Questions matter

GCSE
Engineering

8852/C NEA: Practical engineering

Report on the Examination

8852
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General

This is the third year the GCSE Engineering NEA was marked with full assessment criteria being used since the start of this specification.

It was pleasing to see the Non-Examined Assessment (NEA) was tackled with enthusiasm and creativity by a great many students, displaying a wide range of interesting and diverse solutions proposed to the set task of independent living.

Projects were generally well organised and in the most effective examples students presented their work in sections under headings of the assessment criteria or were colour coded. However, the number of sheets or slides that a student completed often exceeded the 20 recommended by AQA and in some centres this exceeded 80 slides. In many cases this could be significantly reduced with more careful management of the spaces on the sheet and a reduction in the font sizes used for the headings and written text.

This year it was pleasing to see that the majority of centres have been accurate in their assessments of students' work. Centres, staff and students are to be congratulated for this.

Teachers are advised to make use of the Teacher Online materials (TOLs) available on AQA centre services and make contact with their NEA adviser to support future assessments. As moderators do not visit, it is very important that centres should present good quality photographs and some annotation to justify marks awarded. It is also useful if moderators are provided with some photographic evidence of the prototype being made to show evidence of engineering skills that are often hidden in just a final solution photo.

An increasing number of centres had submitted work electronically, in some cases these folders included videos of work being evaluated. Please ensure that the electronic work is either in a PowerPoint or PDF format and sent to the moderator on a memory stick and that any videos are separate clips or embedded and not external links.

Administration

The moderation period is limited, and centres are thanked for their cooperation in completing administrative tasks promptly.

It is worth noting:

• with the online mark submission system, the sample of folders to be sent to the moderator is generated automatically. These folders should be sent to the moderator once the sample has been identified.
• centres must complete a Centre Declaration Sheet and enclose this with the sample
• each student requires a completed and signed Candidate Record Form (CRF); these should be secured to the front of each portfolio or be included with the folders or memory stick when the sample is sent to the moderator. Teachers should be aware that the CRF is often removed from folders in order to read the comments and cross check the marks with those recorded on the system. It is therefore vital that the individual students work is labelled with name and number as once the CRF is removed there is no other form of identification.

• portfolios should be individually fastened together in a logical order, to assist the moderation process. It is the centre's responsibility to present students' work in the best possible manner for moderation to ensure their potential is achieved
• when assessing students' work, reference should be made at all times to the Assessment Criteria.

Teacher Annotation Teacher comments are very useful. They are used by the moderator to confirm why a particular mark was awarded. It is most useful when teacher annotation details and states exactly what a student has done and how this meets specified assessment criteria. General statements or comments copied straight form the assessment criteria are not as helpful.

Task setting

The context of investigating a solution to enable independent living was well interpreted by the majority of centres. The most popular was a pill organiser that included an electronic circuit to remind the user to take their pill or a mechanical version that involved some rational device to present the pills on a daily basis. Another common response was the extended arm (litter picker type product). The use of a mechanical system in this instance was more evident but with less application of an electronic system to this solution. The proposed solution should include both a mechanical and electrical system to obtain maximum credit.

Problem solving

This section gives students an opportunity to demonstrate their ability to analyse a given problem, imagine solutions to that problem, use a range of modelling techniques, produce a prototype and communicate their ideas clearly.

Problem solving occurs throughout the NEA with marks awarded for work that appears across the whole project; problem analysis, problem solving, modelling, communicating and the design for a final prototype.

Students achieving the highest marks for Problem Analysis showed discrimination when selecting material to include, while some students presented material that was purely factual which they did not link to the relevance of the products or systems they were designing. This is worthy of little or no mark recognition and often this time could be utilised more effectively in other sections.

Students achieving the highest marks for Problem Solving produced a range of ideas that gave alternative solutions and explained the reasons behind their choice of solution. They explained their ideas in terms of Input, Process and Output. Where students immediately proceeded with one solution, without any consideration to solving the problem, this limited their marks in this section.

Students tended to show the weakest performance in this section where the work was highly structured and formulaic in its approach. Centres are reminded that **templates and writing frames are specifically forbidden** in the NEA and may be considered malpractice. Students also did not score well when they appeared to complete initial investigation for the sake of it, and then completely ignore their findings as they moved forward.

A range of modelling techniques was used by many students with the most able students modelling both mechanical and electronic solutions. This was done in card, electronic breadboard and using modelling software. It was noted that similarly this year, as previous years, there was more card modelling demonstrated compared with electronic solutions and very little mathematical modelling was evident. Modelling of student ideas is important and gives the students a greater understanding of the solution. This was a missed opportunity for students to develop and demonstrate a wider understanding of the process.

In the main, decisions were explained and well communicated by the most able students. However, many students failed to explain the choices they considered and failed to justify the decisions they made.

Many final prototypes were worthy of good marks where evidence suggested they were fully functioning and manufactured to a high quality. It was interesting to see the wide variety of solutions for the context this year.

Drawing and conventions

This section gives students an opportunity to demonstrate their ability to develop illustrated design ideas that conform to sector-specific conventions, use CAD effectively and clearly annotate their drawings.

Students achieving the highest marks for development drawings developed engineering drawings of their solution that contained detailed annotation and evaluated their solution. Centres without 3D software still produced excellent 2D orthographic hand drawings to sector specific standards and were able to achieve high marks in this sectioin.

Centres are using sophisticated CAD to good effect. There was some excellent orthographic and rendered pictorial views produced and the software then generated appropriate sector specific dimensions, that in some cases showed complex parts. However, title blocks were generally not used to identify parts by many students or were incomplete if using certain pieces of software.
It was disappointing to see that many folders still lacked specific conventions, and a great many did not include tolerances.

Production planning

This section gives students an opportunity to demonstrate their ability to produce and follow a production plan and explain the stages of production before manufacture.

Students achieving the highest marks produced and followed detailed plans that gave information about:

- materials, parts and components to be used
- processes to be used
- use of jigs/or fixtures and/or CNC programming
- tools, equipment and machinery to be used
- the sequence of production, including critical production and quality control points
- how quality will be checked and inspected

• health and safety factors.

Many students, however, gave the use of jigs little or no mention; some missed opportunities by not mentioning the use of CAD drawings to reference or create templates and repeatability. Fewer centres this year had included any evidence of the use of jigs to aid multiple production. The only quality control technique mentioned by many was its use to check fit and function after making rather than using specific measurement and inspection techniques.

Where Health and Safety was mentioned by some students it was merely to wear goggles and an apron or watch out for RSI, with no other specific hazards or risks identified.

A comprehensive production plan is at the heart of a well-planned and produced engineered solution and time spent on the production of a detailed plan before manufacture is generally well rewarded.

Engineering skills used

This section gives students an opportunity to demonstrate their ability to use safely a range of materials and equipment and explain their choices, consider quality control and work to tolerances. A wide variety of engineering skills were evident throughout the work produced. These included the effective use of CAD and CAM and it was noted that more centres are including the use of 3D printing and laser cutting for part or the whole of the prototype production. It was also pleasing to note that many centres' still use traditional tools and techniques such as the use of the centre lathe and pillar drill. Most centres also used a populated PCB board, although the use of microcontroller and commercial items such as Arduino boards remain popular.

A wide range of skills were used by students and were specific to the equipment available to the centre. The most able students outlined the quality control methods used. Many less able students inferred methods but did not evidence them. In addition, many students missed opportunities by not referencing any planned quality control and not mentioning working within the tolerances stated in production plans.

Photos in manufacturing diaries showing how jigs, fixtures and gauges had been used to check components were used by some and were good evidence of the higher marks awarded, however, as previously mentioned, many only concentrated on fit and function when referencing tolerances.

Many students only described one method of production rather than an alternative and in so doing limited the marks they could be awarded. For example, a student would mention the use of the laser cutter but would not mention an alternative CNC/CAM device or technique such as Waterjet, router or by hand. Students achieving the highest marks did give clear and detailed explanations of which alternative processes were considered and explained why particular methods were chosen.

Applying systems technology

This section gives students an opportunity to demonstrate their ability to identify and explain the systems they have used and produce block diagrams to represent them.

As in previous years a number of centres have continued to award marks to students for producing just a flow diagram for constructing their product. In this section students should produce systems block diagrams to help describe the engineering principles which have been used. Input, Process, and Output blocks should be used to describe the systems or engineering principles students use.

Students achieving the highest marks in this section produced system block diagrams for the systems used in their specific projects which included the sub systems used. They also produced detailed explanations of these systems which outlined how they controlled the function of the product.

Many of the students who had included block diagrams, however, only gave the Input, Process and Output for the electronic element of their project and missed opportunities by not considering the mechanical or hydraulic/pneumatic options used. Little mention was given to feedback loops or sub systems. IN addition, many students gave a general description of how the circuit worked but did not explain the rationale for its selection.

Testing and evaluating

This section gives students an opportunity to demonstrate their ability to undertake testing of their product and evaluate its effectiveness. They should also provide an honest evaluation of the product and make recommendations for improvements.

Overall, this section was attempted well when students had produced a final solution for testing. Students achieving the highest marks provided evidence of how they tested their prototype solutions; they explained what tests they used and outlined quality issues. They also evaluated their completed solution in terms of both systems and operation. Students achieving higher marks in this section also included analysis and evaluation throughout the design process.

However, there were still many students who only mentioned testing when they referred to simple visual checks or to simple checks of function and did not check back to drawings or part specifications. Many students had little or no evidence of checking back to tolerances.

Students need to use these methods to analyse their work and suggest future improvements.
Where students didn't achieve higher marks in this section was where the improvements suggested often only referred to taking more time during making or stated they could be more careful during the manufacturing process. The most effective suggestions for improvements talked about how systems operation and/or the manufacturing process could be improved.

There were still a number of centres with no evidence of testing a solution. Less time spent on initial irrelevant research and more time spent in other sections would have been more productive, in many instances.

Overall the quaility of final soultions and quaility of applying the assessment criteria has improved over the lifetime of the specification and centres are to be congratulated on this.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.