GCSE

Rewarding Learning

Chief Examiner'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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GCSE Technology & Design

Chief Examiner's Report

Subject Overview

This examination consisted of four papers GTY11, GTY21, GTY22 and GTY23. In normal circumstances candidates are required to complete the core paper (GTY11) and one of the option papers, option A (GTY21), option B (GTY22) or option C (GTY23). Special circumstances were put in place this year which allowed candidates cashing in for summer 2022 the opportunity to omit the core paper (GTY11) if they so wished and the vast majority of candidates who were cashing in did not enter for this paper. Only a very small number of year twelve candidates (13) entered for the core paper. There was however a large number of year eleven candidates (2757) who sat the core paper. The numbers of candidates entering for the options papers has increased by almost 300 since 2019. Option C was by far the most popular entry (1625) followed by option A (816) and option B (703)

Assessment Unit 1 Technology & Design Core Content

Unit Overview

The paper was well answered by most candidates who were able to attempt all questions. Only a very small minority of candidates did not attempt all questions. The paper catered for the whole range of abilities and allowed for differentiation, and this was reflected in the range of responses and marks awarded. The structure of the paper offered all candidates the opportunity to demonstrate knowledge and understanding of the core content of this specification. In general candidates were able to respond to most questions which had a good mix of low, middle and higher order questions that enabled all candidates the opportunity to obtain marks.

There was no evidence to suggest that candidates had insufficient time to complete the paper. Candidates should be encouraged to produce neat legible handwriting as in several cases markers sometimes struggled to read answers.

Q1 Part (a) was well answered with very many candidates achieving full or almost full marks. Candidates should be reminded that they need to use the correct names as given in appendix 3 of the specification.

Most candidates made a good attempt in Part (b) although some candidates failed to recognise the insulating property of the plastic board.

Q2 Part 2(a)(i) was well answered. Most candidates were able to pick up at least one mark in Part 2(a)(ii) and the more able candidates were able to identify the importance of glue and grain direction.

The focus of Part (b) was on stages of cutting out, but several candidates began by describing marking out as the first stage or sanding as a final stage. A small minority of candidates listed three ways rather than three stages. Part (c) was generally well answered but some candidates mixed up CAD and CAM or provided vague responses.

Q3 This question was generally well answered by most candidates and all candidates were able to achieve some marks. A sizeable number of candidates were unable to correctly name one or both the mechanical symbols (a) as per appendix 3 of the specification. Some candidates did not mark on Fig 3 the direction of rotation and a small number of candidates were unable to correctly name the middle gear.

Q4 Most candidates were able to name the shuttle valve correctly. In Parts (a)(i) and (ii) the more able candidates were able to provide full answers, but several other candidates only explained one part of the action which did not provide enough detail for both marks.

Part (b)(i) was well answered. Some candidates only identified the actuators rather than the control in response to Part (b)(ii) or provided vague or brief responses. Only the more able candidates were able to provide full answers.

Q5 Most candidates answered Part (a)(i) well, but it was surprising to see the number of candidates who were unable identify the try square or explain its use. Many candidates struggled to provide an acceptable answer for (a)(ii).

Part(b)(i) was correctly answered by many candidates who identified the importance of marking both ends but several other candidates were unable to obtain both marks. Some candidates used metal working tools in their response. Part (b)(ii) was generally well answered but a surprising number of candidates were unable to name the wood screw. Most candidates gained some marks in response to Part (b)(iii) but only the more able candidates could provide the level of detail required.

Q6 In general candidates scored full mark or zero or maybe one mark for naming the transistor in response to Part (a). Very many candidates could not name the collector, base or emitter.

Part (b) proved to be a good discriminator, with explanations ranging from excellent to very poor. The more able candidates responded with good answers explaining the operation of the circuit, but most candidates were able to achieve some marks.

Q7 This flowchart question was very well answered by most candidates many of whom scored full marks or almost full marks. The most common errors were incorrect or poorly drawn flowchart symbols and an incorrect wait time in the final wait symbol. Candidates should be aware that only generic flowcharts should be produced and that only the flowchart symbols that appear in appendix 3 of the specification should be used.

Q8 Parts (a)(i) and (iii) were generally well answered and although (a)(ii) was answered correctly by many it was surprising to see how many candidates were unable to correctly match the list of three uses to the three types of steel shown with many candidates confusing the application of mild steel and high carbon steel. Part (iv) proved difficult for many who often gave vague answers. Although many candidates understood that hardening and tempering required heat, they were unable to clearly explain the difference between the two processes for full marks. Only a minority of candidates achieved full marks.

Q9 In Part (a) a sizeable number of candidates were unable to correctly name one or both of the pneumatic symbols (a) as per appendix 3 of the specification. Candidates should be reminded that they need to use the correct names as given in appendix 3 of the specification.

Parts (b)(i) (ii) and (iv) were generally well answered but in Part (b)(iii) several candidates only provided a limited response by explaining how component C controlled the operation when closing the door.

In Part (c) only the more able pupils recognized the need for a second unidirectional flow restrictor and were able to add this correctly in Fig 13. Many other candidates either did not attempt this question or provided incorrect solutions.

Q10 Almost all candidates attempted this question and were able to achieve some marks. The question gave candidates the opportunity to describe their understanding of practical skills and practice. The responses ranged from excellent to poor. Candidate should be reminded that this is a QWC question, and it is therefore important to structure their response accordingly. Appropriate safety precautions need to be embedded in the description, simply presenting lists of safety precautions will yield little marks.

Careful reading of the question is essential. A lot of candidates wrote about the wrong tools, and many referred to tools used for metals. Points were often poorly explained. Several candidates did not seem to realise that that the square piece of oak was the starting point, they described how to cut this out from a much bigger piece. A few other candidates simply copied elements of the question into their response. The more able pupils were able to describe the processes clearly and in a logical manner.

Poor handwriting, spelling and the lack of technical vocabulary was noticeable in many of the responses.

Assessment Unit 2 Option A Electronic and Microelectronic Control Systems

Unit Overview

The general standard of response to the examination paper was good with a significant number of candidates attaining close to full marks. While a small number of candidates did not attempt several questions nevertheless there was a very good engagement with the questions. The type of responses required ranged from graphical and calculation through to written text with most candidates providing easy to interpret responses.

The level of language used throughout the examination papers was appropriate for the candidates sitting the examination.

There was no evidence that candidates in general had insufficient time to complete the examination paper.

Q1 **(a)** A full range of responses from full marks to no marks were received. Generally, candidates who produced an accurate sketch showing pin 1 on a DIL were able to articulate how to identify it.

(b) **(i)** Most candidates achieved full marks with correct circuits for a series arrangement of three resistors clearly shown.

(ii) Most candidates achieved full marks by drawing a correct circuit for a parallel arrangement for two resistors shown.

(iii) Generally, well answered with most candidates showing accurate working out. In the main only 2 methods for calculating the single equivalent resistor value were used. Several responses stated an incorrect unit or had no unit.

(iv) Most candidates provided a reference to tolerance when explaining the necessity for a fourth colour band on a resistor. However, many responses were not awarded 2 marks as they gave a limited explanation.

(v) This question required candidates to calculate the current in a given circuit by manipulating Ohm's law. Many responses were correct with the most common errors involving incorrect placing of the decimal point or omission of the unit.

(vi) Most candidates correctly named an ammeter as the instrument used to measure current.

(vii) For this question candidates were asked to name the type of circuit shown. Most candidates correctly named it as a potential divider or voltage divider circuit. Several candidates who identified it as a series circuit were not given credit.

(viii) The calculation of the output voltage of a potential divider circuit was generally well done by candidates. Candidates who show their working out can be awarded marks for a partially completed calculation.

(c) (i) A 555 monostable circuit was the focus of this question. For Part (i) up to 6 marks were awarded for showing all the required connections to enable the monostable timing circuit to operate. There were a significant number of correct and partially correct responses.

(ii) For Part (ii) candidates were asked to state the purpose of pin 3 and most produced correct responses.

(iii) For this part of the question candidates were asked to sketch the expected output of the monostable timing circuit on given axes. A mark was awarded for any sketch that indicated a low to high (and back to low) square wave signal most candidates produced correct responses.

(iv) Many candidates did not correctly name the two components used in the circuit to provide the time constant. Simply stating 'resistor' and 'capacitor' was considered insufficient for full marks.

(v) This question was answered well with most candidates correctly identify two ways of changing the time constant.

(vi) Candidates who completed the circuit to enable the buzzer to be driven by means of a transistor were awarded full marks. A protective diode was not required but candidates who included it did not lose marks. Similarly, candidates who used a relay and transistor to operate the buzzer were given full credit. The most common errors were associated with incorrect symbols for the transistor or buzzer and omission of a protective resistor.

(d) In this quality of written communication question candidates were asked to discuss any three input components and any two output components that may be used in specific circuits. In general candidates provided well-structured and detailed responses. Several candidates did not write sufficient text to warrant access to higher marks and some candidates did not focus on why and how the chosen components would be used in specific circuits.

Q2 (a) (i) The majority of candidates correctly suggested two benefits of modelling electronic circuits, however, a significant number of responses were not sufficiently qualified to be awarded the marks.

(ii) Most candidates were able to name one method that could be used to model electronic circuits and opted for computer-based modeling, however, very few correctly named a second method such as breadboarding or using modular kits.

(b) **(i) & (ii)** This question was generally well answered with most candidates correctly stating the two binary numbers used in programming and which of these numbers represent high and low.

(iii) The responses to this question were wide and varied with most answers being accepted provided they were related to motor vehicles.

(iv) Most candidates achieved full marks for correctly completing the bit patterns in the table. Some candidates used ticks instead of '1' or 'x' instead of '0' and could not be awarded full marks. Candidates should be reminded that tick is not acceptable as a bit indicator and an x in examination question represents an unused bit.

(c) **(i) – (iii)** The flowcharts in general were answered well with many of the candidates using the correct command shapes for the various functions. The bit patterns for Part (i) were not always correct with unsuitable use of ' x ' where '1' or '0'. Candidates should be encouraged to make the flowchart commands as neat as possible and write the contents legibly.

Assessment Unit 2 Option B Mechanical and Preneumatic Control Systems

Unit Overview

On average candidates performed reasonably within the whole paper with a full range of marks gained. The paper catered for a range of abilities and allowed for progression and differentiation. Majority of candidates attempted to complete and answer all questions accessing the full range of available marks. Candidates answered lower ordering thinking/ recall questions well and it was pleasing that both the mechanisms and pneumatics sections were attempted equally.

Challenging elements of the paper were, as in previous years, the calculation questions. Most candidates gave some response, but candidates should be reminded that working out is important should the candidate not get the correct answer, marks can and will be awarded for correct attempts at solving the calculation, candidates who leave blank spaces are disadvantaging themselves and should show some attempt at all questions.

Handwriting was in the most case legible with varied level of responses to the last long QWC question. While good attempts were made some candidates could be encouraged to produce more in depth and analytical responses to questions requiring a discuss element to the response, especially the QWC question.

Q1 **(a)** Well answered by most candidates, however, some did not identify the jockey pulley, compound gear or meshed bevel gears. Candidates should be reminded to use the names given in the specification appendix and where functions are given, follow the question instructions and record the appropriate letter in the box given instead of making up their own function definition, which occurred quite a few times.

(b) **(i)** Majority of candidates could identify the pear and snail cam the eccentric had a variety of names given that were incorrect. Again, see specification appendix for all correct technical vocabulary.

(ii) Well answered.

(iii) Well answered.

(iv) This question challenged students. Only a few candidates achieved full marks, and some could only identify one correct answer. A high proportion found this challenging as students mostly got this incorrect, did not provide enough detail to their answer or left blank. One word answers, lacking clarity, cannot be rewarded.

(c) **(i)** Mostly answered well, some confusion by a minority identifying this as a simple gear train.

(ii) Many answered this well, however, some candidates gave general advantages of gear systems and did not relate their answer to the specific gear train asked about.

(iii) This was a challenging question with many candidates inverting the formulae.

(iv) If candidates had given an incorrect answer to (c)(iii) Error Carried Forward (ECF) was applied. Some candidates failed to realise the need to use their answer to (c)(iii) and this was left blank.

(v) This question differentiated candidates of various mathematical abilities. Those who were able to identify the correct gears usually went on to show their formula in action to achieve the desired output speed and thus gained full marks. Where candidates stated the 2 gear sizes and did not move on to show their working out, only half of the allocated marks can be rewarded. Candidates are encouraged to read the question and follow the instructions clearly given.

(d) **(i)** Mostly answered well, some identifying the worm wheel as just wheel which is not a sufficient response to gain marks.

(ii) This was a challenging question with many candidates inverting the formulae. When the formula was correct if should be noted that the correct units are required to gain full marks.

(iii) This question differentiated candidates of various mathematical abilities and when answered well full marks were awarded. It was mostly found that candidates could access half of the allocated marks as they identified the diameter of the winch shaft, but went on to work out the rotation for one turn of the worm wheel and not the crank handle as asked.

(iv) This question was commonly left blank and only the most able candidates displayed mathematical ability in calculating the velocity ratio correctly. Many failed to attempt this meaning they lost the possibility of gaining an Error Carried Forward (ECF) mark, all questions should be attempted in some way.

(v) Most candidates were able to identify increasing the handle length to gain velocity ratio. A common mistake was to refer to increasing the size of the winch; the winch is the full system and so candidates need to show understanding of the system operation/parts to gain full marks.

Q2 **(a)** This question was answered surprisingly poorly with candidates not making use of table 3 to answer and simply making up names of symbols not from the list provided. This will not gain marks. Common errors were naming pilot pressure as simply pilot and mixing up pilot/signal and pilot pressure.

(b) **(i)** Well answered.

(ii) Well answered.

(iii) Well answered by the majority with some inverting the formula incorrectly using Pressure/force and some not putting in mm2 units instead using mm3. Correct units are required for full marks.

(iv) This question differentiated candidates of various mathematical abilities and when answered well full marks were awarded. It was mostly found that candidates could access one mark as they identified the need to divide 113/ π, but they did not move on the find the square root. When the radius measurement of 6mm was found many failed to multiply by 2 to get a diameter measurement.

(c) **(i)** Component B successfully identified by the majority, component C still being referred to regularly as a flow resistor or simply a flow control valve. Candidates are reminded to refer to the specification appendix symbols and use the terms given. Component C should be referred to as a Unidirectional flow restrictor.

(ii) This question was answered well by the cohort with many candidates gaining full marks. Majority of candidates could explain the sequence well and use the appropriate technical terminology and component names. Some candidates explained the DAC instroke, but did not specifically discuss that it was slowed, instead saying it was controlled/monitored. Reference to cylinder speed should be in terms of fast/slow etc.

(iii) This question was reasonably answered by students with most candidates gaining 2 marks. Most did not include plunger, but identified lever or push button 3/2 valve instead. AND logic was the most common response, but this was not qualified with an explanation of how this logic may function in this situation.

(d) **(i)** Poorly answered. Common mistake was not to record the answer in a sequence format and often commas to separate the logic sequence were missing leading to no marks being awarded. Some had recorded OR or AND as a response clearly not understanding the term logic sequence.

(ii) This question differentiated candidates of different abilities. Many found this challenging with some leaving this question completely blank. Common mistakes were solid lines used for pilot lines and starting points from the 3/2 valves were not in the correct position. The majority drew neat diagrams using a ruler, however, on occasion this was not the case and made the following of lines difficult for the examiner. A small number of responses were illegible and did not warrant any possible marks.

(e) This question differentiated candidates of different abilities. Most or nearly all the candidates attempted it with varying degrees of success. Rarely was this left unanswered.

Some candidates achieved in the top band mark. Answers were succinct, clear and coherent, making use of the space provided.

Most achieved in the satisfactory mark band giving some reasonable answers with reference to applications and how we use them in society.

Some candidates missed out on marks here as they did not link the answer specifically to the societal impact which resulted in their answer being placed in a lower band.

To be placed in the top band answers should be in depth, analytical responses that show an application of knowledge and an understanding of impact that pneumatic and mechanical systems have had on the use of robotics in society. Candidates should note that spelling, punctuation and grammar are assessed in this question.

Assessment Unit 2 Option C Product Design

Unit Overview

Candidates achieved marks which ranged from very low to mid high. The more able candidates accessed top mark bands in individual questions. Weaker candidates were able to access some of the marks across the paper. Generally, the average score of this paper was low. The language used in the paper was clear and appropriate. There was no evidence that candidates had insufficient time to complete the paper. Many candidates left responses to different questions blank. Teachers are reminded that candidates handwriting must be clear and legible.

Q1 **(a)** Generally, well answered.

(b) Generally, well answered.

(c) Most candidates correctly gave 3 distinct reasons.

(d) Most candidates correctly gave at least 2 reasons.

Q2 **(i)** Generally, well answered although some candidates misinterpreted the question and answered primary and secondary.

(ii) This question successfully differentiated candidates with different abilities. A small number mixed up the 2 definitions.

(iii) Most candidates accessed at least one of the marks suggesting a suitable product.

(iv) Most candidates accessed at least one of the marks suggesting a suitable product. A number gave a repeat definition for technology push rather than the specific feature for their product.

Q3 **(a)** Most candidates accessed some of the marks. Some gave 4 features and no description.

(b) The majority of candidates accessed maximum 2 of the marks for this question. Very few gave an appropriate description of user trips.

(c) Most candidates accessed 4 marks in this question giving a clear description and 2 valid features.

Q4 **(a)** Several candidates gave valid features seen in the image.

(b) **(i)** This question differentiated candidates of different abilities.

(ii) This question differentiated candidates of different abilities. Some gave facts about the designer not appropriate to collaboration or partnerships.

(iii) Generally well answered.

Q5 **(a)** **(i)** Well answered, however, some candidates misinterpreted the question and answered mass production.

(ii) Well answered.

(iii) This question differentiated candidates of different abilities. Many erroneously commented on water flow inside the radiator.

(iv) This question differentiated candidates of different abilities.

(v) Generally well answered.

(b) Poorly answered by most candidates. Top ability candidates accessed the full 4 marks.

(c) Well attempted by most candidates. Candidates achieved across the full range of marks.

Q6 **(a)** Generally, well answered although this question successfully differentiated candidates of different abilities.

(b) Generally, well answered. Candidates should be reminded to show their working out to allow marks to be awarded in the cases of an error.

(c) Generally, well answered. Candidates should be reminded to show their working out to allow marks to be awarded in the cases of an error.

Q7 **(a)** Most candidates accessed full marks outlining specific features from the image.

(b) This question successfully differentiated candidates of different abilities. Many achieved at least half of the available marks.

(c) Generally, well answered.

Q8 This question successfully differentiated candidates of different abilities. Candidates achieved the full range of marks in this question.

Candidates should be reminded not to use colour in this question. They should also be reminded to aim to include annotation addressing all features of the design question.

Assessment Unit 3 Design and Manufacturing Project

Unit Overview

Candidates were working to an adapted Specification this year (2021-2022): Candidates complete the design folder as far as the Development of Proposed Concepts: Modelling and Testing section. 10 marks have been added to both the Concept Analysis and Development of Proposed Concepts: Modelling and Testing sections to allow for evaluation of outcomes of modelling to take place. The Development of Proposed Concepts: Manufacture and Evaluation sections have been removed. The overall weighting for this unit remained unchanged.

Centres produced the required documentation for the 2022 moderation series and the eCRS system was used effectively to submit marks and teacher comments. Many centres provided detailed and pupil-specific feedback to support their marking which was very beneficial. However, some centres did not provide any teacher annotation on the eCRS, and this can hinder the moderation process.

It is important moving forward that candidates sign the Portfolio Cover sample sheet so that quality work can continue to be used for Agreement trials.

The themes for this controlled assessment task issued in the academic year 2019–20 were carried across to 2021–22. Both themes were equally popular with candidates, and it is pleasing that most centres continue to embrace the ethos of the specification with candidates trying to be more analytical within the design process. A small number of centres continue to produce sections of work that are legacy portfolio format, and this is to be discouraged as candidates will not be awarded marks for unnecessary sections of work e.g., Generic electronic component information, Gantt charts and Plans of Manufacture. It is important that all centres ensure that they are fully familiar with the Assessment Criteria for this unit and that they communicate this to their candidates.

Several centres exceeded the page limit for this specification, and it is important that candidates are reminded of page limits, font size as well as the necessity of labelling each page with titles, page numbers, centre number and candidate number. These factors should be checked as part of the internal standardisation process of the centre and amended as necessary before final marks are submitted. Font size was appropriate in many centres although very large WordArt type titles are being used by many candidates.

The Agreement Trial this year was pre-recorded and access links for the recording and support materials were provided to centres. Review of annual Agreement Trial support materials is extremely important to ensure that all teachers have access to guidance provided by the senior moderating team, and to gain further clarification of the mark descriptors for this controlled assessment task.

Design Thinking, Analysis and Specification

Most candidates were able to explore possibilities within an appropriate theme. The candidates who scored highest marks within this section engaged fully with their theme and provided evidence such as spider diagrams, client interviews and background research to show fully the possibilities within the theme and used these to produce excellent design briefs, that were succinct and fully demonstrated their design intent.

It is important that themes chosen by candidates are appropriate for the current cohort of candidates, and that teachers review the new themes when they are released in January of Year 11 to ensure their candidates are working with current themes.

Candidates from some centres are still including generic information on parts and components, materials, and manufacturing processes within this section, often with little or no reasoning on how this information about electronic components, screws, machines etc. could be used within their project work. This type of generic information was found mostly in centres taking a systems approach.

Most candidates were able to research and choose relevant products for analysis within this section, but often the analyses produced were lacking analytical thought, offered mostly descriptive commentary and at times were very repetitive across the chosen products. The best candidates were able to analyse the products using key design factors such as function (fitness for purpose), aesthetics (design features), ergonomics, safety, parts, materials etc. and make recommendations on how they could use their analysis to help them make design decisions in the next stage of the design process.

Candidates were able to produce specifications using appropriate headings, but often they lacked detail, and many candidates did not include quantifiable facts and figures. The most able candidates were able to produce high quality specifications with measurable points that could be used to lead prototype testing and evaluation later in the design portfolio.

To comply with JCQ guidelines all reference material should include sources; many candidates are still not referencing images used within this section.

Concepts and Analysis

Within this section most candidates were able to generate a range of appropriate freehand concepts demonstrating a degree of creativity. However, many candidates lacked 3D or sectional sketches and centres should be reminding candidates that to access the excellent mark band they should be making use of a range of excellent freehand graphical techniques and demonstrating excellent creative thinking within their designs and annotation. Very often annotation was descriptive and lacked any analysis or detailed knowledge or understanding of the potential solution. Candidates are to be discouraged from filling their pages with excess annotation which can detract from the concept drawings. Demonstrating understanding through additional sketching is to be instead encouraged.

It was noted by moderators that in general the candidates who took a product design approach produced concepts that were more creative whereas in many cases candidates from systems centres produced more basic concept ideas that were more focused towards component placement instead of function and aesthetics. Candidates from a small number of systems centres did not include any housing concepts in this section and focused only on the systems concepts which limited them from gaining top band marks. Candidates who are incorporating a system in their project should be including a range of black box (I/C/O) models within this section along with suggested concepts for housing the system.

The quality of sketching varied greatly across candidates and centres and in several centres limited sketching techniques were being awarded top marks in this section. Freehand sketching and the use of a range of sketching techniques are clear areas for development across many candidates. In the best work candidates were able to use 2D, exploded, sectional and zoomed views to show their understanding of the proposed concepts. Top candidates attempted to design concepts that did not already exist on the market, and often included the selection and justification of appropriate materials along with manufacturing and fabrication methods.

The use of any CAD package is in the section is not allowed. Drawings should be from first principles and the use of computer software to generate images that candidates then trace over is to be discouraged and will be addressed during the moderation process.

Development of Proposed Concepts: Modelling and Testing

The quality of design development ranged greatly across candidates and centres with top candidates demonstrated excellent creativity, high quality sketching and CAD techniques and analytical annotation across the development section. In a small number of centres candidates developed more than one concept idea in this section which was unnecessary and gave candidates less opportunity to fully explore the development of the concept they finally chose.

The modelling and development of the chosen system for candidates that were designing a system for their final solution was generally very good, and candidates were able to show their understanding of their system. Centres that had candidates using similar circuit diagrams/PCBS with minimal changes had restricted creativity in their systems design which prevented candidates from accessing top marks. In many cases candidates using a system showed little to no development of the casing at all, and the chosen concept was the housing used for the final solution. Candidates need to show development of both the system and the housing in this section and modelling of the housing should have been carried out and evaluated to help with design decisions. Flowcharts were in some cases very lengthy and repetitive and would have benefitted from the use of macros.

There was some excellent CAD displayed by candidates in this section and the high quality of CAD was commented on by many moderators this year. However, although working drawings were produced on CAD by most candidates very often, they lacked the necessary details for manufacture. Working drawings should be drawn in 3rd angle projection, to BSI standards, and include the convention, drawing scale, title block, materials list, balloon referencing and key dimensions. It is to be noted that candidates with no CAD in their portfolios, but with excellent sketching techniques and quality hand-drawn working drawings were able to still access top marks in this section.

Models were manufactured and photographic evidence included in most portfolios. Modelling techniques used were appropriate in all photographic evidence shown and ranged from paper and card mock-ups to fully manufactured resistant material prototypes. However, the use of models was an area that many candidates struggled with this year and a lot of candidates used modelling as a final outcome rather than them being used to make design decisions to help inform the final outcome. Moderators also noted that many candidates were writing production plans of how they made their model, which was not necessary, and instead candidates would have benefitted from evaluating the model and analysing how it influenced their thinking. Best work was seen when candidates made a physical model after concepts and used this to drive developmental changes. This often manifested in additional CAD models, sub-system physical models or complete physical models being redesigned, and developments made that were informative and solved issues found along the way.

It is important that teachers review Agreement Trial material as the information provided regarding modelling over the past two years has not been fed down to candidates in quite a few centres.

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