aspect of wind generators for which constructive discontent might be relevant. Many students gave good responses focusing how noise or visual pollution might be a catalyst for constructive discontent. Question 8 (a) (ii) asked for an annotation of a simple input-process-output model to explain the process of converting wind energy into electrical energy. The question did not pose a problem for most students who were able to develop and annotate an appropriate diagram. Question 8 (b) (i) asked for two fixed costs relating to the wind farm and Question 8 (b) (ii) asked for two variable costs. These were handled in a fairly straightforward manner by most candidates. Question 8 (c) (i) asked for a list of two characteristics of appropriate technology which are met by supplying energy using wind generators. This was more problematic and some students found the link from the wind farm to the concept of appropriate technology difficult to make. Question 8 (c) (ii) asked for a discussion of three issues involved in the development of a policy for the introduction of a large-scale wind farm – one at community level, one at national level and one at international level. This seemed to be a challenge for most candidates who seemed unable to think about the three different levels and issues at each level. Poor structuring of answers, unnecessarily wordy responses and repetition meant that some extensive responses earned few marks. As often happens students planning their answers in pencil and answering in a structured format using a table or bullet points were able to score best on this question.

Question 9 focused on a robotic assembly line producing stainless steel tumble dryers.
Question 9 (a) (i) asked students to list two advantages of automating the volume production. Most candidates were able to earn 2 marks on this answer. Question 9 (a) (ii) asked for an explanation of how industrial robots offer greater flexibility to automated production systems. Good candidates discussed the programmability and re-programmability of industrial robots and how they could be used to produce different products and variations on products. Weak candidates did not seem to understand the term flexibility. Question 9 (b) (i) asked for a description of a metallic bond and was

very badly answered by the majority of candidates. Question 9 (b) (ii) asked for one advantage and one disadvantage of using stainless steel for the panels of the tumble dryer and posed few problems for all but the weakest candidates. Question 9 (c) (i) asked for a description of how a specific joining process for joining the stainless steel sides of the tumble dryer to its plastic top affects the ease of recycling of the tumble dryer on disposal at the end of its life cycle. Many candidates did not identify a specific joining process. Some candidates provided answers discussing permanent and non-permanent joining processes and earned maximum marks. Question 9 (c) (ii) asked for an explanation of the ways in which automated production impacts on the workforce and working conditions. Whilst there were some very good answers from candidates who planned their answers and organized them using bullet points or a tabular format, there were also some very long, unfocused answers taking several pages with lots of repetition and earning few marks.

Higher level paper three

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-6	7-12	13-16	17-21	22-26	27-31	32-40

General comments

Four G2s were received. One G2 commented that the paper was of a similar standard to the previous year. All four G2s suggested that the level of difficulty was appropriate. One G2 suggested that syllabus coverage was satisfactory and three said it was good. Two G2's suggested that clarity of wording was satisfactory and two that it was good; and one that the presentation of the paper was satisfactory and three that it was good.

Only two G2's made any general comments, and that was that it was a good and fair paper.

The main difficulties for candidates appeared to be with examination technique and knowledge. The range of knowledge and understanding did vary from excellent to very poor. It was clear that some candidates had rote learnt definitions but had difficulty applying them to a context or did not realize that the answer required understanding with examples.

It appeared that for many candidates they had the ability to construct answers, but had not read the question adequately enough to develop an appropriate answer. The weak candidates appeared to be very ill-prepared for the examination; this was typically the case where candidates for the same school attempted different options.

It would be beneficial for all students to practice examination techniques, especially how to answer Question 5 in each option. Some students highlighted or underlined key elements of the questions, and these candidates seemed to do well. The marks allocated for each of the action verbs should be clear to candidates so they can structure answers appropriately.

Some candidates appear to structure their answers, particularly the Question 5's as an essay with an introduction and a conclusion. This generally does not gain them any marks, as marks are only awarded for the relevant points made.

The mean score for the paper was 21.4, exactly the same as May 2005.

The low take up of Options G and H continues and is being addressed in the current guide review.

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

OPTION D – FOOD TECHNOLOGY

This option was a little more popular than last year, but still not selected by a large number of candidates.

Question D1

a) Most candidates made a successful attempt at this question for 2 marks, although some reiterated information which was already supplied, for example, weight.

b) This question was generally not answered well because it seemed that most candidates did not realize they were required to specify a food product, though many gave reasons for the development.

Question D2

Many candidates did not seem to understand the nature of pasteurization and discussed issues related to nutrients.

Question D3

The majority of candidates who answered this question did so successfully.

Question D4

This question was well answered by most candidates by naming the food product and how it had been modified. Some candidates did not orient their answer to food production, but to some other impact of genetic modification.

Question D5

Many candidates did not limit their answers to cooking, but discussed kitchen and personal hygiene in the preparation and storing of food.

OPTION E – COMPUTER AIDED DESIGN AND MANUFACTURING

This option was framed in the context of the use of CAD in the initial design of accommodation.

Question E1

a) There were a number of poor answers to this question because candidates did not focus on the **relationship** between the designer and consumer, but discussed aspects of the advantages of CAD.

b) Many candidates listed a number of criteria, rather than choosing ONE criteria and discussing it by mentioning two points about why the criteria is important.

Question E2

Some candidates provided an explanation of the nature of VR rather than outlining how its use could conserve resources, though the majority of candidates successfully answered this question.

Question E3

The majority of candidates answered this question successfully.

Question E4

Some candidates in their response to this question defined lean production – this was unnecessary and wasted time and space for their answer. Other candidates listed two qualities, rather than choosing ONE and discussing it, and consequently only received ONE mark.

Question E5

Many candidates in their answer to this question discussed the effects of growth, rather than the reasons for growth. Candidates who structured their answer well did better by identifying three reasons and then mentioning two points related to each reason for a total of 9 marks.

OPTION F – INVENTION, INNOVATION AND DESIGN

This option continues to be by far the most popular selected by students.

Question F1

a) Most candidates recognized incremental as small changes but some did not follow through and relate it to the bicycle.

b) Again, as is common in an "Explain" question worth three marks, a number of candidates listed three inventions rather than explaining ONE. A deeper response is required in this type of question, and candidates should be aware of that requirement.

Question F2

Many candidates received full marks for this question, although some described or defined market pull rather than applying the idea to the pump.

Question F3

The majority of candidates successfully provided two points of comparison between the lone inventor and the product champion.

Question F4

The main reason for loss of marks in this question was the lack of understanding of the term "robust design", interpreting it as the strength of the bicycle.

Question F5

The majority of candidates were successful with this question. Some discussed advantages to the manufacturer rather than the consumer; the other main reason for loss of marks was because of an unstructured response. THREE advantages were needed, and then a discussion on each one making two distinct points in each discussion.

OPTION G – HEALTH BY DESIGN

Very few students selected to do this option, and those that did seemed not to have been taught the Option or had spent little time in preparation.

OPTION H – ELECTRONIC PRODUCTS

The very few candidates who attempted this Option performed poorly.

Standard level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-7	8-13	14-20	21-23	24-25	26-28	29-30

General comments

Five G2's were received. All who responded to the item stated that this year's paper was of a similar standard to last year's. All five felt that the level of difficulty was appropriate. One thought the syllabus coverage was satisfactory and four that it was good, two that the clarity of wording was satisfactory and three that it was good, and two that the presentation of the paper was satisfactory and three that it was good.

The mean score for this paper of 21.7 was slightly higher than the May 2005 paper (19.4), but very close to the 2004 mean (20.6) and the 2003 mean (21.8). This is a positive outcome, given that there was a 24% increase in candidates in 2006 compared with 2005.

There were two general comments about the exam in the G2's indicating that it was a fair paper and straight from the syllabus. There were no specific comments about any questions.

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.

The marking software 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	10	31	13	143*	72.58
2	57	138*	1	1	70.05
3	172*	9	11	4	87.30
4	19	14	158*	6	80.20
5	29	20	11	137*	69.54
6	20	9	161*	6	81.72
7	13	52	125*	7	63.45
8	169*	26	2		85.78
9	10	148*	12	27	75.12
10	139*	25	9	23	70.55
11	7	148*	9	33	75.12
12	12	116*	22	47	58.88
13	153*	27	1	16	77.66
14	17	29	30	121*	61.42
15	46	10	11	130*	65.98
16	31	115	4	47	23.85
17	43	34	104*	15	52.79

18	35	5	12	145*	73.60
19	4	3	3	187*	94.92
20	9	4	168*	15	85.27
21	140*	30	11	16	71.06
22	145*	1	47	4	73.60
23	87	14	85*	11	43.14
24	15	29	147*	6	74.61
25	11	15	171*		86.80
26	28	8	48	112*	56.85
27	27	157*	7	6	79.69
28	12	173*	7	5	87.81
29	178*	1	3	15	90.35
30	1	169*	3	24	85.78

The examining team analysed the statistics on all the questions, and while none had a negative discrimination index, those questions where a significant number of candidates selected an incorrect option were more closely scrutinized.

The majority of candidates incorrectly selected option B, machining in Question 16 as an example of shaping, the correct answer being Option D, weaving. In Topic 4 of the syllabus, weaving is explained as a shaping process while machining is an example of a wasting process.

About equal numbers of candidates selected Options C (correct) and A (incorrect) in Question 23. Option A is incorrect because increased flexibility is not a characteristic of automation.

Standard level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-7	8-14	15-16	17-21	22-26	27-31	32-40

General comments

The format of the Paper 2 followed the standard Paper 2 format with the paper divided into two sections: Section A and Section B. Section A comprises three questions – a data-based question (question 1) and two questions providing syllabus coverage. Students are required to answer all three questions in Section A. Section B comprises three questions of which students are required to answer one question. Each question in Section B comprises three parts with each part divided into two or three sub-sections. The questions are contextualized by the provision of stimulus material – generally a photograph reflecting a particular design scenario and the questions posed explore different aspects of the design scenario to provide syllabus coverage. Through the paper the examining team tries to ensure that evidence will be available to enable the determination of the grade boundaries through the application of the Group 4 Grade Descriptors.

Of the six G2 comments three suggested that the paper was of a similar standard to last year and one said that it was a little more difficult. The mean mark for this paper (M2006) was 20.6 overall with new schools performing well with a mean mark of 21.8. 20.6 compares with 17.3 for May 2005, 20.9 for May 2004 and 19.1 for May 2003 suggesting the paper was indeed a little more difficult than the previous year but fairly comparable with earlier papers. All six G2s suggested that the paper of an appropriate difficulty. Two said syllabus coverage was satisfactory and four said it was good. Three suggested that clarity of wording was satisfactory and three that it was good. Two said the presentation of the paper was satisfactory and four said it was good.

Specific G2 comments said: 'In Question 1a students were unsure of the word recessed' and suggested that the diagram should have been marked. Most of the good students coped well with the question and achieved full marks. However it may have impacted on the performance of weaker students. Unfortunately that is the nature of the discrimination in examination papers. Also that in Question 4c(ii) that 'the wording was difficult'. The question required students to explain one way in which by considering the design pre-production designers can minimize the impact of the refrigerator at each of three different stages of its lifecycle. Whilst students did not seem to have problems there were specific issues in relation to the way students responded as might have been expected. Those students providing in-depth responses in relation to ways in which designers could minimize environmental impact achieved the highest marks. Some students did not go into detail but listed three (or more) different ways for each lifecycle stage. The action words Explain and Discuss are expecting a more in-depth treatment of issues. One G2 commented was that it was a fair exam, that the test was well-written and appropriate and that there was good syllabus coverage.

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

Section A

Question 1(a) (i) was generally answered well. Some candidates did not provide units for the total thickness of the six components in the flat pack and so lost a mark. In Question 1(a) (ii) most students, apart from the weakest students, were able to outline one reason for incorporating the recessed section at the front of the base unit. In Question 1(b) (i) the explanations of many students for why measurements of the 5th percentile range would be used to determine horizontal reach in the design of the kitchen units were poor. Question 1(b) (ii) required students to explain the value of using a manikin in the design of the kitchen units. Many answers lacked depth. For three marks an 'Explain' question requires three separate marking points in a detailed explanation. Question 1(c) (i) required students to state one advantage of distributing the kitchen units as flat packs for the manufacturer and answers were generally good. Question 1(c) (ii) was very poorly answered – the question required students to explain how the components of the kitchen unit would be flat packed to prevent their damage during distribution. Many students elaborated on their answers to (i) and explained 'why' not 'how'. It is critically important that students read the questions and answer the question that is asked.

Question 2 (a) required students to state one example of a fixed cost. Most, but not all, students were able to do this. Question 2 (b) required students to explain how fixed costs are reflected in the final cost of an individual product. Whilst there was some very poor answers there was also some extremely good ones in which students explained how a proportion of the fixed costs, dependent on the breakeven point as determined by the manufacturer, are added to the variable costs plus a profit margin to result in the price of the product.

Question 3 (a) required students to define green design and was answered by most candidates. Question 3 (b) asked students to explain the role of legislation in promoting green design. There were few really good answers and many poor ones.

Section B

Question 4 (a) (i) asked students to define fashion and was answered well by most students. Question 4 (a) (ii) asked for an outline of one aspect of the refrigerator that is influenced by fashion. Students offered a variety of answers but most achieved 1 or 2 marks. Question 4 (a) (iii) asked students to compare the influence of fashion and planned obsolescence on the product life of the refrigerator. Again there was a mix of excellent answers and very poor answers. Question 4 (b) (i) asked students to list two advantages of using extrusion for the production of the refrigerator door handles. Most

students answered this question well gaining 1 or 2 marks. Question 4 (b) (ii) was also relatively well answered and asked students to outline one way in which extrusion can be regarded as a clean technology when used in the production of the refrigerator door handles. Question 4 (c) (i) required students to list two ways in which energy labels benefit consumers. Some excellent answers were balanced by some answers that evidenced a lack of clarity about energy labels confusing them with eco-labels. Question 4 (c) (ii) was an extended answer question awarding 9 marks (3 x 3 marks) for an explanation of of one way in which be considering the design pre-production designers can minimise the environmental impact of the refrigerator at each of three different stages of the life cycle. The question was poorly answered with few answers providing sufficiently detailed responses. That is not to say that the answers were not extremely long. However poor structuring leads students to repeat points. Students who planned their answers and made notes in pencil before giving the answer tidily using bullet points or a table achieved higher marks. The value of planning cannot be overemphasised. It is not the impression of the examining team that students are under undue pressure of time during the examination and so there is ample opportunity for planning of responses to these longer questions.

Question 5 (a) (i) asked students to define a literature search and proved extremely problematic for some candidates. Question 5 (a) (ii) required students to state one advantage and one disadvantage of using a performance test to collect data for designing the swing. Most students were able to do this. Question 5 (a) (iii) wanted students to outline one way in which legislation imposes constraints on the designers of the swing set. Some good answers focused on safety issues providing specific examples of where legislation would constrain design. Question 5 (b) (i) focused on outlining one consideration in the selection of material for the swing set and was well answered by many students.
Question 5 (b) (ii) turned to the selection of materials for the swing set cables. Many of the best answers were very succinct and used appropriate terminology to explain the issues for material selection. Succinctness and correct terminology are characteristics that are associated with the best answers. Some students manage to write enormously long responses which do not address the question and so do not gain marks. Question 5 (c) (i) asked students to describe the significance of finishing in the manufacture of the lengths of extruded steel pipe used for the frame of the swing set. Some students gave excellent answers describing the role of finishing in preventing corrosion of the steel pipe or in enhancing the aesthetic characteristics of the pipe. Some students talked about the rough edges generated by cutting the pipe into the desired lengths and how that is treated. Question 5 (c) (ii) was well answered by many students. Again the best answers used pencil notes to marshal thoughts before tidily providing the right answers in tabular or bulleted format. Some of the best answers provided small sketches to illustrate where the specific joining techniques were used in the production of the swing set. Few students were unable to identify appropriate joining techniques but many were unable to explain how the joining techniques were used. As well as succinctness and correct terminology sketches are a feature of the very best student work.

Question 6 (a) (i) asked students to define cost-effectiveness and some students gained no marks by offering definitions of value for money. Question 6 (a) (ii) asked students to describe one way in which the manufacturer may use mathematical modeling to ensure cost-effectiveness in the production of the concept car. Good answers were able to describe how a spreadsheet would be used to do what-if calculations on the materials used for the production of the concept car. Question 6 (a) (iii) was relatively straightforward and asked students to identify one cost-effective material that could be used for producing a small quantity of miniature model cars. Some students responded inappropriately with a clay model. Question 6 (b) (i) wanted a list of two reasons for developing a full size model of the concept car and posed few problems for students. Question 6 (b) (ii) focused on the scale of production appropriate for a full size working model. The term job production was offered by a number of Australian candidates. Question 6 (c) (i) asked for one advantage of producing a full size clay model of the miniature model car and was well answered by many candidates. Question 6 (c) (ii) seemed relatively straightforward to the examining team and asked students to evaluate the extent to which three type of models (mathematical, full size working model and full size clay model) meet the design objectives for green products. Students who organised their responses were able to easily and succinctly provide the depth of response required to achieve full

marks. Remarkably some students are able to write several pages in response and totally miss the point of the question and gain no marks. Volume of response is no reflection of quality of response. Teachers should emphasise the importance of reading the question carefully, planning responses and using formats such as table or bullet points to ensure that distinct marking points are provided and full marks can be gained.

Standard level paper three

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0-4	5-9	10-12	13-16	17-19	20-23	24-30

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 students that a question worth 6 marks is generally looking for 6 specific points in the answer, and that these can be presented as a list of points, and does not need to be structured as an essay. Often two main points are required in the answer, and then these are elaborated on by making two more points about each, for a total of 3 + 3 = 6 marks. Candidates should structure their answer clearly according to this formula.

Five G2's were received, two stated that the paper was of a similar standard to last year. All five felt that the level of difficulty was appropriate. Two stated that the syllabus coverage was satisfactory and three that it was good, two that the clarity of wording was satisfactory and three that it was good, and one that the presentation of the paper was satisfactory and four that it was good.

One G2 made a general comment that the paper was a proper test of the curriculum, it was appropriate, well written and follows the curriculum.

A final G2 comment was that in Option F, more detail about areas of study for the bicycle are required. The bicycle is presented in the Guide as one way of contextualizing study in this area. This is often repeated in the exam as a context because it is familiar to students, but it is just a context for the application of content, not an area of study by itself.

The mean of the paper this year was 14.5, down compared with the mean of 17.5 in 2005, but more similar to the mean of 2004 (13.9) and 2003 (14.7). 24% of the candidates for this year were new, and the inexperience of tackling a new paper could partly explain the lower mean.

In popularity order the options are ranked: F, E, D, C, G, A, B, H. The inconsistencies of candidates options selected at individual schools (students from some schools selected more than 2options) suggests that some candidates are tempted to answer options that they have clearly not been taught and this obviously impacts on their performance. It is also possible that in some schools candidates may be left to prepare for their options individually; an approach that also generally leads to poor outcomes.

The main difficulties for candidates appeared to be with examination technique and knowledge. The range of knowledge and understanding varied from excellent to very poor. It was clear that some

candidates had rote learnt definitions but had difficulty applying them to a context or did not realize that the answer required understanding with examples.

It appeared that for many candidates they had the ability to construct answers, but had not read the question adequately enough to develop an appropriate answer. The weak candidates appeared to be very ill-prepared for the examination; this was typically the case where candidates for the same school attempted different options.

It would be beneficial for all students to practice examination techniques, especially how to answer Question 4 in each option. Some students highlighted or underlined key elements of the questions, and these candidates seemed to do well. The marks allocated for each of the action verbs should be clear to candidates so they can structure answers appropriately.

Some candidates appear to structure their answers, particularly the Question 4's as an essay with an introduction and a conclusion. This generally does not gain them any marks, as marks are only awarded for the relevant points made.

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

OPTION A – RAW MATERIAL TO FINAL PRODUCT

Of the very few candidates who attempted this option, few performed well.

Question A1

a) Candidates answering this question tended to either list both a diamine and adipic acid or not list either.

b) The majority of candidates who attempted this question were able to include three points in their explanation to receive the three marks.

Question A2

Almost all candidates were able to list one reason why the zipper was made of stainless steel, but not all could list two reasons.

Question A3

Candidates tended to either receive full marks or no marks for this question.

Question A4

This question asked candidates to explain two reasons, so it should be clear that each reason is worth three marks and so should include two distinct points. The stronger students recognized this and organized their answer appropriately. A number of candidates stated the two reasons but inadequately discussed them, or listed a number of reasons but discussed none, for which they could only receive 2 marks.

OPTION B – MICROSTRUCTURES AND MACROSTRUCTURES

Only two of 202 candidates attempted this option.

OPTION C – APPROPRIATE TECHNOLOGIES

Question C1

a) Most students achieved two marks for their answer to this question.

b) Many candidates found this question difficult, and few received all 3 marks. Many did not focus in design, but provided a general discussion of alternative energies.

Question C2

Most candidates received one mark for stating that sustainable development meets the needs of the present, but few mentioned the future aspect of sustainability.

Question C3

Most candidates outlined alternative technology for one mark, but failed to relate it to the biogas farm.

Question C4

Generally this question was not well answered with many candidates generally discussing the ethics of conservation and unable to identify specific issues.

OPTION D – FOOD TECHNOLOGY

This option was a little more popular than last year, but still not taken by a large number of candidates.

Question D1

a) Most candidates made a successful attempt at this question for 2 marks, although some reiterated information which was already supplied, for example, weight.

b) This question was generally not answered well because it seemed that most candidates did not realize they were required to specify a food product, though many gave reasons for the development.

Question D2

Many candidates did not seem to understand the nature of pasteurization and discussed issues related to nutrients.

Question D3

The majority of candidates who answered this question did so successfully.

Question D4

This question proved to be more difficult than expected for many candidates, with some getting 2 marks for listing rather than explaining an advantage and a disadvantage.

OPTION E – COMPUTER AIDED DESIGN AND MANUFACTURING

This option was framed in the context of the use of CAD in the initial design of accommodation.

Question E1

a) There were a number of poor answers to this question because candidates did not focus on the **relationship** between the designer and consumer, but discussed aspects of the advantages of CAD.

b) Many candidates listed a number of criteria, rather than choosing ONE criteria and discussing it by mentioning two points about why the criteria is important.

Question E2

Some candidates provided an explanation of the nature of VR rather than outlining how its use could conserve resources, though the majority of candidates successfully answered this question.

Question E3

The majority of candidates answered this question successfully.

Question E4

Many candidates spent time in answering this question by defining JIT and JIC, for which they received no marks. Others gave more than two reasons but provided little explanation of the reasons.

OPTION F – INVENTION, INNOVATION AND DESIGN

This option continues to be by far the most popular selected by students.

Question F1

a) Most candidates recognized incremental as small changes but some did not follow through and relate it to the bicycle.

b) Again, as is common in an "Explain" question worth three marks, a number of candidates listed three inventions rather than explaining ONE. A deeper response is required in this type of question, and candidates should be aware of that requirement.

Question F2

Many candidates received full marks for this question, although some described or defined market pull rather than applying the idea to the pump.

Question F3

The majority of candidates successfully provided two points of comparison between the lone inventor and the product champion. As there are many clear-cut points of comparison, the number of confused answers were surprising.

Question F4

Many candidates were able to list two demands, but not were able to make two points explaining each demand to receive full marks. Some candidates discussed on-going developments of bicycles rather than the consumer demands that led to them.

OPTION G – HEALTH BY DESIGN

Very few students selected to do this option, and those that did seemed not to have been taught the Option or had spent little time in preparation.

OPTION H – ELECTRONIC PRODUCTS

The very few candidates who attempted this Option performed poorly.

Conclusion

Many candidates could quite easily achieve more marks by developing their examination skills. A good understanding of the action verbs (e.g. state, outline, describe, explain) is vital so 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, but this practice is still not widespread. Other candidates who underlined or highlighted key phrases in the questions seemed to do well.

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, and ensuring that a matching number of points are identifiable in the answer. Answers from better candidates were more succinct and used appropriate terminology.

The answering of the last question in the Options proves to be the most difficult for many. The answer pattern is generally a variation on 2x3 or 3x3 for six or nine marks. Candidates should be encouraged to use headings, bullets or blank lines to divide their answer up into the required number of sections.

There are about 16 and 25 lines provided, respectively, for the final question in each option for SL and HL. Candidates should be encouraged to use about that amount of space for their answer. It is not essays that are required, as some candidates structure their answers with introductions and conclusions for which they receive no marks and which consume time and space.

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.

The appeal by the examining team to respond to the examination with comments on the G2 forms is emphasised again. These are carefully scrutinized at the Grade Award meetings and so form an effective means of feedback.

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**

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	3
4	8	2
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

