

GCSE



**Chief Examiner's and
Principal Moderator's Report
Engineering and
Manufacturing**

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 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 ENGINEERING AND MANUFACTURING

Principal Moderator's Report

Internal Assessment Overview

This year teachers and moderators faced the task of returning to full marking and moderation following a two-year absence due to the Covid-19 pandemic. During this period the senior team have worked diligently to produce resources to support the teachers in delivering this specification.

The senior team was encouraged to see that most centres submitted their sample in rank order, with the highest and lowest candidates included, and made a conscientious effort to clearly indicate where one section started and ended. Across the cohort only two centres opted to submit hand drawings in section 4 as offered in the amendments for the 2022 examination series. There were still several centres that submitted candidates who exceeded the twelve A3 pages permitted in this unit.

Assessment Unit 1 Design

Unit Overview

Analyse the Design Brief & Research:

In this section centres were generally conscientious about directly discussing the success criteria outlined in the brief. It was clear from the response that candidates are being taught how to analyse the key factors in the brief and this informed the direction of research. Research showed more diversity in approach with some candidates analysing a full range of products whilst others did a more in-depth technical analysis of two or three. Although both approaches are appropriate, the candidates who did a more technical analysis of less products tended to attract more marks due to the fact they were able to show a more technical understanding of key factors. Candidates generally produced this in a two-page format as recommended in the amplification.

Specification

There was a marked improvement in the standard of specifications across the samples submitted and more candidates were accessing the top mark bands due to producing specifications that were both measurable and technical. It was good to see that many candidates presented specifications that used an appropriate format with multiple bullet pointed statements for each criteria. There were still candidates who presented work in an appropriate format, but offered opinions, not specification statements.

Generation of Design Concepts

In this section candidates generally demonstrated a good range of ideas using appropriate graphical techniques and this allowed an increasing number of candidates to access top mark bands. Many candidates produced appropriate sketches, but did not annotate the sketches to communicate their design thinking. This often led to a lack of clarity to what they were proposing as a solution, yet with some simple annotation of the drawings this could have elevated marks significantly. Marking in this section tended to be lenient and it was difficult to agree work from some centres as a result.

Development of Chosen Solution

This section was marked too leniently. Many centres helped candidates to use appropriate mathematics in the development of the final solution this allowed an increasing number to access the top mark band. The CAD was generally excellent across centres and high-level skills are evident in many centres. There is still a small minority who produce high level CAD and support it with limited annotation. This is an area some centres need to focus on as high-level CAD and thinking often went unrewarded due to the fact it lacked any annotation to explain what was happening in each CAD image. Working drawings were generally of an excellent standard. Please be advised that the senior team have produced additional teaching resources to support teachers in the delivery of this section that will be made available on the CCEA website.

Manufacturing proposal

In the final section most candidates used similar strategies to help present the manufacturing proposal. Gantt charts, tables and exploded diagrams were commonplace and very effective mediums to explain how the proposal would be manufactured and costed. There was more evidence of realistic costings for products, and this was supported by some good calculations. It is still difficult at times to follow these calculations and a lot of candidates still do not state clearly, on completion of the costing process, what it costs to make the batch. This would be easily addressed by centres for the 2022/23 academic year. Candidates communicated with increased clarity their understanding of materials, costs and components and how they would be utilised in the manufacturing process. Please be advised that the senior team have produced additional teaching resources to support teachers in the delivery of this section that is available on the CCEA website.

Chief Examiner's Report

Assessment Unit 2 Production

Overview

Entries were reduced in this series (57 candidates) as this unit was eligible for omission.

The overall performance of candidates was encouraging, most candidates made a coherent response to the paper and submitted both parts of the task.

The candidate responses achieved marks across a wide range and demonstrated a range of levels of skill and accuracy. It was evident that candidates were prepared for the practical skills involved and in using the equipment named in the pre-release material, but that there may have been a weakness in reading the engineering drawing and in working to the +/- 0.5mm tolerance. It was evident that most candidates were competent in addressing the demands of this paper. Candidates made a more accurate response in the acrylic part of the task, the level of accuracy and finish on the acrylic parts tended to be of higher quality than the aluminium part.

The aluminium part was generally marked out with accuracy, but a sizeable proportion of the candidates produced work which was a mirror image of the drawing for all or some of the features. The cutting and finishing of the part to the dimensions presented lacked the required precision and accuracy to attain the higher mark bands in some of the work. Cutting materials and filing to a line to produce an accurate dimension would be a general area for development for students addressing this specification. Producing accurate marking out and precisely positioning center punch marks and drilling holes is also an area that would benefit from additional practice. The parts submitted were generally close to the dimensions stated and both parts were generally completed by the candidates which gave evidence that the candidates had understood the drawings and were able to follow them to produce both parts of the examination.

Having reviewed the work submitted in response to the Unit 2 examination it is recommended that teachers focus on the areas of marking out and producing work that meets the +/- 0.5mm tolerance band on given dimensions. Teachers should ensure that candidates have wide experience and capability in working with the materials and equipment listed in the specification in preparation for the examination.

Q1 (i) 7 off 4mm holes in staggered pitch.

(ii) Hole Diameters.

All candidates produced holes of the correct diameter having selected the correct diameter drill, but a small number of candidates submitted parts where these holes had been omitted. A significant proportion of the candidates failed to drill these holes in the correct location to achieve the top mark band. A greater focus on marking out and location of hole positions with a center punch is required so that candidates can access the higher mark bands in this type of question.

Q2 Position of the flat between the 45 degree faces.

A few candidates were able to achieve the top mark band for this question, but many of the pieces fell outside of the lower limit and received no marks. This indicates that candidates, in some cases, are not reviewing or self-assessing their own performance in relation to achieving key dimensions on their work and have struggled to file the material to an accurate dimension.

Q3 (i) & (ii) 45 degree angles

(i) Accuracy of the angular dimension.

(ii) Offset between 45 Degree faces (5mm).

Some candidates produced very accurate responses to this question achieving top marks, but many of the candidates' work was not accurate or complete enough to gain marks in this question. Candidates should be given the opportunity to practice cutting with a hacksaw to a line relating to a linear or angular dimension and filing and finishing to within 0.5mm.

Q4 (i) 1 off 6mm hole location.

(ii) Hole Diameters

All candidates produced holes of the correct diameter having selected the correct diameter drill, but a small number of candidates submitted parts where these holes had been omitted. A significant proportion of the candidates failed to drill these holes in the correct location to achieve the top mark band. A greater focus on marking out and location of hole positions with a center punch is required so that candidates can access the higher mark bands in this type of question.

Q5 30mm Radius

Almost all candidates produced the radii detailed in the examination paper, but much of the work presented highlighted that many students did not attain the highest mark bands due to a lack of skill in filing to a line and in draw filing a curved edge. The radii on the metal part were completed in general to a higher standard than those on the acrylic part. Given that radii are common features on planar materials I would suggest that candidates should practice marking out techniques and producing accurate and precise radii on a range of material types and thicknesses.

Q6 20mm x 20mm Chamfer

A few candidates were able to achieve the top mark band for this question, but many of the pieces fell outside of the lower limit and received no marks. Candidates should have the opportunity to practice marking and finishing chamfers to within 0.5mm.

- Q7** (i) Hole location for 10mm slot.
(ii) Hole Diameter for 10mm slot.
(iii) Width of the slot measured at the midpoint (10mm).
(iv) Position of slot at open end (35mm and 45mm dimensions).

Most candidates produced holes of the correct diameter as a basis for the slot. A significant proportion of the candidates failed to drill these holes in the correct location to achieve the top mark band. The position of the slot opening on the flange of the angle was generally well addressed by most candidates but mainly in the second mark band. Candidates should be encouraged to adopt a greater focus on marking out and locating of hole positions and saw cuts in the correct position in relation to their marking out.

- Q8** (i) 135 Degree angle.
(ii) 135 Degree angle (at 70mm dimension)

The position of the 135-degree corner on the flange of the angle was generally well addressed by most candidates, but mainly in the second mark band. Candidates should be encouraged to adopt a greater focus on marking out and locating of hole positions and saw cuts in the correct position in relation to their marking out.

- Q9** (i) Location of 10mm hole at apex of 90 degree cut out.
(ii) Hole Diameter.
(iii) 90-degree angle.

The 90-degree cutout was present in the vast majority of the candidates work, but mainly scoring in the second or third mark bands. Candidates should have the opportunity to practice cutting and finishing a range of geometric shapes from a range of materials.

- Q10** 10mm Radius.

The 10mm radius was omitted or not worthy of credit in some of the candidates work. Many candidates achieved scores in the top mark band producing very accurate work. Given that radii are common features on planar materials I would suggest that candidates should practice marking out techniques and producing accurate and precise radii on a range of material types and thicknesses.

- Q11** Quality of finish
(i) Slot edges.
(ii) 90 Degree cut out edges.
(iii) Stepped 45 degree edges.

The quality of finish on much of the work was excellent, but some candidates work was unfinished in places and not worthy of credit. Given that up to 10 marks were available for the quality of finish on these parts candidates should be made aware of the importance of draw filing cut edges on the work they produce in practice tasks.

- Q12** (i) Location of 6mm holes in base of part.

The locations of the 6mm holes in the acrylic part were accurately produced in most of the candidates work. This indicates that candidates were confident in marking and drilling acrylic. All candidates produced holes of the correct diameter having selected the correct drill, but a small number of candidates submitted parts where these holes had been omitted.

Q13 Width of the part base (80mm)

This question produced a good response with a high proportion of candidates scoring in the higher mark bands.

Q14 Angle of the bend (90 degrees).

The angle of the bends was generally very accurate with many candidates achieving the higher mark bands.

Q15 Width of the bent part at the base (40mm measured at two points).

This question produced a good response with a high proportion of candidates scoring in the higher mark bands.

Q16 Position of the 6mm hole on the bent acrylic part.

The locations of the 6mm holes in the acrylic part were accurately produced in most of the candidates work. This indicates that candidates were confident in marking and drilling acrylic. All candidates produced holes of the correct diameter having selected the correct drill, but a small number of candidates submitted parts where these holes had been omitted.

Q17 20mm Radius.

This question produced a good response with a high proportion of candidates scoring in the higher mark bands.

Q18 Quality of finish on edges of acrylic part

The quality of finish on the acrylic part tended to be superior to that of the aluminium part.

Assessment Unit 3 Materials, Processes and Systems

Overview

All questions in the examination paper proved accessible with no evidence of any questions eliciting a markedly low response rate from candidates. The vast majority of candidates attempted all questions within the paper. In general, the quality of responses varied from very detailed to limited and a review of completed scripts suggests that candidates had sufficient time to complete the paper within the allocated timeframe.

Assistant Examiners reported that, in their assessment, the layout and language of the paper was appropriate for GCSE level.

Q1 This question was, generally, very well answered by most candidates, some of the candidates, however, were unable to produce an annotated sketch of the process of press forming the castor bracket within Question 1 (c)(i). It is important that candidates consider the specific constraints associated with the product and its associated context as presented within the PRM as part of their preparations for this examination.

Q2 Most candidates were familiar with standard parts and were able to select an appropriate method to attach the castor. Similarly, many candidates were clearly able to identify an appropriate reason why welding the castor in place would not be suitable for the trolley jack. Most candidates did select an appropriate scale of production, but some failed to identify relevant features of, or justify their suggested scale of production. The vast majority of candidates identified a range of bought in components, but some identified raw materials which were not acceptable in this context.

- Q3** This mathematical, problem-based question presented significant challenge for many candidates. Question 3(b) was especially poorly answered with only a minority of candidates achieving the maximum 6 marks for this question. Candidates who made clear attempts to respond to this question were awarded some credit for their early workings-out. Candidates should be encouraged by centres to display all elements of their working-out to enable examiners to award partial credit where it is clear the candidate has shown a level of knowledge or understanding worthy of credit.
- Examiners will always work to reward learning where it has been evidenced. It was clear that it was the practical application of mathematics and associated thinking skills that presented the most significant challenge for candidates with this question. Centres should be aware that preparedness for questions of this type should form a key component of the teaching and learning of future cohorts in preparations for this examination unit.
- Q4** This question required candidates to use a number of key skills to articulate their responses through sketches and annotation and elicited a wide array of outcomes. Many candidates used their knowledge gained from research of the PRM to display their understanding of engineering and manufacturing principles through the use of 2D sketches and annotation. There were some well-prepared candidates who produced excellent responses right through to basic and often inadequately communicated responses. High quality responses required candidates to, firstly, know and functionally understand suitable attachment methods and processes for metal parts and, in turn, apply their communication skills to articulate this understanding. Marks accrued within this question were often limited as a correlating function of these interrelating skillsets.
- Q5** A wide range of responses were presented in answer to this question. Responses ranged from excellent to basic. The vast majority of candidates attempted this question and the full range of marks was used. Not all candidates were able to give relevant and detailed discussion of the key features of the trolley jack. A number of candidates focused solely on how to use the trolley jack rather than making reference to the features identified in the PRM. This question allowed for candidates to demonstrate their capabilities in the use of written form, style, spelling, punctuation, grammar and technical vocabulary. This presents a challenge for many candidates and is a core skill worthy of more precise focus with future cohorts for some centres.
- Q6** This question was generally well answered apart from Part (c)(i) and (ii) where most candidates were unable to state the correct name for the electronic symbols shown and then explain the function of a capacitor.
- Q7** Question 7 (a)(i) was well answered by most candidates, but Part (b) was less well addressed. Many candidates in Question 7 (b) discussed in detail the process of drilling a hole without showing understanding of how to produce a thread in the hole. Given that the production of internal and external threads are common features of engineered products and that screw threads have been a feature of Unit 2 Production examinations candidates should have opportunities to practice and study the production of internal and external threads.
- Q8** This question was generally well answered apart from Part (c) where some candidates were unable to state a suitable permanent joining method for the stated materials.
- Q9** The mathematical, problem-based parts of this question presented significant challenge for many candidates. Question 9(a) (iii) was especially poorly answered with only a minority of candidates achieving the maximum 3 marks for this question. Most candidates who made clear attempts to respond to this question were awarded some credit for their early workings-out. Candidates should be encouraged by

centres to display all elements of their working-out to enable examiners to award partial credit where it is clear the candidate has shown a level of knowledge or understanding worthy of credit. Examiners will always work to reward learning where it has been evidenced. It was clear that it was the practical application of mathematics and associated thinking skills that presented the most significant challenge for candidates with this question. Question 9 (b) and (c) were well addressed by most candidates.

- Q10** The mathematical, problem-based parts of this question presented significant challenge for many candidates. Most candidates who made clear attempts to respond to this question were awarded some credit for their early workings-out. Candidates should be encouraged by centres to display all elements of their working-out to enable examiners to award partial credit where it is clear the candidate has shown a level of knowledge or understanding worthy of credit.
- Q11** Candidates were generally well prepared for this type of question and were able to answer Question 11(b) and (b) comprehensively. A minority of candidates focused on the impact of changing technology on the business or company rather than the workforce and some gave very limited answers in relation to just in time production. Candidates should be aware that “faster” and “easier” type answers will generally not be enough to gain credit and be encouraged to identify characteristics and explain their understanding or demonstrate their knowledge. This presents a challenge for many candidates and is a core skill worthy of more precise focus with future cohorts for some centres.

Contact details

The following information provides contact details for key staff members:

- **Specification Support Officer: Nuala Tierney**
(telephone: (028) 9026 1200, extension: 2292, email: ntierney@ccea.org.uk)
- **Officer with Subject Responsibility: Judith Ryan**
(telephone: (028) 9026 1200, extension: 2133 , email: jryan@ccea.org.uk)



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