DESIGN TECHNOLOGY

Overall grade boundaries

Higher level

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 14	15 - 26	27 - 38	39 - 50	51 - 62	63 - 74	75 - 100

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 14	15 - 26	27 - 38	39 - 49	50 - 61	62 - 72	73 - 100

Internal assessment

Component grade boundaries

Higher level

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

Standard level

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

General comments

A wide range of suitable projects and investigations were evident throughout the moderation sample, 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. Those schools that continue to adopt design and make activities for all investigations are generally limited by the number of tasks that can be completed in the time available. Although it is best practice to integrate the teaching of the core and options through investigations, the amount of time devoted to IA should not be at the detriment of candidates gaining a detailed insight of subject theory. Schools are asked to avoid excessive use of time for investigations, but are reminded to meet the minimum requirements for SL and HL.

Where schools use only design and make tasks for assessment against the criteria, schools are advised to consider smaller tasks which focus on specific criteria. It is advised to use coursework as a support exercise in order to help candidates understand the theoretical nature of the subject where candidates will be able to develop project skills by concentrating on one or two assessment criteria at a time. For instance, a teacher could provide a brief, specification and some research material which will enable the candidates to develop and model ideas to be assessed for Development, an area that is considered a weakness when moderating the Design Technology project.

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.

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. 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.

The topics covered through coursework must be entered on the form 4/PSOWDT along with the time taken for each investigation and indicate where ICT has been used.

Teachers support materials, notes and project briefs should be attached to the sample of work. Marks need to be highlighted on the 4/PSOWDT form for each assessment criteria. Two marks for P, R, D and E must be submitted, one of the marks must be for the design project and the other for any of the other investigations. Only the work that has been highlighted should be sent for moderation.

Most samples were presented in an organized structure, but teachers are 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 included, pages should be folded and slotted in to the A4 report. All photocopied work must be easily legible; the copying of pencil sketched ideas should be avoided.

Candidate performance against each criterion

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 completing a group task. When using the assessment criteria for a design project, candidates should consider the feasibility of the study, identify the user, analyse the situation, write a clear brief which identifies the intended goal and produce a detailed, not generic, specification. Where possible, photographic evidence of problems is encouraged as these can help establish the need. When completing a lab based investigation, independent and dependent variables must be identified.

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 that controlled variables. Thought showers are useful in analysing the type and range of data to be collected, but do not specify where data is to be collected. An example of planning for research is evident on page 28 of the subject guide. Where planning was limited, collected data was either biased or missing critical information. For example, some candidates had been given the task to design and make a CD/DVD storage unit, but there was no evidence of data collection relating to ergonomics, existing products or the size CD/DVD packaging. Tasks relating to the gathering and analysing of information before tackling the Design Technology Project are to be encouraged. The annotation of data and a summary of data collected should aid candidates in the writing of a detailed specification.

Candidates should fully analyze the brief in Planning if they are to prioritize strategies in which to identify wider issues to be researched. 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 problem.

A literature search, a “history of products” PowerPoint presentation or product analysis and the copying of textbooks is to be discouraged. The need to collect data should be apparent.

Smaller laboratory-based investigations where candidates had to collect raw qualitative/quantitative data offered ample opportunity to address the assessment criteria, but not all candidates had processed the information correctly. Tables and graphs must be correctly labelled and results analysed. Such investigations generally took far fewer hours than design and make tasks to achieve the same mark.

Development (D)

This criterion lends itself to **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. Some schools continue to misinterpret the criteria and submitted inappropriate work for the assessment of Development. Literature search assignments, PowerPoint presentations, computer test simulation software and most laboratory-based experiments are not suitable tasks for assessment of Development if candidates are to have the opportunity to be able to achieve 6 marks. This is an area where candidates can lose a significant amount of marks if interpreted incorrectly.

Teachers should consider how the techniques outlined on page 49 of the subject guide along with card, manufactured boards, CAD and Styrofoam, can be used to aid model development. The development stage is not simply making the same model using a range of techniques; it is the refinement of a solution using appropriate strategies in order to establish materials, construction, dimensions, form and finish. 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 complete and presented in an appropriate format, such as engineering drawings or patterns for textile outcomes. Detailing for textile outcomes need to include copies of scaled patterns that include information on where stitches and other fasteners will be used. Food outcomes need to include a detailed list of ingredients and consider methods of how items can be formed together. Detailing for all outcomes needs to be clear and sufficient for projects to be made.

Teachers should note that there should be a clear difference between the initial stages of development and the final outcome if they are to be able to assess Manipulative Skills for the Design Technology Project.

Where outcomes are only virtual, schools are advised to produce more evidence of development, but also consider the possibility of producing a 2D/3D display outcome that will satisfy some of the manipulative skills criteria. Where resources are limited, teachers should consider tasks that only need limited processing for outcomes to be realized, e.g. Confectionery packaging. Teacher led investigations which focus on this criterion alone will aid candidates in developing the necessary skills to tackle a design and make project.

Evaluation (E)

More time needs to be devoted to this criterion if candidates are to achieve high marks. As this is normally the last element undertaken when completing project work, candidates generally leave insufficient time to complete testing. Ideally, candidates need to test their outcomes in the area designed for, or with the user for whom it had been designed. The more organised candidates did leave adequate time to address the criteria to a satisfactory standard. 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. Strategies in dealing with this before starting such projects need to be considered. 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 process of data collection and identify weaknesses in their methodology in order to suggest improvements.

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. If Gantt charts are used, timings need to be more detailed than weeks; candidates should, ideally, plan to the hour and revise the plan when changes are required. Photographic evidence of candidates using equipment at different stages of realization is encouraged. Health and Safety risks need to be considered and evidence of safe working should be obvious. Outcomes need to be of sufficient complexity for the level studied.

Recommendations 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.
- Please note that when assessing IA – Investigations it may not be possible to use all of the assessment criteria for each investigation. The *development* criterion is suited to IA – Investigations that adopt a design and make approach.
- 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.
- Schools are reminded to flag work for moderation.
- Use of the OCC exemplar material is to be encouraged by teachers in helping them understand and meet the standards of assessment.
- Training for those new to teaching IB Design Technology is encouraged.

Higher level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 10	11 - 14	15 - 19	20 - 23	24 - 26	27 - 30	31 - 40

General comments

25 G2s were received for this paper. These comments are carefully studied at the grade award meeting and along with other evidence, in particular the responses that candidates provide on their papers, are then used to determine the grade boundaries. The Grade Awarding team was very pleased to receive an increased number of G2s, however, **all** schools are encouraged to complete and submit the forms for each session. Valuable feedback is also gained through teacher's reflections on the OCC DT forum.

The Grade Award team is also provided with a computer analysis of candidate performance, a difficulty index (Difl) and a discrimination index (Disl).

Difl reflects the percentages of candidates getting the question right and can range from 0 to 100%. A higher Difl means that the question is easy, a lower Difl that the question is harder.

In terms of Disl, when there is a negative discrimination index, this indicates that candidates found the question difficult and the question and answer is checked carefully.

As the number of candidates for Design Technology continues to grow these statistics become more reliable and thus more useful.

The Grade Award team value all responses provided by teachers through the G2 forms as it supports the decision making process of boundary setting. 50% felt that this paper was of a similar standard to last year, with 29.2% finding it a little more difficult and 8.3% finding it much more difficult. 68% felt that the difficulty of the question paper was appropriate. 56% felt that the presentation of the paper was good.

The questions on this paper are designed to test objective 1 and 2 assessment statements, although it is possible to use an objective 3 assessment statement as the basis for a question. All questions are designed to fit a difficulty matrix (25% are deemed to be easy, 50% moderate and 25% hard) and are carefully considered in order to provide breadth across each topic of the Guide (core and AHL topics).

With regards to wording, 68% considered it to be satisfactory or good.

One G2 commented that ESL (English as a Second Language) candidates might find this paper difficult.

One G2 commented that they felt that the paper was too short with candidates finishing early. We can only suggest that candidates take any extra time to carefully read the questions and check their responses.

Individual question analysis

Question 5

One G2 commented that the guide was not clear enough to provide the answer to this question which meant that candidates would be guessing. It is important to understand that answers are intrinsic in the statements of the guide. Application and assimilation of knowledge is required to generate the correct response. Candidates did find this question difficult (Difl=40.15) with a reasonable level of discrimination (Disl=0.30).

Question 11

One G2 commented that the terminology used within this question was 'unusual'. This was considered in great detail, but the question was considered to be satisfactory. Candidates did not necessarily have a problem with is question and found it fairly easy and it was not negatively discriminating (Difl=65; Discl=0.19).

Question 13

One G2 comment suggested that "cross-sectional" area may not be language that candidates are not familiar with. It was felt that due to the nature and breadth of this subject that it should be common terminology. This was a harder question with a good discrimination index. (Difl=48.24; Disl=0.46).

Question 23

One G2 commented that the options were poorly worded. This question is deliberately meant to be a more difficult question (Difl=30.15; Disl=0.13) where candidates have to consider different sources of power from different eras.

Question 25

One G2 commented that there could be two answers to this question, A and D. By asking for an advantage of using biomass for cooking this eliminates response D. Candidates found this question reasonably difficult. (Difl=57.50; Disl=0.16).

Question 27

One G2 commented that two answers, A and C could be correct. There appears to be confusion here between forces acting on internal structures as opposed to forces acting on mechanisms (moving structures). It is acknowledged that if "static" had been added to the question it may have been beneficial, but it needs to be noted that this is not referred to in the guide. This was a difficult question (Difl=31.32; Disl=0.26).

Question 29

One G2 commented that answer B could be correct as the ratchet and pawl mechanism could still allow for a "smooth' transition of movement. By definition this mechanism provides a "clunky" movement and thus B is incorrect. Candidates found this question moderately difficult with a good discrimination index (Difl=51.62; Disl=0.39).

Question 34

One G2 comment said it was unclear the depth candidates are expected to have knowledge of the Earth Summit. When considering the guide, the term “explain” infers that candidates need to have some understanding of the global conferences listed. This question was found to reasonably difficult with moderate discrimination (Difl=49.26; Disl=0.22).

Question 37

This proved to be the most difficult question on this paper (Difl=23.38; Disl=0.10) highlighting that the majority of candidates did not understand the concept of social sustainability. One G2 comment said that it found it difficult in the guide to find specific attribute definitions of social sustainability. Whilst we acknowledge that this is a difficult question, the possible answers are all appropriate and the concept of triple bottom line are clearly identified in the guide, but would need to be discussed in a class situation for better understanding and clarification.

Question 38

One G2 comment was that the phrasing of the question made it difficult to understand. Although this proved to be a difficult question (Difl=38.09; Disl=0.11). Through a process of elimination it was possible to identify the correct answer.

Question	A	B	C	D	Difficulty Index	Discrimination index
1	304*	132	122	122	44.71	0.33
2	70	40	509*	61	74.85	0.38
3	137	511*	18	14	75.15	0.12
4	205	330*	41	104	48.53	0.28
5	273*	81	100	226	40.15	0.30
6	88	146	37	409*	60.15	0.53
7	211*	60	210	199	31.03	0.19
8	56	39	31	553*	81.32	0.21
9	95	103	19	463*	68.09	0.05
10	294	353*	17	16	51.91	0.34
11	36	442*	117	85	65	0.19
12	156	23	80	421*	61.91	0.32
13	285	39	328*	28	48.24	0.46
14	35	20	292	331*	48.68	0.22
15	218	85	358*	19	52.65	0.23
16	513*	9	111	47	75.44	0.36
17	73	498*	44	65	73.24	0.26
18	48	5	84	543*	79.85	0.30
19	36	265*	149	230	38.97	0.10
20	96	466*	15	103	68.53	0.34
21	5	14	80	581*	85.44	0.20
22	602*	27	14	37	88.53	0.20
23	288	132	205*	53	30.15	0.13
24	137*	294	78	168	20.15	0.13
25	391*	110	60	119	57.50	0.16
26	112	400*	148	19	58.82	0.53
27	213*	40	293	134	31.32	0.26
28	107	358*	106	109	52.65	0.38
29	159	129	351*	41	51.62	0.39
30	78	214	94	293*	43.09	0.29
31	91	195	266*	127	39.12	0.19
32	79	64	483*	54	71.03	0.17
33	384*	41	48	207	56.47	0.27
34	335*	113	87	145	49.26	0.22
35	98	92	452*	36	66.47	0.26
36	81	495*	70	34	72.79	0.32
37	165	211	159*	145	23.38	0.10
38	89	177	259*	155	38.09	0.11
39	58	68	410*	144	60.29	0.27
40	64	418*	45	153	61.47	0.19

Number of candidates 680

Higher level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 5	6 - 11	12 - 18	19 - 25	26 - 33	34 - 40	41 - 58

General comments

This paper is designed to test candidates' subject knowledge and the ability to apply the knowledge to different design contexts in a logical and concise manner. It also tests candidates' ability to analyse and use qualitative and quantitative data as well as to select and apply relevant information to answer questions. In order to do this, the paper is composed of a number of questions based on given data (Section A question 1), a series of short answer questions (Section A questions 2 – 6) and a choice of one out of 3 questions in Section B. The differentiating factors when reviewing candidates' performance, as evidenced in the marked scripts at the Grade Award meeting, is how well candidates have answered the data based question in Section A and the 9 mark question in Section B. Many candidates will be able to answer the short response questions in Sections A and B with good syllabus recall, but only the better candidates are usually able to respond well to the extended response question in Section B requiring the construction of a detailed explanation in applying relevant information to the concepts and principles involved in the stated design contexts. In Section B, question 9 was the least popular and question 8 was the most popular. 25 G2 forms were received by the time of the Grade Award meeting. As can be gleaned from the statistics, most teachers thought that the paper was satisfactory or good. Many teachers commented on the inappropriateness of question 1 (b) (ii) as the question referred to kilometres but the data referred to miles. As can be seen below, members of the Grade Award team took note of the comments. 20% of teachers who completed a G2 form thought that the wording of the paper was poor - a considerable increase on previous years. It may be that the consternation caused by the offending Q1 (b) (ii) question prompted such a response.

Comparison with last year's paper

Not apllicable	**A little easier**	**Similar standard**	**A little more difficult**	**Much more difficult**
8%	8%	63%	21%	0%

Suitability of question paper

	Too easy	**Appropriate**	**Too difficult**
Level of difficulty	4%	83%	13%

	Poor	**Satisfactory**	**Good**
Clarity of wording	20%	56%	24%
Presentation of paper	4%	36%	60%

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

Section A

Question 1

a) (i) Most candidates were able to answer this question correctly.

(ii) This was a straightforward question with many possible answers.

(iii) Candidates needed to focus on the design of the tyres (rather than the wheels) or the suspension.

b) (i) Candidates were required to consider the wider implications of creating electricity – question (a) (i) should have led them in the right direction.

(ii) Apologies are due for the confusion caused by this question. As teachers pointed out in their G2 form responses, it is not appropriate to assume that candidates can convert miles to kilometres from memory. The Grade Award team decided to remove this question from the paper in order to be fair to all candidates.

c) (i) Most candidates provided the correct answer to the question.

(ii) Although most candidates correctly identified the appropriate percentile range, not many achieved all three marks by explaining that designing for a wider percentile range than the 5^{th}-95^{th} would be uneconomical.

d) (i) *Performance Test* was the correct answer based on the syllabus content but *Impact Test* was also accepted as this is referred to in the stem of the question.

(ii) Most candidates correctly referred to safety issues but did not necessarily gain the third mark available by stating that the data from the trial would be qualitative not quantitative.

e) (i) Most candidates gained at least one mark by referring to different head sizes/weights but not many expanded on this answer with reference to the wider user population.

(ii) Many candidates correctly considered different shapes of potential hazards, although for the second available mark a suitable example was required.

Question 2

a) The concept of *constructive discontent* needed to be outlined as a strategy for designers to identify opportunities for re-designing existing products by modifying certain features.

b) Reference to specific evaluation strategies (user trial or user research) was required in order to gain full marks.

Question 3

a) Many candidates failed to succinctly describe the filament winding process and resorted to describing what they could glean from Figure 7.

b) Not surprisingly, most candidates failed to gain any marks for this question as they could not correctly answer part (a).

Question 4

a) Most candidates found this question to be relatively easy.

b) In order to gain all three marks, candidates needed to think through their answer carefully before committing pen to paper. Specific reference to how the purchase of standard performs and caps would impact on the manufacturing process of the bottles was required. Most candidates gained at least one mark but not many achieved all three marks.

Question 5

a) Candidates who read the stem of the question carefully were able to identify the link between "first company to develop the product" and a *pioneering strategy*.

b) One teacher commented that reference to the Minigorilla was 'inappropriate as it is not mentioned in the syllabus' but knowledge of this particular company was not required in order to answer the question but rather a study of the different range of plugs shown in Figure 11.

Question 6

a) Many candidates did not read the question carefully enough and described an alloy rather than a superalloy.

b) Even though many candidates failed to gain full marks for part (a) of the question they did successfully relate the high melting point of a nickel-based superalloy to the heat generated by an aircraft engine.

Section B

Question 7

a) (i) Many candidates' answers were far too vague to gain full marks to this question.

(ii) There are quite a number of advantages that could have been outlined but many candidates did not focus specifically on **one** of them in enough detail.

b) (i) Some candidates confused the concept of *factor of safety* with security checks mentioned in the stem of the question rather than relating it to the structure of the chair.

(ii) Many candidates referred to a wide range of weights of users but this data would have been taken into account by the designer of the chair in relation to expected load rather than an unexpected load.

c) (i) This was a fairly straightforward question, although some candidates confused user trial with user research.

(ii) The aim of the question was for candidates to appreciate the conflict designers have when trying to balance different requirements for the chair. Candidates should have thoroughly read the stem of the question, which refers to the three aspects to be discussed. Once again, candidates who planned their answer astutely and correctly identified three factors in each explanation for security, aesthetics and ease of maintenance achieved high marks.

Question 8

a) (i) Most candidates successfully focused on continuity of supply related to geographical location.

(ii) Many candidates provided vague answers lacking in suitable detail and merely described what they saw in Figure 14 and read in the stem of the question.

b) (i) To answer this question successfully candidates needed to understand the relationship of the thermal conductivity property to the concept of a building envelope.

(ii) Many candidates confused part (a) of the question with part (b). Part (b) follows on from part (a) by focusing on material choice relating to u-value.

c) (i) Not many candidates understood the difference between an active solar water heating system and a photovoltaic system.

(ii) This was not inherently a difficult question but many candidates produced quite convoluted answers. As always with these nine mark questions, there are three marking points for each of three aspects to the question. In this case, the three aspects related to ways in which buildings can be designed to reduce energy consumption. Some candidates clearly felt comfortable with the question and scored highly even though they might not have achieved high marks for other parts of question eight which required technical knowledge.

Question 9

a) (i) As this question begins with the command term *identify* and is worth two marks candidates needed to refer to the relationship of effort, fulcrum and load to a first class lever for full marks.

(ii) A fairly straightforward calculation though many candidates failed to correctly identify the correct elements of the equation.

b) (i) Not many candidates successfully identified design costs as part of the fixed costs which need to be covered before any profit is made.

(ii) The relationship of quantity of production to fixed costs and hence, breakeven point, was not well understood by the majority of candidates.

c) (i) The concept of *form v function* is commonly used in questions, so most candidates seemed familiar with it and how it applied to the given context.

(ii) Many candidates did not fully understand *product life cycle* and confused it with *design cycle*. When planning the answer to this question, it was crucial that candidates considered the appropriate life cycle stage that related to *product image, performance and durability*. Where this was done, high marks were attained.

Recommendations for the teaching of future candidates

The key elements for success on Paper Two are the ability to deal effectively with the data based question (Question 1) in Section A and the ability to score highly on the Section B question. The data based question tests candidates ability to understand and select appropriate data as well as to apply it to concepts and principles taught in the course. The context for question one is not based on the syllabus, therefore candidates should be given experience prior to sitting the examination in analysing data from unfamiliar contexts.

There will always be more data provided than is needed to answer the questions. Therefore, candidates should not be surprised by the amount of data, but should calmly try to assimilate it, and then read the questions carefully to see which parts of the data they need to use. As all candidates undertake a course in Mathematics it is assumed that they are familiar with basic mathematical calculations.

The three questions in Section B are designed to obtain wide syllabus coverage. For question setters, the challenge is to ensure that the questions have parity in terms of degree of difficulty. Naturally, some questions will be more appealing to candidates depending on their preference for different topics in the syllabus and the perceived accessibility of the design context. Candidates should be encouraged to weigh up the pros and cons of each of the questions before deciding which one to answer.

The paper is formatted to encourage candidates to be concise with their answers and recognize the link between the *command term* which starts the question and the amount of marks allocated. Candidates should be familiar with this link and how the command terms are categorized. Many candidates waste time providing lengthy answers which do not gain marks because they are not well-constructed.

Higher level paper three

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 4	5 - 8	9 - 13	14 - 18	19 - 24	25 - 29	30 - 40

General comments

The examining team was heartened to see the increase in the number of Schools sending in G2s this session. The G2s are incredibly helpful in giving feedback to the examining team on the quality of the paper and any problems encountered by the candidates. To those Schools submitting G2s, many thanks are due, to those not submitting, please do so next year. 25 G2s were received. Of these 21 (84%) thought that the level was appropriate and four (16%) thought it was too difficult. In comparison with last year's paper two, respondents said it was a little easier, twelve thought it was of a similar standard and eight thought it was a little more difficult. In terms of clarity of wording, two thought that it was poor, twelve thought it was satisfactory and twelve thought it was good.

In terms of presentation of the paper, two thought that it was poor, nine thought it was satisfactory and fifteen thought it was good. This was the first time that boxes were put around the spaces for the answers and these seemed to invoke negative responses from Schools. The boxes have been included in preparation for e-marking.

One G2 general comment suggested that the paper was *'hard'*, another said it was *'generally quite good'* and a third stated that there were *'no problems'*. A fourth said that the questions were *'suitable to the nature of the guide and straightforward'*. Obviously, reactions to the paper depend on which option that schools tackle. In descending order of popularity were Option E, Option C, Option A, Option D and Option B.

One worrying issue is that the candidates from some (poorly performing) schools between them tackle all the options on the paper. This may be due to a misunderstanding by some teachers that they should select one option and integrate it into the scheme of work. It may be lack of explanation to the candidates that they should only answer one option. In view of the very poor performance, it feels like the candidates may be self-taught on the options. This is counter to the spirit of what is required.

Another worry is that individual candidates tackle all the options on the paper. This may be an attempt to get the best possible marks for the paper, since the examiners are required to mark all the options and award the marks for the best option. However, the candidates doing this are generally very weak, do not focus on one option and not working on one option to achieve the best possible mark disadvantages them further.

Candidates need to be taught how to answer these questions and the significance of the action verbs/command terms which are listed in the subject guide. The examining team is careful to use action verbs/command terms from the guide to indicate to candidates the depth of answer required.

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

OPTION A – Food Science and technology

Question A1

The stem of this question was a table of nutritional information relating to a cheeseburger, large French fries and medium chocolate milkshake meal from fast food restaurant as shown on the company website.

a) The first part of the question required that candidates performed a straightforward calculation to state the percentage of the Guideline Daily Amount (GDA) for an average adult woman. One mark was awarded for stating the percentage of the GDA for energy for an average adult woman as 59% or 1170/2000, i.e. 58.5%, depending on which data the candidate selected. This question posed few problems for most candidates.

b) This question asked candidates to outline one reason why a balanced diet should contain some fat. One mark was awarded for a reason and one mark for a brief explanation. A diversity of answers were included in the markscheme:

- that fat acts as a vehicle to help the absorption of fat-soluble vitamins and these help prevent fat-soluble vitamin deficiencies
- that fat provides energy and low fat diets may not provide enough energy
- that some fatty acids are essential and therefore cannot be produced by the body and must be provided by the diet for health.

This question was not well answered by all but the stronger candidates and most candidates achieved one mark. A number of candidates scored zero on this question.

c) This question asked candidates to explain one implication of excess fat intake for health. One mark was awarded for each of three distinct correct points in an explanation of one implication of excess fat intake for health.

The markscheme noted that high dietary fat intakes, especially of saturated fat, can lead to increased levels of cholesterol which can lead to coronary heart disease/obesity and poor health. Three mark questions are requiring candidates to go into some depth with three distinct points. Those candidates listing three different implications with no detailed explanation did not score more than one mark. Many candidates were able to score two marks on this question. Lack of clarity in the writing of the answer meant that only a few candidates scored the third mark.

Question A2

The context for this question was a photograph of a woman selling food on the street.

a) This question asked for a definition of food hygiene. One mark was awarded for a definition of food hygiene to the effect of *'all aspects of the processing, preparation, storage, cooking and serving of food to make sure that it is safe to eat/does not make people ill'*. This is obviously a long and complex definition. About half the candidates were able to provide adequate definitions and achieve the mark for this question.

b) This question asked candidates to outline one consideration relating to the control of food hygiene for food which is available for purchase on the street. One mark was awarded for each point in an outline of one consideration relating to the control of food hygiene for food which is available for purchase in the street and one for a brief explanation.

   A range of answers were included in the markscheme relating to the control of contamination from dust and other debris, people accidentally or deliberately coughing/spitting into the food, pollution from car exhausts/factories and birds defecating or and growth of bacteria in food which is not properly cooked or stored at an appropriate temperature resulting in food poisoning through the appropriate use of utensils/tongs to pick up food and keeping the food covered to prevent contamination.

Question A3

The context for this question was a photograph of a tomato which had been spoiled.

a) The first part of this question required candidates to identify the type of spoilage shown in the photograph. One mark was awarded for stating the type of spoilage and one for a brief explanation. The type of spoilage was microbiological spoilage as a mould/fungus was clearly growing on the tomato. Many candidates just said microbiological spoilage without any explanation and so achieved just one mark.

b) The second part of the question required candidates to outline how sun drying of tomatoes preserves them. One mark was awarded for stating that sun drying lowers water activity or reduces the water content and one mark for stating that this limits bacterial growth. This was not answered well by many candidates.

Question A4

This was a question about the way in which lifestyle issues have contributed to the growing market for organic products in some countries. One mark was awarded for each of three distinct correct points in an explanation of each of two distinct lifestyle issues which have contributed to the growing market for organic products in some countries. A diverse range of answers were offered in the markscheme including:

- increased health awareness and concerns about food scares, *e.g.* mad cow disease, salmonella in eggs, which has made people much more interested/concerned about where their food comes from and that organic products often have a known provenance.
- fashion and media influences - it is “cool” to be organic and so it makes a statement resulting in ideopleasure
- ethical considerations and concerns about factory farming and animal rights issues with organic produce being seen to be more appropriate.
- promotion of organic products by supermarkets have promoted organic produce given it a higher consumer profile and although more expensive, people are prepared to pay a premium for organic products as they are perceived to be better.

This question proved quite discriminating and good candidates were able to provide answers of sufficient depth to achieve the full six marks. Those candidates not adopting a structured approach and providing what were effectively lists of points rather than developing a deeper explanation achieved fewer points.

Question A5

This question was about undernourishment and how climate change contributed to it.

a) This part of the question asked candidates to describe undernourishment and the markscheme awarded one mark for each of two distinct correct points in a description of undernourishment. Only very good candidates were able to achieve a good description of undernourishment.

b) This part of the question asked candidates to list two implications of climate change that may lead to increased undernourishment in the developing world. A list including: floods; drought; temperature change; erratic weather patterns; gales/high winds, was included in the markscheme. Most candidates were able to list at least one implication of climate change that impacted on undernourishment.

c) This part of the question required one strategy to deal with the implications of climate change for increased undernourishment. Potential answers included:

    - irrigation/flood prevention schemes to ensure optimum water reaches food crops.
    - desalination schemes to remove salt from sea water and make it fit for agricultural use.
    - the breeding of different cultivars that are able to cope with the different conditions, e.g. drought resistant/salt resistant cultivars.

Question A6

The context for this question was the genetic modification of food crops, in this instance the case of Golden Rice. One G2 commented on the use of the word ‘underpinning’ as not being commonly used in the US in Option A question 6a and 6b. The examining team tries to avoid using terms which do not travel well from one context to another.

a) The first part of question 6 asked candidates for an explanation of the principles underpinning genetic modification of crops such as Golden Rice and required three distinct points of explanation to achieve the full marks. Few candidates achieved two or three marks on this question.

b) The second part of question asked for an explanation of one ethical issue underpinning public concerns about the safety of genetically modified foods, e.g. Golden Rice. A range of answers were provided in the markscheme. This was better answered by candidates and many scored two marks. Depth of response is required to achieve the third mark on these three mark questions.

Question A7

This question asked for a suggestion of each of three reasons for the increased incidence of food allergies and food intolerance in developed countries. One G2 commented that this was an unfair question and another that the topic is well outlined in the Guide but that there is no mention of needing to know the reason for their increase. There was no noticeable difference between the performances of candidates on this nine mark question than the other nine mark questions in the other options. A range of answers were included in the mark scheme: better diagnosis of food intolerance; that people eat a wider range of foods than they may have done previously due to travel, the media and the availability of different foods; that foods introduced later in life may cause more problems than those introduced early in life; the increased use of food additives/more exposure to environmental chemicals; increase in manufacture of processed foods which may contain traces or ingredients of trigger foods, *e.g.* nuts/dairy. Good candidates provided a depth of response and achieved high marks for their answers.

OPTION B – Electronic product design

This option was the least popular and not answered by many candidates, therefore, it is difficult to provide meaningful feedback as to candidate performance.

Question 1

The context for this question was a security system with three sensors: A, B and C, which activate an alarm if an intruder is detected.

a) This question asked candidates to state the logic gate required for the security system which was an OR gate. Most candidates including the weakest candidates were able to answer this question.

b) This question required candidates to draw the truth table for all possible combinations of inputs. One mark was awarded for including all eight input combinations (in any order) and one mark for only having a 0 when all inputs are 0 as shown below. This did not prove too challenging for most candidates who were able to construct the truth table.

A	B	C	Q
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

c) The final part of this question required candidates to draw a circuit for sensor A in which sensor A – a pressure pad which acts as a push switch and is closed when stepped on by an intruder – is placed underneath a carpet in the entrance to zone A. One mark was awarded for using the correct symbol for a push switch, one mark for the labelling of 0V, 5V and output A and one mark for the use of a pull down resistor (any value). Surprisingly, this question proved very challenging for many of the candidates attempting Option B.

Question 2

This question drew on section B9 of the Guide.

a) Part (a) asked for a definition of dematerialization. One mark was awarded to a definition to the effect of: *the reduction in the weight and use of materials*. Many candidates were able to provide an appropriate definition and achieved one mark

b) This question asked candidates to list two ways in which manufacturers can minimize the damage caused to the environment during the life of an electronic product. One mark was awarded for each of two ways in which manufacturers can minimize the damage caused to the environment during the life of an electronic product. The markscheme included a variety of answers:

- minimizing the use of toxic materials
- designing products to last longer; designing for disassembly
- designing so product can be upgraded
- designing using recycled material
- designing using reusable parts
- designing for recycling/reuse
- designing for minimal energy usage

This question did not pose major challenges for most candidates.

Question 3

This question focused on the differences between analogue and digital signals and the conversion of an analogue to a digital signal with a Schmitt trigger.

a) The first part of the question required candidates to outline one different between a digital and an analogue signal. The markscheme identified that an analogue signal continuously varies and can take any value, whereas a digital signal takes discrete steps/can be represented as binary number/is on or off/0 or 1. All but the poorest candidates were able to achieve one or two marks on this question.

b) The second part of the question required candidates to outline one reason why a Schmitt trigger NOT gate is more suitable than a standard NOT gate when converting an analogue signal to a digital signal. One mark was awarded for each of two distinct points in the outline. The markscheme identified that a Schmitt trigger has a dead band and does not respond to small changes that might happen with an analogue signal. This question proved more of a challenge for candidates.

Question 4

This question asked candidates to discuss one advantage and one disadvantage for an Internet service provider operating a satellite-based system rather than an optical fibre-based system. The markscheme awarded one mark for each distinct correct point in a discussion of one advantage and one disadvantage. The question paper put in the headings advantage and disadvantage which seems to encourage better responses from candidates. The markscheme identified an advantage as that satellite footprint gives coverage in remote areas and does not have to be laid over terrain physically so that the footprint can be moved easily according to need. It identified a disadvantage as the cost - satellite systems are expensive and the antenna must be accurately pointed at the satellite and can be disrupted by bad weather. This was answered reasonably by all but the weakest candidates.

Question 5

This question focused on convergent technologies

a) The first part of the question asked candidates to outline one way in which convergent technologies can enhance human communication. One mark was awarded for each of two points in an outline. The markscheme identified that converging technologies can remove barriers to communication such as physical barriers, language difference and geographic distance. Most candidates were able to achieve at least one mark.

b) The second part of the question focused on the way that convergent technologies could be applied to national defence again awarding one mark for each of two distinct correct points. The markscheme identified that converging technologies can keep humans remote from the combat zone and provide secure communication of real-time information to front line combatants, information gathering and processing technologies and interfacing combatants with weapon systems. This was relatively straightforward for most candidates.

c) The third part of the question required candidates to outline of one way in which converging technologies could improve human health and awarded one mark for each of two distinct correct points. Converging technologies enable the application of nanotechnologies to implants and brain/machine interface can be used for diagnostic purposes/treatment purposes. This question posed few problems to candidates.

Question 6

This question focused on smart homes and the use of programmable interface controllers in controlling a smart home.

a) The first part of the question asked candidates to explain one way in which modern electronic computer systems are used to monitor and perform functions in a smart home. The markscheme awarded one mark for each of three distinct correct points of explanation.

   The markscheme identified the integration of a range of functions, *e.g.* heating; lighting; power generation, *e.g.* tracking sun with solar array; security, with control by programming or voice control. The question was relatively straightforward for most candidates.

b) The second part of the question required candidates to explain why programmable interface controllers (PICs) are particularly suitable for controlling a smart home awarding one mark for each distinct correct point of explanation. The markscheme identified their multiple inputs/outputs which make them easy to interface with a variety of input and output devices; their data storage capacity; that they are controlled by software not hardwiring and are reprogrammable so they can be upgraded according to system needs. Most candidates found this question straightforward.

Question 7

This question focused on the importance of global standards for digital electronic products and their benefits for users and manufacturers. One mark was awarded for each of three distinct correct points of explanation of the importance of global standards for digital electronic products, of the benefits for users and the benefits for manufacturers. Candidates scoring better on this (and similar extended response questions) put in headings and organise their answers providing three distinct points under each heading. Those candidates not structuring their answers tend to go into a stream of consciousness and often do not provide enough marking points and repeat points. As indicated in the Group 4 grade descriptors answers from the best candidates are often more succinct than those from weaker candidates.

OPTION C – CAD/CAM

Question C1

The context for this question was the CAD image of a ring showing two forms of CAD modelling – solid modelling and wire frame modelling.

a) The first part of the questioner required candidates to state one advantage of wire frame modelling for the manufacturer. The markscheme awarded one mark for stating an advantage and offered a list including: that the manufacturer can see internal design structure of the ring; that it is a relatively simple model; that it is fast to produce and modify; that it can be rotated to provide new desired views; that the manufacturer can see how the diamond is fitted into the setting; and that it provides coordinates for CAM. Most candidates were able to prove a response and achieve a mark.

b) The second part of the question asked candidates to outline one advantage of the solid model for the client. One mark awarded for identifying an advantage of the solid model for the client and one mark for a brief explanation. Most candidates scored at least one mark on this question and many scored two marks.

c) The third part of the question asked candidates to explain one implication of the use of the CAD model of the ring for the cost-effectiveness of production. One mark was awarded for each of three distinct correct points of explanation. Again there were a range of answers. The better answers gave three clear points of explanation and achieved three marks.

Question C2

a) This question asked candidates to state one way in which CAM has impacted negatively on the workforce. One mark was awarded for an appropriate response, e.g. unemployment; 24/7 working; change in nature of jobs; change in requirement for education/training. This was an easy question and most candidates achieved the mark on offer.

b) This question asked candidates to outline one way in which CAD supported flexible working. One mark was awarded for identifying one way in which CAD supports flexible working and one mark for a brief explanation. This question was not well answered by many of the candidates.

Question C3

The context for this question was an image showing finite element analysis (FEA) of part of a bicycle frame.

a) The first part of the question asked candidates to describe what the colours on the FEA image meant. One mark was awarded for each of two distinct correct points in a description of what the colours on the image meant. This question was found to be relatively straightforward by most candidates who achieved two marks for answers to the effect that the red bits on the FEA image indicated high stresses and the blue/green bits indicated low stresses.

b) The second part of the question went on to ask how the FEA image would be used by a designer. One mark was awarded for each of two distinct correct points. Points were awarded for identifying that the design would be modified to reduce the stresses to ensure product safety. This question proved more problematic for many candidates and many candidates only scored one of the two marks on offer.

Question C4

The context for this question was an image of a rapid prototype of a mobile phone produced using laminated object manufacture (LOM). One mark was awarded for each distinct correct point in an explanation of each of two limitations of rapid prototyping using LOM. A range of marking points was offered in the markscheme. The question required candidates to identify the limitations of LOM as a rapid prototyping technique and also to be able to provide sufficient depth of response to achieve all six points.

Good answers tended to be well structured, often using bullet points to emphasise the distinct points in the response. Unstructured answers often were repetitive and so did not score full marks.

Question C5

a) The first part of this question asked candidates to outline one way in which the use of a single-task robot might be considered cost-effective by a small company. One mark was awarded for each of two distinct correct points in an outline. A range of responses were included in the markscheme:

- that it is good for simple, repetitive tasks and can replace human labour and so achieve cost savings; that is can be used in extreme environments and so saves having to put a human at risk
- that it would be relatively cheap and the return on investment could be achieved quickly
- that it can be integrated into an existing production system using people so that there would be no need to invest in a complete/expensive new production system.

Surprisingly, although the question seemed quite straightforward many candidates only scored one point rather than two for this question.

b) The second part of this question asked for an outline of one way in which the use of a multi-task robot might be considered to be cost-effective by a company which batch produces different components. One mark was awarded for each of two distinct correct points of response. The markscheme was looking for the issue of reprogrammability so that the robot could be reprogrammed to do a number of different tasks on an assembly line. This question was not well answered by candidates and many scored zero points. It is important to recognise that the questions are likely to be trying to elicit different responses and on these multi-part questions candidates should plan their answers rather than jump in else they might find themselves repeating an answer to an earlier part of the question or not being able to identify an appropriate response to a later part having put the same thing for the first.

c) The third part of the question asked candidates to outline how a team of robots contributed to assembly-line production. One mark was awarded for each of two distinct correct points in an outline. The markscheme offered two sets of responses:

- one about sequencing the team of robots along the assembly line so they could undertake a series of tasks in the assembly of the product
- the other was about the inbuilt quality control resulting form the deployment of robots as a result of the low manufacturing tolerances achieved.

Question C6

This question focused on the use of CAM, medium-density fibreboard (MDF) and knock down (KD) fittings for the manufacture of flat-pack furniture, e.g. kitchen cabinets.

a) The first part of the question required candidates to compare the use of CAM and KD fittings to more traditional manufacturing techniques for the manufacture of the kitchen cabinet. Compare questions require candidates to identify a relevant aspect and to show how the aspect relates to the things being compared (see below). One point was awarded for a relevant aspect and one for saying how the aspect relates to that which is being compared.

Candidates often lost the third point by not being structured in their responses. Use of a table format for the response ensures that the full marks are achieved.

Aspect:	**Use of CAM/KD fittings**	**More traditional manufacturing techniques**
Costs;	cheaper to produce using CAM and KD fittings;	much more expensive as it takes longer;
Assembly;	easy for customer to assemble so often used for flat-pack furniture;	generally assembled by craftsperson;
Quality control ;	consistent as controlled by computer;	relies on skill/attitude of people;

b) This question asked candidates to discuss one issue relating to the use of MDF in the manufacture of the kitchen door for the kitchen cabinet using CAM. Four sets of answers were offered: the first related to the quality of the finish and that MDF required finishing, for example by the use of a veneer; the second related to safety and that MDF gives of a potentially toxic dust during manufacture and that appropriate safety measures need to be put into place; the third related to the constraints on the use of cutting and joining techniques and the impact of this for the designer; the final set related to the product life cycle and that MDF is not as durable as solid timber and therefore is likely to be damaged more easily in use and more likely to become obsolete in a short time. This question was poorly answered and many candidates did not score the full three marks on offer.

Question C7

This question asked candidates to discuss three advantages and/or disadvantages of computer-integrated manufacture (CIM) to a car manufacturer. The markscheme awarded one mark for each of three distinct correct points in a discussion of each advantage or disadvantage. One G2 commented that this was a confusing and misleading question and asked what the candidates were supposed to do. It was clear that the candidates understood that they could offer advantages or disadvantages in response to the question.

What was also clear was that many candidates did not understand the significance of CIM. Many discussed the use of robots. Some talked about CAM. Only a few candidates gave good answers to this question. The best answers demonstrated a clear understanding of CIM and were well structured.

OPTION D – Textiles

Question D1

The context for this question was the ripstop nylon used to make a kite. The stimulus material showed an image of a boy flying a kite and a picture of a kite.

a) The first part of the question asked candidates to state one aspect of the specification of the material for the kite. One mark was awarded for a correct answer. A long list of possible answers was included in the markscheme. Most candidates were able to achieve one mark.

b) The second part of the question asked candidates to outline one aesthetic consideration which makes nylon a suitable material for use in the production of the kite and awarded one mark for each distinct correct point. That the kite requires a brightly coloured material and nylon fibres can be produced in a range of colours; that designs are often printed on the material and nylon can easily be printed on were offered in the markscheme as potential responses. Most candidates achieved at least one mark and many achieved two marks on this question.

c) The third part of the question asked candidates to explain how the characteristic of ripstop would be manufactured into the nylon for the kite. One mark was awarded for each of three distinct correct points of response. Assessment statement D.2.16 states: "Explain how the desired characteristics are developed in textile products through treating the raw material, manufacturing and finishing". Ripstop is one of the characteristics that the teacher's notes list for consideration. Despite this, it was as if most candidates had never heard of the term. There were some valiant attempts at answers by some candidates!

Question D2

a) The first part of this question required candidates to state one advantage of designing smart clothing. Several potential answers were offered in the markscheme. Most candidates were able to achieve the mark on offer.

b) The second part of the question required candidates to outline one benefit of the manufacturers of fashion clothing collaborating with electronics companies to produce wearable computing garments. One mark was awarded for each of two distinct correct points of outline. The markscheme offered two pairs of answers:

- first that the partners offer different skills sets and so there are collaborative learning opportunities for both partners
- second that there is the potential to develop new products/markets and both companies can benefit from product diversification/market development.

Surprisingly, this question proved a challenge and many candidates gained just one mark.

Question D3

a) The first part of this question required candidates to describe the sublimation printing process. One mark was awarded for each of two distinct correct points in a description. The markscheme offered the response that dyes are printed onto fabric and heat is applied so the dyes sublime (change from solid to gas without passing though a liquid phase) and the image formed. This question was not a major challenge for candidates.

b) The second part of the question asked candidates to outline one limitation of using the sublimation printing process and awarded one mark for each distinct correct point of outline. The markscheme offered three pairs of responses:

- durability since the image fades over time as the dye washes out of the fabric
- image quality – there is a slight blurriness at the edge of a colour results from diffusion of the gaseous dye through the fabric
- substrate material – the image can be printed directly onto fabric.

This question was poorly answered by many candidates.

Question D4

This question required candidates to explain two issues relating to the manufacture of silk substitutes. One mark was awarded for each distinct correct point in an explanation of each of two issues. Several responses were offered in the markscheme:

- the inferiority of silk substitutes, the elite status of silk products
- the impact on the silk industry. As with all questions offering three marks for appropriate depth of response
- candidates offering well structured answers achieved the highest marks.

Those candidates not structuring their responses tended to repeat points and not to provide the requisite depth of response.

Question D5

a) The first part of this question awarded one mark for each of outlining one benefit of manufacturers achieving the European Union (EU) flower for their textile products and one mark for a brief explanation. Several pairs of answers were offered in the markscheme:

- that the EU flower indicates to the consumer that the product has met the most stringent environmental standards which are independently verified and endorsed by the EU
- that it satisfies the market for “greener products” potentially increasing sales
- that it may anticipate future legislation and in being pro-active in making changes early a manufacturer may not to be caught out later
- image and endorsing a pro-active “green” corporate strategy.

This was reasonably well answered by most candidates.

b) The second part of the question required candidates to outline one environmental issue relating to the dyeing of dyeing of cotton cloth and awarded one mark for each distinct correct point of response. Most candidates were able to comment on the toxic nature of textile dyes and their environmental impact is released into ecosystems.

c) The third part of this question required candidates to outline one issue relating to the use of pesticides in cotton production. One mark was awarded for each distinct correct point in an outline of one issue relating to the use of pesticides in cotton production. This question was less well answered and many candidates scored zero or one point rather than the full two marks.

Question D6

a) The first part of this question required candidates to explain one reason why, despite the increased development of new technology, production of many textile products is still labour intensive. One mark was awarded for each of three distinct correct points in an explanation. One response related to the common location of the manufacturing plants of textile companies in developing countries where there is no minimum wage and low employment protection which can make it more cost-effective to use human labour than buy expensive machinery to automate the production process. A second response was that the high end of the textile industry involves bespoke tailoring which is labour intensive due to individual nature of design and production processes and that there is a market where clients are prepared to pay a premium. This question was not well answered by many of the candidates.

b) The second part of the question required candidates to explain one benefit of recycling textile products. One mark was awarded for each of three distinct correct points of explanation of one benefit. One response in the markscheme was about reduced consumption of virgin raw materials and the associated reduced energy use making it a more cost-effective process, a second response was that waste material for landfill reduced can contribute to the greening of textile industry which appeals to ecofans. This question tended to be answered more fully and candidates generally achieved better marks than on section (a).

Question D7

This question required candidates to discuss three ways in which the use of CAD/CAM in the textile industry has helped to minimize waste. One mark was awarded for each of three distinct correct points in a discussion of each of three ways in which the use of CAD/CAM in the textile industry has helped to minimize waste. A range of potential answers were offered in the markscheme as follows:

- facilitates the development and resizing of designs; no need for pattern pieces; quality control.
- precision cutting; lower tolerance on components; eliminates human error.
- tessellation of product components; more components produced per length of fabric; maximises the conversion of raw material into product/reduces waste.
- allows for mass customization/JIT; products made to order; no waste as products paid for prior to production so no obsolete shop stock.

Candidates needed to develop a depth of response to achieve full marks. Better candidates producing well-structured responses achieved eight or nine marks on the question. Again those not structuring their answers tended to repeat themselves and did not score full marks.

OPTION E – Human factors design

Question E1

The context for this question was a diagram of the human information-processing system in operation when a car is being driven.

a) The first part of the question asked candidates to state which part of the human information-processing system is represented by a physiological action. One mark was awarded for stating motor processes/output. Most candidates achieved the mark on offer for this response.

b) The second part of the question required candidates to describe the sensory process in the human information-processing system. One mark was awarded for each of two distinct correct points of description. The markscheme explained that the eyes take in information and send information to brain for processing. Many candidates managed to get both marks on offer for this question.

c) The third part of the question asked candidates to explain the function of memory in the human information-processing system. One mark was awarded for each of three distinct correct points of explanation. The markscheme identified that information from the sensory processes needs to be stored temporarily so that the brain can determine the appropriate action to take before it sends the information to the motor processes. This question was generally poorly answered by candidates with only the better candidates achieving the full three marks on offer.

Question E2

The context for this question was a candidate who continued to wear his favourite pair of training shoes despite them being worn out and him having been given a new pair.

a) The first part of the question asked candidates to state one aspect of the four pleasure framework of which this is an example. One mark was awarded for identifying an appropriate aspect. The markscheme identified physio-pleasure and psycho-pleasure as appropriate answers. The most popular wrong answer was ideo-pleasure.

b) The second part of the question asked candidates to outline one reason why the four pleasure framework is considered part of human factors design. One mark was awarded for each of two distinct correct points in an outline. The markscheme identified that the four pleasure framework relates to the psychological function of products/why people like products and psychological factors are part of human factors design. Surprisingly with the four pleasures framework being the focus of topic E11 this question was very poorly answered by many candidates.

Question E3

The context for this question was two photographs of the Ad-specs – adaptive spectacles designed for use by people in developing countries.

a) The first part of this question asked candidates to outline one reason related to human factors for the size of the lenses of the Ad-specs. One mark was awarded for each of two distinct correct points in an outline. The markscheme identified that one size fits all and that a large size was chosen so they would be suitable for all users. This was fairly straightforward for all but the weakest candidates.

b) The second part of the question asked candidates to outline one aspect of the design of the spectacles which had been compromised by the size of the lenses. The markscheme awarded one mark for each of two distinct correct points in an outline. The markscheme identified aesthetics/style and that the Ad-specs were functional not decorative.

Question E4

The design context for this question was a metal garden chair – the Forest chair - manufactured by Fast Italy. Candidates were asked to discuss two physiological human factors issues in relation to the Forest chair. One mark was awarded for each of three distinct correct points in an explanation of each of two physiological human factors issues in relation to the Forest chair. The first problem evidenced by some candidates was that they did not understand the term physiological human factor. A second problem was that those candidates who did not structure their answers well tended to repeat themselves and therefore did not provide enough depth of response to achieve three marks. The markscheme offered a range of answers:

- comfort; metal provides a hard surface to the chair; this may make the chair uncomfortable when sitting for a long time.
- the chair may feel very hot/cold depending on the weather conditions; metal is a very good conductor of heat; this may make the chair feel uncomfortable when first sitting down.
- safety; the holes could snag clothing; or pinch the skin/become finger traps for children.
- ease-of-use for elderly/infirm people; the sides of the chair are made from thin metal; this does not provide much support for hands when a user is pushing him/herself out of the chair.
- shape; the chair is designed to support the back/hips; but may not be suitable for very large people to fit in it.

There were some very good answers but also some extremely weak ones.

Question E5

The context for this question was the use of digital humans in the gathering of data relating to the design of a car so as to protect its occupants in a collision. A big issue in relation to candidates answering this question is that some (weaker) candidates clearly did not understand what a digital human is and confused robots with digital humans.

a) The first part of this question asked candidates to outline one way in which the use of digital humans can contribute to the tests. One mark was awarded for each distinct correct point in an outline of one way in which the use of digital humans can contribute to the tests. The markscheme identified that digital humans can be used in a simulation of the car crash and thus provide data on the effects of the crash on different parts of the body. Good candidates were able to achieve full marks. Many scored zero for the reasons explained above relating to confusing digital humans with robots.

b) The second part of this question asked candidates to outline one limitation of using digital humans for the tests. One mark was awarded for each distinct correct point of response. The markscheme explained that people react differently in car crash situations depending upon a range of psychological/physiological factors and also that it is difficult to simulate precisely how people will react in a car crash so that using digital humans for the tests may not provide reliable data. This was poorly answered by many candidates.

c) The third part of this question asked candidates to outline one way in which digital humans can increase the speed of the product cycle. One mark was awarded for each correct point of response. The markscheme identified a range of responses: that products can be developed more quickly means that more design iterations can be completed in less time; data concerning human factors can be collected more quickly and fed into the product development cycle; the use of digital humans is quicker in tests, tests with physical models would take much longer. Many candidates were unable to offer a response that achieved any marks although there were also a number of excellent responses.

Question E6

a) This question asked candidates to explain one human factors issue in relation to the design of a railway carriage for a wheelchair user. One mark was awarded for each of three distinct correct points in an explanation of one human factors issue. A range of answers were included in the markscheme:

- access; there is usually a gap between the platform and the carriage; wheelchair users would need a ramp/lift/helper.
- circulation space within the carriage; so the wheelchair user can manoeuvre the wheelchair; to locate the wheelchair in a safe position.
- safety; emergency controls/sensors; at a height suitable for wheelchair users to reach.
- facilities; toilets/tables/luggage racks; must be designed for ease-of-use by wheelchair users.

Candidates were generally able to score quite well on this with many achieving the full three marks.

b) This question asked candidates to explain one limitation of relying on information from the Internet for the purchase of a new wheelchair. One mark was awarded for each of three distinct correct points in an explanation of one limitation. Again a range of answers were provided in the markscheme. Surprisingly this question was generally less well answered than part (a) of the question.

Question E7

The context for this question was a photograph of a cooker incorporating an eye level grill. Candidates were asked to discuss three safety issues concerning the use of the grill shown in the photograph. One mark was awarded for each of three distinct correct points in each of three safety issues concerning the use of the grill. A range of answers were offered in the markscheme:

- height of the grill; may not be at eye level for all users; some users may have to stand on tip-toe to see if food cooked; accidents more likely to happen.

- eye-level means that the face and eyes are at the same height as the grill; hot fat may spit out from the grill; could hit eyes/face and cause injury.
- with the grill at eye-level; smoke from the grill could get into the eyes; this may cause an accident.
- to use the grill pan; users have to hold the grill at head height; this puts strain on the arm.
- grill pan handle; could get hot as near the heat source; so burn the skin of the user.
- pulling the grill pan from the grill with hot food; puts strain on muscles; could cause an accident.

It was clear that candidates were unsure about which part of the cooker was the grill and it might have been best if the grill had been labelled. Some candidates provided excellent answers but there were a lot of candidates who went completely off track in their responses and were awarded zero marks. The examiners sometimes get the impression that Option E is seen as an easy option and tends to attract some very weak candidates.

Standard level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 7	8 - 10	11 - 14	15 - 17	18 - 19	20 - 22	23 - 29

General comments

Fifteen G2s have been received for this paper. These comments are carefully studied at the grade award meeting and along with other evidence, in particular the responses that candidates provide on their papers, are then used to determine the grade boundaries. The Grade Awarding team was very pleased to receive an increased number of G2s, however, **all** schools are encouraged to complete and submit the forms for each session. Valuable feedback is also gained through teacher's reflections on the OCC DT forum.

The Grade Award team is also provided with a computer analysis of candidate performance, a difficulty index (Difl) and a discrimination index (Disl).

Difl reflects the percentages of candidates getting the question right and can range from 0 to 100%. A higher Difl means that the question is easy, a lower Difl that the question is harder.

In terms of Disl, when there is a negative discrimination index, this indicates that candidates found the question difficult and the question and answer is checked carefully.

As the number of candidates for Design Technology continues to grow these statistics become more reliable and thus more useful.

The Grade Award team value all responses provided by teachers through the G2 forms as it supports the decision making process of boundary setting. 53.3% considered this paper to be of a similar standard to that of last year. 13.3% found it a little more difficult, whilst 6.7% found it much more difficult. 80% considered the level of difficulty to be appropriate. 86.7% felt that the clarity of wording was good and all considered presentation of the paper was satisfactory or good.

Individual question analysis

Question 7

One G2 comment stated that the answers were ambiguous. This was the most difficult question on the paper with a positive discrimination index (Difl= 28.11; Disl=0.10). A, B, C and D are terms used within the Life Cycle Analysis and should be discussed in relation to this. After a considered debate and considering the feedback, it was felt that the wording of this question could have been more explicit and to be fair to all candidates, the decision to remove this question from the Grade Awarding process was made.

Question 8

One G2 comment was that the word "possible" was not helpful in the question. Upon discussion it was felt that this did not hinder candidates. The question had very a positive discrimination index (Disl=0.49) highlighting that the better candidates were able to answer this question correctly.

Question 12

Whilst acknowledging that the question was appropriate, one G2 comment suggested that the wording was not good. The word "usually" implies "not always" and therefore the wording was deemed to be appropriate. Despite this, candidates found this question to be easy with reasonable discrimination (Difl=78.03; Disl=0.29).

Question 13

One G2 comment suggested the answers were not appropriate for this question. It needs to be clarified that the term "packaging" includes bottles. This was a reasonably difficult question with reasonable discrimination (Difl=53.61; Disl=0.29).

Question 14

One G2 comment suggested that "cross-sectional" area may not be language that candidates are not familiar with. It was felt that due to the nature and breadth of this subject that it should be common terminology. This was a harder question with a good discrimination index. (Difl=48.24; Discl=0.46).

Question 17

One G2 commented that it was difficult to clearly define the context of the question due to the lack of information in the teachers' notes to. Whilst acknowledging that this question was difficult (Difl=29.80; Disl=0.11), the Grade Award team considered the question and answer to be correct and appropriate. It must be noted that the teacher's notes are provided as guidance only.

Question 21

One G2 comment commented that the lack of political could cause lack of agreement in target setting. The Grade Award team determined that this did not have an impact on candidates understanding of the question. This question was of medium difficulty with good discrimination (Difl=53.46; Disl=0.31).

Question 22

One G2 commented that 'moral' is a relative term. Despite this candidates found this question relatively easy with good discrimination (Difl=66.82; Disl=0.35).

Question 25

One G2 commented that A and C were correct. Candidates need to focus on the final price of the product and not just cost price in order to arrive at the correct response. Although this question was difficult it did have a positive discrimination (Difl=36.87; Disl=0.25).

The following table provides a summary of the how each candidate answered each question, the resulting difficulty index and discrimination index.

Question	A	B	C	D	Difficulty Index	Discrimination index
1	244*	106	180	121	37.48	0.30
2	15	28	439*	169	67.43	0.41
3	122	490*	21	18	75.27	0.14
4	122	96	252*	181	38.71	0.36
5	123	13	38	477*	73.27	0.26
6	183*	69	191	208	28.11	0.19
7	94	397	106	54	0	0.00
8	88	139	125	299*	45.93	0.50
9	85	118	25	423*	64.98	0.19
10	41	173	83	353*	54.22	0.46
11	284	317*	15	34	48.69	0.43
12	65	508*	20	58	78.03	0.29
13	87	349*	125	90	53.61	0.30
14	247	57	295*	51	45.31	0.48
15	58	46	268	279*	42.86	0.39
16	176	111	343*	21	52.69	0.25
17	300	194*	90	67	29.80	0.10
18	452*	27	115	57	69.43	0.36
19	72	438*	62	79	67.28	0.29
20	67	11	85	488*	74.96	0.47
21	36	142	125	348*	53.46	0.33
22	74	435*	33	108	66.82	0.34
23	7	18	95	531*	81.57	0.27
24	568*	29	20	34	87.25	0.18
25	152	217	240*	42	36.87	0.26
26	253*	152	66	180	38.86	0.19
27	99	396*	37	118	60.83	0.32
28	493*	22	53	83	75.73	0.18
29	415*	160	47	29	63.75	0.42
30	94	43	189	325*	49.92	0.12

Number of candidates 651

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

14 G2 feedback forms were received from teachers and as can be seen from the information in the tables below, the examination paper was deemed to be satisfactory by the vast majority respondents.

The Standard Level paper follows a similar format to the Higher Level paper with a data based question in Section A followed by short answer questions and a choice of three questions in Section B. Candidates answer one of the Section B questions and the mark allocation is the same as for the Higher Level Section B question – this ensures that there is parity between the papers, although the Higher Level paper examines 12 core topics rather than 7 at Standard Level.

This paper is designed to test candidates' subject knowledge and the ability to apply the knowledge to different design contexts in a logical and concise manner. It also tests candidates' ability to analyse and use qualitative and quantitative data as well as to select and apply relevant information to answer questions. The differentiating factors when reviewing candidates' performance, as evidenced in the marked scripts at the Grade Award meeting, is how well candidates have answered the data based question in Section A and the 9 mark question in Section B. Many candidates will be able to answer the short response questions in Sections A and B with good syllabus recall but only the better candidates are usually able to respond well to the extended response question in Section B, which requires the construction of a detailed explanation in applying relevant information to the concepts and principles involved in the stated design contexts. In Section B, questions 4 and 5 were equally popular and question 6 the least popular. One teacher objected to the inclusion of the context for question 6 as it assumed candidates had experience of toast and toasters. If this was the case with any candidates then they should have avoided the question – the reason for providing a choice of questions in Section B is to offer candidates this facility.

Comparison with last year's paper

Not applicable	A little easier	Similar standard	A little more difficult	Much more difficult
27%	0%	53%	20%	0%

Suitability of question paper

	Too easy	Appropriate	Too difficult
Level of difficulty	0%	93%	7%

	Poor	Satisfactory	Good
Clarity of wording	0%	87%	13%
Presentation of paper	7%	46%	47%

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

Section A

Question 1

a) (i) This was an easy question for nearly all candidates.

(ii) Although this question relied on an uncomplicated addition quite a few candidates muddled up the figures.

(iii) This question was well understood by most candidates though some did not fully recognise the implication of the command term *identify* and merely stated an answer.

b) (i) The majority of candidates found this question easy.

(ii) One G2 comment objected to this question on the grounds that the techniques involved are not covered by the Assessment Statement (AS) 5.1.2 in the Subject Guide. However, the AS does ask candidates to outline the techniques and AS 5.1.3 relates the techniques to appropriate materials. Most candidates seemed to understand the question and gained marks for it, although to gain full marks, candidates needed to sequence their answer correctly by referring to extrusion, followed by cutting and then the application of the finish.

c) (i) Many candidates did not read the question carefully enough – it asked for a specific percentile, not a range, therefore, 5^{th} – 95^{th} was not acceptable.

(ii) This proved a relatively straightforward question for nearly all candidates.

Question 2

a) The answer to this question was not an easy definition to articulate, especially for candidates with English as their second language, but as all definitions are stated in the *Glossary* in the Subject Guide, conscientious candidates would have learnt the definition.

b) Many convoluted responses were provided for this question indicating that candidates understood the concept of the expansion joint but did not carefully craft their answer to convey their understanding,

Question 3

a) Another *definition* question which needed to be answered carefully in order to communicate the meaning effectively.

b) Many candidates seemed to confuse *mechanisation* with *automation* in relation to assembly-line production

Section B

Question 4

a) (i) There is a long list of possible answers to this question; hence, it was relatively easy to gain both marks.

(ii) In contrast, this question was not easy as candidates needed to make the link between a range of sizes for people and the chair as a robust design, leading to a family of products.

b) (i) There seemed to be much confusion in the minds of many candidates relating to the concept of *break-even* and the balance *of fixed and variable costs*.

(ii) There are three aspects to the answer to this question. Knowledge of injection moulding; relating to cost; and effective production based on a range of sizes. Candidates needed to plan their answer carefully in order to gain all three marks.

c) (i) This question focused on which percentile would be used for different ages of children in order to decide on the height of each chair in the range.

(ii) Candidates needed to construct their answer to explain three aspects of *design for materials, design for process* and *design for assembly* which impact on the chair design. Many answers were haphazardly put together with much overlap between the explanations of each strategy.

Question 5

a) (i) This was an easy question for nearly all candidates.

(ii) The question focuses on why a consumer would purchase the product i.e. the relationship of price to penalties – the stem of the question leads candidates in this direction.

b) (i) This question was answered reasonably well, although candidates needed to outline **one** difficulty rather than provide a list.

(ii) This question was straightforward for the majority of candidates.

c) (i) The question asks for a *list* of ergonomic considerations, therefore candidates should not waste time *describing* considerations.

(ii) The question links the context given to candidates' knowledge of the design process - (topic one) and their own experience in using the process for the design project component of internal assessment. Candidates needed to differentiate between the use of tests, models and experiments for developing the design. Many candidates discussed the design development phase of the process in general terms without focusing on specific aspects in relation to the three activities.

Question 6

a) (i) In order to answer this question accurately, candidates needed to convey the meaning of *constructive discontent* in the manner that designers identify opportunities for the re-design of existing products by focusing on features which could be improved.

(ii) Most candidates understood the benefit of adopting a *pioneering strategy.*

b) (i) Some candidates did not read the question carefully enough i.e. in relation to *physical properties* rather than properties in general.

(ii) This question was answered reasonably well by most candidates.

c) (i) To answer this question, candidates needed to link their knowledge of planned obsolescence to the design specification i.e. the choice of materials and components.

(ii) Candidates who grouped criteria in relation to the three stated categories and astutely differentiated the criteria for each category were able to gain full marks.

Recommendations for the teaching of future candidates

The key elements for success on Paper Two are the ability to deal effectively with the data based question (Question 1) in Section A and the ability to score highly on the Section B question.

The data based question tests candidates ability to understand and select appropriate data as well as to apply it to concepts and principles taught in the course. The context for question one is not based on the syllabus so candidates should be given experience prior to sitting the examination in analysing data from unfamiliar contexts. There will always be more data provided then is needed to answer the questions so candidates should not be surprised by the amount of data but just calmly try to assimilate it all and then read the questions carefully to see which parts of the data they need to use. As all candidates undertake a course in Mathematics it is assumed that they are familiar with basic mathematical calculations.

The three questions in Section B are designed to obtain wide syllabus coverage and for question setters the challenge is to ensure that the questions have parity in terms of degree of difficulty. Naturally, some questions will be more appealing to candidates depending on their preference for different topics in the syllabus and the perceived accessibility of the design context. Candidates should be encouraged to weigh up the pros and cons of each of the questions before deciding which one to answer.

The paper is formatted to try and encourage candidates to be concise with their answers and recognize the link between the *command term* which starts the question and the amount of marks allocated. Candidates should be familiar with this link and how the command terms are categorized. Many candidates waste time providing lengthy answers which do not gain marks because they are not constructed astutely enough.

Standard level paper three

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 3	4 - 6	7 - 9	10 - 13	14 - 18	19 - 22	23 - 30

General comments

The examining team was heartened to see the increase in the number of Schools sending in G2s this session. The G2s are incredibly helpful in giving feedback to the examining team on the quality of the paper and any problems encountered by the candidates. Those Schools submitting G2s, many thanks, to those not submitting, please do so next year.

15 G2s were received in relation to the standard level paper. Of these 10 (66.7%) thought that the level was appropriate and five (33.3%) thought it was too difficult. In comparison with last year's paper, seven thought it was of a similar standard, two thought it was a little more difficult and two thought it was much more difficult. In terms of clarity of wording, three thought that it was poor, nine thought it was satisfactory and three thought it was good. In terms of presentation of the paper, two thought that it was poor, seven thought it was satisfactory and five thought it was good. This was the first time that boxes were put around the spaces for the answers and these seemed to invoke negative responses from schools. The boxes are there in preparation for e-marking.

One G2 general comment said that the paper was *'generally quite good'*. One said that Option A was *'very easy compared to Option E'* – although this was not obvious from the candidates' responses. One G2 commented that some questions were too ambiguous, which may have resulted in vague/incorrect answers being given. Obviously reactions to the paper depend on which option that schools tackle. In descending order of popularity were Option E, Option C, Option A, Option D and Option B.

One worrying issue is that the candidates from some (poorly performing) schools between them tackle all of the options on the paper. This may be a misunderstanding by some teachers that they should select one option and integrate it into the scheme of work. It may be lack of explanation to the candidates that they should only answer one option. In view of the very poor performance, it seems like the candidates may be self-taught on the options. This is totally counter to the requirements of the course.

Another worry is that individual candidates tackle all the options on the paper. This may be an attempt to get the best possible marks for the paper as examiners are required to mark all of the options and award the marks for the best option. However, the candidates doing this are generally very weak, do not focus on one option and do not achieve the best possible mark for that option. This disadvantages those candidates.

Candidates need to be taught how to answer these questions and the significance of the action verbs/command terms which are listed in the subject guide. The examining team is careful to use action verbs/command terms from the guide to indicate to candidates the depth of answer required.

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

OPTION A – Food Science and technology

Question A1

The stem of this question was a table of nutritional information relating to a cheeseburger, large French fries and medium chocolate milkshake meal from fast food restaurant as shown on the company website.

a) The first part of the question required that candidates performed a straightforward calculation to state the percentage of the Guideline Daily Amount (GDA) for an average adult woman. One mark was awarded for stating the percentage of the GDA for energy for an average adult woman as 59% or 1170/2000, i.e. 58.5%, depending on which data the candidate selected. This question posed few problems for most candidates.

b) This question asked candidates to outline one reason why a balanced diet should contain some fat. One mark was awarded for a reason and one mark for a brief explanation. A diversity of answers were included in the markscheme, e.g. that fat acts as a vehicle to help the absorption of fat-soluble vitamins and these help prevent fat-soluble vitamin deficiencies; that fat provides energy and low fat diets may not provide enough energy; that some fatty acids are essential and therefore cannot be produced by the body and must be provided by the diet for health. This question was not well answered by all but the stronger candidates and most candidates achieved one mark. A number of candidates scored zero on this question.

c) This question asked candidates to explain one implication of excess fat intake for health. One mark was awarded for each of three distinct correct points in an explanation of one implication of excess fat intake for health. The markscheme noted that high dietary fat intakes, especially of saturated fat, can lead to increased levels of cholesterol which can lead to coronary heart disease/obesity and poor health. Three mark questions are requiring candidates to go into some depth with three distinct points. Those candidates listing three different implications with no detailed explanation did not score more than one mark. Many candidates were able to score two marks on this question. Lack of clarity in the writing of the answer meant that only a few candidates scored the third mark.

Question A2

This question focused on body mass index (BMI) and its limitations as a health indicator.

a) The first part asked candidates to state the range of BMI that is considered to be overweight, i.e. 25–29.9. Some candidates put down just one number not a range. Many achieved the one mark on offer.

b) The second part of the question asked candidates to outline one limitation of using BMI as a health indicator. For two marks, two distinct points are required. Many candidates were able to provide answers to the effect of that BMI measures total body weight, not the amount of fat a person is carrying and that fat may not be responsible for the weight they carry.

Some athletes, e.g. rugby players and weight lifters, and people who are naturally stocky often have a BMI indicating they are overweight due to extra muscle/bone mass, not because of excess body fat. Other athletes, e.g. long distance runners, will be underweight according to their BMI due to low body fat and aerobic slow twitch muscle fibres, which develop naturally as a result of their particular sport.

Elderly people and people who have been ill may have lost muscle mass will appear to be underweight although it is normal to lose muscle mass/body fat in old age/poor health. Conversely, a BMI in the normal range does not necessarily indicate someone is in good health and they may also be carrying more body fat than is good for them.

Question A3

The context for this question was a photograph of a tomato which had been spoiled.

a) The first part of this question required candidates to identify the type of spoilage shown in the photograph. One mark was awarded for stating the type of spoilage and one for a brief explanation. The type of spoilage was microbiological spoilage as a mould/fungus was clearly growing on the tomato. Many candidates just said microbiological spoilage without any explanation and so achieved just one mark.

b) The second part of the question required candidates to outline how sun drying of tomatoes preserves them. One mark was awarded for stating that sun drying lowers water activity or reduces the water content and one mark for stating that this limits bacterial growth. This was not answered well by many candidates.

Question A4

This question asked candidates to outline one important consideration relating to the selection of the members of a taste panel. One mark was awarded for identifying an appropriate consideration and one for a brief explanation. Taste panel members must match the target market for the product, e.g. children or adults, since foods designed for one target market may not suit the taste of other markets. Good candidates provided very full answers to this question and achieved the two points on offer.

Question A5

This was a question about the way in which lifestyle issues have contributed to the growing market for organic products in some countries. One mark was awarded for each of three distinct correct points in an explanation of each of two distinct lifestyle issues which have contributed to the growing market for organic products in some countries. A diverse range of answers were offered in the markscheme including:

- increased health awareness and concerns about food scares, e.g. mad cow disease, salmonella in eggs, which has made people much more interested/concerned about where their food comes from and that organic products often have a known provenance

- fashion and media influences - it is “cool” to be organic and therefore it makes a statement resulting in ideopleasure
- ethical considerations and concerns about factory farming and animal rights issues with organic produce being seen to be more appropriate
- promotion of organic products by supermarkets have promoted organic produce given it a higher consumer profile and although more expensive, people are prepared to pay a premium for organic products as they are perceived to be better.

This question proved quite discriminating and good candidates were able to provide answers of sufficient depth to achieve the full six marks. Those candidates not adopting a structured approach and providing effectively lists of points rather than developing a deeper explanation achieved fewer points.

Question A6

This question asked for a suggestion of three reasons for the increased incidence of food allergies and food intolerance in developed countries. One G2 commented that this was an unfair question and another that the topic is well outlined in the guide but that there is no mention of needing to know the reason for their increase. The examining team feels that the question requires candidates to bring together material from across the various topics and sub-topics that comprise the option but that this is not unfair. Certainly, there was no noticeable difference between the performances of candidates on this nine mark question than the other nine mark questions in the other options. There was a range of answers in the mark scheme which included:

- better diagnosis of food intolerance
- that people eat a wider range of foods than they may have done previously due to travel
- the media and the availability of different foods
- that foods introduced later in life may cause more problems than those introduced early in life
- the increased use of food additives and more exposure to environmental chemicals
- increase in manufacture of processed foods which often include with traces/ingredients of trigger foods; e.g. nuts/dairy.

Good candidates provided a depth of response and achieved high marks for their answers.

OPTION B – Electronic product design

As mentioned in the Higher Level report this option was the least popular and not answered by many candidates so it is difficult to provide meaningful feedback as to candidate performance.

Question B1

The context for this question was a security system with three sensors: A, B and C, which activate an alarm if an intruder is detected.

a) This question asked candidates to state the logic gate required for the security system which was an OR gate. Most candidates including the weakest candidates were able to answer this question.

b) This question required candidates to draw the truth table for all possible combinations of inputs. One mark was awarded for including all eight input combinations (in any order) and one mark for only having a 0 when all inputs are 0 as shown below. This did not prove too challenging for most candidates who were able to construct the truth table.

A	B	C	Q
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

c) The final part of this question required candidates to draw a circuit for sensor A in which sensor A - a pressure pad which acts as a push switch and is closed when stepped on by an intruder – is placed underneath a carpet in the entrance to zone A. One mark was awarded for using the correct symbol for a push switch, one mark for the labelling of 0V, 5V and output A and one mark for the use of a pull down resistor (any value). Surprisingly this question proved very challenging for many of the candidates attempting Option B.

Question B2

This question focused on the use of a solar cell to charge a six volt battery so that light can be provided at night.

a) The first part of the question asked candidates to calculate the current taken from the battery to power a three Watt bulb. One mark was awarded for stating the correct answer with units using the formula P=V.I so I = P/V = 3/6 = 0.5 amperes/0.5 A.

b) The second part of the question asked candidates to list two reasons why solar technology is particularly suitable for remote areas in developing countries. One mark was awarded for stating each of two reasons why solar cell technology is particularly suitable for remote areas in developing countries. The markscheme identified that there would be no national grid, that there would be no running costs (fuel/batteries/*etc.*) and that no maintenance is required.

Question B3

This question focused on the differences between analogue and digital signals and the conversion of an analogue to a digital signal with a Schmitt trigger.

a) The first part of the question required candidates to outline one different between a digital and an analogue signal. The markscheme identified that an analogue signal continuously varies and can take any value whereas a digital signal takes discrete steps/can be represented as binary number/is on or off/0 or 1. All but the poorest candidates were able to achieve one or two marks on this question.

b) The second part of the question required candidates to outline one reason why a Schmitt trigger NOT gate is more suitable than a standard NOT gate when converting an analogue signal to a digital signal. One mark was awarded for each of two distinct points in an outline of one reason why a Schmitt trigger NOT gate is more suitable than a standard NOT gate when converting an analogue signal to a digital signal. The markscheme identified that a Schmitt trigger has a dead band and does not respond to small changes that might happen with an analogue signal. This question proved more of a challenge for candidates.

Question B4

This question asked candidates to list two reasons why programmable interface controllers (PICs) are present in many modern electronic products. One mark was awarded for each of two reasons. The markscheme identified versatility, low cost, low power and upgradeability. This question was fairly straightforward and posed few problems.

Question B5

This question asked candidates to discuss one advantage and one disadvantage for an Internet service provider operating a satellite-based system rather than an optical fibre-based system. The markscheme awarded one mark for each distinct correct point in a discussion of one advantage and one disadvantage. The question paper put in the headings advantage and disadvantage which seems to encourage better responses from candidates. The markscheme identified an advantage as that satellite footprint gives coverage in remote areas and does not have to be laid over terrain physically so that the footprint can be moved easily according to need. It identified a disadvantage as the cost - satellite systems are expensive and the antenna must be accurately pointed at the satellite and they can be disrupted by bad weather. This was answered reasonably by all but the weakest candidates.

Question B6

This question focused on the importance of global standards for digital electronic products and their benefits for users and manufacturers. One mark was awarded for each of three distinct correct points of explanation of the importance of global standards for digital electronic products, of the benefits for users and the benefits for manufacturers. Candidates scoring better on this and similar extended response questions do better when they put in headings and organise their answers providing three distinct points under each heading. Those candidates not structuring their answer tend to go into a stream of consciousness and do not provide enough marking points and often repeat things. As pointed out in the Group 4 grade descriptors, answers from the best candidates are often more succinct than those from weaker candidates.

OPTION C – CAD/CAM

Question C1

The context for this question was the CAD image of a ring showing two forms of CAD modelling – solid modelling and wire frame modelling.

a) The first part of the question required candidates to state one advantage of wire frame modelling for the manufacturer. The markscheme awarded one mark for stating an advantage and offered a list including: that the manufacturer can see internal design structure of the ring; that it is a relatively simple model; that it is fast to produce and modify; that it can be rotated to provide new desired views; that the manufacturer can see how the diamond is fitted into the setting; and that it provides coordinates for CAM. Most candidates were able to prove a response and achieve a mark.

b) The second part of the question asked candidates to outline one advantage of the solid model for the client. One mark awarded for identifying an advantage of the solid model for the client and one mark for a brief explanation. Most candidates scored at least one mark on this question and many scored two marks.

c) The third part of the question asked candidates to explain one implication of the use of the CAD model of the ring for the cost-effectiveness of production. One mark was awarded for each of three distinct correct points of explanation. Again, there were a range of answers. The better answers gave three clear points of explanation and achieved three marks.

Question C2

a) This question required candidates to state one limitation of using a three-axis machine when making a product. Those candidates identifying that a product resulting from use of a three-axis machine would have a flat base or that a three-axis machine cannot do undercuts achieved one mark. Most candidates were able to respond appropriately to this question.

b) This question asked candidates to outline one advantage of using a three-axis machine over using a five-axis machine to make a product. One mark was awarded for each of two distinct correct points in an outline of one advantage. Many candidates identified that three-axis machines are cheaper and therefore more cost-effective than five-axis machines which are usually very expensive. Many candidates scored two points for their responses.

Question C3

The context for this question was an image showing finite element analysis (FEA) of part of a bicycle frame.

a) The first part of the question asked candidates to describe what the colours on the FEA image meant. One mark was awarded for each of two distinct correct points in a description of what the colours on the image meant. This question was found to be relatively straightforward by most candidates who achieved two marks for answers to the effect that the red areas on the FEA image indicated high stress and the blue/green areas indicated low stress.

b) The second part of the question went on to ask how the FEA image would be used by a designer. One mark was awarded for each of two distinct correct points. Points were awarded for identifying that the design would be modified to reduce the stresses to ensure product safety. This question proved more problematic for many candidates and many candidates only scored one of the two marks on offer.

Question C4

This question asked candidates to outline one subtractive manufacturing technique. One mark was awarded for identifying one subtractive manufacturing technique and one mark for a brief explanation. Acceptable responses included milling/routing/sanding/cutting/use of lathe (e.g. laser cutting, knives, hot wires, arc cutting, plasma cutting, plotter cutting) and that the technique removes material from a block to produce the shape required. This question seemed to be relatively straightforward and most candidates were able to achieve both marks on offer.

Question C5

The context for this question was an image of a rapid prototype of a mobile phone produced using laminated object manufacture (LOM). One mark was awarded for each distinct correct point in an explanation of each of two limitations of rapid prototyping using LOM. A range of marking points was offered in the markscheme. The question required candidates to identify the limitations of LOM as a rapid prototyping technique and also to be able to provide sufficient depth of response to achieve all six points. Good answers tended to be well structured, often using bullet points to emphasise the distinct points in the response. Unstructured answers often were repetitive and therefore did not score full marks.

Question C7

This question asked candidates to discuss three advantages and/or disadvantages of computer-integrated manufacture (CIM) to a car manufacturer. The markscheme awarded one mark for each of three distinct correct points in a discussion of each advantage or disadvantage. One G2 commented that this was a confusing and misleading question and asked what the candidates were supposed to do. It was clear that the candidates understood that they could offer advantages or disadvantages in response to the question. It was also clear that many candidates did not understand the significance of CIM. Many discussed the use of robots, some discussed CAM. Only a few candidates gave well constructed answers to this question. The best answers demonstrated a clear understanding of CIM and were well structured.

OPTION D – Textiles

Question D1

The context for this question was the ripstop nylon used to make a kite. The stimulus material showed an image of a boy flying a kite and a picture of a kite.

a) The first part of the question asked candidates to state one aspect of the specification of the material for the kite. One mark was awarded for a correct answer. A long list of possible answers was included in the markscheme. Most candidates were able to achieve one mark.

b) The second part of the question asked candidates to outline one aesthetic consideration which makes nylon a suitable material for use in the production of the kite and awarded one mark for each distinct correct point. That the kite requires a brightly coloured material and nylon fibres can be produced in a range of colours; that designs are often printed on the material and nylon can easily be printed on were offered in the markscheme as potential responses. Most candidates achieved at least one mark and many achieved two marks on this question.

c) The third part of the question asked candidates to explain how the characteristic of ripstop would be manufactured into the nylon for the kite. One mark was awarded for each of three distinct correct points of response. Assessment statement D.2.16 states: "Explain how the desired characteristics are developed in textile products through treating the raw material, manufacturing and finishing". Ripstop is one of the characteristics that the teacher's notes list for consideration. Despite this, it was as if most candidates had never heard of the term. There were some valiant attempts at answers by some candidates!

Question D2

a) Candidates were asked to state one natural fibre used in lace-making. One mark was awarded for an appropriate response. The markscheme identified cotton and silk as acceptable answers. Most candidates were able to achieve one mark for their responses.

b) The second part of the question asked candidates to outline one disadvantage of using lace for producing a tablecloth. One mark was awarded for each distinct correct point of response. Several answers were identified in the markscheme:

- that lace provides an uneven surface so objects placed on the tablecloth will be unstable
- that it is full of holes therefore liquids pass through and can damage surface underneath
- that it is difficult to launder and therefore not practical as a tablecloth is likely to need laundering very often
- that it is a delicate fabric and therefore is easy to damage
- that it is difficult to iron due its uneven surface/delicate fabric.

Although seemingly straightforward, some candidates did not achieve both marks on offer.

Question D3

a) The first part of this question required candidates to describe the sublimation printing process. One mark was awarded for each of two distinct correct points of description. The markscheme offered the response that dyes are printed onto fabric and heat is applied so the dyes sublime (change from solid to gas without passing though a liquid phase) and the image formed. This question was not a major challenge for candidates.

b) The second part of the question asked candidates to outline one limitation of using the sublimation printing process and awarded one mark for each distinct correct point of outline. The markscheme offered three pairs of responses:

- durability since the image fades over time as the dye washes out of the fabric
- image quality – there is a slight blurriness at the edge of a colour results from diffusion of the gaseous dye through the fabric
- substrate material – the image can be printed directly onto fabric.

This question was poorly answered by many candidates.

Question D4

This question required candidates to describe the purpose of spinning when making yarn. One mark was awarded for each of two distinct correct points of description. The markscheme provided two responses:

- the spinning twists the textile fibres into a continuous thread by hand/by using a spinning wheel and that the yarn can be spun into threads of different thickness
- the thread will be stronger once spun and that it will be an even thickness.

This question seemed to be relatively straightforward for candidates.

Question D5

This question required candidates to explain two issues relating to the manufacture of silk substitutes. One mark was awarded for each distinct correct point in an explanation of each of two issues. Several responses were offered in the markscheme – the inferiority of silk substitutes, the elite status of silk products, the impact on the silk industry. As with all questions offering three marks for appropriate depth of response candidates offering well structured answers achieved the highest marks. Those candidates not structuring their responses tended to repeat points and not to provide the requisite depth of response.

Question D6

This question required candidates to discuss three ways in which the use of CAD/CAM in the textile industry has helped to minimize waste. One mark was awarded for each of three distinct correct points in a discussion of each of three ways in which the use of CAD/CAM in the textile industry has helped to minimize waste. A range of potential answers were offered in the markscheme as follows:

- facilitates the development and resizing of designs; no need for pattern pieces; quality control.
- precision cutting; lower tolerance on components; eliminates human error.
- tessellation of product components; more components produced per length of fabric; maximises the conversion of raw material into product/reduces waste.
- allows for mass customization/JIT; products made to order; no waste as products paid for prior to production so no obsolete shop stock.

Candidates needed to develop a depth of response to achieve full marks. Better candidates producing well-structured responses achieved eight or nine marks on the question. Again, those not structuring their answers tended to repeat themselves and did not score full marks.

OPTION E – Human factors design

Question E1

The context for this question was a diagram of the human information-processing system in operation when a car is being driven.

a) The first part of the question asked candidates to state which part of the human information-processing system is represented by a physiological action. One mark was awarded for stating motor processes/output. Most candidates achieved the mark on offer for this response.

b) The second part of the question required candidates to describe the sensory process in the human information-processing system. One mark was awarded for each of two distinct correct points of description. The markscheme explained that the eyes take in information and send information to brain for processing. Many candidates managed to get both marks on offer for this question.

c) The third part of the question asked candidates to explain the function of memory in the human information-processing system. One mark was awarded for each of three distinct correct points of explanation. The markscheme identified that information from the sensory processes needs to be stored temporarily in order for the brain to determine the appropriate action to take before it sends the information to the motor processes. This question was generally poorly answered by candidates with only the better candidates achieving the full three marks on offer.

Question E2

a) The first part of this question asked candidates to define user population. One mark was awarded for a definition of user population to the effect of: range of users for a particular product or system. Most candidates were able to produce definitions which achieved one mark.

b) The second part of this question required candidates to describe the concept of “methods of extremes” to limit sample sizes. One mark was awarded for each of two distinct correct points in a description. The markscheme explained that sample users are selected to represent the extremes of the user population – the largest and the smallest or the lightest and the heaviest potential used and that a small number of intermediate values would then be used. This question challenged candidates and only a small number were able to achieve marks for their responses.

Question E3

The context for this question was two photographs of the Ad-specs – adaptive spectacles designed for use by people in developing countries.

a) The first part of this question asked candidates to outline one reason related to human factors for the size of the lenses of the Ad-specs. One mark was awarded for each of two distinct correct points in an outline. The markscheme identified that one size fits all and that a large size was chosen so they would be suitable for all users. This was fairly straightforward for all but the weakest candidates.

b) The second part of the question asked candidates to outline one aspect of the design of the spectacles which had been compromised by the size of the lenses. The markscheme awarded one mark for each of two distinct correct points in an outline. The markscheme identified aesthetics/style and that the Ad-specs were functional not decorative.

Question E4

This question asked candidates to describe why mapping is an important consideration in human factors design. One mark was awarded for each of two distinct correct points in a description of why mapping is an important consideration in human factors design. The markscheme suggested that mapping relates to the correspondence between the layout of a product and its controls which enables a product to be used intuitively. Candidates either knew what mapping was or not and so tended to achieve zero or two marks.

Question E5

The design context for this question was a metal garden chair – the Forest chair - manufactured by Fast Italy. Candidates were asked to discuss two physiological human factors issues in relation to the Forest chair. One mark was awarded for each of three distinct correct points in an explanation of each of two physiological human factors issues in relation to the Forest chair. The first problem evidenced by some candidates was that they did not understand the term physiological human factor. A second problem was that those candidates who did not structure their answers well tended to repeat themselves and therefore did not provide enough depth of response to achieve three marks. The markscheme offered a range of answers:

- comfort; metal provides a hard surface to the chair; this may make the chair uncomfortable when sitting for a long time.
- the chair may feel very hot/cold depending on the weather conditions; metal is a very good conductor of heat; this may make the chair feel uncomfortable when first sitting down.
- safety; the holes could snag clothing; or pinch the skin/become finger traps for children.
- ease-of-use for elderly/infirm people; the sides of the chair are made from thin metal; this does not provide much support for hands when a user is pushing him/herself out of the chair.
- shape; the chair is designed to support the back/hips; but may not be suitable for very large people to fit in it.

There were some very good answers but also some extremely weak ones.

Question E6

The context for this question was a photograph of a cooker incorporating an eye level grill. Candidates were asked to discuss three safety issues concerning the use of the grill shown in the photograph. One mark was awarded for each of three distinct correct points in each of three safety issues concerning the use of the grill. A range of answers were offered in the markscheme:

- height of the grill; may not be at eye level for all users; some users may have to stand on tip-toe to see if food cooked; accidents more likely to happen.
- eye-level means that the face and eyes are at the same height as the grill; hot fat may spit out from the grill; could hit eyes/face and cause injury.
- with the grill at eye-level; smoke from the grill could get into the eyes; this may cause an accident.
- to use the grill pan; users have to hold the grill at head height; this puts strain on the arm.
- grill pan handle; could get hot as near the heat source; so burn the skin of the user.
- pulling the grill pan from the grill with hot food; puts strain on muscles; could cause an accident.

One G2 commented that there should have been more explanation of what the grill is - it was clear that candidates were unsure about which part of the cooker was the grill and it might have been best if the grill had been labelled as suggested by another G2. Some candidates provided excellent answers but there were a lot of candidates who went completely off track in their responses and were awarded zero marks. The examiners sometimes get the impression that Option E is seen as an easy option and tends to attract some very weak candidates.