

May 2013 subject reports

Design Technology

Overall grade boundaries

Higher level

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 13	14 - 25	26 - 36	37 - 48	49 - 61	62 - 73	74 - 100

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 14	15 - 26	27 - 38	39 - 49	50 - 61	62 - 73	74 - 100

General comments

The overall performance of candidates was disappointing compared to previous years. It was clear from the marking and moderation processes that there was a good percentage of very able candidates who had worked hard and knew a great deal about the subject. However, very few of these candidates managed to achieve top grades. Members of the Grade Award Panel spent some time discussing possible reasons for this situation.

Feedback from teachers indicated that the written papers were, in general, fair to candidates and not more difficult than in previous years. The Grade Award Panel focused on two major considerations for the underachievement. One consideration was that few candidates planned their answers carefully enough to extended response questions i.e. 9 mark questions on Paper Two Section B and 6 and 9 mark questions on Paper Three. It was clear that able candidates had sufficient knowledge to understand and answer these questions but did not structure their responses to differentiate succinctly when discussing or explaining two or three issues relating to the given context.

The second consideration, and the one which had the most impact on the final grading, was underperformance with the Internal Assessment (IA) i.e. practical work. Inappropriate tasks and/or lack of sufficient evidence to satisfy the different aspects of the assessment criteria caused many candidates to underachieve by a grade and in some instances two grades, compared to their performance with the written papers. As the IA component is worth 36% of the total marks available it is easy to appreciate why poorly executed tasks or a Practical Programme which does not allow candidates to demonstrate knowledge and skills as set out in the assessment criteria has such a detrimental effect on the final grade.

Members of the Grade Award Panel mused that perhaps the change in emphasis for professional development opportunities from face-to-face workshops to online workshops was

a contributory factor in this trend. Online workshops clearly have a place in professional development allowing teachers to participate without missing valuable time in school and a longer period of involvement in the workshop so more time to reflect on each module. However, it may be that discussion relating to planning an appropriate Practical Scheme of Work and moderation of IA tasks is less effective with distance learning than the more dynamic interaction achieved in a face-to-face situation.

With the provision of more online workshops it is apparent that many teachers do not have the opportunity to attend face-to-face workshops in Design Technology, especially at levels two and three. However, with the impending launch of the new syllabus for first examination in 2016 there should be much more face-to-face professional development opportunities available throughout the IB regions as indicated on the IBO website.

Practical work

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 8	9 - 17	18 - 25	26 - 32	33 - 39	40 - 46	47 - 60

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

Most schools follow the correct procedures and include completed forms, with only a few choosing to design their own 4/PSOWDT. Those that use this approach need to ensure that all data fields are included for moderation. Schools should ensure all data fields are completed, to include time per investigation, syllabus coverage and use of ICT applications. Inappropriate work includes group tasks where write-ups are a collaborative effort. Teacher notes for each investigation are to be included with the sample and where possible work should be clearly flagged to aid moderation. It is not necessary to send all work for moderation, as only the investigations and project with the highest marks are needed for each criterion. Scanned and photocopied work must be legible if schools are to avoid requests for further copies and evidence of work.

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

A wide range of suitable projects and investigations were evident the samples received for April 2013. This was the largest sample to date and most schools are to be commended on their creativity and imagination in devising suitable investigations that meet the requirements of the IB DT course. Work included small design and make activities based on the design cycle and experiments that followed a more scientific approach. Those schools that are established in the teaching of IB Design Technology, or have recently attended training continue to do well when developing a course that meets the assessment criteria. Some schools choose to assess design and make activities for all investigations thus limiting the number of projects that can be completed in the time available.

Small lab based investigations tend to require less time than design and make tasks (normally no more than 3-4 hours) and the integration of such assignments in to the course structure is to be further encouraged as it is possible to target each assessment criterion individually if candidates need further opportunities so as to raise achievement.

Teachers are to be reminded that candidate work should not be assessed where too much information has been provided, as the work must be of that of an individual candidate. This is common when outlining a suitable project/investigation task and as a result more open ended tasks are required for the assessment of Planning. Where group work is to be assessed, each candidate must show evidence of their own work. It is not satisfactory for a group to submit one common document or share written work for assessment.

Literature assignments and product analysis tasks which include PowerPoint presentations, historical documents, essays based on visits are not suitable for assessment of Development.

Only tasks that are suitable to achieve a maximum of six marks per criteria should be used to assess work.

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

Planning (P)

The majority of candidates were able to achieve a minimum of at least a Partial for this criterion. However, some candidates did not perform so well, especially when repeating a common problem set by the class teacher or when submitting identical work of another candidate. When using the assessment criteria for a design project, candidates should consider the feasibility of the study, identify the user, write a clear brief which identifies the intended goal and write a detailed specification. The most detailed specifications are composed on summary of the research and are best presented in order of priority. Where possible photographic evidence of problems is encouraged as these can help establish the need. When completing a lab based investigation a problem is to be identified and independent/dependent variables made clear. Work should be clearly titled, and where possible include reference to the assessment aspects.

Research (R)

Not all candidates had considered the need to plan data collection from a variety of sources or include a list of apparatus and order of method for an experiment. Further detail is generally needed here for candidates to be awarded complete. An example of planning for research for a design project is evident on page 28 of the subject guide. Where planning was limited, collected data was either biased or missing critical information. Candidates should fully analyze the brief in Planning if they are to prioritize strategies in which to identify wider issues to be researched. Candidates 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 problem. A wider range of data primary and secondary sources is needed if not to simply rely on data sourced purely the internet. Smaller laboratory-based investigations where candidates had to collect raw qualitative/quantitative data offered ample opportunity to address the assessment criteria, but some candidates had failed to identify anomalies or process the information correctly.

Development (D)

There is still some confusion regarding which type of investigation suits this assessment criterion. Design based activities, where candidates have the opportunity to generate and develop an innovative range of ideas using suitable techniques, such as sketching, CAD or modelling is the most appropriate type of task to address the assessment needs. Other tasks can be considered, but only tasks where a full 6 marks can be achieved should be considered. Some schools continue to misinterpret the criteria and submit inappropriate work. Development is to include an element of refining solutions through modelling and the use of a wider range of techniques to optimise a solution is to be encouraged. Detailing for the solution to be realized needs to be detailed and presented in an appropriate format, such as engineering drawings. Detailing needs to be clear and sufficient for projects to be made.

Evaluation (E)

Some candidates produced significant work in meeting this criterion, but others did not leave sufficient time to conduct a detailed evaluation of the outcome and procedures. Ideally candidates need to test their outcomes in the area designed for, or with the user for whom it had been designed. Projects which offer a limited or virtual outcome do not lend themselves well to addressing this assessment criterion, especially when it comes to testing, identifying weaknesses and suggesting realistic recommendations. Recommendations for the design

project need to include a revised specification, sketched modifications and consider the need for scaling up production. For laboratory-based tasks, candidates need to evaluate the method of data collection and identify weaknesses in order to suggest improvements as this is often confused with improving the material or item being tested. Further emphasis is needed if candidates are to achieve a complete for each aspect of Evaluation. When planning a course sufficient time should be provided to complete a detailed response

Manipulative Skills (MS)

In most cases thorough planning had taken place, but there is a need for some schools to be more detailed in their identification of materials and processes in order to plan time effectively. Engineering drawings are assessed as part of the development, but they can be referred to and altered if necessary throughout the making process. The best examples included evidence of detailed plan of action, which included processes, materials, risk assessment and times, plus a photographic diary of making. Outcomes need to be of sufficient complexity for the level studied. Although some work fell below the standards needed, most was very good, some excellent and even sometimes well beyond the requirements of the course. Where this is the case a balance is needed so as to give each criterion equal weighting.

Recommendations and guidance for the teaching of future candidates

- The assessment weightings and time allocations for Investigations and the Design Project need to be considered when developing a scheme of work in schools.
- Design and make tasks should offer sufficient opportunities to achieve high marks for development and evaluation. Tasks that offer limited opportunities are to be avoided.
- Practical schemes of work that make use of design and lab tasks generally offer more opportunities for pupils to meet the assessment criteria.
- Teachers support materials, notes and project briefs should be attached to the sample of work. Marks selected for moderation need to be highlighted on the 4/PSOWDT form for each assessment criteria. Only the work that has been highlighted should be sent for moderation. Most samples were presented in an organized structure, but teachers are to be reminded that work for each criterion needs to be flagged. Teachers are also reminded to complete all sections of the 4/PSOWDT, including details of the project, ICT usage, topics covered in each IA and the time taken for each IA. Schools are advised not to make their own versions of the 4/PSOWDT as all data input fields are required by the moderator and senior moderator.
- Teachers are encouraged to send an individual candidate sample per folder/folio with the form 4/PSOWDT attached. Dividers should be used to indicate the start of different investigations and all work sent to moderators should be in A4 format. Where A3 drawing work is to be included, pages should be folded and included in the A4 report. All photocopied work must be easily legible; the copying of pencil sketched ideas is to be avoided.
- Teachers are reminded to check the OCC for regular updates regarding the new Design Technology syllabus for first examination May 2016.

Higher level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 10	11 - 14	15 - 18	19 - 22	23 - 26	27 - 30	31 - 40

General comments

There were no G2's received for this session. Can we please encourage schools to return these forms in the future as the comments on these forms along with other evidence; in particular the statistical data generated from responses that candidates provide on their papers are then used to determine grade boundaries for this paper. We would also urge schools to post their reflections on the OCC DT forum.

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

Question 12

Upon careful consideration, it was decided to accept responses A and D for this question as there may have been some confusion with candidates interpreting Figure 3. Whilst candidates did not find this question difficult (Difl=89.16; Disc=0.10), the statistics did highlight the fact that either answer was chosen by the candidates.

Question 14

Whilst this was not necessarily a difficult question it was poorly discriminating (Difl=73.68; Disc=0.24). To answer this question correctly students needed to know and apply the knowledge from the guide concerning shape memory alloys.

Question 25

Originally this was a moderately difficult question with a good discrimination (Difl=55.1; Disc=0.37), but upon careful consideration, it was decided to accept responses A and C for this question.

Question 35

This was a moderately difficult question with a reasonable level of discrimination (Difl=46.45; Disc=0.27). Whilst the majority of students chose the correct response C, many responded D. It should be noted that a solar collector is used in both active and passive solar energy systems and therefore cannot be the correct answer.

Question 36

This was a difficult question with a moderate level of discrimination (Difl=33.42; Disc=0.25). Most students either opted for the correct response A (Hardness), whilst a high proportion selected B (Stiffness). Unless the material is hard it will not penetrate the can's material without deformation. Whilst stiffness is a factor, the Sieger Eminent can opener is not a precision tool and a degree of flexibility in the blade would have been acceptable.

Higher level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 5	6 - 11	12 - 17	18 - 24	25 - 32	33 - 39	40 - 60

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

Question 1

Although this question seemed to be accessible for most candidates as they were able to tackle each sub-part many candidates failed to gain full marks as they needed to appreciate the full requirements of each of the sub questions. There were many generic answers which did not relate specifically to the given context.

- a) Generally all parts were answered successfully though many candidates failed to gain both marks for part (iii) as no justification was provided for an answer relating to less than 4.6 hours.
- b) (i) & (ii) Many candidates did not differentiate their responses adequately for these questions. Candidates should appreciate that providing similar answers to two questions is not what is required.
- c) (ii) Most candidates were able to gain at least one mark but not many developed their answer in sufficient detail for all three marks.
- d) (ii) The question relates to safety of the passengers rather than safety of people on the ground.
- e) (ii) There were many convoluted responses to this question resulting in most candidates gaining only one mark.

Question 2

Many candidates confused “work hardening” with “annealing”.

Question 3

- b) Many responses to this question related to solar energy in general rather than active solar collection for a specific application e.g. heating water.

Question 5

The majority of candidates did not know about cantilever beams.

Question 6

- b) Nearly all candidates gained a mark for stating that steam power was more efficient than water power but not many candidates made reference to the level of efficiency.

Question 7

This was the most popular question followed by question 8 and then question 9 though candidates who attempted question 9 usually performed well.

- a) (ii) Candidates whom appreciated that the comparison of both types of turbines related to the context of use on roof tops were able to gain the available marks.
- b) (ii) As usual with extended response questions relating to three distinct issues, candidates who planned their answer carefully and set out the issues succinctly gained most marks. Many other candidates merely listed a random range of considerations which did not match the markscheme.

Question 8

- b) (ii) Candidates needed to develop their answer from part (i) and use the correct terminology with reference to strength and stiffness in order to gain all three marks.
- c) (i) A surprising number of candidates did not understand the concept of abrading.
- (ii) Most candidates felt able to tackle this question satisfactorily but few gained more than six marks due to lack of structure “explaining” three advantages rather than just describing them.

Question 9

- (b) (ii) This proved quite a difficult question for most candidates. Many responses were quite vague and few candidates managed to gain all three marks.
- (c) (i) Few candidates successfully justified the scale of production (batch) in relation to the market for corkscrews and the high price of the Socrates version.
- (ii) Only a small number of candidates organised their response into three distinct aspects of the design of the Socrates corkscrew in relation to price and value-for-money.

Recommendations and guidance for the teaching of future candidates

For question 1 candidates should spend time assimilating all the data supplied before looking at individual questions and considering which aspects of the data is relevant. Some parts of question 1 require candidates to consider the design context and speculate on aspects of the design. Candidates should recognize that generalisations are unlikely to gain marks.

Candidates should read each of the Section B questions carefully before deciding which one to tackle. Some candidates just choose the design context they feel more comfortable with rather than analysing the requirements of the various aspects of the questions and considering the nature of the responses that should be made. The Section B questions are designed to cover different topics in the syllabus though the 9 mark question will have most impact on the final mark achieved. In many instances candidates perform well on the shorter questions but relatively poorly on the final question.

Candidates need to be familiar with the type of answer required for each question based on the Command Term used at the start of the question. Candidates should take into account the amount of marks allocated to each question which matches the type of response required.

Higher level paper three

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 3	4 - 7	8 - 11	12 - 17	18 - 23	24 - 29	30 - 40

General comments

There is an ongoing issue for lots of candidates in relation to producing sufficient depth of response to achieve three marks on three-mark questions. Teachers should emphasise that well-structured answers make it easier for candidates to check that they have provided three distinct points in their responses to such questions. The command term used to phrase the question and the mark allocation should be a clear indication of depth of response required from candidates.

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

Option A

Candidates answering Option A often seem to lack an understanding of the more technical aspects of food science and technology which are identified in the Guide.

Question 1

- This question posed few problems for all but the least able candidates.
- This question should have been straightforward and required candidates to identify that gluten in flour is hydrated in the production of dough to form an elastic matrix which contributes to the elastic nature of the bread dough.
- Again this question should have been straightforward and required candidates to identify that yeast ferments sugar to produce small bubbles of carbon dioxide in the dough which expand on heating to reduce the density of the bread.

Question 2

- This question should have been straightforward and required candidates to identify an advantage of Flavr Savr™ tomatoes over traditionally-grown tomatoes.
- This question also should have been straightforward and required candidates to identify one reason why the Flavr Savr™ tomato was withdrawn from the market. Most candidates were able to provide a reasonable answer to this question.

Question 3

This question focused on the eatwell plate – a system developed by the UK's Food Standards Agency and based on the food group system.

- This question should have been straightforward and required candidates to identify one reason why it is important that governments raise public awareness of food-related health issues
- This question was also straightforward and required candidates to identify one reason one reason why the eatwell plate would not be appropriate for children below the age of

two years. All but the very weakest candidates were able to provide reasonable answers to this question.

Question 4

This question on how travel and the media have contributed to the development of an international cuisine was answered reasonably well by all but the weakest candidates.

Question 5

- a) This question required candidates to describe one measure used to estimate the number of hungry people in a country. It was not well-answered by candidates.
- b) This question required candidates to list two criteria for food security. There was generally no answer offered than a particular set of wrong answers.
- c) This part of the question asked for the identification of one reason why international strategies for maintaining food security are important. This part was answered better than the other two parts.

Question 6

This question focused on food safety. It is clear that some candidates are not able to distinguish between food safety and food security.

This question asked for an explanation of one way in which proper cooking of food can help control food poisoning. Most candidates were able to identify that raising the temperature of food above 78 degrees Celsius kills the bacteria that would cause food poisoning.

The second part of the question asked about how good personal hygiene can help to prevent food poisoning. Many candidates were able to identify that this related to reduction of the bacterial load on hands and hence the potential for contamination of food when touching it.

Questions 7

This question required candidates to explain three implications of urbanization for the food industry in developed countries. Whilst it did not seem problematic in any particular way, the question invoked lengthy but often unstructured responses with lots of repetitive and irrelevant material. Better structuring of responses is a must for these 9-mark questions.

Option B

Option B is not a popular option and is attempted by very few Schools/candidates.

Question 1

- a) The first part of this question asked candidates to state the type of circuit. Most candidates correctly answered comparator and achieve one mark.
- b) The second part of this question required candidates to make calculate the time constant for the circuit. It required candidates to identify and substitute into the formula $T = CR$. Most candidates were able to complete this satisfactorily.
- c) The third part of the question required candidates to explain how the circuit operated when the switch is opened. Responses were variable but some candidates were able to offer very full answers explaining the operation of the circuit and achieved full marks.

Question 2

- a) This question asked candidates to state one service cost consideration for the consumer

when purchasing a washing machine. It was not answered well by candidates although there was no particular reason why this should have been.

- b) The second part of the question asked candidates to identify on way that design for disassembly promotes the upgradeability of electronic products. This was answered reasonably well by most candidates.

Question 3

- a) The first part of the question required candidates to complete a truth table and was reasonably answered by many candidates.
- b) The second part of the question asked why, in practice, digital logic functions would be implemented using NAND gates. Most candidates identified the issue of cost-effectiveness.

Question 4

This question was about the bandwidth implications for consumers of TDM and FDM. This posed some challenges for candidates but the better candidates produced well-structured answers and achieved 3 marks.

Question 5

- a) The first part of this question asked for a description of one benefit of converging technology to national security. It seemed to be straightforward for many candidates.
- b) The second part of the question asking candidates to identify one way in which nanotechnology could be utilized in the implementation of “The Communicator” similarly posed few problems for candidates.
- c) The third part of the question asked for an identification of one way in which “The Communicator” promotes global cooperation and again posed no particular problems and was well-answered by most candidates.

Question 6

This question required an explanation of how solar panels could be used in a smart home to generate electrical energy. A fairly straightforward question, it was answered reasonably well by most candidates.

Question 7

The final question in this option was worth 9 marks and required a discussion of three issues a designer may need to consider in designing a laptop for different global markets. Structure is the key to these three times three-mark questions and helps candidates to avoid repetition. Many candidates were able to offer three distinct issues. Better candidates provided enough depth of response to achieve reasonable marks.

Option C

Option C is the second most popular option.

Question 1

- a) The first part of the question asked candidates to state the type of CNC machine used to manufacture a part shown in Figure C1. Most candidates correctly answered CNC lathe.
- b) This question asked how the CNC machine would need to be reprogrammed if the part were made of metal rather than plastic. This proved difficult and while many candidates identified reducing the feed speed there were some candidates who clearly

had no idea.

- c) The third part of the question, worth three marks, asked for an explanation of why the product would require more than one tool for manufacture. It posed few problems for candidates.

Question 2

- a) This question asked for candidates to state one way in which the use of robots in a manufacturing system has helped to reduce material waste and was very well answered with most candidates focusing on robots producing fewer errors.
- b) The second part of this question asked for an outline of how the use of robots allows for flexibility in a manufacturing system in relation to scale of production and was generally not as well answered as the first part of the question. There was no common pattern to the poorer answers.

Question 3

This question offered a picture of the mould flow simulation of the plastic casing of an electronic product.

- a) The first part of the question asked candidates to describe the purpose of the mould flow simulation. It was generally well answered and posed few problems.
- b) The second part of the question asked for an outline of one way in which CAD simulations can aid cost analysis in planning the manufacture of the plastic product. There were some good answers produced by some candidates and few problems emerged.

Question 4

This question required a discussion of two benefits of rapid prototyping in the design development of the perfume bottle prototype. The mark scheme offered lots of alternatives and most candidates were able to produce answers which matched the mark scheme. Depth of response for the third mark in each cluster of points was the major issue.

Question 5

- a) This question asked for an outline of one disadvantage of CAD for the designer and was generally well answered by candidates.
- b) This question asked for an outline of one way in which CAM has impacted on the role of the manufacturer in a small-scale furniture business and again was generally well answered.
- c) This question asked for one advantage of exploded view CAD drawings for consumers when deciding whether to purchase flat-pack furniture was not as well answered although there was no common pattern to the poorer answers.

Question 6

- a) This question, worth three marks, asked for a suggestion of one reason why the Morgan Motor Company continues to use traditional methods to make the car rather than use CAM and was generally well answered apart from the issue of depth of response.
- b) This question, also worth three marks, asked for an explanation of one social implication of maintaining traditional manufacturing techniques in the Morgan Motor Company. Most candidates offered an explanation of the employment implications and skills associated with traditional manufacturing techniques.

Question 7

This question asked for a discussion of three benefits for consumers of purchasing classroom furniture produced by CAD/CAM. This question posed few problems apart from the issue of depth of response.

Option D – Textiles

This is not a very popular optional though it is more popular than option B

Question 1

- a) This question asked candidates to state one characteristic of polyester that makes it suitable for the graft apart from biocompatibility. A range of answers were identified in the mark scheme and the question posed no problems
- b) This question asked for one benefit of using a woven fabric for the graft. Again a range of answers were offered in the mark scheme and the question was answered well by most candidates.
- c) This question required an explanation of one reason why biocompatibility is important in the development of textile vascular grafts. It was answered well by the majority of candidates.

Question 2

- a) This question was worth one mark and asked candidates to state one disadvantage of wearable computing for consumers. Again a range of answers were included in the mark scheme and most candidates achieved one mark.
- b) This question, worth two marks, asked candidate for one benefit of aligning wearable computing with the fashion market. It posed no particular problems for candidates.

Question 3

- a) This question asked for an outline of one benefit of the introduction of circular knitting machines for manufacturers. There were a range of possible answers in the mark scheme and most candidates found an answer and achieved the one mark on offer.
- b) This question asked for an outline of one benefit of the introduction of circular knitting machines for consumers. Again, there were a range of possible answers in the mark scheme and most candidates found an answer and achieved the one mark on offer.

Question 4

This six-mark question required a discussion of each of two issues [three marks per issue] relating to the branding of textile products for adolescents. It was straightforward and as for most 3-mark questions the major issue related to depth of response.

Question 5

- a) This question asked for an outline of the importance of salt (sodium chloride) in the process of dyeing cotton. It was not well answered which looked like it was an issue relating to lack of knowledge on the part of some candidates.
- b) The question required candidates to state one environmental issue involved in the commercial dyeing of cotton products. It was a straightforward question for most candidates.
- c) This question asked for one benefit of using Retayne on cotton fabrics to fix the dye during the dying process for the consumer. Again, was a straightforward question for most candidates

Question 6

- a) A three-mark question requiring a discussion of one issue relating to the adoption of fair trade regulations for a company in a developed country. Not as well answered as answers to the second part of the question but no pattern to the weaker answers.
- b) A three-mark question requiring a discussion of one issue relating to the adoption of fair trade regulations for a company in a developing country. No particular problem – some excellent answers offered by candidates.

Question 7

This question asked not an explanation of three advantages [3 marks per advantage] of using nylon for an automobile (car) airbag. The question posed few problems apart from the issue of depth of response. A lot of alternative responses offered in mark scheme. Some good answers offered.

Option E — Human factors design

This is by far the most popular option.

Question 1

- a) The first part of this question, worth one mark, asked candidates to state the type of data scale represented by the general comfort rating scale shown in Figure E1. The answer of ordinal seemed straightforward but was identified by only about half the candidates. There was a whole range of wrong answers but no common pattern.
- b) The second part of the question, worth two marks, asked for a reason for using this type of data scale. Candidates who had recognized the type of scale correctly were generally able to offer a reason for its use. Some candidates who got the first part wrong also were able to offer an appropriate response to this question and achieve a mark.
- c) The third and final part of this question, worth three marks, asked for an explanation of which point on the comfort rating scale would be appropriate for the design of public seating in a railway station as part of a policy of Design for Discomfort. Wrong answers tended to identify a very high number on the scale. There were some very good answers offered by stronger candidates.

Question 2

- a) This one-mark question asked for a definition of workspace envelope. It was generally well answered by most candidates.
- b) This two-mark question asked candidates for one piece of anthropometric data required when considering the workspace envelope of a wheelchair user at a desk. The question posed few problems and reach was the most popular answer offered by candidates.

Question 3

- a) This question showed an image of a door handle and asked candidates to state one advantage of it in relation to human factors. It seemed a straightforward question but it was poorly answered with candidates often finding difficulty in identifying a human factors consideration related to the handle.
- b) This question showed an image of a door knob and asked candidates to state one advantage of the door knob in relation to human factors. Again the question was poorly answered although there did not seem to be a particular reason for this.

Question 4

This question asked offered an image of The Butterfly Stool candidates to discuss each of two human factors considerations in its design. Matching responses to the mark scheme and depth of response were major issues.

Question 5

- a) This question asked candidates for one reason why the background colours of road signs often correspond to the colours used on maps. Whilst this is less directly matched to the assessment statements in the Guide than other questions it posed few problems and was generally well answered even by weaker candidates.
- b) The second part of this question asked candidate to explain one advantage of the use of LED signs for authorities responsible for motorways (highways). It was generally well answered with no pattern to the poorer answers.
- c) The third and final part of this question asked candidates to state one disadvantage of the use of LED signs on motorways (highways) for motorists. The most popular answer related to them being distracting.

Question 6

- a) The first part of this question asked for an explanation of one reason why human factors research is often not considered a priority in developing countries. It was generally well answered with candidates identifying the cost of human factors research as a major issue.
- b) The second part of this question asked for an explanation of how mass customization has improved the scope for designing for people with disability. It was less well answered than the first part but there was no common pattern to the poorer answers.

Question 7

This question required consideration of three pieces of legislation which impact on human factors aspects of the design of an open-plan office. It was generally not well answered. Good answers identified three distinct issues that are covered by legislation and then provided detailed explanation of each issue. Most candidates were able to identify temperature as an issue.

Standard level paper one

Component grade boundaries

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

General comments

17 G2's were received for this paper. Could we please encourage as many schools as possible to return these forms as the comments that are submitted, are carefully considered at the grade award meeting and along with other evidence; in particular the responses that the candidates provide on their papers, are used to determine grade boundaries. Similarly we would endorse the use of the OCC to post reflections on this paper.

Pleasingly, feedback indicates that 70.6% felt that the presentation of the paper was good. With regards to wording, 70.6% considered it to be satisfactory or good although it was suggested through one G2 comment that at times that the wording could be difficult for students learning English as a second language.

One G2 comment noted that students not only require knowledge, but deductive reasoning skills as well. The questions on this paper are designed to test objectives one and two, although of course it is possible to use an objective 3 assessment statement as the basis for a question as it includes knowledge of objective 1 and 2. Student feedback indicates that this paper was not too difficult and that the questions were accessible.

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

Question 2

Two G2's commented that a lack of clarity and an issue with wording could have posed problems with this question. It was not obvious from the statistics that the students found this the case (Difl=74.09; Disl=0.22). Holistic knowledge of the concept of prototyping is required.

Question 10

One G2 commented that all of the responses to this question are facilitated by the use of standardized components. Whilst there is an overlap between responses, a precise understanding of terminology is required. Students did find this question difficult with a moderate level of discrimination (Difl=34.17; Disl=0.25).

Question 14

Upon careful consideration, it was decided to accept responses A and D for this question. Whilst candidates did not find this question difficult (Difl=84.45; Disc=0.14), the statistics did highlight the fact that either answer was chosen by the candidates.

Question 15

Whilst we acknowledge why candidates may jump to the conclusion that response C was correct the key element in the stem is that that relates to the structure of the door. The door structure is more affected by thermal expansivity. This was a difficult question with a reasonable level of discrimination (Difl=39.78; Disc=0.31).

Question 16

One G2 commented that this was a 'tricky' question. The statistics do not suggest that this was the case (Difl=63.59; Disc=0.32). Questions are set to discriminate what candidates need to know. In this instance knowledge of thermosetting plastics, adhesives and the concept of design for disassembly was required.

Question 18

One G2 commented that there was information lacking for this question to be answered. This was not evident in the candidates' responses and the relevant statistics. Candidates found this question reasonably difficult, with a good discrimination index (Difl=67.51; Disc=0.32).

Question 21

One G2 expressed a concern over the wording of the response related to the reduced emission of toxic waste. The key factor here is what is considered to be the definition of 'waste'. Waste is a generic term, in-fact it can be a natural bi-product. End of pipe is part of a clean technology program, which 'cleans up' something that is a problem to the environment. In this case the emission of toxic materials. This was a moderately difficult question with good discrimination (Difl=48.18; Disc=0.40).

Question 22

One G2 commented that more than one of the answers could have been correct, whilst another suggested the question was not clear. Although acknowledging that this was a difficult question (Difl=55.88; Disc=0.22), it was deemed to be a fair question. Through a process of elimination it was possible to identify the correct answer.

Standard level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 4	5 - 8	9 - 12	13 - 16	17 - 21	22 - 25	26 - 40

General comments

According to the responses via the G2 forms, the Paper appears to have been very well received by candidates and teachers with 94.4% considering it to be an appropriate level of difficulty. 11.1% of teachers expressed a concern with the clarity of the wording whilst 88.9% considered being either satisfactory or good. As always paper setters have made every effort, as they will continue to do so, to ensure that all questions are accessible to our students and duly take into consideration the many that are studying English as a Second Language.

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

Section A

Question 1

Many students were able to recognize that for part (a) (ii) that the evaluation strategy used would be a performance test. Many that knew this also stated in part (a) (ii) that the reason the test was over two years was to test durability and reliability.

One G2 commented that for part (b) (ii), that there were a number of valid answers. In fact from the scripts it appeared that candidates did not necessarily appear to have a problem with this question, with most scoring at least one mark when talking about the hazard of large predators. Part (c) (ii) did prove difficult for candidates to gain all three marks. Many candidates simply listed specific material characteristics or properties. The candidates were expected to recognize that a new composite was manufactured to perform to a set of specific requirements and to provide pre-determined properties and characteristics. Providing a specific example would have only been given one mark.

Question 2

For part (a) although the command term in the stem was *state*, a diagram of a diamond used in flow charts was accepted. Many candidates failed to gain all three marks for part (b) as responses tended to be unstructured and thus did not generate three distinct points. It was important to explain that a prototype is an advanced model, but was not the finished product, as it still represented a concept.

Question 3

Many candidates appeared to struggle with part (b). Through the stem, candidates were expected to explain the relationship of qualitative and quantitative data to the concept of perception when considering ergonomics. Many simply stated what qualitative and quantitative data is and did not consider the context.

Section B

Question 4

This was the most popular question followed by question 6 and then question 5. Question 4 was pleasingly well received and a G2 comment stated that it was well worded and pitched to the correct level.

For part (a) (i) some students merely stated a percentile rather than acknowledging that it was adults. For part (b) (ii) many candidates simply stated that it was cheaper to manufacture the chair in China. Manufacturing costs are cheaper in China rather than Scandinavia and despite increased distribution and transport costs, it is more cost-effective to produce in China. Very few candidates gained high marks for part (c) (ii). Those that did carefully structured their responses, managing to provide responses in triplets. Many candidates stated that plywood was cheaper, rather than commenting on its cost-effectiveness. It was also necessary to mention that plywood has a good strength to weight ratio, rather than simply stating that it was strong.

Question 5

One G2 commented that they felt there was not enough information in the stem of question (a) (i) to give an accurate market segment. Most candidates were able to identify correctly the market segment, but failed to outline why, in order to gain the full two marks. Many candidates found it relatively easy to gain at least one mark for part (c) (i) by stating that the torch could get broken, but failed to *outline* why this could happen. In question (c) (ii) candidates were able to identify corporate strategies (*product development, market development, diversification and imitative*), but could not use this information and apply it to the context of the stem. Better planning was required so that candidates could structure their responses in order to attain more marks.

Question 6

Most candidates for (a) (ii) correctly outlined why green would be used in such a product, but few mentioned why white was utilised as a neutral colour that portrayed a clean image. Whilst many candidates referred to the fact that liquids from the cans/bottles might spill for (b) (ii), they also needed to outline that this would mean that regular maintenance/cleaning would be required. Many of the candidates responding to (c) (ii) were able to recognize that as this product uses electricity, it causes pollution/waste due to the fact that the electricity used may be produced from fossil fuels and thus picked up all three marks in this triplet. Many also stated that another limitation was that the Minima used plastic bags to collect the waste or that it did not separate out the materials (plastics, steel, aluminium), but very often did not explain these points to gain all marks. Once again, a more structured response to this question is required in order to ensure that three distinct points were explained.

Standard level paper three

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 3	4 - 6	7 - 8	9 - 13	14 - 17	18 - 22	23 - 30

General comments

There is an ongoing issue for lots of candidates in relation to the production of sufficient depth of response to achieve three marks on three-mark questions. Teachers should emphasise that well-structured answers make it easier for candidates to check that they have provided three distinct points in their responses to such questions. The command term used to phrase the question and the mark allocation should be a clear indication of depth of response required from candidates.

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

Option A

Candidates answering Option A often seem to lack an understanding of the more technical aspects of food science and technology.

Question 1

- This question posed few problems for all but the least able candidates.
- This question should have been straightforward and required candidates to identify that gluten in flour is hydrated in the production of dough to form an elastic matrix which contributes to the elastic nature of the bread dough.
- Again this question should have been straightforward and required candidates to identify that yeast ferments sugar to produce small bubbles of carbon dioxide in the dough which expand on heating to reduce the density of the bread.

Question 2

This question focused on the eatwell plate – a system developed by the UK's Food Standards Agency and based on the food group system.

- This question should have been straightforward and required candidates to identify one reason why it is important that governments raise public awareness of food -related health issues
- This question also should have been straightforward and required candidates to identify one reason one reason why the eatwell plate would not be appropriate for children below the age of two years

Question 3

- This question was straightforward and most candidates were able to provide reasonable answers.
- This question also was straightforward and all but the weakest candidates were able to provide reasonable answers.

Question 4

This question required an outline of one reason why values of body mass index (BMI) might be misleading was answered reasonably well by most candidates.

Question 5

This question on how travel and the media have promoted the development of an international cuisine was answered reasonably well by all but the weakest candidates. The issue of structuring and depth of response was the major issue for candidates not achieving two or three marks.

Question 6

This question required candidates to explain three implications of urbanization for the food industry in developed countries. Whilst it did not seem problematic in any particular way, the question invoked lengthy but often unstructured responses with lots of repetitive and irrelevant material. Better structuring of responses is a must for these 9-mark questions.

Option B – Electronic Product Design

Option B is not a popular option and is attempted by very few Schools/candidates.

Question 1

- a. The first part of this question asked candidates to state the type of circuit. Most candidates correctly answered comparator and achieve one mark.
- b. The second part of this question required candidates to make calculate the time constant for the circuit. It required candidates to identify and substitute into the formula $T = CR$. Most candidates were able to complete this satisfactorily.
- c. The third part of the question required candidates to explain how the circuit operated when the switch is opened. Responses were variable but some candidates were able to offer very full answers explaining the operation of the circuit and achieved full marks.

Question 2

- a) This question asked candidates to draw a circuit to show how an open loop system works. It posed few problems for candidates.
- b) The second part of the question asked candidates to describe the effect an open loop system would have on the operation of a toaster. This did not seem to be difficult for most candidates.

Question 3

- a) The first part of the question required candidates to complete a truth table and was reasonably answered by many candidates.
- b) The second part of the question asked why, in practice, digital logic functions would be implemented using NAND gates. Most candidates identified the issue of cost-effectiveness.

Question 4

This question asked candidates to identify two key components in a digital hearing aid and posed few problems and was generally well answered.

Question 5

This question was about the bandwidth implications for consumers of TDM and FDM. This posed some challenges for candidates but the better candidates produced well-structured answers and achieved 6 marks.

Question 6

The final question in this option was worth 9 marks and required a discussion of three issues a designer may need to consider in designing a laptop for different global markets. Structure is the key to these three times three-mark questions and helps candidates to avoid repetition. Many candidates were able to offer three distinct issues. Better candidates provided enough depth of response to achieve reasonable marks.

Option C – CAD/CAM

Option C is the second most popular option.

Question 1

- a) The first part of the question asked candidates to state the type of CNC machine used to manufacture a part shown in Figure C1. Most candidates correctly answered CNC lathe.
- b) This question asked how the CNC machine would need to be reprogrammed if the part were made of metal rather than plastic. This proved difficult and while many candidates identified reducing the feed speed there were some candidates who clearly had no idea.
- c) The third part of the question, worth three marks, asked for an explanation of why the product would require more than one tool for manufacture. It posed few problems for candidates.

Question 2

- a) This question asked for candidates to state a wet rapid prototyping technique. Stereolithography was the most popular response.
- b) This question, worth two marks, asked for a description of an advantage of using a wet prototyping technique. This seemed fairly straightforward for most candidates.

Question 3

This question offered a picture of the mould flow simulation of the plastic casing of an electronic product.

- a) The first part of the question asked candidates to describe the purpose of the mould flow simulation. It was generally well answered and posed few problems.
- b) The second part of the question asked for an outline of one way in which CAD simulations can aid cost analysis in planning the manufacture of the plastic product. There were some good answers produced by some candidates and few problems emerged.

Question 4

This question required candidates to describe a four-axis machining process. Although there were some very good answers achieving both marks on offer there were also some very poor

answers from some of the weaker candidates generally in relation to the function of the fourth axis.

Question 5

This question required a discussion of two benefits of rapid prototyping in the design development of the perfume bottle prototype. The markscheme offered lots of alternatives and most candidates were able to produce answers which matched the markscheme. Depth of response for the third mark in each cluster of points was the major issue.

Question 6

This question asked for a discussion of three benefits for consumers of purchasing classroom furniture produced by CAD/CAM. This question posed few problems apart from the issue of depth of response.

Option D - Textiles

This is not a very popular option

Question 1

- a) This question asked candidates to state one characteristic of polyester that makes it suitable for the graft apart from biocompatibility. A range of answers were identified in the mark scheme and the question posed no problems for candidates.
- b) This question asked for one benefit of using a woven fabric for the graft. Again a range of answers were offered in the mark scheme and the question was answered well by most candidates.
- c) This question required an explanation of one reason why biocompatibility is important in the development of textile vascular grafts. It was answered well by the majority of candidates.

Question 2

- a) This question required candidates to state one benefit of producing yarn from mixed fibres – it posed no problems for candidates and was generally well answered.
- b) This question required candidates to outline one advantage of spinning wool fibres into yarn. This posed few problems for candidates and was well answered.

Question 3

- a) This question asked for an outline of one benefit of the introduction of circular knitting machines for manufacturers. There were a range of possible answers in the mark scheme and most candidates found an answer and achieved the one mark on offer.
- b) This question asked for an outline of one benefit of the introduction of circular knitting machines for consumers. Again, there were a range of possible answers in the mark scheme and most candidates found an answer and achieved the one mark on offer.

Question 4

This question asked for an outline of one benefit of using CAM for embroidering clothes. It posed no problems for candidates and was well answered.

Question 5

This six-mark question required a discussion of each of two issues [three marks per issue] relating to the branding of textile products for adolescents. It was straightforward and as for most three-mark questions the major issue related to depth of response.

Question 6

This question asked for an explanation of three advantages [3 marks per advantage] of using nylon for an automobile (car) airbag. The question posed few problems apart from the issue of depth of response.

Option E – Human factors design

This is by far the most popular option.

Question 1

- a) The first part of this is question, worth one mark, asked candidates to state the type of data scale represented by the general comfort rating scale shown in Figure E1. The answer of ordinal seemed straightforward but was identified by only about half the candidates. There was a whole range of wrong answers and no common pattern.
- b) The second part of the question, worth two marks, asked for a reason for using this type of data scale. Candidates who had recognized the type of scale correctly were generally able to offer a reason for its use. Some candidates despite getting the first part wrong were able to offer an appropriate response to this question and achieve their marks.
- c) The third and final part of this question, worth three marks, asked for an explanation of which point on the comfort rating scale would be appropriate for the design of public seating in a railway station as part of a policy of Design for Discomfort. Wrong answers tended to identify a very high number on the scale. There were some very good answers offered by stronger candidates.

Question 2

- a) This one-mark question asked for one way in which designers allow for variability for human dimensions within a size range. This was poorly answered by many candidates with no common pattern of wrong answer.
- b) This two-mark question asked candidates to outline the percentile range used for shoe sizes for the mass market. Many candidates correctly identified 5th to 95th as the correct response and went on to provide an explanation of this choice. The most common mistake here was not offering a range.

Question 3

- a) This question showed an image of a door handle and asked candidates to state one advantage of it in relation to human factors. It seemed a straightforward question but it was poorly answered with candidates often finding difficulty in identifying a human factors consideration related to the handle.
- b) The second part of the question relate to an image of a doorknob and asked candidates to state one advantage of it in relation to human factors. Again the question was poorly answered although there did not seem to be a particular reason for this.

Question 4

This question asked candidates to identify one disadvantage of using appearance prototypes at the design development stage. This question posed few problems and some very good answers were produced even by the weaker candidates.

Question 5

This question asked offered an image of The Butterfly Stool candidates to discuss each of two human factors considerations in its design. Matching responses to the markscheme and depth of response were major issues.

Question 6

This question required consideration of three pieces of legislation which impact on human factors aspects of the design of an open-plan office. It was generally not well answered. Good answers identified three distinct issues that are covered by legislation and then provided detailed explanation of each issue. Most candidates were able to identify temperature as an issue.