Questions matter

Notes and guidance: Non-exam assessment

This resource provides guidance and advice to allow students to demonstrate their ability during their Non-examination assessment (NEA) in GCSE Engineering.

The single context is released by AQA on or about the first of June each year. This is for students who will take the written paper in the following year.

It contains an explanation of the context and three differentiated examples which students can select and use as a basis for their own project or they can develop their own unique solution.

Even where a whole group selects to follow a single example there should be sufficient differences in the written and practical outcomes to identify an individual's approach to the problem posed.

Contents

Version 1.0
December 2023

© 2023 AQA

Examples of past contexts and problems

Context 1

Energy consumption has a huge impact on the environment.

Engineers have a responsibility to design products and systems that address environmental and energy issues.

Problem 1

The decline in the use of fossil fuels has meant that we need to rely on alternative sources of energy. We use energy in many ways: for heating/lighting, for transport, for manufacturing and for leisure. Your task is to engineer a device that uses energy produced by an alternative method to burning fossil fuels.

Three examples of possible solutions

- Engineer a prototype device that uses wind power to drive a bird scarer.
- Engineer a prototype device or system that uses a solar cell to power a vehicle.
- Engineer a prototype device or system that uses water power to provide lighting.

Context 2

Toys and games are linked to developing sensory-motor skills in children and can increase IQ, promote problem-solving skills, develop social and emotional intelligence, can lead to better and improved concentration, and can instil creativity and imagination.

Engineers and designers often focus on the problem of producing mechanical and/or intelligent toys and games.

Problem 2

Children of all ages can benefit from playing with toys and games that challenge them. Your task is to engineer a device or system that would help children develop through play.

Three examples of possible solutions

- Engineer a prototype device that would encourage children to recognize different shapes and/or sizes.
- Engineer a prototype device or system that would move or react in some way when children interact with it.
- Engineer a prototype device or system that moves autonomously for a timed period.

Whilst all the contexts are open and afford students the opportunity to display what they can do; the examples offer differing challenges of complexity or difficulty.

© 2023 AQA

You can find the current context on Centre Services using the NEA filter.

Overall the NEA has a weighting of 40% of the final marks for this qualification. The NEA project in its entirety should take approximately 30 hours to complete and consist of a working prototype and a concise portfolio including sector-specific drawings and an evaluation of their product/solution.

The assessment is broken down into six sections each focusing on an important aspect of engineering design and development.

See section 4.4.2 of the specification "Taking the task" for further guidance

© 2023 AQA

Section 1: Problem solving

Section 4.4.6.2 of the specification.

This section is worth 15 marks.

Although this is the first section of the NEA assessment it covers all of the activity of the student from their first investigations and concepts through to the final working prototype.

Outcomes:

- written description of the task, clearly defining the problem to be solved
- communicated ideas including a brief specification
- a completed prototype produced to test the idea(s).

Problem analysis

Students need to analyse the context, in doing this, mind maps or multi-causal diagrams as well as written text can be used.

They may wish to explore existing solutions, but these must not be presented without commentary or acknowledgement. Downloading images from the internet is unlikely to be profitable, but disassembling existing products may provide insight into how a similar solution might be constructed or improved.

As a conclusion a short specification of what the eventual solution is required to achieve is useful, provided it includes testable criteria. Generic criteria such as "easy to use" should be avoided.

Problem solving/solution development

This analysis should progress to developing several outline proposals, each capable of further detailed development, although to save time either one, or elements of several ideas combined should then developed into a single proposal which can be modelled.

The main priorities of any development work will be around ensuring correct and reliable functioning, selection of materials or systems and ease of manufacture and maintenance. The importance of good communication cannot be overstated at this stage.

A detailed account of the functioning of the product both with reference to mechanisms and electronics where used with photographic evidence should be included.

Modelling

Modelling will form an important part of this development, this may take various forms, including the use of mechanisms kits and electronic breadboarding, drawing and sketching, building models from easily manipulated materials such as card and balsa, calculating and using various computer based applications to refine their ideas.

By using such methods, the student will be able to explore various aspects of the task and formulate a strategy that enables them to formalise this into illustrated design ideas.

© 2023 AQA

Communicating

Across the entire project it is important that the student communicates with the reader in a clear and concise way. Any decisions they make should be referenced to help the reader understand their thought processes and why they followed a particular course of action eg why one material was selected rather than another, why a microcontroller is used rather than discrete components. These can be justified by relating them to technical demand, including speed of operation, current consumption or simply due to availability or cost.

Some of this work will overlap with 4.4.6.3 Drawings and conventions and care should be taken not to over reward by duplicating marks but applying the assessment criteria accurately.

Production of a prototype

Once the prototype is completed and evaluated then conclusions can be drawn regarding its quality. That is not its physical appearance, but simply how well it meets the objectives identified by the student at the commencement of the NEA.

Top tip

Students should explain how any information obtained affected their thinking.

Teacher checklist

- Is the problem accurately identified?
- Are all specification points realistic and testable?
- Are reasons given for any changes in the development of the solution?
- Is the development of the solution easy to follow?
- Does the prototype function as planned?

© 2023 AQA

Section 2: Drawings and convention

Section 4.4.6.2 of the specification.

This section is worth 15 marks.

It is important that students learn how to present information in graphical form. This can take various forms including:

- isometric drawing
- orthographic drawing
- exploded drawing
- assembly drawings.

They can be produced using any suitable CAD package or drawn by hand.

Students should follow the sector specific conventions of technical drawings which may include a Title Block giving: Name of the drawing, scale, date and projection method.

Presentation drawings may be produced using 3D modelling software and possibly rendered to give a lifelike image.

Orthographic drawings should be dimensioned, and tolerances added where appropriate.

Most commonly available electronic design software will generate circuit schematics, but these do not always conform to the industry standard, this is acceptable.

Annotation should be added to explain the function and material or component choices.

Top tip

All drawings must be supported with detailed annotation explaining the parts of the prototype development.

Teacher checklist

- Do the drawings provide sufficient information for accurate manufacture or assembly?
- Does the annotation clearly link the object being produced with its function and use?
- Are reasons given for size, component choice?
- Is it clear how the device would operate?
- Are orthographic views dimensioned?

Section 3: Production planning

Section 4.4.6.4 of the specification.

This section is worth 15 marks.

Students can be given the freedom to choose their own layout for this section. Do not confine students to work in a table format. They may choose to use flowcharts, paragraphs or a table format to evidence detailed planning and sequencing of the product to be made.

Students should produce (as appropriate):

- a detailed production plan
- an explanation of each of the stages of production
- an explanation of the quality control techniques used to produce the product.

How the item is to be produced or assembled should explained in detail with emphasis on any risks specific to the process and not limited to generic health and safety rules.

Quality control measures and expected timings to be included. Reference to technical drawings highlighting tolerances when writing step by step processes shows evidence of detailed planning.

Evidence of repeatability

Using CAD-CAM or physical jigs to ensure repeatability. Eg when turning components on a CNC lathe, the accuracy of the machine when following the G&M codes should ensure identical outcomes. Students do not need to program in G&M codes as normally there is software available to convert from 3D modelling packages to machine instructions. Physical jig such as simple shaped block for bending to an angle or hole templates for series or positions of holes.

Top tip

Production planning should be written in the future tense.

Teacher checklist

- Have engineering drawings been used to provide information?
- Have a range of processes and materials been used?
- Are tolerances included?
- Has repeatability been considered?
- Does the sequencing make sense?
- Has health and safety been applied?
- Do the manufacturing operations have an appropriate level of demand?

© 2023 AQA

Section 4: Manufacturing and engineering skills

Section 4.4.6.5 of the specification.

This section is worth 15 marks.

Students should use a range of processes and materials when manufacturing the product. Both hand and CAM machines can be used in the completion of the project. There must be a balance between the two where possible.

However, some students may be producing a proportion of the prototype using commercial kits, either electronic, where they are soldering components into a provided PCB or mechanical using VEX, LEGO or similar components. Here they should try to manufacture some parts, perhaps by 3D printing, laser cutting or vinyl cutting. To ensure a more complete outcome.

This section can be presented with clear photographs annotated with detailed descriptions using correct technical terms for tools and machines.

Quality control methods using precision measuring equipment like Vernier calipers and micrometers to ensure tolerances are maintained.

Electronic soldering methods should include good practice methods like the use of heat shrink sleeves, braiding of wires and use of stress free holes when soldering wires on the PCB.

Teacher checklist

- Have several processes been used?
- Have a range of different skills been used?
- Are tolerances accurate?
- Do the manufacturing operations have an appropriate level of demand?
- Are technical terms used correctly?

© 2023 AQA

Section 5: Applying systems technology

Section 4.4.6.6 of the specification.

This section is worth 10 marks.

Students should show the working of the systems using system block diagrams in the Input – Process – Output format, with feedback present where needed.

The same representation to be used for all systems. For example, pneumatic, mechanical and electronic/electrical systems.

For electronic systems students are free to use microcontrollers like Picaxe, Genie, Arduino or Microbit as the process component. Alternatively, single process ICs such as timers or counters can be used.

Teacher checklist

- Has more than one system been used?
- Does the prototype have a control system?
- Have block diagrams been used to explain the operation of the system(s)?
- Are sub-systems and feedback included?

© 2023 AQA

Section 6: Testing and evaluation

This section is worth 10 marks.

In this section students will test the product against the specification produced in Section 1. Students are encouraged to be honest and critical with their testing and recording the results.

Objective testing is important. Testing of the final completed prototype against pre-set objectives gives better feedback for improvement.

Evaluation should be based on all the systems used. Students should then provide their suggested improvements.

If time permits, modifications can be taken further by proposing a better version through further research and/or CAD modelling.

A detailed account of the functioning of the product both with reference to mechanisms and electronics, or other systems if used, with photographic evidence should be included.

Teachers should note that evaluation is how well does the solution work and how could it be better.

Students should consider and assess how well the solution meets the requirements of the problem and how the solution could be improved if the problem were to be revisited.

Top tips

- To encourage students to access the higher band make sure relevant research and design decisions are backed by analysis.
- The NEA portfolio should show continuity and lead from one section/task to the next summarising each page.
- All problem solving ideas and development are annotated, and reasoned decisions are explained. The concept of relevant dimensions and scaling should be understood in the prototype development stage.
- Electronics circuit should be explained and presented as system block diagrams giving the function when programmable microcontrollers are used as processes when solving the context given.
- At least two systems, mechanical and electronic, should be included in the final solution to obtain the marks in the top level of application of systems technology.

Teacher checklist

- Is there evidence of testing?
- Have improvements been discussed?
- Is the evaluation objective and reflective?

© 2023 AQA

Checklist

NEA Portfolio content

Name: Date:

	Things to check	Comments/page or slide number(s)
A	Included the front page with name, candidate number and title	
	Does every page have a title/number?	
	Is your page completely used with no blanks and font size no more than 18? (PowerPoint)	
1	**Context**	
	Have you explained the problem?	
	Have you analysed the problem?	
	Have you disassembled a product to analyse information?	
	Have you summarized a conclusion?	
2	**Research of suitable mechanisms and electronic/electrical systems**	
	Have you explained any advantages and disadvantages of the mechanisms and how they can be used?	
	Have you explained advantages and disadvantages of the electronics and processes and how they can be used?	
3	**Specification**	
	Have you justified every specification point with reasons and how it could be tested?	

© 2023 AQA

	Things to check	Comments/page or slide number(s)
4	**Ideas**	
	Do you have a range of ideas? Including your Circuit Designs.	
	Is it well drawn, detailed, rendered and presented well?	
	Have you related the ideas to the specification and problem?	
5	**Developed ideas**	
	Have you selected an idea and developed it?	
	Have you explained it with sufficient detail?	
6	**Physical modelling**	
	Have you made a high-quality model showing the inside and outside detail?	
	Have you taken photos of your model in different views?	
	Have you drawn the changes/improvements you will make to your model?	
7	**CAD Modelling**	
	Have you used CAD to model parts or the whole of your product?	
8	**Final Idea**	
	Have you drawn a detailed 2D/3D drawing with annotation including sizes and materials?	
9	**Engineering Drawings** **15 Marks**	
	Orthographic drawings with **Title Block**	
	Isometric drawings with **Title Block**	
	Assembly drawings (important parts) with **Title Block**	
	Exploded drawings with **Title Block**	

© 2023 AQA

	Things to check	Comments/page or slide number(s)
10	**Production Plan** **15 Marks** Have you provided a detailed plan as if you are making the prototype using materials and machines and equipment (both hand tools and power tools)	
	Production Plan for making the case: lathe/brazing/etc.	
11	**Systems technology: electronics/pneumatic/hydraulic…** **10 Marks**	
	Have you provided a final circuit with detailed explanation of how it works?	
	Are systems explained by using block diagrams? (Input Process Output)	
12	**Engineering skills** **10 Marks**	
	Have you provided step by step photo evidence of how you would make it?	
	Have you included quality control (QC) photos? Including evidence of tolerance and Health and Safety.	
13	**Testing and evaluating**	
	Have you provided evidence of testing of the prototype against the specifications and engineering drawings?	
	Have you provided evidence of testing the circuit using Breadboard?	
	Have you included an evaluation with explanation?	
	Have you drawn modifications to improve the Model (both case and electronics)?	
	Have you included the how and why?	

© 2023 AQA and it’s licensors. All rights reserved.