OCR
Oxford Cambridge and RSA

GCE AS Level

Design and Technology

H004 to H006

OCR Report to Centres June 2018

About this Examiner Report to Centres

This report on the 2018 Summer assessments aims to highlight:

- areas where students were more successful
- main areas where students may need additional support and some reflection
- points of advice for future examinations

It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the examination.

The report also includes links and brief information on:

- A reminder of our **post-results services** including **reviews of results**
- Link to **grade boundaries**
- **Further support that you can expect from OCR**, such as our Active Results service and CPD programme

Please note that for this series there is no report for H005/01, Principles of Fashion and Textiles, due to low entries.

Reviews of results

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GCE AS Level

Design and Technology (H004 - H006)

OCR REPORT TO CENTRES

H004/01 Principles of Design Engineering

General Comments:

The first Principles of Design Engineering examination demonstrated that candidates had already adapted to the new content of the AS course. The new science and mathematics content within the specification poses new challenges, whilst the core design engineering content reflects a more modern look at technology and engineering within industry today. Candidates presented a breadth of knowledge and skills required to respond to the paper, with some candidates scoring extremely well, and a majority able to respond to the entire paper with detail.

For the core knowledge, candidates were given opportunity to demonstrate their understanding of the design process, gears, materials, electronic inputs and outputs. It was clear that candidates had a strong knowledge of mechanical systems and joining processes for metals. Many candidates also had a strong understanding of how sensors work, their functionality, and how programmes are designed to support their use in consumer products. Candidates were also asked to draw diagrams for; component assembly; circuit design; and a flow chart relating to programming. Candidates responded well to these questions, and were credited marks where there was clarity of communication and accuracy to their solutions. Many candidates showed confidence in flow chart design using appropriate symbols and arrows, whilst the design of a circuit presented a more challenging task, with candidates able to draw the required components as symbols, but less frequently seen to continue to arrange these into a viable circuit.

For the mathematics content, candidates were able to apply their knowledge of trigonometry, ratios, probability and many other areas to design engineering context based questions. These saw candidates accessing all of the marks where they read and understood the requirements of the question, and subsequently calculated the correct answer. When candidates scored only some of the marks, they did so by showing their working out. Where candidates had taken the right approach, this invariably led to the right answer. Where candidates had little access to the question, it was evident that the candidates did not have the knowledge to respond to these questions, or had not read the text that supports the question, and therefore did not access any marks.

For all of the level based questions 3a, 4b and 5b, which are worth proportionally more marks than other questions in the paper, candidates were differentiated well. Candidates who did not to discuss, analyse or evaluate engineered products in their answers, scored lower marks. Candidates who could discuss renewable energy, environmental incentives and consumer demand in relation to electronic or mechanical products and systems went on to achieve higher marks in these types of questions. Many candidates demonstrated an understanding of the considerations that go into designing and manufacturing products and systems, and were able to confidently describe these within each question area. Candidates across the cohort did not share a consistent knowledge of environmental incentives or directives, though the WEEE initiative was included by a good proportion of the entries.

For some questions, candidates were required to emphasise with design engineers on key design and manufacturing decisions, which was challenging for many candidates, but again gave them the chance to demonstrate an understanding of industry. The planned obsolescence

question 5a was particularly challenging for candidates, with many unable to describe how it is considered and designed for in a product or system.

Overall there was a strong response to this first paper, and shows considerable promise for next year's sitting.

Comments on Individual Questions:

Question 1a
Candidates were asked to describe two research methods for investigating stakeholder requirements for the given engineered product, a microwave oven.

For each unique identification of a research method, a mark was awarded, with an additional mark given to candidates who could describe the content or method for each stated method. Methods such as; focus groups, observational data or SWOT analysis needed to relate to the microwave in the candidate description rather than be generic statements for full marks.

Question 1b
For this question the candidates were asked to explain engineering related applications of CAE to the development of the electronic system in the microwave oven. Many candidates understood the nature of simulating circuit design on the computer, the need to explore the gear system inside the oven, and the relevance of designing the PCB and its supporting software to give the microwave its function.

Question 1c(i)
Using the diagram, candidates were asked to label an input and an output from the microcontroller unique to those already listed, which would be an expected typical function for a microwave oven.

Candidates confused with the nature of inputs often responded with "door open sensor", functionality which would be catered for with the existing input. Inputs which related to a microwave user input were accepted. Expected outputs accepted included the timer or clock function, or a further expected display on the screen. Candidates who reworded existing outputs including "Heater" or "Buzzer/bell" were not awarded marks for repetition.

Question 1c(ii)
For this question, candidates were required to give a definition of an open loop system and relate their answer to a microwave oven. Successful candidates achieving full marks acknowledged in their answer a lack of feedback to the microcontroller, thus requiring the user to end a function being carried out by the microwave, or that it would complete and stop by itself. Candidates alternatively mentioned a lack of sensors detecting progress of a function as implying a lack of feedback, and equally were awarded marks.

Question 1c(iii)
For this question a breadth and array of different sketches were seen from candidates for the circuit diagram of a microcontroller with both a switch and pull-down resistor. It was agreed during marking that candidates would not be penalised for a lack of formal representation of a circuit diagram, but needed to use both the correct circuit symbols for a resistor and switch to be awarded marks. A reference to the voltage was required for full marks.

Question 1c(iv)
Candidates commonly identified that Ohm's law would be required for this calculation. Where candidates calculated that the voltage drop across all three LEDs was 7.5 volts, and that the subsequent remaining voltage was 4.5 volts, they invariably continued onto gain the full marks. The most common mistake was where candidates used the 7.5 volts as the voltage for which to identify the current.

Question 1d(i)
In this question, candidates struggled to access working out marks because they did not know to identify the gear ratio for pairs of gears (B:A and D:C) before multiplying these to identify the total gear ratio of the compound gear train. Where candidates then divided the rpm speed by this total gear ratio, full marks were awarded, with or without the working out present. Candidates were awarded error carried forward marks for this question, but more often received no marks for working out as the gear ratios for paired gears were incorrectly calculated.

Question 1d(ii)
In this second sketch/diagram based question, candidates were asked to communicate through sketches and notes a suitable joining method for a gear and shaft both made from an unnamed metal alloy. Marks could be awarded for either a mechanical method of joining (such as a grub screw) or appropriate heat based joining method (such as brazing). For candidates to achieve full marks, they had to convey the requirements of each feature for the shaft and the gear.

For example, using brazing would require chamfered channels for the filler to flow, whilst for a grub screw, a threaded hole in the gear and indent in the shaft both need to be present. Candidates who failed to score full marks often did not convey the level of detail in either the sketch or supporting notes to be able to conclude that the gear would not move under load, or failed to use sufficient technical language for key terms relating to their chosen method.

Question 2a
In this mathematical question, candidates had to recognise that the new battery represented 120% of the lifespan of the older battery. Full marks were awarded for a correct answer, irrespective of working out, whilst a mark was awarded if the candidate implied that they identified this relationship between the old and new battery. The common misconception with this question was where candidates identified the new battery as having 100% lifespan, and therefore the old battery lasted 20% less than the new battery, and had 80% of the lifespan by comparison. In this instance no marks were awarded, and a common wrong answer of 3.6 hours was seen by a large number of candidates.

Question 2b
When candidates identified that the diagram showed a right angled triangle they were awarded one mark because they had recognised and continued to answer the question using trigonometry. Candidates then identified that the information relates to the opposite and adjacent, and therefore tangent. Candidates showing working out of tan12° = unknown/800 went on to achieve two of the three marks, with the final being awarded for adding this answer to 100mm to achieve the final length of h. Some candidates forgot to add this additional 100 mm measurement on at the end.

Question 2c
This was a challenging question for the majority of candidates, because the wording of the question should lead the candidates to identify that the process of selecting each switch from the batch is mutually exclusive to the other. Candidates who did not identify this went on to score no marks. Those who identified that the selection process was exclusive knew that the probability of not finding a faulty switch would be $1 - \frac{1}{5000}$. This value multiplied by itself would therefore lead to the correct answer.

Question 2d(i)
Almost all candidates plotted the data onto the graph without issue. The drawing of the line of best fit was more varied, and whilst most drew an appropriate line that helped them to achieve a correctly predicted answer in question 2d(iii), those that drew an incorrect line often drew a line connecting the points, or drew a line too shallow.

Question 2d(ii)
Many candidates found this question accessible and it was the language used to describe the relationship that differentiated the awarding of marks. Candidates achieving full marks used terms such as “positive correlation” or “consistent relationship”. Where candidates achieved slightly less than full marks, their strategy was to either describe the relationship without these terms, for example “the voltage goes up by the same amount/an even amount as the force”, which though inaccurate shows the candidate understands that the relationship is proportional, or they responded with calculations, for example “when the voltage increases by 0.053 volts the Newton force goes up by 1”.

Question 2d(iii)
Candidates who accurately drew the line of best fit for question 2d(i) were able to continue this line and identify a value within the accepted range within the mark scheme. Where candidates failed to respond with an appropriate predicted value, they either traced their position on the line of best fit wrongly to the axis, or had drawn a shallow line of best fit, both of which resulted in a value outside of the tolerated range.

Question 3a
The first levelled response question was a clear differentiator in this paper, with only a few candidates achieving full mark responses, and the majority ranging between 2 and 4 marks.

Where candidates were more successful, they had identified that not only did the public want to see automatic sink taps in use, but also other stakeholders, including the local council, the cleaners, and fitting or repair contractors. If they had identified multiple stakeholders, they were then able to go on and discuss two or more of these and how the taps might improve the experience of public toilet use. The two commonly discussed stakeholders were the user (the public) and the owners of the toilets (the council).

Beneficial reasons to the user/public mainly focused on hygiene with some discussing cross contamination, ease of use (including some responses outlining that the public would include groups such as disabled or elderly), inclusivity, the ease of function thanks to the sensors triggering the water, and public perception of the toilets being better. The benefits to the council included reducing water consumption because the taps could not be left on, better safety due to the control of the temperature of the water, and reduced maintenance and cleaning (in relation to contractors). A small number of candidates discussed a reduction of wear and tear in the mechanical taps

Presenting the required argument for a growing demand was often lost from the majority of candidate responses at all Levels. Candidates almost entirely listed 2 or 3 good reasons for including automatic taps, but not the alternative of mechanical taps, or a reason why the demand was growing. In future, candidates aiming for the Level 3 response need to create a discussion rather than listing positives, and link the growing demand to the changes in function or benefit to broader stakeholders.

Candidates achieving level 2 responses often did not present any discussion, and simply listed positive implications for the users.

Candidates achieving a level 1 response identified one reason, and outlined it in detail with no discussion.

Where a candidate did not present a point relevant to automatic taps, they were not awarded any marks.

Question 3b

This question was quite challenging for candidates due to it requiring them to empathise with manufacturers of the taps, and identify why non-ferrous metals were suited to manufacturing. Many candidates falsely discussed reasons that related to use, such as not rusting or heat tolerance. These candidates invariably scored much lower marks here.

In order to achieve the marks for this question, candidates had to identify that non-ferrous metals propose some benefits to the manufacturer. Similar to the use related response above, the fact that non-ferrous metals do not rust means that they do not require an applied finish during manufacture. This means that if a non-ferrous metal is polished or its surface improved, it would not need an additional process before being suitable for packaging and sale, which is not true of ferrous metals. Non-ferrous metals are suitable to many common processes such as casting, CNC machining, drilling, cutting threads, and other potential processes to make taps. This again is not true of some ferrous metals, therefore can be given as an answer. Non-ferrous metals are commonly unreactive, and would not affect the water passing through them, unlike some ferrous metals. Some non-ferrous metals such as aluminium, do not degrade if reprocessed, as their material properties remain consistent after each recycle, again something not seen in ferrous metals. The melting or softening temperature of non-ferrous metals is suited for hot water temperatures, which is also true of ferrous metals, but this response was accepted, and rewarded with a second mark if this related to quality testing approaches in manufacture, rather than in use as mentioned earlier.

It was recognised in marking that candidates often focused on rusting and melting temperature for this question, and it was decided they would be awarded two marks, with no further marks awarded for explanations unrelated to the manufacture of the taps.

Question 3c(i)

Candidates found this question very accessible, and were able to construct a lower score response without any prior knowledge about the specific functions of infrared sensors. Candidates commonly identified that a signal was produced by the sensor that would be sent out, bounced off an object, and received back to the sensor. Alternatively the sensor was described to detect heat or motion in front of itself. Responses from candidates that related to the sending of a signal or motion detection were more accurate in this instance, as the water from the tap would affect the accuracy of the sensor if trying to detect heat.

Many candidates outlined that the sensor would send out a signal and receive it, and this would trigger the turning on of the water. Less candidates then went on to describe the process by which the water stops. When candidates proposed a timer to cut the water off, or the repeating of the signal process that started the water, they achieved full marks.

Question 3b(ii)
This question required candidates to draw a flowchart diagram, and marks were not deducted if the drawing of expected shapes was not accurate. The candidates did however have to present the key features of the process of automatic tap operation, which had to include the water turning off, which as in question 3c(ii), was not considered by the candidate. If candidates referenced to; the sensor starting the process; the water being turned on; a timer delay of 2 seconds being in place to shut off the water at the end; and most importantly a loop to check for the presence of hands at the tap, the candidate achieved full marks. A mark was deducted for each of these key elements that were missing.

Question 4a(i)
This mathematical question was tackled well by candidates on the whole. Once candidates had identified that the measurement of flow rate was in minutes, and the time in hours, a simple conversion of units to 60 minutes meant candidates only had to multiply this value by the flow rate per minute. Where candidates did not achieve full marks, this was where they had not made a closing statement that fan A had a better flow rate than the required flow rate of the system. When candidates included this for all three marks, they either wrote a greater/less than statement, or described the outcome in words.

Question 4a(ii)
For this question candidates had to describe the importance of a second piece of data from the table provided in the question. Candidates had to imagine a scenario where either the voltage, dimensions of the fan, speed or rotation of the fan, or the temperature range would be important to know prior to designing the system. Candidates were welcome to describe this scenario, and full marks were awarded where the response was judged appropriate by the examiner. Responses that related to the dimensions affecting the material for the casing or the internal layout of components were very common, whilst less candidates chose to discuss the temperature range, which would affect the potential range of climates the product could perform in.

Question 4a(iii)
This calculation question required candidates to multiply the dimensions of the material to achieve a total volume of material. This could then be multiplied by the density to calculate the mass of the material required for the box. No conversion of units was required for this question, and the majority of candidates were able to score full marks.

Question 4b
For the second levelled question, candidates were tasked with identifying only the negative implications of renewable energy for the air monitoring system, or other similar engineered products or systems. This question was answered with a very broad spread of success, with candidates more commonly scoring 1-2 marks (level 1) than the middle band of 3-5 (level 2) . A larger than expected proportion of candidates scored 0 whilst those achieving a mark in the 6-8 band (level 3) were lower than anticipated.

The question gave candidates an opportunity to discuss the impact of renewable energy as a source, and the context of the question was carefully chosen to be a product/system that would

always be running. This should draw candidates to conclude that there would be an issue in that renewable energy provides an inconsistent power feed. In the context of the system discussed, it would mean that potentially the system would stop working for periods where there was no power to the system from the renewable source, and that this would require additional components in the electrical design to compensate for this, such as a battery that could even out spikes by charging or releasing charge depending on the weather.

Many candidates approached the question by discussing different types of renewable energy in turn, and subsequently discounting the viability of each. Common sources included solar and wind, though some candidates attempted to further this approach by discussing tidal, wave and geothermal, but with less specificity. Candidates who discussed the merits of using a dual system of solar and wind were able to argue its need given the varying weather in the UK, whilst some candidates identified that for each additional component, an additional cost would be incurred.

Candidates who compared the ease of mains power over renewable sources achieved marks often in the middle level, as they focused more on the inconsistency of the power source than the wider implications such as design, cost, and increased complexity. Finally candidates who discussed the requirement to maintain and service renewable systems, from potential wear and tear or debris on solar panel surfaces, scored well when they were able to discuss this in the context of the system essentially being designed to be installed and left alone.

Question 4c(i)

For this question supported by an annotated photograph, it was important that the candidate discussed only what was visible in the photo either by annotation or in clarity of the image. Candidates could not fabricate features or functions that are not clear and obvious in the design, for example; parts using the same tool in construction/assembly; parts being lightweight, neither of which are visible information nor annotated.

Candidates could discuss two features annotated and talk about their importance in the function of the monitoring system. Many candidates identified the clarity of the casing, which would communicate to the user a requirement to inspect or change the filter. The inclusion of both in and outflow was discussed as being useful to keep the water constantly flowing through the system, rather than being filled with water, inspected, then cleared to refill again. The user in the photo is clearly screwing or unscrewing the casing to access the filter, which candidates often discussed as a positive function as it allowed for maintenance of the system over time. Though not annotated, the wall mounting bracket was identified by many candidates, with possible benefits being that the filter could be installed close to the water supply, mounted to different surfaces, or be moved if required to be. A large majority of candidates scored full marks for this question.

Question 4c(ii)

This question was a good differentiator between candidates, and resulted in a near equal spread of candidates to each of the possible marks awarded. The possible openness of the question might have confused candidates, but the question offered opportunity for responses relating to either the design or manufacturing phase. Candidates who fell foul here discussed product analysis or evaluation at the end of the process only, when the product was complete, and not during the earlier stages of the process.

Candidates who recognised that both analysis and evaluation can be used at any step of the designing or manufacturing phase were able to justify what they might be used for. Candidates

needed to identify two separate unique examples of either analysis or evaluation, and justify their inclusion (rather than effectively not conducting the tasks). The list of potential answers are drawn from the specification, and candidates had to explain why they might be conducted.

Question 5a

This question was challenging for candidates, with an overwhelming majority scoring 0. The context of the question related to planned obsolescence, but required candidates to emphasise with the design engineer and not the customer (which is the more common discussion for candidates). This is challenging, as candidates had to consider why a design engineer might include obsolescence in their design considerations, which many see as a negative feature of modern products.

For candidates who scored well here, there was a consideration that planned obsolescence will stop the product being used beyond a pre-designed safe time frame, before being either serviced by an expert, or being taken out of use. Many features of cars are like this, as they ensure the vehicle continues to be tested for the benefit of the user and other road users. Some candidates identified that firmware updates or upgrading operating systems for electronic products was a positive, as it would allow the product to perform better, but would become obsolete if the user opted to not upgrade the product. This is a common approach in modern electronic product design, with smart phones and cars such as the Tesla now receiving firmware updates to improve the customer experience at no cost. Some systems will even improve the performance of the product to make it safe following an accident where new data has been identified and required the product to be changed.

Some candidates were able to identify a much broader response that planned obsolescence could result in more secondary services to support the customer post purchase, such as repair shops, takeback opportunities, and the possibility of customers improving their product or system years after purchase instead of buying a whole new product/system.

Question 5b

The third and final levelled response question required candidates to discuss an engineered product or system in relation to environmental incentives or directives. As there are no specific directives or incentives identified in the course specification, candidates were welcome to respond to this question in any way that saw they identify a scheme they knew about, that related to an engineered product or system. However despite this completely open opportunity to respond, no candidates achieved full marks in this question, and most candidate only achieved a level 1 response.

A very common mistake from candidates was that they chose to discuss no engineered products, i.e. products that are not either electronic or mechanical in their design and function. Candidates who discussed food packaging or recycling schemes run by their local council made numerous points that simply did not equate to relevant engineered product directives or incentives.

Some candidates were able to discuss the WEEE directive, and considered product take-back schemes as being positive for both customers and manufacturers. Candidates also discussed white goods incentives such as buy back schemes which they may have experienced when their family have replaced items such as washing machines. Candidates who took a more generic approach were able to discuss incentives such as battery collection schemes which would benefit a broad range of consumer product markets A small number of candidates discussed car

trade in schemes such as recent programmes to remove cars over 10 years old or from specific diesel age groups, in exchange of financial incentives to purchase newer vehicles.

Whilst many candidates continued to outline and discuss programmes they had experienced, very few candidates took the approach to discuss how these incentives or directives have actually impacted on how products are produced. This requires candidates to again emphasise with the manufacturer or design engineer, and discuss how they might have to consider directives and incentives when developing a new solution. A small minority of candidates chose this approach and discussed how car companies might develop electric vehicles due to market pull, and identifying old family vehicles or diesel transport vehicles as a key market to target in the development of a new product. The consideration of provision to the public of electric vehicle charging stations could have been discussed as an issue or barrier to new car development.

Candidates who considered the circular economy approach of renting products or systems over purchasing them, or closing the loop on products and systems in use so that they are repurposed rather than scrapped or recycled, were few but noteworthy.

Candidates who discussed recycling schemes that are effective in the UK, such as the glass, aluminium and copper systems, achieved some marks for providing a suitable engineered product context to justify why a design engineer might design products in these materials, knowing the material will more likely be recycled or from a recycled source for manufacture.

H006/01 Principles of Product Design

General Comments:

This was the first time for this paper and only a small sample took the examination. The examination required candidates to answer all five questions. Examiners found many examples of sound technical knowledge where clearly candidates have made the step up from GCSE to GCE level. The new science and mathematics content within the specification certainly increased the challenge of the paper.

A significant part of preparation for the exam should include techniques to allow the candidates to recall information and adapt it for the question given. Examiners are aware of the pressure on candidates in this examination and there were many questions to answer in the time allocated.

The main content of the exam was focused on candidates understanding of the design process, materials, processes, manufacturing techniques and health and safety. Many candidates had a strong knowledge of the design process and materials as well as how products could be manufactured in Industry. Where candidates had to draw diagrams there was a need for clarity of communication and accuracy. The areas where candidates lacked detail, was often in the philosophy of Product Design and how to assembly designs.

Centres need to remember that manufacturing processes can be used to support ergonomics, although generally ergonomics had clearly been taught well. Candidates must also learn to analyse a range of contemporary products whilst bringing in a range of processes and materials.

For the mathematics content, candidates were able to apply their knowledge of angles, radius, trigonometry, percentages and various other areas to the Product Design context based questions. Candidates who read and understood the requirements of the question accessed all of the marks by calculating the correct answers. Candidates who showed their working out but were not correct were still able to gain some marks. Candidates who did not access any marks either did not have the knowledge required or had not read the text fully which supported the questions.

The level based questions 1(e), 3(a), (b), 5(b), showed the differentiation needed as they were worth significantly more marks than other questions in the paper. Candidates needed to discuss their answers demonstrating knowledge in metal and plastic manufacturing processes, modern technologies and subject experts in the development of product design. Those who did not discuss analyse or evaluate these topic or processes in their answers, scored lower marks.

Certain questions did discriminate well between candidates particularly where candidates had to discuss how products are developed. Question 5(b) was particularly challenging for candidates with limited responses about the ways in which experts could have a bearing on how products are developed and include relevant examples.

Comments on Individual Questions:

Question 1a
For this question the candidates were asked to analyse features that would make a speaker portable.

For each feature identified, a mark was awarded. Possible features included the clip, size, lightweight and the fact that it was battery powered. Most candidates scored the full three marks for this question.

Question 1b
Candidates were asked to explain one reason why an alloy had been used to manufacture the carabiner clip. Most candidates understood why an alloy had been used but often lost gaining full marks through lack of clear explanation. This still seemed to be a question which most candidates found accessible with a high percentage achieving full marks.

Question 1c(i)
Referring to the portable speaker candidates needed to give two justified reasons why extrusion had been used to form the alloy rod. Candidates clearly struggled with the fact that the answer needed to focus on extrusion as a process rather than in relation to the speaker.
Reasons included the fact that it produced a continuous cross-section giving a consistent diameter. It is also a low cost process whilst producing continuous long lengths was an answer many candidates seemed to miss.

Question 1c(ii)
For this question, candidates were required to explain one reason why casting was not a suitable process for manufacturing the curved component of the carabiner clip. This was a challenging section for candidates who needed to know the casting process and when it is a suitable process to use. Candidates could refer to either sand or die casting methods but this clearly tested candidates with few gaining full marks. Possible reasons could include no grain flow in the material, high tooling costs and that if sand casted was used it would leave a grainy surface finish.

Question 1d(i)
This was a one mark question regarding a suitable process for finishing the carabiner clip. Due to the image on the question paper it demonstrated that the clip was the same colour and finish as the rest of the speaker. This meant anodising was the most suitable method. No marks were awarded for incorrect processes identified.

Question 1d(ii)
This question required them to explain the advantages of using the finishing process identified in (i). This was more accessible as it required them to give possible advantages of applying the finish to the shown product. This meant if they made an error in the previous answer they error was not necessarily carried forward. Answers could include making the surface more durable, resistant to corrosion, aesthetic reasons as well as it still being able to be recycled.

Question 1e
This was the first levelled response question which was a clear differentiator, with only a few candidates achieving full mark responses, and the majority ranging between 2 and 4 marks.

Where candidates were more successful, they discussed how modern technology had improved the development of specific products. Answers could include Bluetooth technology, USB charging facilities being built into furniture, increased security features like voice recognition in electronics, cloud storage, GPS location technology. High level responses required them to identify a number of named examples with analysis on how they influenced the development of their named product.

The most common example focused on the mobile phone but the misconception was on the product rather than discussing the modern technology involved in its development.

Other common mistakes included only naming one modern technology or naming a number of modern technologies but lack of depth in analysing meant they failed to reach a Level 3 response.

Question 2a
In this mathematical question, many candidates found this question accessible, and it was well answered. Candidates had to work out the angle of rotation to move the circle of a fidget spinner from one point to another.
Due to this being a 1 mark question no marks were awarded for incorrect responses.

Question 2b(i)
This was also a mathematical question which was accessible for most candidates. It required dividing the given diameter of 30mm by 2 to get the radius of each circle.

Question 2b(ii)
Provided candidates had identified the radius they were then able to use this information to calculate the length. Candidates could gain full marks if they had shown the correct answer without working out being shown. They needed to rearrange Pythagoras theorem to calculate the length in mm. Some candidates forgot to times this by 2 to get the correct final answer.

Question 2b(iii)
This required the candidates to think about how to package the fidget spinner. If the correct working out was applied but there was an error from the previous question the mark was still awarded. The question required the answer from (ii) to be added to two more radius measurements to calculate the minimum internal length required for the square base of the packaging.

Question 2c
This required candidates to work out the mean spin time based on data given in a table. This was well answered by the majority of candidates and was a simple type of average mathematical equation to solve. Almost all candidates answered this question without issue.

Question 2d
This mathematical question required candidates to apply their knowledge of percentages. They needed to work out how many boxes of ball bearings were needed to make 140 spinners. The question then required a total cost with a 5% discount to be applied if more than 5 boxes were ordered. They could be awarded full marks if correct answers were given without working out being shown. Errors carried forward were awarded marks if the correct workings had been applied.

Question 3a
This was the second levelled question, where candidates were asked to show how a threaded metal insert would be manufactured as a batch of 7,000. This question was answered with a very broad spread of success, with candidates more commonly scoring 1-2 marks (level 1) than the middle band of 3-5 (level 2). A larger than expected proportion of candidates scored 0, whilst those achieving a mark in the 6-8 band (level3) were lower than anticipated.

This question gave candidates the opportunity to explain the die casting process using notes and/or annotated sketches. Answers were expected to include accurate technical terms and detailed information of material, equipment and machinery required. The process would need to be clearly explained through notes and/or clear sketches.
Many candidates approached the question by including information on how the wooden door handle would be made. This did not score any marks and sometimes lost them valuable exam time.

Question 3b
The third levelled response question required candidates to demonstrate their understanding of how a packaging product for the product shown in question 3(a) could be made in a school workshop. The question was answered with a very broad spread of success with a majority of candidates scoring 2-3 (level 2). The question gave candidates an opportunity to use material, equipment and machinery required that would be found in a school workshop. Sketches could be used with relevant notes and all stages included. Important success criteria were needed like draft angles and how to use the vacuum former correctly and safely. The final stage needed to show how the package would be finished.

Question 3c(i)
This question focused on how risk assessments should be carried out to assess potential hazards and the control measures that needed to be applied. Candidates found this question very accessible, and were able to identify the correct control measure to the hazard.

Where a candidate had not identified a specific hazard related to the manufacture of the packaging they were not awarded any marks.

Question 3c(ii)
This two mark question required candidates to explain one reason why it is important to carry out risk assessments. Most candidates gave a reason with the majority of them justifying their answer. Those who scored only 1 mark was often due to a lack of understanding of how to explain an actual risk assessment. Another common misconception was focusing on health and safety rules.

Question 4a
This question focused on a child's scooter and candidates found this part of the question very accessible. This required them to think about the height of the handle bars being adjustable. Most focused on children growing whilst still using the scooter and of them being different sizes. They were also able to confidently justify their answers.

Question 4b
This question required candidates to name a suitable thermoplastic for the manufacture of the wheel and justify their response for 3 marks. Quite a few gained full marks on the response but a common mistake was to name a thermoplastic which would not be suitable. The plastic needed to be tough and durable but some candidates named acrylic which would not have been a

suitable material. Candidates needed to think of the friction that the wheel would be under and the fact that it needed to potentially be recycled at the end of its life.

Question 4c

The next part to this question was looking at how the underneath of the scooter deck had been designed to provide structural integrity. This 2 mark question was well answered with most identifying that reinforcing gave it rigidity whilst still being flexible during use. This reinforcing also did not increase the weight of the overall deck. Candidates clearly understood how and the reasons for reinforcing structures under pressure.

Question 4d(i)

This short answer question was quite challenging to the majority of candidates. It was clearly identified in the diagram that the question referred to the surface of the padded sleeve and not the padding itself. The most common correct answer was nylon with a few mentioning polythene. Candidates who did not identify the correct material were awarded no mark.

Question 4d(ii)

This was a better scoring 1 mark question with candidates referring to the fact that the material was waterproof. Other responses could include its ability to be printed onto and the ability to resist mildew or bacterial growth. Even if they had scored no marks for the previous section they may have scored on this section.

Question 4d(iii)

In this mathematical question, candidates had to understand that the sleeve thickness needed to be included twice for the full diameter. One mark was awarded for correctly calculating the outer diameter of the sleeve. One mark was awarded for correctly solving the equation to calculate the outer circumference. Then one mark was awarded for correctly calculating the external surface area. If correct working out was used but an error had been carried forward 2 marks could still be awarded.

The diameter of the bar was 30mm and the sleeve material was 2mm making the outer diameter of the sleeve 34mm. The outer circumference of the sleeve was $\pi x 34 = 106.8mm$. Then the external surface area of the sleeve was 106.8 x 480 = 51270.79mm

Question 4e

Many candidates found this question accessible and it required them to describe three physical tests that would be carried out on the scooter once it had been constructed. This saw a lot of candidates gaining the full 6 marks. Most identified that possible tests could include a destruction test on what weight the deck or the actually scooter could stand. Another common answer included testing the grip of the deck and size of the actual scooter with children.

No marks were awarded for those tests which would normally be carried out during development or manufacture of the scooter itself.

Question 4f

This was also a well answered section which saw over ½ the candidates scoring full marks. It asked for justified reasons why the scooter had been designed so that parts could be replaced or changed by the user. This allowed candidates to respond with either the customer wanting to customise their scooter with special parts or the opportunity to replace parts that became worn

or broken. Answers included the fact people would have the product for longer due to being able to repair it and therefore see value in the brand.

Question 5a

This question was a clear differentiator in the paper, with only a few candidates achieving full mark responses and the majority ranging between 2 and 4 marks. Quite a few misread the question and therefore scored no marks due to incorrect answers.

Where candidates had been more successful, they had included environmental concerns, changes in legislation, technology being updated and changes in fashion/trends. The most common focus was the latter two answers which often related to mobile phone developments. A few touched on environmental and a product developed due to a need like the development of the wind up radio.

Question 5b

The final levelled response question was quite challenging for the majority of candidates. The wording of the question should have led the candidates to discuss ways in which designers could use experts in specific subject areas to support decision making in product design. Answers needed to include information about specialists having up to date knowledge and information on standards, legislation, regulations etc. They needed to explain how this information from experts would be used to help in the impact on the decision making process. Examples could include Environmentalists / Scientists who could give input regarding life cycle assessment, suitability of material choice and what impact the product might have on the environment during use. Another example could of included engineers advising on structural problems that arise during a products development.

A larger than expected proportion of candidates scored 0 whilst those achieving a mark in the 6-8 band (level 3) were lower than anticipated. Most candidates only achieved a level 1 response.

A common mistake from candidates was that they chose to discuss experts who would be involved in evaluating or testing the final product once it was manufactured. Also they often did not include examples of specific experts. A small minority of candidates did not attempt this part of the question at all.

H004/05/06 - 02/03 Product Development

General Comments

In the first series of the newly reformed AS Level NEA we were pleased to receive, view and moderate some extremely good examples of iterative design in the development of a product, across all three endorsed titles.

Centres should be aware that electronic portfolios are now a **mandatory requirement** with A3 style paper portfolios no longer being acceptable. In essence the majority of centres either sent work via USB drive or uploaded to the repository. Both of these work well with PowerPoint utilised to very good effect, but not being the only permissible method.

Excessive file sizes can however be a problem. Complex presentations that take a long time to load are counterproductive.

Whilst interactive dialogue is a vital component there is absolutely no requirement for a presentation to have upwards of 15/20 videos embedded. We would not expect a centre to have more than ten and it can be counterproductive to have numerous videos on a single slide of a presentation. They should always be compressed and short snappy videos are often enough to demonstrate testing or opinion.

Many centres provided a separate folder containing ‘clearly labelled’ videos, enabling most moderators to view all video files. It is preferable however that this facility is used as a backup, as viewing videos in context during the PowerPoint is a far more valuable exercise.

Centres should be aware that unless work is required for archiving or awarding purposes then it is our intention to return all work at the end of the moderation series.

NEA Forms and Administration

Centres should ensure that moderators receive a Candidate Declaration and Candidate Record Form for each candidate in the sample. Failure to do this will delay moderation whilst the moderator waits for these **mandatory forms** to be submitted.

The CCS160 (Centre Authentication Form) should not be sent in with the sample, it should signed by all teachers involved and retained within the centre as required by JCQ.

Observations on the Candidate Record Forms can be very helpful, particularly in indicating where levels had been met and criteria reached. However, to ensure evidence is not missed and to save time with administration, the locations of the evidence are also required. We recommend candidates complete a reference document to help colleague’s list locations and external moderators identify these locations of evidence for each marking criterion. OCR will be amending the Candidate Record Form for 2019 and supplying a recommended student resource called ‘Identifying Evidence’ to support centres with this.

Candidates often used headings to manage the design process successfully, with simple explanations of what each page contained as well as lessons learnt/next steps as they moved through the iterative process, this is an extremely useful strategy for them to utilise.

Marks must be uploaded by May 15th at the latest. Work must be sent/uploaded within three days of receipt of the sample request email. It remains a frustration following up on work/forms not received in the week following this date and slows the moderation process unnecessarily.

Key Points

The purpose of the moderation process is to ensure that centre assessments are in line with a common national standard. This is achieved by adjusting any centre assessment where the moderation process indicates that this is necessary based on the sample of work viewed. Centres receive a detailed report following moderation which identifies specific areas of the assessment criteria which need attention, where applicable. We strongly recommend that centres use these reports to review and reflect their approaches for the coming year.

For internally assessed components where the assessment contains many sections as in H004/5/6, erring on the side of generosity in the assessment of some areas of assessment can have a significant cumulative effect.

When centres have candidates entered for more than one endorsed title it is essential that they internally moderate across all candidates' portfolios to arrive at a consensus.

As the submission for these components has to be electronic, it makes sense using the interactive forms**,** which correctly totals candidate marks thus avoiding clerical errors.

Strand by strand guidance on H004/5/6 Product Development requirements

This is not an exhaustive list and these comments relate directly to the AS Level Specification which can be found on the OCR website. Chapter 10 NEA Product Development of the OCR A/AS Level Design & Technology text book is particularly informative and is extremely detailed.

This Product Development carries 90 marks.

Strand 1 - Explore

OCR suggests approximately 45 hours for completion of this non-exam assessment. This does not present a limit, but it is important to recognise that if candidates are producing excessive work that becomes irrelevant to the context and brief, or is not concise. The term concise is very important – too many candidates presented numerous slides that were not focussed nor directed at the beginning of the NEA – this is counterproductive and ultimately does not add to the experience they have nor is it within the ethos of the specification.

OCR publishes the Contextual Themes on 1st June. If a candidate did not follow one of these then centres should mark them in MB1 for 'Investigations of the context' and 'Design Brief'. If the candidate has strong work in these areas, but still falls foul of not following a set task they should still not be above MB2 for these two statements.

The use of primary users/stakeholders is fundamental within these endorsed titles. Candidates should continually refer back to and have direct contact with their primary user/stakeholders in their explorations throughout.

A good range/contrast when exploring existing products offers candidates an opportunity to gain valuable insights and further understanding. Involving users/stakeholders in discussions at this stage can also be very useful.

The exploration of materials is best employed within the iterative design process and linked/related directly to the ideas/developments that are taking shape. Standalone slides on a list of generic materials that bear little relevance to the product chosen are of limited value.

There appeared to be some misunderstanding of the technical specification. In essence this should be offer sufficient clarity for commercial manufacture of the intended design solution to a third party so they are able to make a prototype of it themselves. Working drawings and/or lay plans are fundamental to this.

Strand 2 – Create: Design Thinking

OCR overtly encourages creative and innovative product developments that not only demonstrate a progressive (iterative) design process, but also take into consideration the feedback and requirements of primary users and other stakeholders. It may not always be possible for candidates to work with external people, but working with a member of staff or peer who can offer a realistic persona of the stakeholder is really important to offer sufficient feedback and support to the design process.

A wide range and variety of different ideas being presented offers candidates the opportunity to develop their ideas innovatively and with an open mind, in keeping with the iterative philosophy. Stereotypical responses and a limited range of different approaches should be avoided if at all possible.

Strand 3 – Create: Design Communication

Different methods of communication and presentation should be expected and there is no expectation that an idea will begin its iterative journey as a sketch, although many candidates find this helpful. The start point is fluid with sketch modelling and CAD being examples of well used techniques during the current series.

It is essential that for all evidence to be fully considered through moderation that centres are following the submission guidelines set out in the specification; that file sizes are compacted wherever possible; and all videos and audio files are tested to make sure they are accessible from external devices.

The real time capture of findings and decision making is a crucial element of the NEA.

Strand 4 – Create: Final Prototype(s)

It is important that candidates recognise the different between the design solution they have developed for industrial production and the final prototype(s) they make as the most accurate possible representation of the intended solution as outlined in the technical specification. The final prototype(s) should be able to clearly present the design solution's quality and functionality to a third party stakeholder.

If evidencing the use of hand tools, machinery, digital design and/or digital manufacture throughout the project is absent/limited then centres should be marking in MB1 for 'Use of specialist tools and equipment'. If they have not evidenced one method and the rest of their work is strong then marks should not be credited above MB2 for this statement.

There should be sufficient video and photographic evidence of the final prototype(s) to assess or evaluate its quality, viability and/or success. Moderators must be able to view the final prototype with clarity. The quality of photographs particularly of close up work is important, as is video evidence to confirm functionality and scale.

Moderators should also be able to clearly see evidence to suggest how the product could be viable for the intended market.

Strand 5 - Evaluation

Designing iteratively requires that ongoing analysis and evaluation of ideas/solutions is fundamental to candidate's success. Centres should endeavour to instil a mind-set of continual refinement toward the most appropriate and advanced solution for the market and opportunity being designed for and within the facilities and resources available.

The views from primary users/stakeholders in real time should be evident and/or evaluations of others' opinions in order to inform the next steps/progression of the design process.

Testing and analysis should be rigorous and objective. Evidence of the planning and implementation of this should be clearly presented. User/stakeholder testing when analysing the design solution / final prototype(s) is expected.

Final Points

Candidates should not over-enhance the background of design sheets. The use of Arial 10 point as an absolute minimum should be encouraged for PowerPoint presentations.

The centre and candidate name and number must be on all work that is presented.

A portfolio needs to be numbered or separate chronological index added to aid navigation for internal marking and moderation purposes.

Staff/peers acting in the role of user/stakeholder persona is a useful tactic but this must be clearly articulated and referenced within the portfolio. All work undertaken and decisions taken must be by the candidate.

Acknowledging sources, assistance with a bibliography is very helpful and must be confirmed by every individual candidate on a Candidate Declaration Form.

The overall ethos for this specification is based on 'real time recording' of events as they actually happen. Interactive dialogue involves discussing the selected product/comparative products, iterative development, ongoing analysis/evaluation and testing with others and responding to suggestions made. Evidence of interaction should be recorded in real time with the active

comments of those involved recorded first hand and not retrospectively. The re-typing of genuine first hand comments is totally counterproductive and should be avoided**.**

Reminder

OCR AS Product Development offers three clear endorsed titles:

- Design and Technology: Design Engineering (H004)
- Design and Technology: Fashion and Textiles (H005)
- Design and Technology: Product Design (H006)

It is absolutely imperative that centres fully appreciate and carefully choose the route that best suits the needs and aspirations of their candidates. The endorsed title entered for must be clearly evident in the NEA project undertaken.

The brief commentary below is a reminder of the basic premise of each. Products from H006 cannot be entered for H004 for example if not clearly related to engineering. The need for a focussed development of a product is at the very core of this NEA and as such areas such as buildings and architecture are unlikely to offer the same scope to successfully fulfil the criteria of the endorsed routes and should be approached with caution, narrowing down to a very clear product with the context.

Design Engineering (H004) focuses on engineered and electronic products and systems in respect of:

- Function, operation, components and materials
- The selection and uses of the above in commercially viable products and/or systems.

Fashion and Textiles (H005) focuses on a range of different fashion and textiles products, along with their applications and analysis, in respect of:

- Materials, components, process and trends, and their selection and use
- The selection and use of the above in industrial and commercially viable products and practices.

Product Design (H006) focuses on consumer products and applications, and their analysis in respect of:

- Materials, components, process and their selection and uses in products and/or systems
- The selection and use of the above in industrial and commercially viable products and practices.

It is strongly recommended that centres visit www.cpdhub.ocr.org.uk or call the Customer Contact Centre in order to take advantage of the support that can be offered in making informed choices for marking this component.

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