EXAMINERS' AND MODERATORS' REPORTS

LEVEL 1 / LEVEL 2 AWARD IN ENGINEERING (TECHNICAL AWARD)

WINTER 2024

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ENGINEERING (Technical Award)

Level 1 / Level 2 Award

Winter 2024

UNIT 1 – 9356 – MANUFACTURING ENGINEERING PRODUCTS

General Comments

This is now the second series for Unit 1 and it was good to see continual improvement from a wide range of centres. There was a wide variation in the methods chosen by candidates to present their evidence and an overall reduction in the amount of centre issued templates, this is to be encouraged as candidates must develop their own method of presenting information.

Centres should be aware that where templates are provided for all candidates, then this will limit the availability of assessment outcomes due to the candidate being led by the centre. This is outside the level of control permitted by WJEC / Eduqas.

There was a marked improvement in candidates' application of Health and Safety with far more detailed risk assessments being undertaken. Severity of risk and detailed mitigations were evident in the higher mark outcomes and there were far fewer generic responses which were more prevalent in the last series.

Overall, a large proportion of centres now clearly understand the requirements of the specification as this was evident in the quality and diversity of outcomes seen.

The details below highlight both areas of good practice seen by the moderation team and identify any areas that may benefit from detailing possible improvements.

Comments on individual questions/sections

Task 1(a) – (10 Marks) AO1 and AO3

AO1 (4 Marks)
This task is continuing to be undertaken well by candidates with clear descriptive responses and detailed commentary seen in a variety of presentation methods. By far the most common method favoured by candidates is to use the provided engineering drawings to annotate details directly onto the drawings. This allows each part to be identified and, in many submissions, additional details such as possible materials or engineering processes were also evident. Centres are reminded to be aware that Task 1(a) in both AO1 and AO3 may include a number of assessment opportunities for candidates in other tasks, common being Tasks 2(a) and 2(b).

AO3 (6 Marks)
Candidates in general performed well in this section with many interpreting both information from the data pack and their own online research for addressing specific materials. Centres should be reminded that the data pack information is not exhaustive and may be added to by centres depending on the materials and processes available to candidates. Centres must, however, include a range of data and not just the appropriate information for the task. Information for this section should also include information from the issued brief.

A high number of candidates across all mark ranges took opportunities in AO3 to discuss key areas such as tapping drill sizes, features such as chamfers, blind holes, and machine speeds. This information often appeared on the Engineering Drawings, within candidates

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own tables or linked in with production planning later in the assessment. All are valid methods of displaying the above information.

Task 1(b) - (4 Marks) AO1
The evidence from moderation showed that this task was again done well by candidates and showed a range of methods being used to display key information related to technical details of the product. It was again good to see centres encouraging candidates to develop their own methods of presenting this information. Details were provided in a variety of styles including tables, sketches of component parts, individual parts of the engineering drawings used to clarify and explain key points and information.

Many centres now implement digital portfolios of evidence, and it was clear that candidates could take advantage of working more productively using tables and scans of component drawings to assist in the presentation of information.

Task 2(a) - (10 Marks) AO2
As with the last series, this section was addressed in a number of ways by candidates and allowed access to the full range of marks for AO2 in this task. A great deal more of stock information was evident and this had been one of the key areas looked at in the last CPD events. It was encouraging to see most centres are now ensuring that candidates are familiar with stock forms and sizes and are building it into their delivery of the course.

Materials, as expected are diverse with mostly appropriate selections being made available to candidates. Centres are reminded that it is at the discretion of the candidate which materials are selected and it is expected that not all samples seen will necessarily be produced from the exact same material for each component part. The mark scheme for Task 2(a) requires a selection of materials and this is stated in each of the four-mark bands. Centres should avoid outcomes made from a single material wherever possible.

The use of cutting list, planning sheets, job sheets are all acceptable methods to address this task and again, candidates used a range of methods to present the information.

There was a good selection of tools and equipment choices made across most areas of the assessment boundaries.

Task 2(b) - (10 Marks) AO2
Candidates addressed this section in a variety of ways using multiple methods of displaying their planning information. GANTT charts were used to sequence key parts of production to good effect without being excessive in their use. Tables were also a common method used by candidates and in many instances incorporated links to health and safety and other areas of assessment such as contingencies and finishing details.

Contingency planning was clearer and more realistic in this series with candidates giving more real-world possibilities whilst offering valid alternatives should unplanned events occur.

Centres should also be reminded that planning sequences may be grouped to avoid excessive repetition. For example, if a candidate is required to turn three lock screws, all different sizes, the actual production of the lock nuts is identical so despite size differences, it is acceptable to have these components under one sequence.

It would be beneficial to candidates to identify key areas in sequencing and not just have a general heading such as ‘turning’. Higher end responses would be expected to detail areas such as facing off, reducing diameter and so forth.

Again, digital submissions were common with centres allowing tables and GANTT charts to be produced quickly and accurately.

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Task 2(c) - (6 Marks) AO3
As highlighted earlier, the application of Health and Safety control measures were much better applied with candidates displaying a better understanding of risk and mitigation in a number of the mark bands. Centres should ensure they develop the skills needed to allow candidates to apply risk assessment from an early stage of the course to ensure familiarity and understanding.

In many cases risk assessments were broken down and aligned with key sequences of the planning undertaken in Task 2(b). These were mostly focused on items of equipment such as lathes, mills and drills, which offered clear opportunity to conduct detailed risk assessments and clear mitigations to reduce risk levels. There were far fewer examples of basic statements such as 'tie back hair' which does not allow for adequate risk assessment processes. The application of guarding on equipment was far better understood in this series which again showed centres taking onboard focuses within CPD events.

Also candidates should group tasks such as sawing, filing etc. under a general, combined risk assessment section for hand tools.

Task 3 - (16 Marks) AO2
There was evidence of many high-level outcomes seen by the moderation team. In many portfolios, high levels of accuracy finish and quality could clearly be seen in the final prototype. Candidates often displayed a good range of materials and again, in many cases, work diaries with photographic evidence of components were used to excellent effect to show stages of production as candidates progressed through the work. Many candidates used these same pictures to assist in the evaluation in Task 4b.

Observation records were used efficiently by centres with most having detailed annotation of the candidates' production stages allowing moderators to clearly see how marks were awarded for this task.

In most submissions, candidates provided clear and detailed photographs of their work which allowed moderators to confirm the quality of the outcomes against the awarded marks. In a small number of cases, photographs were too small to see clearly, and requests had to be made for additional photographic evidence. To avoid this, centres should provide large enough photographs of a sufficient resolution of their candidates completed and assembled product as well as a disassembled photograph of the component parts produced during the task.

Task 4(a) - (12 Marks) AO2
This task was undertaken well by the majority of candidates displaying a good range of skills in the production of their engineering outcome. Many outcomes showed a wide range of processes which were appropriate and allowed the prototype to be produced accurately whilst applying a range of materials which met the requirements of the specification.

There is still a number of submissions which are over reliant on laser cutting to produce the final outcome. Centres need to be aware that producing outcomes in this way limits the access to higher mark ranges and candidates will have limited opportunities.

If candidates produced both the support arms and pivot arms of the unit 1 task using laser cut acrylic, they would limit their access to the higher mark bands. This is due to the fact that limited processes have been used compared to a candidate who would have formed the same parts from aluminium. If a candidate produced two of the parts in acrylic and two in aluminium, many of the processes would be covered allowing more access to higher end marks.

The outcome requirement is to produce the engineered product as closely as possible to the provided engineering drawings. 3D printing duplicate parts after one had been produced

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accurately in an appropriate material is acceptable as the candidate will have displayed the skills in the first part. i.e. turned seat post lock and 3D printed quick release pin.

Centres should also be aware that an accurate outcome in unit 1 will assist candidates in the linked design task in unit 2.

As a general reminder, centres should also avoid using soft woods or timber as this is not typically considered as a material for engineering and can have an adverse impact on the accuracy of components produced.

Task 4(b) - (12 Marks) AO3
Evaluations by candidates were far better structured in this series with better links to the engineered drawings and given specification and brief. In many submissions, candidates also offered viable suggested improvements on how to improve the prototype often linking suggestions to accuracy, quality of finish or material selection.

There were fewer statements relating to how hard the candidate worked which is a positive whilst many submissions used the work diaries well to enforce accuracy of outcomes and quality of finish. There were many examples of candidates using pictorial evidence of component parts being measured using digital callipers to show levels of tolerance.

Centres should focus on ensuring candidates review the criteria, tolerances, and their own working methods to a considerable level of detail. This should include a comparison between the sizes given and what the candidate achieved, any changes that may be implemented to the planning stages or alternative ways to process material to improve accuracy and quality.

Summary of key points

As mentioned in the introduction, submission of this qualification continues to improve with the majority of centres. Centres should consider the following key points as they continue to develop this new qualification.

- Consider developing digital portfolios with candidates as this allows more efficient workflow and allows candidates to generate tables and charts more efficiently. As always, practicing these skills in year 10 would be beneficial in preparation for the assessed task for Unit 1.

- Ensure that enough skills and processes are evident in candidate outcomes and limit the amount of laser cut outcomes where possible. This will be reflected in the available marks for processing component parts.

- Ensure photographic evidence is clear and suitable to assist the moderator. Unclear or missing photographs will need to be resolved to allow the moderation process to be completed.

- Centres should ensure that a suitable range of materials are available for candidates to decide which to use to produce their component parts for the engineered product.

- Ensure evaluations refer back to the criteria such as tolerances or any other details supplied in the brief. Candidates also need to ensure they offer relevant improvements in areas such as finishes, processing and accuracy, as well as improvements to planning.

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ENGINEERING (TECHNICAL AWARD)

Level 1 / Level 2 Award

Winter 2023

UNIT 2 – 9357 – DESIGNING ENGINEERING PRODUCTS

General Comments

This series saw a more substantial volume of submissions for unit 2. This allowed for a clearer assessment of how centres are applying this unit with their candidates.

It was encouraging to see that many of the areas identified for improvement in the last series have been addressed by many of the centres seen during this moderation process.

In the previous series only a small number of candidates showed how their solution would attach to the existing vice from the unit 1 task. In this series, the number of candidates addressing this key point was much higher which allowed access to the higher mark ranges of the assessment.

Candidates should be issued with the unit 1 technical drawings to allow them to fully address the unit 2 brief.

Engineering drawings are improving but there is still development needed in this area to again allow access to the higher mark ranges. CAD submissions were more evident which does give benefits to quality of outcome and dimensional accuracy. CAD also featured strongly in many portfolios to address the requirement of the specification to model candidate solutions.

The details below highlight both areas of good practice seen by the moderation team and identify any areas that may benefit from areas of improvements.

Comments on individual questions/sections

Task 1(a)(i) - (2 Marks) AO2

Functions of the product were generally detailed in submission with a good number of candidates using the Unit 1 drawings to identify features of the original Unit 1 product. This allowed candidates to quickly focus on details such as how the two products must interrelate to achieve a successful outcome. Key parts in the main were identified by most candidates but would have benefitted from more technical detail.

Task 1(a)(ii) - (2 Marks) AO2

During this submission, candidates were able to identify appropriate products which showed similar characteristics and requirements of the Unit 2 brief. In a small number of submissions, the products selected had no functional properties that could be linked to the given brief. This made addressing Task 1(b) much more difficult for candidates to discuss and rationalise their selection for Task 1(a)(ii).

Whilst this seems a simple requirement with a lower mark tariff, centres need to ensure their candidates understand the need to select appropriate products to be able to access the higher mark bands in Task 1(b). Candidates should limit their selection to no more than three examples.

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Task 1(b) - (5 Marks) AO3
This task was answered well by candidates who understood that the selected products from Task 1(a)(ii) needed to have a justification for their selection in a way that relates to the brief for the unit. A good proportion of candidates clearly understood that their selected products could either be adapted or the mechanical principals of those products could be applied in their own engineered solutions.

Where candidates had selected products that had limited applications that could be used in their designs, candidates again found it difficult to move out of the lower mark band. Familiarity of undertaking this type of task should be explored early in the course to allow candidates to gain a better understanding of linking appropriate engineered products.

Task 2(a) - (4 Marks) AO2
There was good evidence of strong design solutions from many candidates and a far better understanding of how the design solutions needed to relate to the engineered product produced in Unit 1. This was a weak area in the previous series, and it was good to see that this was now addressed well by most candidates across the range of outcomes. Clear connections between the candidates' solutions and the existing product were evident and illustrated in a range of media. Excellent physical models were undertaken by some candidates showing how component parts interrelated whilst many opted to visualise the same information using CAD. Both are acceptable and selecting one of the methods is sufficient to address the criteria for this task.

Candidates who did present either type of modelling (an AO2 requirement), clearly found it easier to explain and justify their design solutions for their engineered product. It was clear that features were well thought out and, in many instances, linked back to the selected products in Tasks 1(a)(ii) and the candidate justifications in Task 1(b).

Annotation in general was well done but many candidates needed to apply a more engineering type of approach focusing on addressing the brief, especially key parameters or required features. Considerations for materials and sizes should also be considered here as outlined in the specification.

Task 2(b) - (4 Marks) AO3
Whilst this was well done by many candidates displaying a range of ways to present the information, there needs to be stronger references back to the criteria set in the brief. Areas such as operational parameters were rarely addressed in this section. There needs to be a greater focus on this task to allow justifications to be more relevant and applied fully to selecting the most appropriate solution developed by the candidate.

The ACCESSFM tool was used by a number of candidates, but this can be limiting in allowing access to the higher mark bands. To achieve this, candidates need to address more of the engineering principals rather than aesthetics etc.

The way in which many candidates presented the task was appropriate with many using a point or similar rank method to select their final design solution, it is only the focus of the criteria used that needs to be addressed as discussed above. Candidates should also include a conclusion to summarise their final choice of design.

Task 2(c) - (4 Marks) AO2
It was encouraging to see a diverse range of presentation techniques used to clearly present their design ideas.

CAD was well applied in many submissions allowing two and three dimensional views of the proposals to be seen in a variety of finishes and materials. Models were again applied well

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many focusing on connecting parts and clearly showed the development of the technical detail in the upper mark bands. Annotation was evident in the majority of submissions, but the detail and use of technical vocabulary and appropriate terminology varied significantly.

It was also encouraging to see a good number of candidates using the original engineering drawings from Unit 1 in various areas of their design and development stages. In a number of submissions, the models produced in foam, wood or card were shown in situ with the outcome from unit 1, clearly showing how the design solution met the Unit 2 brief.

This is an area that centres should consider developing for future series to allow access to the higher bands in marking.

Task 3(a) - (6 Marks) AO2
This was again a mixed response this series with candidates using CAD or traditional drawing techniques. There was an improvement in the understanding shown in the layout of orthographic projections using either of the above methods, but many examples lacked clear dimensioning or did not follow the drawing conventions required to accurately give details of size or technical information. This is clearly and area to develop for centres.

Isometric views are a requirement of each mark band, these were evident a number of portfolios seen by moderators.

Development of this task requires candidates to gain familiarity with conventions early in the course as this will allow them to generate accurate engineering drawings of their final outcomes.

As mentioned, traditional drawings techniques were evident and are perfectly acceptable for assessment, but it was clear to see that candidates who opted to use CAD were able to generate evidence in a higher level of detail. Centres may consider exploring the many free options of CAD packages now available online.

Task 3(b) – (3 Marks) AO1
Responses to this task are still quite varied with many candidates still seem to confuse this with task 4(b) and gave details on how to produce the outcome. For this task, candidates need to focus on details such as how mechanical aspects are addressed. For example, the vice must be locked into position on the clamp. It should also focus on finishing details. For example, a high-quality finish should be applied to the product. Material properties should be covered. For example, stating that they need to be durable or lightweight. Other technical details possibly linked to mechanical aspects should also be covered such as a quick release clamping system must be employed to remove the vice from a table.

These are based on the final design solution proposed by the candidate.

Task 4(a) - (4 Marks) AO2
This series saw a wider range of mathematical techniques being used by candidates to determine responses such as calculation of the volume of material needed to cast a component part or working out the overall cost of the product from stock material size and price.

Candidates should ensure that their responses are relevant to the product they have designed and show sufficient detail in workings out such as mathematical conventions and the correct use of units.

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A small range of responses here showed a stress analysis CAD outcome with a statement of how many Kg the product can withstand before failing. These often include no calculations or conventions and should be avoided.

Candidates can decide on which area to apply this task to, many worked out area and cost, but it is important to ensure that sufficient depth and challenge is present.

Task 4(b) - (6 Marks) AO3
It was again clear that many candidates connected Task 2(b) in unit 1 and the requirements of this task in Unit 2. The main outcome should include the methods and processes to produce the component parts, the selection of materials to be used and give justifications for their selection. Candidates should also indicate the methods of finish for component parts but again ensure justifications are given for their choices.

There is an opportunity to incorporate simple testing to determine material choice and to enforce their justifications for material choice.

Many candidates connected this with the planning task in Unit 1 and used similar methods to present the information. Overall, the range of outcomes seen covered the main areas of the task but to access the higher bands, clearer and reasoned justifications are needed.

Summary of key points

Overall, the approach to Unit 2 is continuing to improve in many areas and this report should allow centres to review their delivery in some areas to address some of the key points mentioned above. The following points are the main areas which would benefit from further development.

- Task 1(a) Ensure that there is a clear relationship between what is to be designed and how it relates to the existing Unit 1 engineered outcome.

- Task 3(a) Continue to develop understanding of drawing conventions with a particular focus on the correct use of dimensions and how they are used in an engineering drawing. Higher band outcomes should also be able to apply hidden detail in their responses.

- Developing specifications to address Task 3(b) which are linked to their design outcome and clarify key specification points as detailed for this task above.

- Task 4(b) needs further development to ensure candidates are familiar with the key areas linked to the assessment task detailed above.

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ENGINEERING (TECHNICAL AWARD)

Level 1 / Level 2 Award

Winter 2023

UNIT 3 – 9358 – SOLVING ENGINEERING PROBLEMS

General Comments

It should be noted that this was the first examination for the new specification. There were changes in format from the legacy specification, with the inclusion of Question 4 which was a 10-mark extended answer question.

Most candidates attempted most questions on the paper. In a few cases, there was evidence of candidates not having read questions carefully before answering. It is most important that candidates take the time to read the question paper before attempting to answer questions, as this can help to ensure that basic errors are avoided. Candidates have a good knowledge of general Health and Safety, however, still find engineering drawings a challenge.

Questions relating to the recognition of basic engineering materials were generally quite well answered, but detailed knowledge of specific materials was less common. Answers to questions about basic engineering processes were also lacking.

There were many well answered papers but some of the answers within the extended answer questions lacked the depth required for higher marks. The quality of the presentation of the answers does need to be addressed.

Comments on individual questions/sections

Question 1 (a) (i) – (1 Mark)
Most candidates were able to state that an alloy is a mixture of two or more metals. However, many were simply naming different metals or saying that it was a mixture of two different ‘materials’.

Question 1 (a) (ii) – (2 Mark)
Popular answers for this question were that an alloy makes the frame more lightweight and makes the frame corrosion resistant. Most candidates were able to list at least one of these as their answer.

Question 1 (a) (iii) – (4 Marks)
This question was answered well with most candidates referring to testing the moving parts of the bike before it leaves the factory, including testing the suspension, brakes, and sprocket. Another popular answer was to test the motor on the bicycle.

Question 1 (a) (iv) – (1 Mark)
A well-answered question with candidates suggesting the use of paint or dip / powder coating as an effective method of protecting the bicycle frame to protect it from environmental degradation.

Question 1 (b) – (6 Marks)
Most candidates were able to list advantages and disadvantages of using carbon fibre rather than an alloy to manufacture the bicycle frame. Common advantages included ‘no need to put a finish on the frame’, ‘good strength to weight ratio’ and that it is ‘lightweight’. Common

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disadvantages included that it is ‘difficult to repair’, ‘it is an expensive process to manufacture with’ and ‘it cannot be recycled’.

Question 1 (c) – (6 Marks)
This question was answered very well, with most candidates suggesting welding as a permanent method of joining the bicycle’s frame, and nuts and bolts as a semi-permanent method of attaching the motor to the frame.

Question 2 (a) (i) – (3 Marks)
Mild steel was most candidates’ answer for this question. Aluminium was also a popular answer but not suitable to manufacture the toolmakers’ clamp. Hardwearing and having high impact strength were common reasons for choosing mild steel.

Question 2 (a) (ii) – (1 Mark)
Most candidates listed a hacksaw or milling machine as being suitable to cut the square section material here. Both good answers that made candidates recall a tool or machine they had used in the workshop.

Question 2 (a) (iii) – (6 Marks)
The responses to this question were quite mixed, with many able to identify the vernier callipers and chuck, along with their respective use. However, a very small minority was able to identify the tailstock and it’s use in the workshop.

Question 2 (b) – (6 Marks)
This question was answered very well. Candidates were familiar with the process of cutting an internal thread and could explain the whole process using notes and sketches.

Question 2 (c) (i) – (5 Marks)
This question was answered very well, with most candidates being awarded at least 3 marks out of the possible 5. Some candidates did not seem to quite understand the question and drew the jaw in isometric or in full orthographic.

Question 2 (c) (ii) – (3 Marks)
Most candidates were able to calculate how many lengths of square section metal would need to be ordered for this task. Some forgot to double up on the number of jaws that each pupil would receive and gave the incorrect answer.

Question 2 (c) (iii) – (3 Marks)
Very few candidates were able to complete this question. Many did not attempt to answer the question at all.

Question 3 (a) (i) – (2 Marks)
The majority of candidates were able to identify the machine in the picture as a centre lathe, with fewer able to list a type of turning tool that can be used on it.

Question 3 (a) (ii) – (6 Marks)
This question was answered very well, with very few candidates unable to list three risks and a control measure for each one. Answers referred to flying debris from the machine and contact with moving parts. Popular control measures included the use of PPE and the use of suitable guarding on the machine.

Question 3 (a) (iii) – (3 Marks)
This question was answered very well, with most candidates correctly completing the Health and Safety acronym as Personal Protective Equipment.

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Question 3 (b) (i) - (3 Marks)
The majority of candidates answered this question correctly, using Ohms Law to calculate the resistance. In some cases, candidates had used the incorrect formula for the calculation.

Question 3 (b) (ii) – (3 Marks)
This question was answered well with candidates referencing pollution to the environment, noise pollution and damage to the local wildlife, as environmental impacts of using a diesel-powered generator.

Question 3 (b) (iii) - (2 Marks)
This question was attempted by most candidates, all suggesting wind, solar or battery power as an alternative renewable energy source to power the machine. This showed a basic knowledge of various energy sources by the candidates.

Question 3 (b) (iv) - (4 Marks)
This was a question to show an understanding of how a machine should be inspected to ensure good working order. Several candidates described methods such as: regular maintenance of the machine, regular cleaning of the machine, checking of the motor and checking of the electrical parts and components.

Question 4 – (10 Marks)
With the introduction of a 10-mark extended answer question on this paper, it was pleasing to see so many candidates using all the available space to complete their answer. There were many well-developed answers, resulting in high marks out of the 10 available. Candidates did not simply list advantages and disadvantages of using an electric car. They developed their points and justified their point of view.

Summary of key points

- Teaching properties and characteristics of different materials need to be further developed.
- Teaching candidates to sketch and draw engineering drawings by hand needs to be developed. Perhaps there is an over-reliance of CAD which is great for understanding and creating drawings however does not support the development of drawing skills.
- Technological developments seem to be taught well at centres. This is a continuing year on year trend.
- Candidates still need to be far more aware of engineering processes, hand tools and the stages of production so that they can sketch various processes with ease.

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