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DESIGN TECHNOLOGY

Overall grade boundaries

Higher level

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 14	15 - 26	27 - 38	39 - 49	50 - 62	63 - 74	75 - 100

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 14	15 - 26	27 - 38	39 - 50	51 - 62	63 - 73	74 - 100

General comments

The purpose of this report is to provide feedback to teachers on the various components of the May 2010 examination, including comments on the general performance of candidates for individual questions, and to highlight any problems/issues so that teachers may prepare candidates for future examinations. It is important that teachers are aware of the whole process relating to the structure of examination papers and their assessment including the use of the Group 4 Grade Descriptors.

The incremental increase of new schools and, hence, more candidates for Design Technology continued for May 2010 and it was pleasing to note that many of the new schools were well prepared for the different components, particularly the Internal Assessment (IA). The increase in candidates resulted in a large increase at the grade 4/5 boundaries with subsequent higher performances expected in future years, as teachers are able to reflect upon the success of their candidates and improve their programmes of study accordingly.

638 candidates sat the 2010 Higher Level papers compared to 531 candidates in 2009, a percentage change of 20.15%. 583 candidates sat the 2010 Standard Level papers, including 4 candidates in French, compared to 519 candidates for 2009, a percentage change of 21.33%.

Very few G2 feedback forms for the different components of the written papers were received in time for consideration by members of the Grade Award (GA) Team. This was surprising given the increase in participating schools and the ability to complete the forms online as well as on paper. The GA team assumed that "no news is good news" and that the majority of teachers were satisfied with the written papers, otherwise they would have submitted a G2 to express their concerns. However, it is still important to receive G2 forms which praise the layout and content of the written papers to inform the team that good papers have been produced and indeed one of the forms received did that.

From the teacher comments in the few G2 forms sent in to the IB and the evidence in the scripts, it seems that the written papers were well presented and offered candidates the opportunity to show their knowledge. Parity was achieved between the questions for different options on Paper 3 and for the choice of questions in Section B of Paper 2.

Questions at each level of study appeared to be accessible for the vast majority of candidates with few questions remaining unanswered completely.

2010 is the second year of examining of the revised syllabus. Clearly, for many teachers who prepared candidates for the 2009 examinations, improvements have been made to schemes of work and how candidates are prepared in order to tackle the different styles of questions on each written paper. For papers Two and Three, understanding of the "command terms" as listed in the Subject Guide (pages 10 & 11) continues to be a key aspect of success and teachers are encouraged to reinforce the meaning of each term and the level of response expected by candidates matched to the allocation of marks for the three levels.

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

Schools continue to offer a range of work, from small design and make activities through to laboratory based experiments, as well as some challenging project work. Those schools that are established in the teaching of IB Design Technology continue to do well when developing a course that meets the assessment criteria and covers subject topics. Some schools continue to adopt design and make activities for all investigations, which, due to the extensive nature of the design cycle, can sometimes be limiting when planning a course to meet the time requirements and provide ample opportunities for other learning experiences.

Where this is the case, schools should consider smaller tasks in which they can develop candidate's knowledge, values, attitudes and skills which will better prepare them for the design technology project. Schools are to be reminded that they do not have to assess each of the criteria for every task.

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.

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 encouraged.

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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 by 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.

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. All photocopied work must be easily legible; the copying of pencil sketched ideas is to 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. When completing a lab based investigation 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. As a result collected data was either biased or missing critical information. For example, some candidates had been given the task to design a chair, but there was no evidence of data collection relating to ergonomics or existing products. 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 and the copying of textbooks is to be discouraged.

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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 with some analysis. 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 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 so as 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 detailed 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.

Teachers should note that there should be a developmental difference between the modelling stage 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.

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)

Candidates should be encouraged to devote more time to this criterion if they are to achieve high marks. 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. Recommendations for the design project need to include a revising the specification, sketching modifications and identifying changes to the outcome 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.

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. The amount of time given to the Design Project has changed since May 2009 and this should be reflected in the level of candidate work produced.

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.

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.

Higher level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 10	11 - 14	15 - 18	19 - 22	23 - 27	28 - 31	32 - 39

General comments

Three G2s had been received for this paper at the time of the Grade Award meeting. These comments were studied carefully at the grade award meeting and were used alongside other evidence, particularly candidate responses to the paper, to determine grade boundaries. At the grade award meeting we are provided with a computer analysis of candidate performance, a difficulty index (DifI) and a discrimination index (DisI). DifI reflects the percentage of candidates getting the question right and can range from 0 to 100%. A higher DifI means that the question is easy, a lower DifI that the question is harder. In terms of DisI, a negative discrimination index means that the better candidates found the question difficult and would prompt us to check the question carefully. The Grade Award team are grateful for the input from teachers through the G2 forms as it informs the process of boundary setting. 66% considered this paper to be of a similar standard to last year's paper, with 33% finding it a little more difficult. 100% considered the level of difficulty to be appropriate. 100% considered the syllabus coverage to be good. 66% felt that the clarity of wording was good and 66% considered the presentation of the paper to be good.

There were some comments on the G2s suggesting that some questions would have benefitted from a more specific context or a photograph to help the candidates understand the context. There were also comments about the clarity of some of the photographs. There were questions common to both the higher and standard level papers.

Individual question analysis

Question 1

Candidates obviously have a good knowledge of the design process. This was an easy question and only moderately discriminating (DifI=87.36; DisI=0.22).

Question 2

This question highlighted a discrepancy in the interpretation of "design specification". Quite a few candidates stated that it was "criteria for a design proposal" rather than "major constraints". The mark scheme was adjusted accordingly so both A and D were correct. (DifI=26.22; DisI=0.09).

Question 5

Candidates with a good understanding of the terminology in topic 2 did better in this question. This question proved to be a moderately easy question with moderate discrimination (DifI=74.25; DisI=0.19).

Question 6

Candidates who had a strong understanding of topic 6 did better in this. It was a moderately easy question with a moderate discriminator. (DifI=54.19; DisI=0.11).

Question 12

One G2 comment said: *'It could be any answer".* It was felt that the question would have been better understood if the word "man-made" had been used rather than "composite*".* But the majority of candidates got this right so it was not felt to disadvantage the candidates. A moderately easy question with low discrimination (DifI=64.93; DisI=0.33).

Question 13

This question highlighted the need for candidates to be taught the properties of both thermosets and thermoplastics. This was a moderately hard question with moderately high discrimination (DifI=24.17; DisI=0.07).

Question 16

This question highlighted the need for candidates to be taught the terminology in topic 5. This was a moderately easy question (DifI=49.29; DisI=0.21).

Question 17

This was a moderately easy question. Candidates who answered 50th percentile did not take into consideration the fact that car seats are adjustable. (DifI=51.82; DisI=0.16).

Question 19

Most candidates answered this correctly, however the question did highlight a need to teach the meanings of the technical terminology used in topic 7. Moderate difficulty and low discriminator (DifI=50.24.; DisI=0.36).

Question 21

More candidates answered A than the correct answer D. Perhaps on the false assumption that labour decreased with the introduction of steam power. This was a moderately hard question and a moderate discriminator (DifI=24.64; DisI=0.18).

Question 23

Candidates that got this question wrong had misinterpreted the question and failed to see that it was a negative question. This was a moderately hard question and a moderate discriminator (DifI=33.81; DisI=0.12).

Question 25

One comment on the G2s stated that a picture of the chair would have helped clarify the context. But this did not disadvantage candidates as the majority got it right. This was a moderately easy question (DifI=66.35; DisI=0.25).

Question 28

A comment on the G2s stated that the photograph was "*poor quality*". This did not appear to disadvantage the candidates. This was a moderately easy question and a low discriminator (DifI=40.6; DisI=0.20).

Question 35

One comment on the G2s stated that "*a diagram would have helped*". (DifI=32.07; DisI=0.29).

Question 38

This question highlighted the need for candidates to be taught the molecular structure of materials as outlined in the guide. This was a moderately easy question (DifI=54.66; DisI=0.36).

Question 39

This question proved to be misleading so in order to be fair to candidates it was removed.

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Question	A	B	C	D	Difficulty Index	Discrimination index
1	553*	64	4	12	87.36	0.25
2	166*	75	44	348*	81.20	0.20
3	16	594*	9	14	93.84	0.12
4	522*	68	37	6	82.46	0.30
5	59	47	470*	56	74.25	0.24
6	31	343*	243	15	54.19	0.12
7	158	449*	5	21	70.93	0.27
8	51	10	141	431*	68.09	0.34
9	541*	37	9	45	85.47	0.24
10	47	200	353*	32	55.77	0.51
11	544*	4	8	77	85.94	0.10
12	113	78	411*	31	64.93	0.35
13	93	153*	102	283	24.17	0.07
14	228	212*	131	62	33.49	0.18
15	27	90	481*	34	75.99	0.24
16	62	312*	10	249	49.29	0.21
17	20	328*	94	191	51.82	0.14
18	537*	19	59	18	84.83	0.19
19	145	156	318*	14	50.24	0.36
20	20	32	563*	18	88.94	0.17
21	280	112	84	156*	24.64	0.20
22	16	15	585*	17	92.42	0.13
23	313	41	64	214*	33.81	0.10
24	319*	153	123	38	50.39	0.31
25	1	26	186	420*	66.35	0.25
26	18	47	77	491*	77.57	0.33
27	144	142	300*	47	47.39	0.41
28	77	257*	298*	1	87.68	0.14
29	19	190	110	312*	49.29	0.40
30	476*	11	15	131	75.20	0.37
31	109	169	314*	39	49.61	0.31
32	20	269*	156	188	42.50	0.27
33	41	156	422*	11	66.67	0.25
34	271*	68	89	203*	42.81	0.34
35	117	195	117	203	32.07	0.27
36	159*	268	37	169	25.12	0.31
37	27	76	513*	17	81.04	0.18
38	103	155	346*	27	54.66	0.36
39	120	25	129	358	0	0.00
40	7	62	17	546*	86.26	0.18

Number of candidates 633

Recommendations for the teaching of future candidates

It is important that candidates understand the technical terminology in the guide and are able to apply it to design contexts. They need a thorough knowledge of the glossary terms to allow them to answer the questions intelligently. It is also important that candidates have a thorough understanding of the properties and structure of all of the materials as outlined in the guide.

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Higher level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 5	6 - 10	11 - 17	18 - 25	26 - 33	34 - 41	42 - 60

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 most popular and question 8 the least popular.

3 G2 forms were received by the time of the Grade Award meeting. As can be gleaned from the statistics above all teachers who returned the forms thought that the paper was well presented and the questions fair to candidates. One G2 comment stated that context chosen for Question 1 was particularly accessible to candidates and that there was nothing misleading about the questions in Section B which offered good syllabus coverage. Another G2 form stated that it was "an exceptional test!"

Comparison with last year's paper

Much easier	A little easier	Similar standard	A little more difficult	Much more difficult
0%	66.67	33.33	0%	0%

Suitability of question paper

	Too easy	Appropriate	Too difficult
Level of difficulty	0%	100%	0%

	Poor	Satisfactory	Good
Syllabus coverage	0%	0%	100%
Clarity of wording	0%	0%	100%
Presentation of paper	0%	0%	100%

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 though many candidates failed to include the correct units.

(iii) Nearly all candidates achieved the correct answer to this question.

b) (i) Many candidates seemed to be confused by this question and did not make the connection between the "operation and use stage" and the electrical energy consumption.

(ii) This question posed few problems for the majority of candidates.

(iii) This question differentiated well between abilities with the better candidates able to identify that there are zero greenhouse gas emissions and so concluded that the kettles must be disposed of in landfills.

c) (i) Many answers to this question were vague resulting in only one or two marks gained rather than the three marks available. For three mark questions it is important that candidates consider their response carefully before writing the answer and do not just write the first thing that comes into their head.

(ii) Most candidates stated correctly the redesign aspect although some mentioned use of fewer components.

(iii) The majority of candidates recognized the fact that disassembly eases either repair, reuse or recycling but did not focus on **one** of these concepts to outline for both marks.

d) (i) The majority of candidates failed to understand the concept of "internationally recognized marks" in relation to recycling and reuse.

(ii) Not surprisingly, candidates who failed to correctly understand the first part of the question also became confused by the second part.

Question 2

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

b) Many of the candidates confused on-shore and off-shore wind farms with some interpreting off-shore as inland farms and on-shore as on the coast.

Question 3

a) Most candidates stated that kinetic energy relates to movement but not many candidates went on to define potential energy in relation to the position and arrangements of its parts.

b) This question was generally not answered well with most candidates failing to appreciate that a rubber band actually resists being stretched out of shape.

Question 4

a) Some candidates did not define the concept of a building envelope well enough to gain the mark though it should be emphasised that any candidate who used their own words to express the meaning contained in the IB definition was awarded the mark.

b) An explanation was required here for **how** the building envelope contributes to the amount of energy used rather than a description of the energy requirements of a building.

Question 5

a) This question proved surprisingly difficult for many candidates who failed to make the connection between the bonding arrangements of thermoplastics and vacuum forming.

b) Following on from the generally weak answers in part (a) few candidates knew enough about the practicalities of vacuum forming to understand that undercutting can be a major problem with some designs.

Question 6

a) The concept of torque seemed to be quite alien to many candidates though it was a straightforward question to those who did know.

b) Most candidates could relate to linear and rotational motion but only the more astute managed to explain the relationship between them for full marks.

Section B

Question 7

a) (i) This was a relatively easy question for most candidates, but some candidates merely listed the general characteristics of glass rather than making the connection with the design context.

(ii) This was not answered fully by many candidates who merely stated the definitions of one-off and batch without applying it to the lantern production.

b) (i) Many candidates chose to outline welding as a suitable method which was inappropriate to the context.

(ii) Many candidates did not read the question carefully enough and did not identify the link between part (i) and part (ii) consequently the use of the word "plastic" caused these candidates to explain the use of plastic in the lanterns rather than the plastic deformation of the metal.

c) (i) Most candidates managed to identify the use of the waste material for the lanterns but not all related this to the concept of design for materials.

(ii) All candidates made a reasonable attempt at answering this question and the higher ability candidates managed to structure their response into three carefully presented aspects of how the lanterns were an example of appropriate technology.

Question 8

a) (i) The majority of candidates were able to gain two marks for this question.

(ii) The relevance of elastic strain was not well explained by many candidates who failed to relate the concept to yield point.

b) (i) This question was straightforward for nearly all candidates.

(ii) The majority of candidates failed to answer this question well as they assumed that weaving would be a weak technique to use and hence reduce the product life cycle.

c) (i) Candidates were generally able to identify an appropriate reason but did not structure their answer well enough to maximise on the marks available.

(ii) Although many candidates could think of advantages to the use of lamination they did not always plan their response astutely to ensure that they gained one mark for identifying an advantage, another mark for outlining the advantage and a further mark for relating this to the hammock frame.

Question 9

a) (i) This question was generally answered well.

(ii) Most candidates clearly understood the concepts of radical and incremental design and how they relate to the context.

b) (i) The majority of candidates struggled with the question and just referred to low weight so the product could float but some higher ability candidates thought carefully about the definitions of weight and mass and realised their importance for use in and out of the water.

(ii) Most candidates managed to obtain marks for reference to depth and the more able candidates went on to develop their answer to consider forces relating to current and the nature of the activity.

c) (i) Most candidates answered this question well.

(ii) Some candidates did not understand the concept of value-for-money and others muddled up issues relating to the three aspects but those who carefully planned their answer generally gained high 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 nine mark question in Section B.

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.

Higher level paper three

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 4	5 - 9	10 - 13	14 - 18	19 - 23	24 - 28	29 - 40

General comments

Paper 3 is designed to provide a range of questions reflecting each of the design technology options A-E and providing evidence for the various aspects of the Group 4 grade descriptors. There is a sharing of questions between HL and SL with questions HL questions 1, 3, 4 and 7 being the same as SL questions 1, 3, 5 and 6 respectively. Each option on HL Paper 3 adds to a total of 40 marks. Candidates are required to answer one option.

Options C (CAD/CAM) and E (Human Factors Design) are by far the most popular although Option A (Food Science and Technology) and Option D (Textiles) are growing in popularity. Few schools do Option B (Electronic Product Design).

The G2s provide invaluable evidence for the grade award meeting and again the examining team strongly urges teachers to submit G2s. With a growing number of schools involved in the subject there is the opportunity for rich feedback to the team. Positive as well as negative comments can help the team resolve issues emerging in the grade awarding process and particularly in the setting of grade boundaries. Only two G2 forms were received for the HL paper. In terms of 'comparison with the previous year' one thought the paper was a little easier than the previous year and one thought it was about the same standard. Both G2s thought that the 'level of difficulty' was appropriate. One thought that 'syllabus coverage' was satisfactory and the other thought it was good. Both thought 'clarity of wording' and 'presentation of paper' was good. In terms of specific comments one G2 stated that the paper was understandable and appropriate. The other G2 commented about Option C saying that the *'problem with this option is that candidates (and teachers) do not have first-hand experience of the high-end, expensive industrial machines they are expected to learn about'*. It is up to the school which option they pick and how that option is covered. There is a range of learning support materials available for use in schools and industrial visits are one way of helping candidates to understand the implementation of some of the newer and more expensive technologies. Option C is likely to be the most resource-hungry option and the other options may be less costly to deliver.

Attention is brought again to the listing of command terms in the subject guide on pages 10 and 11. Each question uses a command term which determines the mark allocation and hence the depth of response required. As is continually emphasised in subject reports, a three-mark question requires a candidate to provide greater depth of response than a two-mark or a one-mark question.

Good candidates know their work and are able to provide well-structured answers. Structuring of the answers is particularly important for the extended response questions, i.e. HL question 7/SL question 6. Candidates who do not structure their answers often provide repetitive answers or do not go into sufficient depth to earn the third mark. Teachers are advised to help candidates develop structured answers using past questions.

One very worrying feature of the scripts from some schools is that candidates answer different options and very poorly. One explanation for this is that options are self-taught rather than being teacher-taught as part of an integrated scheme of work. Teachers should link the teaching of the option to the teaching of the core rather than treating it totally separately.

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 introduced olive oil as a complex mixture of fatty acids, vitamins, volatile components, water soluble components and small bits of olive. It goes on to say that the fatty acids in olive oil are unsaturated fatty acids – oleic, linoleic and linolenic. It then provides the formula for each unsaturated fatty acid.

   a) This question asked candidates to define unsaturated fatty acid and was worth one mark. It was very poorly answered and most candidates were unable to identify that an unsaturated fatty acid contains a carbon-carbon double bond.

   b) This question asked candidates to describe the importance of unsaturated fats to health and was worth two marks. Again the question was very poorly answered by many candidates.

   c) This question asked candidates to explain the importance of unsaturated fatty acids in the development of rancidity and the shelf life of cooking oils. Candidates did not recognise that the carbon-carbon double bond makes the fatty acid susceptible to oxidation resulting in oxidative rancidity and the development of off flavours in the oil and reducing the shelf life of the cooking oil.

Question A2

   a) This question asked candidates to define food security. Approximately half of the candidates were able to provide a reasonable definition.

   b) This question required candidates to list two criteria for food security. This question was very poorly answered.

Question A3

This question showed the Coca-Cola product family comprising a number of different branded products.

a) This question asked for candidates to list two functions of the packaging of Coca-Cola. Most candidates were able to provide reasonable answers to this question.

b) This question asked candidates to outline one way in which the packaging of Coca-Cola has contributed to the development of the Coca-Cola brand. Many candidates were able to identify the shape of the bottle, the distinctive script and the red colour of the packaging and it's labelling as contributing to the development of the brand to earn two marks.

Question A4

a) This question asked candidates to explain the significance of the resistance of crops to the herbicide Roundup™. The question was worth three marks. Approximately half of the candidates were able to identify that crops which are resistant to the herbicide are able to grow when treated with it whereas non-resistance plants, e.g. weeds are not able to do so.

b) This question focused on a reason why manufacturers might not want to label genetically-modified crops or their products. Not all candidates were able to provide good answers but a good proportion (approx. 80%) were able to gain one or two marks on this question and about half the candidates were able to provide enough depth of response to earn three marks.

Question A5

a) This question asked candidates to list two categories of bacterial food poisoning. This question should have been straightforward but was very badly answered by candidates.

b) Candidates were asked to describe the temperature danger zone for bacterial growth. The temperature range ($10\text{-}63^{\circ}$C) was the preferred answer. About half the candidates were able to gain both marks for this question.

c) This question asked candidates to outline one way in which lifestyle factors contribute to the increased incidence of food poisoning. The mark scheme for this question offers a number of possible answers. This question was answered reasonably by a number of candidates.

Question A6

This question required candidates to explain the influence of market pull and technology push on the development of new food products. It was worth six marks. Candidates were generally able to provide reasonable answers to this question. Well-structured answers generally achieved 3 marks. Some less well-structured answers were repetitive and did not achieve full marks.

Question A7

This question asked candidates to explain three ways in which on-farm processing can enhance farm sustainability and was worth nine marks. There were some good answers in which candidates selected three distinctly different ways in which on-farm processing enhances farm sustainability and then achieved depth of response and hence the full nine marks. Candidates not doing this often repeated themselves and thus did not achieve full marks.
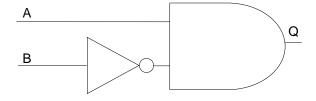
OPTION B – Electronic product design

Question 1

This question focused on a digital control system for activating a garden irrigation system comprising a moisture sensor and a temperature sensor providing digital inputs to a logic system controlling an irrigation system.

a) This question asked candidates to identify the key components of the temperature sensor. Most candidates were able to correctly identify a thermistor or a temperature sensitive resistor as the appropriate component for the temperature sensor.

b) This question asked candidates to complete the truth table for the logic system. The mark scheme awarded one mark for Q=1 when A=0 and B=1 and one mark for Q=0 in all other instances as shown below.

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

c) This question required candidates to draw the circuit for the logic system and was worth three marks. The mark scheme awarded one mark for the correct symbol for an AND gate, one mark for the AND gate having two inputs A and B and one mark for the NOT gate on input B as shown below.

The question was not answered appropriately by a number of candidates.

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Question 2

a) This question asked for a definition of nanotechnology. Approximately half of the candidates were able to provide a recognisable definition and were awarded one mark.

b) This question asked for a description of one application of nanotechnology. Those candidates able to provide a definition of nanotechnology were generally able to follow on and provide a description of an appropriate application.

Question 3

This question showed an input to a logic system for a temperature control system in a smart home and a graph showing the characteristics of a thermistor.

a) Part (a) of the question required candidates to read from the graph to state the resistance of the thermistor at 10^oC. Most candidates were able to provide an answer of 450–500 Ω. Candidates not stating the units were penalised by one mark.

b) Part (b) of the question required candidates to explain why the thermistor could be used to provide logic 0 when the temperature rises about approximately 10^oC in the logic system. One mark was awarded for identifying that above 10^oC the value of X falls below 470 Ω, a second mark for identifying that the input to the logic gate then rises above 2.5 V and a third mark for identifying that the output then switches to logic 0. A small number of candidates achieved all three marks.

Question 4

a) This question asked candidates to explain how PICs are integrated into control circuits to implement the smart home concept. Good candidates were able to explain for one mark that a range of input and output devices are used to implement the PIC with the real world, for a second mark that the PIC makes "intelligent" decisions based on pre-programmed protocols and for a third mark that it reacts to inputs producing outputs to maintain or change environments.

b) Part (b) of this question asked candidates to explain how a door can be locked and unlocked using PIC technology. One mark was awarded for identifying that an electromagnet/solenoid would be used to move current flowing through solenoid in one direction will open the bolt and when flowing in the opposite direction will close the bolt, a second mark for identifying that two PIC outputs are needed, a third mark for an amplifier interfaces PIC with solenoid as PIC outputs do not provide enough current.

Question 5

a) Part (a) asked candidates to outline one implication of product stewardship for designers. One mark was awarded for identifying one implication of product stewardship for designers and one mark for a brief explanation. Most candidates were able to achieve at least one mark on this question, many achieved two marks.

b) This question asked candidates to outline one way in which take-back legislation would impact on the cost of a product. One mark was awarded for identifying one way in which take-back legislation would impact on the cost of a product and one mark for a brief explanation. This question was relatively well answered by candidates.

c) This question asked candidates to outline one way in which service costs contribute to the replacement of electronic products rather than their repair. One mark was awarded for identifying that service costs comprise call-out charges, cost of parts, cost of time to undertake the repair and can be substantial and one mark for stating that it is often cheaper to replace products than to repair them.

Question 6

This question asked candidates to explain how a digital hearing aid can be customized to meet the requirements of an individual user initially and through its product lifecycle. The mark scheme awarded one mark for each of three distinct correct points in an explanation of how a digital hearing aid can be customised to meet the requirements of an individual user initially and through the product lifecycle. Good candidates were able to explain that initially and audiogram analyses frequency response of an ear and that the hearing aid can be programmed to divide/filters incoming sound into frequency bands and to amplify these bands where appropriate and recombine them to compensate for hearing deficiencies. They were also able to explain that a person's hearing may deteriorate over time and that a new audiogram would provide information to re-programme the PIC and this is to extend the product life.

Question 7

This question asked candidates to explain three reasons why copper wires are being replaced by fibre optic cables in modern digital communication systems based on frequency division multiplexing. One mark was awarded for each of three distinct correct points in an explanation of each of three reasons why copper wires are being replaced by fibre optic cables in modern digital communication systems based on frequency division multiplexing. Good candidates provided well-structured answers, avoided repetition and gained high marks. Less well-structured answers were often repetitive and did not achieve good marks.

OPTION C – CAD/CAM

Question C1

The stem of this question provided information on a flat-pack self-assembly wardrobe and showed the wardrobe, the knock-down fittings that would be used in its construction and two pictures showing assembly instructions.

a) Part (a) of the question asked candidates to state one benefit for the consumer of using knock-down (KD) fittings in the design of the wardrobe in Figure C1. The mark scheme offered a vast array of potential benefits and most candidates were able to achieve the one mark on offer.

b) Part (b) of the question asked candidates to describe how the exploded drawing in Figure C1 would help consumers to assemble the wardrobe. Again this posed few problems to most candidates.

c) Part (c) of the question asked candidates to discuss one advantage of using CAM in the manufacture of the flat-pack furniture. This part of the question provide more challenging especially in relation to achieving a sufficient depth of response to achieve the full three marks on offer as a result of making three distinct correct points of response.

Question C2

a) Part (a) of this question asked candidates to define artificial intelligence. Few candidates were able to identify that this relates to a computer-based machine or robot that has the ability to learn from information gained through feedback.

b) Part (b) of this question asked candidates to outline one way in which feedback plays an important role in developing artificial intelligence. One mark was awarded for identifying one way in which feedback provides an input signal to the processor and plays an important role in developing artificial intelligence and one mark for a brief explanation.

Question C3

The stem of this question showed different views of a ring produced using CAD.

a) Part (a) asked candidates to outline how the use of CAD has simplified the designing of jewellery. One mark was awarded for identifying one way in which the use of CAD has simplified the manufacture of jewellery and one mark for a brief explanation. A range of potential answers were offered in the mark scheme and most candidates were able to achieve full marks for this part of the question.

b) Part (b) of the question asked candidates to outline how a scanner could be used to aid jewellery design using CAD. Most candidates were able to explain that the scanner would be used to input images to the CAD system and the designs would then be manipulated using CAD.

Question C4

The stem of this question and accompanying Figure showed a CAD image of the housing of an electronic product. The question asked candidates to discuss two limitations of using 3-axis machining to make the product. This question proved challenging. Those candidates who understood the limitations of 3-axis machining and were able to provide well-structured answers were able to achieve full marks. Some candidates scored poorly on this question as a result of poorly-structured and repetitive answers.

Question C5

a) Part (a) asked candidates to outline how CAD has changed the nature of the designer-client relationship. Most candidates were able to identify that CAD enables a more participatory approach with the client interacting with the design.

b) Part (b) asked candidates to identify one advantage of using CAD in terms of working across time zones. The mark scheme awarded one mark for identifying a reason about how CAD allows for 24 hours a day working across time zones and one mark for a brief explanation. Most candidates were able to identify that CAD allows teams to work in different places and enables collaborative working 24 hours a day, 7 days a week.

c) Part (c) asked candidates to outline one implication of computerized manufacture on the infringement of copyright laws. One mark was awarded for identifying one implication of computerized manufacture on the infringement of copyright laws and one mark for a brief explanation. Most candidates were able to identify that it is very easy to copy designs and that slight modifications to a design means it can be produced without breaching copyright;

Question C6

The stem of this question showed photos of two different chairs – Ben Wilson's Chairfix design and Gerrit Rietveld's Mondrian-inspired chair.

a) Part (a) of this question asked candidates to discuss one issue associated with using MDF as a material to make the Ben Wilson chair in a CAM system. One mark was awarded for identifying an issue associated with using MDF as a material to make the Ben Wilson chair on a CAM system and one mark for each of two distinct correct points of explanation. Many candidates were able to identify an appropriate issue. Good candidates were able to structure their answers and achieve all three marks on offer.

b) Part (b) of the question asked candidates to compare the use of CAM to make the Ben Wilson chair with the use of more traditional methods to make the Gerrit Rietweld chair. One mark was awarded for identifying an issue and one mark for each of two distinct correct points of explanation. The mark scheme identified initial investment; training requirements, working environment, communication and wastage as issues.

Question C7

This question asked for discussion of three advantages to the manufacturer of operating a computer integrated manufacturing (CIM) system. The mark scheme awarded one mark for each of three distinct correct points of discussion of three advantages to the manufacturer of operating a computer integrated manufacturing (CIM) system. It identified staff morale, reduction of waste, cost-effectiveness of manufacture and quality as four issues. Each issue needed to be followed through with two distinct correct points of discussion. Well-structured answers achieved full marks. Poorly-structured answers tended to be repetitive and gained fewer marks.

OPTION D – Textiles

Question D1

This question focused on a biomimetic fabric used in the production of swimwear and showed a body suit and instructions for measuring a person for the bodysuit.

a) Part (a) asked for a definition of biomimetic and most candidates were able to offer a recognisable definition and achieve one mark. Most candidates were able to provide a definition to the effect of 'the application of methods and systems found in nature to the study and design of engineering systems and modern technology' and achieved one mark.

b) Part (b) asked candidates to outline one reason why the bodysuit has to fit like a second skin. The mark scheme awarded one mark for reducing drag and one for a brief explanation, for example, that the tight fit streamlines the body shape. Most candidates responded correctly and were awarded two marks.

c) Part (c) asked candidates to explain why a composite material is used for the manufacture of Fastskin®. The critical advantage of composites is that the desired properties of the material can be designed in. In this case the proportion of Lycra® and polyamide can be adjusted to determine the stretchability/dimensional stability of the fabric. Although this question did not seem particularly challenging it was poorly answered by many candidates.

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Question D2

a) Part (a) asked candidates to state one impact of mechanisation in the textile industry on the family life of textile workers. One mark was awarded for a correct response. A number of possible answers were identified in the mark scheme including that children were forced to work, that families were split up, that it forced a shift from a rural environment to an urban environment, that it forced families into crowded living conditions and that families had to endure long working hours and were afforded little time off. Most candidates were able to identify an impact and achieve one mark.

b) Part (b) required an outline of one impact of automation of the textile industry on the working conditions of the workforce. The mark scheme identified health and safety issues since automated production is safer for the workers than mechanized production and that they are cleaner and quieter. This was answered reasonably well by candidates.

Question D3

The stem of this question showed a 6-needle embroidery system suitable for small-scale commercial use and for education. The system has a range of inbuilt designs as well as allowing users to create their own designs on a PC and transfer them to the system for sewing.

a) Part (a) asked candidates to describe the market for products developed using the embroidery system. The system supports craft/small scale production and would be used for one-off designs for up-market applications rather than for mass production and thus would be of interest to sports clubs and other clients requiring small volumes of products. Most candidates achieved at least one mark on this question.

b) Part (b) asked for an outline of one way in which the embroidery system can help to enhance designer-client relationships. Interaction between the designer and the client enables involvement of the client in design process and enables changes to be made at an appropriate time rather than a product being manufactured and resources/time wasted. Many candidates were able to achieve both marks on offer for this question.

Question D4

a) Part (a) asked for an explanation of how manufacturers would achieve the EU Flower system for a textile product. A manufacturer would have to undertake product life cycle analysis focusing on the criteria set by the EU for the product category and supply test data to National Standards Authority, which would inform the EU if the product meets the criteria. If it does, the European Commission would publish the award across the EU.

b) Part (b) asked for a discussion of the key environmental impacts associated with the cutting of cotton fabrics. Cutting creates waste and should be done in a way that reduces waste. Waste generally goes to landfill unless it is recycled to reduce the environmental impact. Surprisingly, only the better candidates were able to achieve two or three marks for their responses to this question.

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Question D5

a) Part (a) asked candidates to identify one input device for use with wearable computing. One mark was awarded for identifying an appropriate input device and one for a brief explanation. Passive sensors (e.g. heat/light sensors), adapted keyboards (e.g. in pocket linings/wireless/Bluetooth) and microphones were all identified in the mark scheme as appropriate input devices. Most candidates were able to gain one, if not two marks for this question.

b) Part (b) asked for the identification of one obstacle to the expansion of the wearable computing market. One mark was awarded for identifying an obstacle to the expansion of the wearable computing market and one mark for a brief explanation. Cost, need, fashion, health and safety and distinctiveness were identified in the mark scheme. This question was generally answered well by candidates.

c) Part (c) asked for an outline of one benefit of laser welding as a joining technique for the manufacture of wearable computing garments. One mark was awarded for identifying one benefit of laser welding as a joining technique for the manufacture of wearable computing garments and one for a brief explanation. Various benefits were identified in the mark scheme including that laser welding does not produce holes in the fabric, strength, enhanced performance characteristics, reduced labour needs, reduced manufacturing costs, ease of automation and sealing of seams. Most candidates achieved at least one mark for this question.

Question D6

This question asked candidates to discuss two advantages of using SMART textiles in cars. The mark scheme identified that comfort sensors in the textiles used for seats can detect the comfort levels of driver/passenger and make appropriate adjustments. Also, that "triple fresh" and similar treatments on carpets and decompose pollutants, e.g. cigarette/animal smells and keep cars smelling fresh. Also, that detectors can check if the driver is asleep or awake and, if necessary, apply the brakes, enhancing road safety. This question was answered reasonably well by candidates and good candidates achieved three marks.

Question D7

This question asked candidates to explain three ways in which finishing processes can be used to modify the performance characteristics of textile products. One mark was awarded for each of three distinct correct points of explanation of each of three ways in which finishing processes are used to modify the performance characteristics of textile products. Fire retardance, waterproofing, soil release and ease of maintenance were all identified as ways in which the performance characteristics of textile products would be modified.

OPTION E – Human factors design

Question E1

The stem of this question showed a sketch of a paper prototype which could be used in a paper prototyping session.

a) Part (a) of the question asked candidates to state one advantage of paper prototyping. The mark scheme offered a list of alternative responses including: cheap, easy to do; accessible; quick; easily modified; design can be developed quickly; makes communication easier between team members. Most candidates were able to achieve the one mark on offer.

b) Part (b) of the question asked candidates to outline one way in which paper prototyping can be seen as an example of participatory design. One mark was awarded for noting the involvement of users and one mark for them being able to contribute to the development of the design. Most candidates were able to achieve two marks on this question.

c) Part (c) asked candidates to explain the role of the user in a paper prototyping session. One mark was awarded for each distinct correct point of explanation. The mark scheme identified that the user represents the target market, that s/he receives guidance from a facilitator as s/he interacts with the user–product interface. Most candidates were able to achieve at least two marks on this question.

Question E2

a) Part (a) asked candidates to state one advantage of motion capture for digitally representing motion. One mark was awarded for stating one advantage of which there are many, e.g. that it reduces the cost of animation, saves time and creates more natural movements than manual animation. Most candidates were able to offer an appropriate response and achieve the one mark on offer.

b) Part (b) of the question asked candidates to outline one way in which digital humans increase the pace of the product development cycle. One mark was awarded for identifying one way in which digital humans would increase the pace of the product development cycle and one mark for an explanation. The term 'digital humans' posed a problem for some candidates who confused digital humans with robots.

Question E3

The stem of this question presented a kitchen layout annotated with work triangles.

a) Part (a) of the question asked candidates to describe the relationship of work triangles and kitchen layout design. One mark was awarded for each of two points of description. Though not always elegantly articulated most candidates were able to come up reasonable responses. Some candidates jumped in and in answering this question provided the answer to the second part of the question rather than the first. Candidates should read the whole question before answering so they can plan their responses appropriately.

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b) Part (b) asked candidates to outline how the use of a work triangle may assist a designer to resolve safety issues in the design of a kitchen layout. One mark was awarded for outlining one way in which work triangles can assist and one mark for a brief explanation. The mark scheme identified that work triangles enable an efficient arrangement of products and fixtures which reduces travel and lessens the chances of an accident *e.g.* when carrying heavy pans/pans with hot liquids. Most candidates were able to achieve the two marks on offer for this question.

Question E4

This question presented three layouts for a cooker hob with four burners and four control knobs. It asked candidates to discuss two issues for the designer in deciding which layout should be adopted as the standard design. The mark scheme awarded one mark for each three distinct correct points of discussion of two issues for the designer. The shape of the hobs, the safety in use, the mapping between the control knobs and the burners and the ease of identifying which control operates which hobs were issues identified in the mark scheme. Most candidates were able to provide a reasonable answer to the question.

Question E5

a) Part (a) of this question asked candidates to outline one advantage of globalization to the manufacturer of products for people with a disability. The mark scheme awarded one mark for identifying an advantage and one mark for a brief explanation. Suitable responses included that disability groups in one country may be a small market but that the amount of disabled persons worldwide add up to a large market and this makes the manufacture of products for this market more cost-effective.   Most candidates were able to achieve two marks on this question.

b) Part (b) asked candidates to outline one benefit of increased access to the internet for consumers with disabilities. The mark scheme awarded one mark for identifying a benefit and one mark for a brief explanation. Suitable responses included that: consumers can interact with other consumers with the same disability, sharing recommendations of products based on satisfactory use; consumers have access to products worldwide which would be difficult to find without the resources of the internet; consumers are able to access to detailed information about products is available; and can therefore make an informed choice; consumers can quickly access information and order products from home at anytime of the day or night rather than having to made a costly/difficult trip to a retail outlet. This question was generally well answered by candidates.

c) Part (c) asked candidates to identify one barrier of the use of global legislation for ensuring inclusive design for community facilities. One mark was awarded to identifying a barrier and one for a brief explanation. This question proved challenging for candidates and many did not earn any marks for their responses.

Question E6

a) Part (a) of the question asked candidates to suggest why international standards are important in the design of road signs. This question posed few problems to candidates and most were able to provide good answers and earn three marks.

b) Part (b) of the question asked candidates to explain one human factor consideration for designers of freeway (motorway) signs. One mark was awarded for each of three distinct correct points of explanation.

Decision sight distance, the positioning of signs, the size of signs and the letters/symbols on the signs, the distance and the information coding were all identified as considerations in the mark scheme. This question also posed few problems and candidates were able to provide good responses.

Question E7

This question asked candidates to discuss three human factors considerations relating to standardization in the design of an open-plan office. This question was very poorly answered by candidates. Many candidates did not focus on issues of standardization. Some provided poorly-structured answers and were extremely repetitive in their responses so did not achieve the marks on offer. Notwithstanding this there were some very good well-structured answers from candidates that had clearly read and understood the question.

Standard level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 7	8 - 11	12 - 16	17 - 18	19 - 21	22 - 23	24 - 28

General comments

One G2 had been received for this paper at the time of the Grade Award meeting. The teacher's comments were studied carefully at the grade award meeting and were used alongside other evidence, particularly candidate responses to the paper as evidenced through the statistics (difficulty index (DifI) and discrimination index (DisI)), (see the section reporting on the Higher Level paper one for explanation of these terms), to determine grade boundaries for the paper.

The Grade Award team are grateful for the input from teachers through the G2 forms as it informs the process of boundary setting. The one response we received indicated that the level of difficulty to be appropriate and that they thought that the syllabus coverage was poor. Clarity of wording was satisfactory and the presentation of the paper was good.

The teacher who returned the G2 felt that the paper was "*over biased towards Business and Economics*".

Individual question analysis

Question 1

Candidates obviously have a good knowledge of the design process. This was an easy question and was only moderately discriminating (DifI=88.61; DisI=0.23).

Question 2

This question highlighted a discrepancy in the interpretation of "design specification". Quite a few candidates stated that it was "criteria for a design proposal" rather than "major constraints. The mark scheme was adjusted accordingly so both A and D were accepted. (DifI=20.28; DisI=0.12).

Question 5

Candidates with a good understanding of the terminology in topic 2 did better in this question. This question proved to be an easy question with moderate discrimination (DifI=80.60; DisI=0.24).

Question 14

It was felt that the question would have been better understood if the word "man-made" had been used rather than "composite". But the majority of candidates got this right so it was not felt to disadvantage the candidates. A moderately easy question with low discrimination (DifI=62.46; DisI=0.32).

Question 15

This question highlighted the need for candidates to be taught the properties of both thermosets and thermoplastics. This was a moderately hard question with high discrimination (DifI=20.64; DisI=0.01).

Question 16

This question highlighted the need for candidates to be taught the properties of timbers and to be aware that cost is relative to the type of timber. This was a moderately easy question. (DifI=24.91; DisI=0.15).

Question 19

The answer to this question was changed to either B or C as shoes can be joined either way. This was a moderately easy question with moderately high discrimination (DifI=40.57; DisI=0.27).

Question 20

This question was removed.

Question 22

This question was removed.

Question 29

This question was difficult for candidates who did not know the definitions in topic 2. This was a moderately hard question with moderate discrimination (DifI=32.92; DisI=0.29).

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	498*	41	5	18	88.61	0.24
2	114*	142	38	268*	67.97	0.25
3	15	519*	14	14	92.35	0.15
4	237*	24	230	71	42.17	0.27
5	453*	74	28	7	80.60	0.25
6	40	5	138	378*	67.26	0.40
7	157	366*	8	31	65.12	0.24
8	50	53	26	433*	77.05	0.31
9	485*	26	17	34	86.30	0.27
10	44	244	230*	43	40.93	0.48
11	479*	1	7	75	85.23	0.10
12	25	25	414*	98	73.67	0.37
13	54	216*	195	97	38.43	0.47
14	136	51	351*	24	62.46	0.30
15	137	116*	91	214	20.64	-0.01
16	140*	74	170	178	24.91	0.11
17	52	168	293*	49	52.14	0.42
18	66	252*	19	225	44.84	0.28
19	31	272*	228*	31	88.97	0.13
20	131	137	145	149	0	0.00
21	13	45	41	463*	82.38	0.30
22	15	50	225	272	0	0.00
23	99	97	26	340*	60.50	0.41
24	163	276*	33	90	49.11	0.48
25	84	129	328*	21	58.36	0.29
26	27	26	502*	7	89.32	0.12
27	62	23	18	459*	81.67	0.28
28	83	331*	129	19	58.90	0.36
29	66	82	185*	229	32.92	0.31
30	239*	66	129	128	42.53	0.43

Number of candidates 562

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Standard level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 3	4 - 7	8 - 11	12 - 15	16 - 20	21 - 24	25 - 40

General comments

Only two G2 feedback forms were received from teachers as can be seen from the information in the tables below. The examination paper was deemed to be very satisfactory by both 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 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 5 was the most popular and question 6 the least popular though there was not a huge difference between the percentage take – up of each question.

Comparison with last year's paper

Much easier	A little easier	Similar standard	A little more difficult	Much more difficult
0%	0%	100%	0%	0%

Suitability of question paper

	Too easy	Appropriate	Too difficult
Level of difficulty	0%	100%	0%

	Poor	Satisfactory	Good
Syllabus coverage	0%	100%	0%
Clarity of wording	0%	0%	100%
Presentation of paper	0%	0%	100%

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

Section A

Question 1

a) (i) This was a straightforward question which was answered correctly by the vast majority of candidates.

(ii) This was also a straightforward calculation though some candidates lost a mark for not stating the correct units.

(iii) This calculation proved too difficult for many candidates who did not correctly identify the data required, although it differentiated well between the different ability levels of candidates.

b) (i) Candidates who knew the difference between the corporate strategies studied as part of topic 2.3 in the Subject Guide were able to answer this question satisfactorily.

(ii) The majority of candidates answered this question correctly.

(iii) The wording of this question seemed to confuse some candidates who assumed that "inform" meant how to tell the customer rather than to assist the product development.

Question 2

a) There were a large number of vague definitions for "plastic deformation". In order to gain the mark candidates did not have to repeat the definition in the Glossary of the Subject Guide word for word but in their own words they did need to convey the meaning of the IB definition.

b) A surprising amount of candidates misread this question and explained the use of plastic for the seat and back of the chair even though the question clearly links the concept of plastic deformation with the use of metal tubing. Some answers referred to the importance of plastic deformation in use rather than in manufacturing. Candidates should be aware also that part (b) of a question follows naturally from part (a) as further development of the question.

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Question 3

    a)   Although it was clear that most candidates understood the meaning of automation not all candidates mentioned computer control as part of the definition.

    b)   This question needed careful consideration before providing an answer so that a comparison was made between mass customization and craft production rather than merely defining both concepts. If candidates identified the role of the consumer in each process then usually the comparison flowed correctly from this point.

Section B

Question 4

    a)   (i) Most candidates achieved the mark for this question.

            (ii) The wide choice of answers for this question meant that most candidates were able to score highly on it though some answered in relation to the customer rather than the manufacturer.

            (iii) Most candidates were able to outline a suitable reason for the limited colour range of the chair.

    b)   (i) Quite a number of candidates stated a percentile range rather than a specific percentile.

            (ii) Although most candidates clearly understood the concept of physiological factor, not many were able to structure the response to the question carefully enough to gain all three marks. There was a tendency to list a number of physiological factors rather than concentrate on one factor and develop an answer.

    c)   (i) Most candidates focused on a strength test and achieved the available marks.

            (ii) Many responses to the question were vague and did not refer to specific aspects of the chair while others wrote broadly about comfort and aesthetics.

Question 5

    a)   (i) Many candidates did not find this question easy. They needed to recall the list of physical properties from section 4.2 of the syllabus and decide which one applied to the context. Many answers were based on properties other than physical ones. Candidates who could differentiate between the different categories of properties were able to deduce that hardness was the most appropriate physical property in this context.

            (ii) This proved a surprisingly difficult question for many candidates as they had to relate knowledge of polypropylene to an appropriate manufacturing technique i.e. injection moulding.

            (iii) Many candidates were able to gain the marks for this question by applying their generic knowledge of the reasons why many inventions do not become innovations.

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

            (ii) Although this question was generally answered reasonably well, not many candidates gained full marks – quite a few candidates mentioned preventing the pen rolling off the desk rather than focusing on ergonomic considerations.

c) (i) Most candidates realised that the pen is usually discarded once the ink runs out as it is a relatively inexpensive item to replace.

(ii) This question differentiated well amongst candidates for although nearly all candidates were able to tackle the question and gain marks, only the better candidates planned their response carefully enough to focus on three distinctly different aspects and provide a full enough answer for each aspect to gain three marks.

Question 6

a) (i) Many candidates stated "moulding" as the answer, which was too vague. Knowledge of specific manufacturing techniques is required and the clue to the answer was in the stem of the question which refers to a "metal block".

(ii) The majority of candidates were able to relate to the use of the dispenser and realize that the metal would be heavy in order to achieve stability of the product in use.

(iii) Quite a few candidates did not seem to understand the command term "list" and provided lengthy answers which were a waste of their time.

b) (i) Very few candidates went back to the wording of the question to identify that the dispenser was designed with fewer components compared to other designs.

(ii) The majority of candidates were able to explain the function of the oval hole when using the dispenser but not many were able to also relate the shape of the hole to the overall form of the object.

c) (i) Most candidates focused on the blade as a potential safety hazard, although not all answers were in the form of an "outline" rather than merely just referring to the blade.

(ii) This question offered many candidates the opportunity to gain marks if they focused on specific strategies for evaluation and related the strategies to the design of the dispenser rather than providing just generic answers i.e. what user trials generally aim to do.

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 nine mark question in Section B.

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.

Standard level paper three

Component grade boundaries

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

General comments

Paper 3 is designed to provide a range of questions reflecting each of the design technology options A-E and provide evidence for the various aspects of the Group 4 grade descriptors. There is a sharing of questions between HL and SL with questions HL questions 1, 3, 4 and 7 being the same as SL questions 1, 3, 5 and 6 respectively. Each option on HL Paper 3 adds to a total of 30 marks. Candidates are required to answer one option.

Options C (CAD/CAM) and E (Human Factors Design) are by far the most popular although Option A (Food Science and Technology) and Option D (Textiles) are growing in popularity. Few schools do Option B (Electronic Product Design).

As for the HL paper, the G2s provide invaluable evidence for the grade award meeting and again the examining team strongly urges teachers to submit G2s to provide positive as well as negative comments which can help us in the resolution of issues emerging in the grade awarding process and the setting of grade boundaries. Four G2 forms were received for the SL paper. In terms of 'comparison with the previous year' two thought the paper was a little easier than the previous year and two thought it was about the same standard. Three G2s thought that the 'level of difficulty' was appropriate and one through that it was too easy. All four thought that 'syllabus coverage' was satisfactory. Three thought 'clarity of wording' as satisfactory and one thought it was good. One thought that the 'presentation of paper' was satisfactory and one thought it was good. In terms of specific comments one G2 commented that it was hoped that scanners related to flat bed and 3D scanners and that few candidates would have had experience of 3D scanners. One G2 commented that in relation to stress analysis and question A3 (b) and that there was six points from a one line assessment statement that had probably impacted negatively on candidate scores. It is difficult to understand this comment as A3 (b) is about packaging and the development of the Coca-Cola brand and was worth two marks. One G2 commented that Option A is easier than the other options in the paper. Evidence from candidate performance would suggest that this is not true and whilst there were some particularly good candidate performances (as there were for all options) there were also a number of very poor candidate performances. Option A is growing in popularity but not as quickly as one might anticipate if it were perceived to be easier than other options. The examining team wonders if option E is perceived to be easier as it and Option C are by far the most popular.

Attention is brought again to the listing of command terms in the subject guide on pages 10 and 11. Each question uses a command term which determines the mark allocation and hence the depth of response required. As is continually emphasised in subject reports a three-mark question requires a candidate to provide greater depth of response than a two-mark or a one-mark question.

Good candidates know their work and are able to provide well-structured answers. Structuring of the answers is particularly important for the extended response questions, i.e. HL question 7/SL question 6. Candidates who do not structure their answers often provide repetitive answers or do not go into sufficient depth to earn the third mark. Teachers would be well advised to help candidates to develop structured answers.

One very worrying features of the scripts from some schools is that candidates answer different options and very poorly. One explanation for this is that options are self-taught rather than being teacher-taught as part of an integrated scheme of work. Teachers should link the teaching of the option to the teaching of the core rather than treating it totally separately.

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 introduced olive oil as a complex mixture of fatty acids, vitamins, volatile components, water soluble components and small bits of olive. It goes on to say that the fatty acids in olive oil are unsaturated fatty acids – oleic, linoleic and linolenic. It then provides the formula for each unsaturated fatty acid.

a) This question asked candidates to define unsaturated fatty acid and was worth one mark. It was very poorly answered and most candidates were unable to identify that an unsaturated fatty acid contains a carbon-carbon double bond.

b) This question asked candidates to describe the importance of unsaturated fats to health and was worth two marks. Again the question was very poorly answered by many candidates.

c) This question asked candidates to explain the importance of unsaturated fatty acids in the development of rancidity and the shelf life of cooking oils. Candidates did not recognise that the carbon-carbon double bond makes the fatty acid susceptible to oxidation resulting in oxidative rancidity and the development of off flavours in the oil and reducing the shelf life of the cooking oil.

Question A2

a) This question required candidates to define lifestyle. Most candidates were able to provide a reasonable definition of the term.

b) This question asked candidates to identify one lifestyle actor which affects food choice and impacts on health. Most candidates were able to identify a lifestyle factor and then go on to provide a brief explanation of how it affected health.

Question A3

This question showed the Coca-Cola product family comprising a number of different branded products.

    a) This question asked for candidates to list two functions of the packaging of Coca-Cola. Most candidates were able to provide reasonable answers to this question.

    b) This question asked candidates to outline one way in which the packaging of Coca-Cola has contributed to the development of the Coca-Cola brand. Many candidates were able to identify the shape of the bottle, the distinctive script and the red colour of the packaging and it's labelling as contributing to the development of the brand and to earn two marks.

Question A4

This question asked candidates to outline one way in which food can influence the incidence of cancer. This question proved challenging to some candidates.

Question A5

This question required candidates to explain the influence of market pull and technology push on the development of new food products. It was worth six marks. Candidates were generally able to provide reasonable answers to this question. Well-structured answers generally achieved 3 marks. Some less well-structured answers were repetitive and did not achieve full marks.

Question A6

This question asked candidates to explain three ways in which on-farm processing can enhance farm sustainability and was worth nine marks. There were some good answers in which candidates selected three distinctly different ways in which on-farm processing enhances farm sustainability and then achieved depth of response and hence the full nine marks. Candidates not doing this often repeated themselves and thus did not achieve full marks.

OPTION B – Electronic product design

Question B1

This question focused on a digital control system for activating a garden irrigation system comprising a moisture sensor and a temperature sensor providing digital inputs to a logic system controlling an irrigation system.
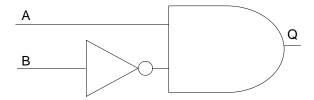
    a) This question asked candidates to identify the key components of the temperature sensor. Most candidates were able to correctly identify a thermistor or a temperature sensitive resistor as the appropriate component for the temperature sensor.

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b) This question asked candidates to complete the truth table for the logic system. The mark scheme awarded one mark for Q=1 when A=0 and B=1 and one mark for Q=0 in all other instances as shown below.

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

c) This question required candidates to draw the circuit for the logic system and was worth three marks. The mark scheme awarded one mark for the correct symbol for an AND gate, one mark for the AND gate having two inputs A and B and one mark for the NOT gate on input B as shown below.

The question was not answered appropriately by a number of candidates.

Question B2

a) This question required candidates to calculate the power delivered to a torch bulb if a 6 volt battery supplies 2 amperes. Using the formula: $P = V.I$ candidates were able to calculate that the power delivered would be 12 Watts. About half the candidates were able to correctly answer this question.

b) Part (b) of the question asked candidates to identify the likely outcome if a 4 volt torch bulb were to be connected to the charged battery by mistake. One mark was awarded for identifying that the bulb would be likely to overheat or blow and one mark for identifying that the power/voltage of the battery would exceed the rating of the bulb. Most candidates found this question relatively straightforward.

Question B4

This question asked candidates to outline one reason why only a fraction of the capacity of a PIC is used in many electronic products. Most candidates were able to provide reasonable answers to this question in line with the mark scheme and achieve two marks.

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Question B5

This question asked candidates to explain how a digital hearing aid can be customized to meet the requirements of an individual user, initially and through its product lifecycle. The mark scheme awarded one mark for each of three distinct correct points in an explanation of how a digital hearing aid can be customised to meet the requirements of an individual user, initially and through the product lifecycle. Good candidates were able to explain that initially an audiogram analyses frequency response of an ear and that the hearing aid can be programmed to divide/filters incoming sound into frequency bands, amplifies these bands, where appropriate, and recombine them to compensate for hearing deficiencies. They were also able to explain that a person's hearing may deteriorate over time and that a new audiogram would provide information to re-programme the PIC and this to extend the product life.

Question B6

This question asked candidates to explain three reasons why copper wires are being replaced by fibre optic cables in modern digital communication systems based on frequency division multiplexing. One mark was awarded for each of three distinct correct points in an explanation of each of three reasons why copper wires are being replaced by fibre optic cables in modern digital communication systems based on frequency division multiplexing. Good candidates provided well-structured answers, avoided repetition and gained high marks. Less well-structured answers were often repetitive and did not achieve good marks.

OPTION C – CAD/CAM

Question C1

The stem of this question provided information on a flat-pack self-assembly wardrobe and showed the wardrobe, the knock-down fittings that would be used in its construction and two pictures showing assembly instructions.

a) Part (a) of the question asked candidates to state one benefit for the consumer of using knock-down (KD) fittings in the design of the wardrobe in Figure C1. The mark scheme offered a vast array of potential benefits and most candidates were able to achieve the one mark on offer.

b) Part (b) of the question asked candidates to describe how the exploded drawing in Figure C1 would help consumers to assemble the wardrobe. Again this posed few problems to most candidates.

c) Part (c) of the question asked candidates to discuss one advantage of using CAM in the manufacture of the flat-pack furniture. This part of the question proved more challenging, especially in relation to achieving a sufficient depth of response to achieve the full three marks on offer as a result of making three distinct correct points of response.

Question C2

a) Part (a) of the question asked candidates to state the term given to the manufacturing of 3D parts by depositing molten material in a series of layers. About half the candidates were able to provide an appropriate response.

b) Part (b) of the question asked candidates to describe a context where a laser cutter could be used to manufacture parts.

Question C3

The stem of this question showed different views of a ring produced using CAD.

a) Part (a) asked candidates to outline how the use of CAD has simplified the designing of jewellery. One mark was awarded for identifying one way in which the use of CAD has simplified the manufacture of jewellery and one mark for a brief explanation. A range of potential answers were offered in the mark scheme and most candidates were able to achieve full marks for the part of the question.

b) Part (b) of the question asked candidates to outline how a scanner could be used to aid jewellery design using CAD. Most candidates were able to explain that the scanner would be used to input images to the CAD system and the designs would then be manipulated using CAD.

Question C4

This question asked candidates to list two issues for manufacturers when choosing CNC equipment. One mark was awarded for each of two issues. Cost, flexibility, maintenance, tooling, training, speed and quality of finish were identified as issues in the mark scheme.

Question C5

The stem of this question and accompanying Figure showed a CAD image of the housing of an electronic product. The question asked candidates to discuss two limitations of using 3-axis machining to make the product. This question proved challenging. Those candidates who understood the limitations of 3-axis machining and were able to provide well-structured answers were able to achieve full marks. Some candidates scored poorly on this question as a result of poorly-structured and repetitive answers.

Question C7

This question asked for discussion of three advantages to the manufacturer of operating a computer integrated manufacturing (CIM) system. The mark scheme awarded one mark for each of three distinct correct points of discussion of three advantages to the manufacturer of operating a computer integrated manufacturing (CIM) system. It identified staff morale, reduction of waste, cost-effectiveness of manufacture and quality as four issues. Each issue needed to be followed through with two distinct correct points of discussion. Well-structured answers achieved full marks. Poorly-structured answers tended to be repetitive and gained fewer marks.

OPTION D – Textiles

Question D1

This question focused on a biomimetic fabric used in the production of swimwear and showed a body suit and instructions for measuring a person for the bodysuit.

a) Part (a) asked for a definition of biomimetic and most candidates were able to offer a recognisable definition and achieve one mark. Most candidates were able to provide a definition to the effect of 'the application of methods and systems found in nature to the study and design of engineering systems and modern technology' and achieved one mark.

b) Part (b) asked candidates to outline one reason why the bodysuit has to fit like a second skin. The mark scheme awarded one mark for reducing drag and one for a brief explanation such as that the tight fit streamlines the body shape. Most candidates responded correctly and were awarded two marks.

c) Part (c) asked candidates to explain why a composite material is used for the manufacture of Fastskin®. The critical advantage of composites is that the desired properties of the material can be designed in. In this case the proportion of Lycra® and polyamide can be adjusted to determine the stretchability/dimensional stability of the fabric. Although this question did not seem particularly challenging it was poorly answered by many candidates.

Question D2

a) This questions asked candidates to define brand. Many candidates were able to define a brand as a product/service/concept from a known source which can be marketed to promote customer loyalty and achieve one mark.

b) A question asking candidates to outline one strategy which would contribute to the development of a brand. The mark scheme identified several strategies including sponsorship, *e.g.* of sports events such as Olympics, which offer great exposure for sponsors to promote brand awareness; support for good causes, *e.g.* children's charities, which can appeal to specific market segments, *e.g.* philanthropically or environmentally-aware consumers; consistency of use of colour/logos/strap-lines which reinforce the brand image. Most candidates were able to achieve one or both marks for this question.

Question D3

The stem of this question showed a 6-needle embroidery system suitable for small-scale commercial use and for education. The system has a range of inbuilt designs as well as allowing users to create their own designs on a PC and transfer them to the system for sewing.

a) Part (a) asked candidates to describe the market for products developed using the embroidery system. The system supports craft/small scale production and would be used for one-off designs for up-market applications rather than for mass production and thus would be of interest to sports clubs and other clients requiring small volumes of products. Most candidates achieved at least one mark on this question.

b) Part (b) asked for an outline of one way in which the embroidery system can help to enhance designer-client relationships. Interaction between the designer and the client enables involvement of the client in design process and enables changes to be made at an appropriate time rather than a product being manufactured and resources/time wasted. Many candidates were able to achieve both marks on offer for this question.

Question D4

This question asked candidates to outline one negative impact of product branding of textile garments on the health of adolescents. Branded products are often promoted by models which may be extremely underweight (e.g. size 0). Adolescents are strongly influenced by such promotions and may seek to achieve similar physique to the detriment of their health.

The question posed no particular problems and again most candidates were able to gain one mark if not two for this question.

Question D5

This question asked candidates to discuss two advantages of using SMART textiles in cars. The mark scheme identified that comfort sensors in the textiles used for seats can detect the comfort levels of driver/passenger and make appropriate adjustments. Also, that "triple fresh" and similar treatments on carpets and decompose pollutants, e.g. cigarette/animal smells and keep cars smelling fresh. Also, that detectors can check if the driver is asleep or awake and if necessary apply the brakes enhancing road safety. This question was answered reasonably by candidates and good candidates achieved three marks.

Question D6

This question asked candidates to explain three ways in which finishing processes can be used to modify the performance characteristics of textile products. One mark was awarded for each of three distinct correct points of explanation of each of three ways in which finishing processes are used to modify the performance characteristics of textile products. Fire retardance, waterproofing, soil release and ease of maintenance were all identified as ways in which the performance characteristics of textile products would be modified.

OPTION E – Human factors design

Question E1

The stem of this question showed a sketch of a paper prototype which could be used in a paper prototyping session.

a) Part (a) of the question asked candidates to state one advantage of paper prototyping. The mark scheme offered a list of alternative responses including: cheap; easy to do; accessible; quick; easily modified; design can be developed quickly; makes communication easier between team members. Most candidates were able to achieve the one mark on offer.

b) Part (b) of the question asked candidates to outline one way in which paper prototyping can be seen as an example of participatory design. One mark was awarded for noting the involvement of users and one mark for them being able to contribute to the development of the design. Most candidates were able to achieve two marks on this question.

c) Part (c) asked candidates to explain the role of the user in a paper prototyping session. One mark was awarded for each distinct correct point of explanation. The mark scheme identified that the user represents the target market, that s/he receives guidance from a facilitator as s/he interacts with the user–product interface. Most candidates were able to achieve at least two marks on this question.

Question E2

a) Part (a) asked candidates to state the measurement scale used for dates, e.g. 2010, in the Western world. Dates can be positive and negative and so the scale is an interval scale. Few candidates got this right and some left it blank. Some candidates seemed to have guessed at the answer (incorrectly).

b) Part (b) asked candidates to outline why a comfort rating scale of 1-10 is an ordinal scale. The mark scheme awarded one mark for the numbers representing only a convenient order and one mark for pointing out that the numbers do not relate to absolute values. This was very poorly answered by many candidates.

Question E3

The stem of this question presented a kitchen layout annotated with work triangles.

a) Part (a) of the question asked candidates to describe the relationship of work triangles and kitchen layout design. One mark was awarded for each of two points of description. Though not always elegantly articulated most candidates were able to come up reasonable responses. Some candidates jumped in and in answering this question provided the answer to the second part of the question rather than the first. Candidates should read the whole question before answering so they can plan their responses appropriately.

b) Part (b) asked candidates to outline how the use of a work triangle may assist a designer to resolve safety issues in the design of a kitchen layout. One mark was awarded for outlining one way in which work triangles can assist and one mark for a brief explanation.

The mark scheme identified that work triangles enable an efficient arrangement of products and fixtures which reduces travel and lessens the chances of an accident *e.g.* when carrying heavy pans/pans with hot liquids. Most candidates were able to achieve the two marks on offer for this question.

Question E4

This question asked candidates to describe one reason why a designer would use an appearance prototype at the design development stage of a product. One mark was awarded for each of two distinct correct points in a description of why an appearance prototype would be used in design development. This question did not pose any major problems to candidates and most were able to provide a reasonable response and achieve the two marks on offer.

Question E5

This question presented three layouts for a cooker hob with four burners and four control knobs. It asked candidates to discuss two issues for the designer in deciding which layout should be adopted as the standard design. The mark scheme awarded one mark for each three distinct correct point of discussion of two issues for the designer. The actual shapes of the hobs, the safety in use, the mapping between the control knobs and the burners and the ease off identifying which control operates which hobs were issues identified in the mark scheme. Most candidates were able to provide a reasonable answer to the question.

Question E6

This question asked candidates to discuss three human factors considerations relating to standardization in the design of an open-plan office. This question was very poorly answered by candidates. Many candidates did not focus on issues of standardization. Some provided poorly-structured answers and were extremely repetitive in their responses so did not achieve the marks on offer. Notwithstanding this, there were some very good well-structured answers from candidates that had clearly read and understood the question.