GCE

Rewarding Learning

## Chief Examiner's and Principal Moderator's Report

# Technology and Design

Summer Series 2022

# Foreword

This booklet outlines the performance of candidates in all aspects of this specification for the Summer 2022 series.

CCEA hopes that the Chief Examiner's and Principal Moderator's report(s) will be viewed as a helpful and constructive medium to further support teachers and the learning process.

This booklet forms part of the suite of support materials for the specification. Further materials are available from the specification's microsite on our website at www.ccea.org.uk.

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# GCE Technology and Design

# Chief Examiner's Report

## Overview

Candidates taking this examination had to sit first the compulsory Design and Materials paper, followed by selecting and completing two questions from one of the three available options. In the AS 2: Coursework: there were a total of 647 candidates who entered this unit Product Development. There were 645 candidates, in total, in Paper 1 (STE11) who sat this compulsory one-hour Design and Materials option. In Paper 2 there were 200 candidates who responded to the Electronic and Microelectronic Control Systems, 98 opted for the Mechanical and Pneumatic Control Systems, with the remaining 347 candidates choosing to respond to the Product Design. In the A2: Coursework: there were a total of 637 candidates who entered this unit. There were 177 candidates who responded to the Electronic and Microelectronic Control Systems, 77 opted for the Mechanical and Pneumatic Control Systems, with the remaining 379 candidates choosing to respond to the Product Design.

# Assessment Unit AS 1 Core Unit

All questions in this core unit proved accessible and there was no evidence that the paper was too long for the time allocated. A full range of marks were awarded, and candidates seemed to have sufficient space to complete each part of the questions.

**Q1** This question was answered well by many candidates. Common errors were an inability to distinguish between physical and mechanical properties and a clear explanation of the term durability.

**Q2** This question was generally well answered. In Part (c) some candidates failed to provide different reasons for test and inspect procedures.

**Q3** The first part of this question dealing with wood veneers was well answered in most cases. However, the second part dealing with the process of enamelling was poorly answered in many cases with candidates displaying a limited or no knowledge of the process.

**Q4** The first part of this question was answered well with most candidates aware of the main characteristic associated with a thermoplastic polymer. A surprising number of responses to the second part did not contain a complete or accurate description of the vacuum forming process. Several responses did not contain sufficient annotation to achieve full marks.

**Q5** The first part of this question was answered well by many candidates. A number provided characteristics of reflective film related to its ability to reflect light which was specifically excluded in the question.

The second part on holograms produced a mixed response with some candidates scoring full marks and some scoring zero.

**Q6** A full range of marks were awarded in this question. In some cases, candidates confused aesthetic and ergonomic factors. Whilst there are some aspects of the product in question which could reasonably be analysed in terms of both aesthetics and ergonomics the distinction had to be made clear by the candidate. An example of this is the water level indicator which whilst primarily an ergonomic feature, could also be discussed in terms of its aesthetic appeal due to the choice of colour and font.

The question required candidates to refer to two distinctly different aspects of both ergonomics and aesthetics. Some candidates provided an explanation of two features which were similar in nature. Also, some candidates explained more than two features and so wasted time and answer space on a response which would not attract credit.

**Q7** There were two different design tasks presented in this question.

In each case candidates must provide a workable and realistic solution to the task.

In response to the first part of the question several candidates did not address the central requirement of the design task which was 'redesign the front of the tray'. There were many examples in the scripts of small compartments in the tray with no indication of how these would be attached to the tray itself or if the brush would stand upright but not fall into the paint as requested in the question. Some candidates, did, however, produce workable and realistic solutions illustrated with sketches and annotation where appropriate and achieved high marks as a result. The full range of marks available were awarded in this question.

Similarly for the second part of the question a full range of marks were awarded but with fewer achieving full marks. The main issues here were a lack of addressing of how the design would be attached to the leg of the ladder so holding the tray safely and securely. A further design requirement was for the ability of the user to quickly attach the tray and in several cases this was not clearly evident.

# Assessment Unit AS 1 Paper 2 Option A, B and C

## Option A Electronic and Microelectronic Control Systems

All questions in this unit proved accessible and there was no evidence that the paper was too long for the time allocated. A full range of marks were awarded, and candidates seemed to have sufficient space to complete each part of the questions.

**Q1** **(a)** **(i)** Most candidates did not obtain full marks in this question as they did not fully articulate the operational principle that voltage is divider.

**(ii)** The majority of candidates correctly calculated the output of the voltage divider. Candidates should be reminded of the importance of showing their working out as marks can be awarded for partially worked out answers.

**(iii)** Most candidates correctly completed the table for the stated environmental conditions.

**(b)** **(i)** This question was generally well answered with most candidates making a good attempt to state the greater output voltage range provided by a dual power supply.

**(ii)** The additional components and values required for completion of the operational amplifier circuit were generally correct from most candidates.

**(c)** **(i)** The majority of candidates correctly calculated the power dissipated by the heater. Candidates should be encouraged to show working out as marks can be awarded for partially worked out answers.

**(ii)** Most candidates correctly referred to high gain or high-power current/ power capabilities of a Darlington pair compared to using a single transistor.

**(iii)** A good response to this question was noted with most candidates correctly drawing a Darlington pair arrangement although a significant number of responses omitted an appropriate base resistor.

**(iv)** The responses to this question were generally poor with many candidates giving generic advantages and disadvantages of PIC based systems. Candidates were expected to refer to the specific comparator circuit in their answer.

**Q2** **(a)** **(i)** Most candidates were awarded full marks in this question as they correctly referred to Vo, the positive rail and the action of the push to break switch.

**(ii)** Most candidates correctly calculated the equivalent resistance with an appropriate method of calculation being acceptable.

**(b)** **(i)** The majority of candidates were able to deduce the correct number of possible input combinations although a significant number of responses incorrectly stated the number as 7.

**(ii)** The completion of the truth table was well done by most candidates.

**(c)** **(i)** There were a pleasing number of correct responses to this question. Examiners awarded the mark only if the reed switch symbol was connected to the existing circuit.

**(ii)** Most candidates provided a succinct description of how a reed switch operates however a significant number of responses did not refer to an applied magnetic field.

**(iii)** Candidates were required to sketch a graph showing the voltage at the trigger pin of a 555 monostable timer. A significant number of the graphs were drawn in an inverted format and as a result were awarded one mark.

**(iv)** The responses to this question were mixed with a small number of correct answers. In general candidates failed to accurately explain the function of the threshold pin.

**(v)** The majority of candidates correctly calculated the required value for the resistor. Candidates should be advised to show their working out as marks can be awarded for partially worked out answers.

**(vi)** A pleasing number of correct responses were provided for this question. Candidates produced a variety of correct alternative arrangements for a selective rotary switch.

## Option B Mechanical and Pneumatic Control Systems

All questions in this unit proved accessible and there was no evidence that the paper was too long for the time allocated. A full range of marks were awarded, and candidates seemed to utilise the space well for both questions.

**Q3** **(a)** Most candidates correctly answered this question. Some did not label the levers. Some drew applications of levers.

**(b)** **(i)** The majority of candidates were able to complete this calculation correctly.

**(ii)** Most candidates successfully calculated the velocity ratio. A small number of candidates made an error by inverting the formula.

**(iii)** This calculation presented a higher-level challenge. A small number of candidates gained full marks in this question. Many candidates did not attempt this question.

**(c)** This question generally well answered by most candidates.

**(d)** **(i)** The majority of candidates successfully drew an air bleed and the correct piping to the 5/2 valve. Most candidates completed the solenoid activated connections.

**(ii)** A smaller number of candidates completed a solution and piping for valve C.

**Q4** **(a)** **(i)** This question was well answered by many candidates.

**(ii)** This question was well answered by many candidates.

**(b)** The majority of candidates gained marks in this question. In several cases the sketch for the cotter pin was either unclear or incorrect. Some candidates placed the cotter pin in a position that would not secure the motor shaft to the agitator shaft.

**(c)** This question was poorly attempted by many the candidates, with most gaining a maximum of two marks. A very small number of candidates took account of efficiency in their calculations.

**(d)** This question differentiated candidates' level of ability. Generally, most candidates correctly operated valve A, B and the shuttle valve and demonstrated the ability to pipe these to the 5/2 valve. The minority of candidates correctly added a method of automatic return with a non-contact method.

**(e)** This question produced a wide range of answers with a number failing to recognise that the changes to the circuit proposed in the question would result in an open loop arrangement.

## Option C Product Design

All questions in this unit proved accessible and there was no evidence that the paper was too long for the time allocated. A full range of marks were awarded, and candidates seemed to utilise the space well for both questions.

**Q5** **(a)** This question was based on headphones. The response to the opening part of Question 5 was good with most candidates able to distinguish between primary and secondary sources in relation to research methods. In Part (ii) many candidates were able to provide a specific secondary source.

**(b)** This question generated a mixed response. Part (i) was well answered as candidates were successful in coming up with two reasons why one off could be considered a costly scale of production. In contrast Part (ii) was poorly answered with many candidates unable to provide a good quality annotated sketch to explain the steam bending process.

**(c)** This question also generated a mixed response.

**(i)** Many candidates were able to explain the purpose behind introducing the 'right first time' approach.

**(ii)** Many candidates failed to explain that it was the use of statistics to help select products for testing.

**(d)** This design-based question carrying six marks. It required candidates to produce sketches for a low-cost wall mounted bracket which would securely hold the headphones and store the cable whilst allowing the user quick and easy access. The lack of quality sketches and annotation by many candidates restricted their marks. Candidates who received marks in the high band tended to focus on what was being asked in the question and illustrated and highlighted the key points in their response. Candidates need to be reminded that a clearly

annotated sketch is required to enable the examiners to understand the response and mark positively. In a small number of cases candidates produced designs which were not appropriate as a bracket.

**Q6** **(a)** This question was based on kitchen cookware. The response to this question was disappointing. Many candidates understood the term inversion but failed to explain how it was used to generate new creative ideas.

**(b)** This question generated a good response. Many candidates were able to come up with three characteristics associated with the health and safety at Work Act. A small number of candidates simply stated health and safety rules associated with the Technology and Design workshop.

**(c)** This question was split into three parts. Part (i) was well answered with many candidates able to provide two main characteristics associated with a Gantt chart. In a small number of cases candidates provided repeat, slightly reworded answers for their second characteristic. Part (ii) and Part (iii) were generally well answered with many candidates able to outline what is meant by JIT and able to provide two main reasons why the company would want to adopt this system.

**(d)** In this question many candidates found it challenging to provide three different characteristics associated with a patent. Several candidates did not know the key facts associated with patents which resulted in some answers containing very vague statements.

**(e)** This question focused on nanotechnology and was well answered. Many candidates were able to explain what was meant by the term nanotechnology and provide an application. In some cases, the application provided by candidates could only be described as general or vague.

**(f)** This is the final part to this question and to the section. Many candidates were able to design a strainer, but a number did not provide a suitable means to secure or enable the user to remove the strainer easily and quickly from the saucepan. In several cases the sketches for the designs were difficult to understand, which makes it challenging for the examiners to be positive when awarding marks. On a final note, candidates need to spend more time practicing these design-based questions to improve their responses, to give them confidence in their sketching and annotation and to utilise the space provided on the pro forma answer page.

# Principal Moderator's Report

## Assessment Unit AS 2 Coursework: Product Development

### Overview

This academic year (2021-22) candidates were working to a revised specification (see addendum in link below) in which coursework had two sections removed – Manufacture and, Testing and Evaluation, with an additional ten marks being awarded in Section 2 - Redesign Solutions and Development. Overall weighting of this unit remained unchanged.

Many centres continue to navigate the eCRS system with ease, presenting administration materials to a high standard that enabled the moderation process to be conducted. In some centres eCRS documentation simply contained the score awarded for each section or simply quoted the marking criteria. In examples where eCRS documentation contained little or no explanation for the marks awarded it was difficult for the moderator at times, to justify the mark awarded. Centres are reminded that the purpose of the moderation process is to ensure that the specification standards are carried across all centres consistently and is not for the moderator to re-mark the work of each candidate.

On several occasions moderators found candidate work exceeded the page limit stipulated in subject specification. Centres must ensure that this is addressed when delivering the unit of work and amended as part of the internal standardisation process if a candidate fails to meet the specification requirements.

Centres are encouraged to make use of agreement trial material throughout the academic year.

Agreement trial material continues to provide invaluable CPD opportunities, assisting teachers in becoming familiar with appropriate product selection and standards within this specification.

Review of agreement trial material annually is of paramount importance and presents teachers with the valuable opportunity to review the work of candidates first hand, to support continued communication of standards and approaches to the delivery of this unit.

## Investigation and Analysis

Overall, this section was generally completed to a high standard with the moderating team largely able to agree marks that had been awarded in centres.

Selection of an appropriate product for re-design is paramount to the potential success of each candidate. The class teacher should act as a facilitator and ensure that the task the candidate undertakes is appropriate and achievable.

In examples achieving top mark band scores, candidates were found to clearly identify an appropriate product for re-development with succinct discussion on areas for improvement. At AS level, four similar products are considered to be a broad range, with similar products considered to be products that fulfil the same purpose. Most candidates referenced the sources, but this was not always consistent or sufficient in detail – centres should be aware of JCQ guidance on plagiarism and referencing.

In examples that accessed the top mark band, candidates conducted thorough analysis using a range of key headings. Discussing material properties in depth and how these related to the product rather than simply listing a range of generic properties for that specific material. Top candidates also conducted detailed analysis of sustainability considerations that explored the product in a manner that went beyond simple discussion of recyclability by considering dematerialisation, functionality, transportation and packaging.

To complete this section top candidates selected an appropriate product for re-design giving detailed justification for this selection and clearly addressing the key areas for improvement. This not only assists moderation but also ensures that the candidate has clearly defined areas that he/she will develop throughout Section 2.

## Re-Design Solutions and Development

Moderators found that this section was the cause of greatest disagreement when conducting the moderation process and assessment of marking by centres. Quite often the work presented was not of standard, as set out in the agreement trial material, to justify the top marks awarded in centre.

In examples where candidates accessed the top mark band, they often had thoughtful and highly focused specifications. These specifications were clearly derived from thorough analysis of their selected product and areas for development, enabling candidates to produce an excellent array of quantifiable/measurable points.

Moderators reported that in most of the candidate work accessing top mark band, good hand graphics and CAD were instilled throughout this section. Top candidates employed a range of graphic communication skills adroitly to explore each area for development – as identified in Section 1.

The specification addendum for 2021/22 awarded ten additional marks for this section to allow for evaluation of outcomes of modelling to take place. It is encouraging to see that many centres have continued to encourage the use of modelling in candidates work but, in several examples, this was simply added as an additional page towards the end of this section. Candidates who accessed the top mark band infused a range of modelling techniques throughout this section. These candidates were creative in their re-design thinking but also in the methods and materials used to model aspects of their design idea(s). Rather than simply, describing the model, or how they made it, top candidates showed excellent analytical skills by describing what they had learned from this model, and crucially, how it has informed their development process.

CAD is being used widely to: produce models for testing, provide 3D renderings for visual comparison or aesthetic details, and to provide detailed working drawings. Candidates accessing the top mark band for this section used CAD imaginatively to provide information on hidden details and to produce a range of models using CAM techniques. Some candidates still rely heavily on CAD in the early stages of re-design when a range of sketches produced by hand would enable the candidate to explore potential solutions much more rapidly. This would also build upon exam technique for design-based questions in the terminal examination.

Again, some centres are awarding top marks for work that is overly annotated. To access the top mark band candidates should be following the cyclical nature of design when developing a range of re-design solutions.

Working drawings are still of concern when conducting moderation. Often when top marks are awarded for this section a teacher will cite high level working drawings as part of the justification for the mark awarded. However, often the working drawing does not follow set conventions (first or third angle projection), give clear indication of sizes (to the nearest whole number) and/or lack detailed cutting lists. In the best examples, candidates produced working drawings that would enable third party manufacture.

## Specification Addendum

https://ccea.org.uk/downloads/docs/Specifications/GCE/GCE%20Technology%20and%20Design%20%282016%29/GCE%20Technology%20and%20Design%20%282016%29-spec-addendum-2022-Standard.pdf

# Chief Examiner's Report

## Assessment Unit A2 1 Option A, B and C

### Option A Electronic and Microelectronic Control Systems

**Q1** **(a)** **(i)** Correct responses to this question were fewer than expected as many candidates failed to identify the significance of how the choice of the value for R1 will determine the output voltage range of the voltage divider.

**(ii)** Most candidates correctly calculated the output voltage of the voltage divider. Candidates should be reminded of the importance of showing their working out as marks may be awarded for partially worked out answers.

**(b)** **(i)** Candidates answered this question well with most stating the correct formula for an inverting operational amplifier. A significant number of responses omitted the negative symbol. For the calculation of the required gain candidates were awarded full marks based on their gain formula carried forward.

**(ii)** A pleasing number of candidates produced correct responses to this question. Again, for the value of resistors chosen the gain values from Part (i) were carried forward.

**(c)** **(i)** This question was based on a Gray Code convertor system and most candidates correctly completed the missing logic states on the incomplete truth table.

**(ii)** A variety of configurations were used by candidates to complete the Karnaugh maps with mostly correct responses for the minimised expressions.

**(iii)** For this part of the question candidates were asked to draw a logic circuit for the specified outputs. A surprising number of candidates produced three separate logic circuits and were therefore unable to access full marks.

**(d)** Marks were awarded for a well-structured explanation of the requirement for voltage regulation followed by a discussion of two methods that can be employed. The quality of written communication is assessed in this question and most candidates provided sufficient well-structured content to access the available marks. Most candidates referenced Zener diodes and fixed voltage regulators as the methods employed. A small number of candidates did not write sufficient text to enable higher band marks to be awarded.

**(e)** Most candidates produced annotated circuit diagrams and associated flow charts that correctly met the four specification points. The most common fault was in relation to the second transistor driver where a relay was often added despite there being no requirement for one. There were some excellent flow charts which made good use of decisions, sub routines and loops in order to produce the flash sequence for the red lamp. Candidates should be encouraged to annotate their flow charts in order to clearly show their thinking.

**Q2** **(a)** **(i)** This question was answered well by most candidates although a significant number of responses referred to slotted optical switches.

**(ii)** The vast majority of candidates added the correct symbols for the transmitter and receiver for an optical switch. One mark was awarded for each correct symbol however symbols that were drawn upside down were not awarded a mark.

**(iii)** Responses to this question were generally good with most candidates sketching an accurate representation of the output voltage for the reflective optical switch. Several of the responses were 'upside down' and as a result were not awarded full marks.

**(b)** **(i)** A small number of responses correctly articulated an explanation of the function of the step input on a stepper motor driver. Many candidates simply repeated wording of the question.

**(ii)** The responses to this question were generally limited with many candidates explaining generic advantages and disadvantages of a stepper motor compared to a DC motor. Some of these generic advantages had no bearing on the application. Candidates were asked to refer to the specific application of the car park barrier.

**(iii)** The calculation of the number of steps and the resultant frequency was well answered by many candidates but some candidates did not show their working out.

(**c)** **(i)** The number of fully correct responses to this question was limited as many candidates did not explain the main advantage of multiplexing. Most explanations focused incorrectly on reliability, driver complexity or visibility.

**(ii)** A pleasing number of correctly completed bit pattern tables was noted for this question.

**(iii)** Candidates were required to write a flow chart using the minimum number of commands to control the dot matrix display. Most responses were awarded partial marks. The main errors were in the setting of the correct timing for the specified frequency.

**(d)** **(i)** The responses to this question were mixed with many candidates explaining generic advantages a seven-segment display compared to a dot matrix display. Candidates were asked to refer to the specific application of the car park display.

**(ii)** A good number of candidates correctly explained the term common cathode however a significant number of responses had correct annotation but incorrect circuit diagrams or correct circuit diagrams and incorrect annotation.

**(iii)** The calculation of the resistor value was correctly answered by many candidates.

**(e)** For this question candidates were asked to produce and annotate a circuit to fulfil the requirements listed in the bullet points. There was a wide range of responses to this question with most candidates scoring between three and eight marks. For full marks candidates were expected to include detailed circuits that showed knowledge and understanding of how the tens and units of a counter could be controlled to count up and down. Most candidates opted for a PIC based solution, but in many cases, the associated flowchart did not fully meet the requirements of the bullet points.

## Option B Mechanical and Pneumatic Control Systems

**Q3 (a) (i)** This introductory question required candidates to briefly explain the meaning of the term metric module. There was a good number of correct responses to this question.

**(ii)** A four-block pulley system was the focus of this question. Candidates who used an annotated sketch to outline and briefly explain how mechanical advantage is achieved were awarded up to five marks. There were a wide range of acceptable sketches however where the explanations were superficial only partial marks could be awarded.

**(b) (i)** There was a significant number of correct responses to this question which required an annotated sketch of a flexible coupling. Most candidates were also able to outline one key advantage.

**(ii)** The quality of written communication (QWC) was assessed in this question which required a discussion of the four main characteristics of O rings and gaskets. The responses in general were good however some candidates did not write sufficient text in order to access the full range of marks.

**(c) (i)** This calculation question based on an indoor crane was generally well answered with most candidates showing their method.

**(ii)** The responses to this question which was based on forces in a cylinder were generally inaccurate. Several methods used incorrect formula and a significant number presented numerical errors. It is important that candidates clearly show their working out as marks can be awarded for partially correct calculations.

**(iii)** This was another calculation question where candidates were required to use the appropriate formula and use the information given in order to determine the output power of a transmission shaft. A significant number of responses used an incorrect formula.

**(iv)** Vacuum cup features were the focus of this question where candidates were asked to outline how these features would allow the lifting of stone slabs. Many candidates referred to generic features of vacuum cups rather than focusing on the application.

**(d)** An appropriate design for a locking mechanism was required for this 10-mark question. This question presented a challenging design context and candidates who produced practical and clearly annotated solutions achieved the highest marks. There were many poorly annotated responses for designs that had no discernible means of moving a stone slab from location A to location B.

**Q4 (a) (i)** For this general safety question most candidates correctly outlined two main procedures used to minimise the risk associated with mechanical systems.

**(ii)** A pleasing number of candidates provided excellent explanations of the meaning of viscosity in relation to engine oil lubrication. Candidates were not required to refer specifically to SAE classification and one mark was awarded for a partial explanation.

**(b) (i)** A good number of candidates produced clearly annotated sketches of the main features of a single plate clutch however a significant number of sketches were either so small or so unclear that it was difficult to determine the accuracy of the response. With respect to the application a surprising number of responses incorrectly stated small garden tools such as strimmers. These types of applications commonly use centrifugal type clutches.

**(ii)** Air consumption questions have been answered well in past series and this year was no exception with a significant number of candidates obtaining full marks. Where candidates had shown a correct method, some marks could be awarded for partially correct answers.

**(c)** An offset cam profile was required for this question. As in previous questions of this type, accuracy in the construction of the drawing is important. The most common errors were in relation to the distance from the minimum diameter to the profile edge. A significant number of responses did not show the correct direction of rotation.

**(d)** This question required candidates to complete a group changeover pneumatic circuit to satisfy a given specification. As in previous series this question was well answered by many candidates. Clear labelling of group changeover signals and accurate piping lines helped to confirm the candidates' circuit design in most cases and a significant number of candidates were awarded full marks.

**(e)** **(i)** Candidates were required to complete an automatic box crusher circuit. Many responses successfully included a means of counter activation using the one-way trip valve however there were only a small number of fully completed circuits that would operate automatically.

**(ii)** Candidates were required to design a suitable mechanism to enable a double acting cylinder to rotate a turntable by 360 degrees. Many candidates presented solutions based on a treadle linkage. Since the solution to this question required candidates to annotate any fixed or moving pivots full marks for this question could only be awarded where this was the case. As always candidates should be encouraged to fully annotate their drawings/sketches to explain to examiners the operation of their solution.

## Option C Product Design

**Q5** **(a)** This part of the question was well answered with most candidates able to provide two reasons why products are redesigned.

**(b)** Most candidates were able to explain what is meant by a product life-cycle assessment. Some candidates' answers fell short of obtaining two marks due to limited responses and some candidates confused the life cycle assessment with the product life cycle.

**(c)** Many of the candidates did not provide two different factors associated with market pull and, in some cases, gave duplicate or very similar answers.

**(d)** **(i)** Many of the candidates were unable to provide two different factors associated with market development and gave duplicate or similar answers. Most candidates were able to come up with one correct response to this question mainly related to changes in consumer demands.

**(ii)** Candidate responses highlighted that many did not understand what is meant by the term diversification. Some candidates did not respond to this question.

**(e)** There were a broad range of responses made by candidates. Some of the candidates confused rethink and reuse, giving answers that focussed on recycling. Many candidates gave answers containing general information rather than using practical or appropriate examples. There were some excellent responses where candidates explained about rethinking manufacturing techniques for a higher level of sustainability, designing for recyclability and using common parts and components available at low cost to make repair a viable option.

**(f)** Candidates were asked to explain two ways ICT is used in design and manufacture other than CAD and CAM. An alarmingly high number of candidates made detailed responses to this question but focussed on CAD and CAM systems in their answers. No reference to these two terms were given credit.

**(g)** Candidates were asked to explain one issue related to sustainability in the disposal of plastics. Many candidates mentioned about the manufacturing processes and extraction of the raw material, and the sustainability associated with this did not address the question regarding the of disposal of plastics.

**(h)** **(i)** Candidates were asked to outline two benefits that would persuade a company to adopt quick change injection moulding techniques. Many responses in this question focused reductions in downtime and labour costs, but some candidates gave general answers which showed a lack of understanding of the quick-change injection moulding process.

**(ii)** Many candidates seem to focus in on three facts about Dyson in general, discussing general facts about Dyson products and omitting information about the influence of the work of Dyson.

**(j)** Candidates were asked to design a compactor to be used to create additional space by pushing the household waste down into the bin and be attached/stored in the lid of the wheelie bin. Many candidates seemed to overthink this question and as a result the solutions were over complicated. Many candidates gave no clarification as to how some parts fitted together. Most candidates failed to explain how the design minimised the use of materials. The quality of sketches in a large proportion of the responses were limited.

**Q6** **(a)** This question was well answered with most candidates able to outline two main reasons why new products arise.

**(b)** Many candidates failed to obtain four marks. Many of the responses were quite limited and did not display enough subject knowledge about the 3-D scanning process and its benefits in design and manufacturing.

**(c)** **(i)** Many candidates provided excellent explanations of the difference between the inception and introduction stages of the product life cycle. In a few cases some candidates only stated an explanation for the introduction stage and failed to answer the part of the question regarding differences between inception and introduction.

**(ii)** A high percentage of candidates were able to suggest an appropriate strategy to prolong the decline stage of the product life cycle. Some candidates gave limited answers which focussed on advertising and promotion of the product.

**(d)** **(i)(ii)** Most candidates had a good sound understanding of what is meant by the term cost plus pricing however some candidates were unable to provide a suitable disadvantage associated with this pricing strategy.

**(iii)** A sizable percentage of candidates displayed a vague understanding of the term perceived value pricing. Terms like “set prices similar to competitors” were commonplace with no reference the key features of perceived value pricing.

**(e)** This was addressed in a limited way in terms of responses from candidates. Several candidates failed to produce a meaningful response or in some cases gave two very similar advantages. Most candidates did identify that Trade fairs are time consuming and costly as a means of promotion.

**(f)** **(i)** In this question candidates tended to state an appropriate national government incentive but made limited reference to how this incentive influenced the design of products.

**(ii)** Candidates seemed to lack understanding of how difficulties and barriers to trade impact sales of products. Many candidates focussed on consumer preferences in different markets and gave examples which did not address the question.

**(g)** **(i)(ii)** This was very well answered by the vast majority candidates. Candidates mainly identified that consumer pressure and consumer opinions were a concern for companies in relation to their greenhouse gas emissions and that these emissions cause global warming which drives climate change.

**(iii)** This question generated a disappointing response. A lot of responses focused in on the disposal of plastics, biodegradable plastics, and the extraction of raw materials, but did not address the issues associated with the use of recycling plastic content.

**(h)** **(i)** Many candidates seemed to overthink this problem and as a result produced complex solutions which did not fully reflect the intended function of the toe line. Many candidates made limited reference in their answers to how it was to be firmly positioned on the lawn. Many of the design solutions had elaborate means to allow it to be flat packed and in many cases the solution had lots of parts and complex components.

**(ii)** Many candidates were able to present a packaging solution that was appropriately dimensioned with good annotation but much of the sketching was limited and lacking detail. Many of the candidates opted for heavy wooden boxes made from hardwoods with only a few choosing more conventional packaging materials such as cardboard. Candidates generally identified a material, but did not discuss how they had attempted to minimise the materials used in their packaging solution.

# Principal Moderator's Report

## Assessment Unit A2 2 Coursework: Product, System Design and Manufacture

### Overview

This academic year (2021-22) candidates were working to a revised specification (see addendum in link below) in which coursework had two sections removed – Manufacture and Testing and Evaluation, with an additional 10 marks being awarded in Section 3 - Development. Overall weighting of this unit remained unchanged.

Many centres continue to navigate the eCRS system with ease, presenting administration materials to a high standard that enabled the moderation process to be conducted. In some centres eCRS documentation simply contained the mark awarded for each section or simply quoted the marking criteria. In examples where eCRS documentation contained little or no explanation for the marks awarded it was difficult for the moderator at times, to justify the mark awarded. Centres are reminded that the purpose of the moderation process is to ensure that the specification standards are carried across all centres consistently and is not for the moderator to re-mark the work of each candidate.

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Agreement trial material continues to provide invaluable CPD opportunities, assisting teachers in becoming familiar with appropriate product selection and standards within this specification.

Review of agreement trial material annually is of paramount importance and presents teachers with the valuable opportunity to review the work of candidates first hand, to support continued communication of standards and approaches to the delivery of this unit.

## Identifying a Problem, Client or User Needs and Design Specification

In general, this section appears to be well embedded with a significant number of candidates achieving top mark band for their work. The importance of selecting an appropriate problem with sufficient scope for development and providing extensive opportunities for innovation must not be undervalued at this stage of the project work. It is important that candidates recognise the difference between AS and A2 coursework in this context – at A2 level they should be exploring a problem and arriving at a final solution, as opposed to AS where they should be redesigning an existing problem.

Analysis of existing products continues to be structured and conducted appropriately by many candidates. Centres are reminded that at A2 a broad range of existing similar products for analysis is considered to be three. This will allow for a thorough and critical analysis in which candidates can demonstrate their subject knowledge using a rich array of technical vocabulary.

Design specifications continue to be an area that requires improvement. Measurable, quantifiable and relevant points that draw upon the analysis conducted will enable candidates to explore a range of innovative design solutions going forward. Detailed specification points will also inform the design and development process and allow for thorough testing of a completed product.

## Initial Ideas, Selection of Ideas for Development

Quality design thinking, and innovation must be evident throughout this section of work. Unfortunately, in some cases moderators reported work that had received a mark in this band yet did not illustrate innovative design and/or high-level system or sub-systems. Some portfolios still carry a heavy weighting of annotation which should be discouraged.

In many system-based portfolios, candidates produced a sufficient range of system/sub-system designs that were in keeping with A2 level. In some cases, candidates still describe the function of a component rather than a detailed analysis of how this component could potentially be used to solve the client problem. Most candidates provided a range of suitable casing designs displaying some excellent CAD skills and some consideration for component placement. Candidates should be discouraged from excessive annotation and reminded that in this section they should be demonstrating innovation through their casing design. In the best examples, candidates utilised a wide range of graphic communication skills, blending hand graphics and CAD renderings to create innovative designs that were clearly guided by their client needs. An infusion of hand graphics, CAD renderings and system/sub-system design that is non-linear should be encouraged at this stage of the design process.

Product design portfolios are still of concern. Often moderators reported a lack of innovation as a result of a limited design opportunity. Centres are reminded that class teacher(s) should give guidance in the planning and realisation of each internal assessment task (Section 7.2 "Setting the Tasks"). In some portfolios it was clear that the candidate had a set design in mind which greatly limited the innovative nature of this section. Candidates should be strongly discouraged from including images of industrial processes and/or large drawings of generic fixings (such as butt hinges). In the best examples, candidates explored a wide range of ideas before selecting an appropriate idea for development. Justification for this selection was often included in the candidates' work, but could be explored in more detail by clearly linking back to the client needs. A blend of hand sketches and CAD renderings should be encouraged throughout this section, but often there was an overreliance on annotation which took away from the design process. Top candidates used annotation appropriately to support high quality graphics and communicate potential solutions to the problem.

Candidates should be encouraged to evaluate their proposals as they progress through this section of work, before coming to conclusions and deciding upon ideas that will be suitable for development. The selection of a proposed solution for development should be explicit.

## Development

Unfortunately, moderators in several cases are still finding it difficult to agree with centre marks that have been awarded in this section. The design pathway can often be abandoned at this stage due to preconceived ideas and/or the over development of initial ideas. Often the final design, housing design and/or system demonstrate a lack of development with the final solution appearing early in this section. A premediated design proposal or outcome will inevitably limit innovation and ultimately limit the marks that can be awarded.

The specification addendum for 2021/22 awarded ten additional marks for this section to allow for evaluation of outcomes of modelling to take place. Candidates achieving top marks in this section infused modelling throughout this section of work. A range of CAD and physical modelling was evident throughout most work, but some candidates were being awarded top marks for simply producing lots of models without in-depth analysis. This is where moderators found greatest disagreement with centre marking. Models should be used to inform the design process so candidates must demonstrate what they have learned as a result of modelling, and how this in turn, influenced the design decisions.

In some centres candidates produced similar circuit designs limiting the possibility of creativity. Often system casings appeared quite generic and boxy with some evidence of component placement considered. Ergonomic and anthropometric considerations were given cursory glances with little evidence of evaluative commentary to enhance the selected solution. Innovation was often neglected at this stage in favour of designs that would be easily manufactured.

Product design portfolios often lacked the innovative nature of this specialism at this stage, resulting in candidates' work lacking thorough analysis of modelling with fully defined solutions arriving quickly in this process. In examples where candidates achieved top marks it was clear that the final solution was driven by purposeful modelling with detailed evaluative comments throughout. This led to an innovative design solution in which the candidate displayed high order thinking skills.

Numerical analysis should be infused throughout this section. Some candidates choose to conduct this when the final proposal has been reached, but to access the top mark band candidates must be encouraged to produced numeric analysis as part of the development pathway, formulating conclusions and making decisions based upon the evidence provided.

Planning for manufacture and working drawings continue to improve. The best examples show clear consideration for each component part. Plans should be written in future tense. Centres are reminded that working drawings should contain realistic measurement data and contain sufficient information for third party manufacture. Often moderators reported that candidates' engineering drawings and production planning lacked sufficient detail for third party manufacture.

## Specification Addendum

https://ccea.org.uk/downloads/docs/Specifications/GCE/GCE%20Technology%20and%20Design%20%282016%29/GCE%20Technology%20and%20Design%20%282016%29-spec-addendum-2022-Standard.pdf

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