Questions matter

A-level

Design and Technology: Product Design

7552/1 Paper 1

Report on the Examination

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General Comments

All questions in paper 1 were compulsory and responses were recorded in an integrated question and answer booklet. A number of students made use of additional answer booklets in order to expand upon their answer. Where additional pages are used, or where students are using a word processor, it is important to clearly label their responses as many inaccuracies were found with question numbering.

The paper had a total of 120 marks and equated to 30% of the overall qualification.

Low level responses were often found to include generic statements and basic descriptions or observations supported by the stimulus material provided in the questions, whether that be visual stimulus or information drawn from tables.

Students are becoming more familiar with the requirements of specific questions and assessment objectives. Many students still appear to structure their responses as “one mark per point or two marks per point explained’. This strategy, although appropriate for some learners, does often limit the student’s ability to access the top ‘detailed’ mark band as statements like this often fail to illustrate the point made.

As in previous years, it remains clear that students are more familiar with workshop processes than industrial manufacturing processes and procedures.

Students need to be able to identify command words in the question and ensure that they link their response to any provided context. It was observed that many students focus on familiar terms and often do not fully read the focus of the question.

As in previous series, many students unnecessarily write out the question or information provided at the beginning of their response. Centres should encourage students to proceed straight into their response.

Maths specific comments

The maths content was more accessible to learners this year with a significant increase in the number of students attempting to answer the maths questions. The move to split larger tariff questions into smaller parts appears to have supported students.

Students are advised to show their working out when answering the maths questions as this may allow them to access method marks for early calculations where the final answer may be inaccurate.

Students should be clear on the use of formulae, particularly when using diameter and radius values in calculations related to area and circumferences of circles.

They should also be encouraged to lay out their calculations in an ordered and logical manner.

Care should be taken when rounding answers. Inaccurate or early rounding can cause subsequent inaccuracies later in the question.

Question 1

Students were asked to give three reasons why cellulose acetate is used in packaging.

- It was clear that the material was well recognised by students
- References to biodegradability and transparency were the most popular answers.
- Many students suggested generic properties of packaging, such as 'lightweight' and in responses such as this, it was not clear that they were referring explicitly to cellulose acetate.

Question 2

Students were asked to analyse and evaluate the suitability of ABS for the manufacture of a construction worker's helmet.

- It was clear that students were familiar with both the material and the context of the question; this enabled them to respond with confidence when identifying features and providing clear justification and evaluation of the points made.
- Most students focused on the property toughness and successfully linked it to the context, this was closely followed by reference to its ability to be pigmented and this again was well explained.
- Lower-level responses tended to understand the application and context, but often did not use the correct material properties, or the response showed some confusion and lack of clarity particularly between their understanding of toughness and hardness.

Question 3

Students were asked to identify the polymer stock forms for three polymer manufacturing processes.

- Stock forms are becoming much more familiar to students.
- There was good understanding of injection moulding and vacuum forming, with most students referring to polymer granules and polymer sheets.
- Rotational moulding and its use of polymer powder was the least familiar stock form.

Question 4

Students were asked to explain why thermochromatic pigment had been used in a child's forehead thermometer.

- This was a well answered question with the vast majority of students providing a relevant response.
- Lower-level responses tended to focus on the thermochromic aspect of the thermometer and correctly stated that the colour of the thermometer changed in response to a heat input.
- Many students made reference to the thermometer being non-toxic with some good comparisons to more traditional thermometers. Observations such as the thermometer not needing batteries, and the range of colours displayed being easier to interpret than a numerical scale on a glass thermometer, illustrated the familiarity of the context by students.

Questions 5.1 and 5.2

Students were asked to calculate the price of a sheet of plywood using a previous costing and percentage price increase. They were then asked to calculate how many could have been purchased with a given amount of money before the percentage price increase.

- Both elements of the question were found to be accessible, with over half of all students accessing full marks.
- Common errors tended to be with students misunderstanding how to calculate the percentage increase.
- Where students had provided an incorrect answer for 5.1, they often accessed a method mark in 5.2 when using their incorrect value.
- Many students didn't correctly round down their answer for 5.2, not recognising that the final answer should be a complete sheet.

Question 6

Students were asked to describe the process used to create a laser-cut plywood coaster.

- It was clear that all students were familiar with the laser cutter, and most were aware that it could both cut and engrave the pattern shown in the image provided.
- Most students understood that there was a need for a 2-D CAD drawing and that the drawing needed to be exported to the laser cutter. At this point there was a significant variety in the level of depth in students' responses.
- Lower-level responses tended to be very general in nature with the use of incorrect terms, such as 'the design is printed on the coaster', or simply stating that the design is then laser cut.
- The more comprehensive responses outlined appropriate power and speed settings for cut and engrave, could explain how they were often indicated by the line colour on the CAD drawing, with some also showing an understanding of autofocusing and raster and vector graphics.
- It was clear that many students had experienced the process first hand, whereas others may have created a drawing and perhaps a teacher or technician had set up the machines.

Question 7.1

Students were asked to calculate the area of a pattern on a diagram of a coaster.

- An accessible maths question with over half of all students scoring full marks.
- The image on the coaster consisted of a triangle and trapezium. It was clear that the method for calculating the area of the triangle was much more familiar to students than the method needed to calculate the area of the trapezium.
- As with all of the maths questions, students were able to achieve relevant method marks for each of the shapes regardless of whether their final answer was correct.

Question 7.2

Students were asked to calculate the time taken to engrave a shaded part of a coaster and time taken to cut the coaster's circumference.

- Although this question required students to have correctly established the area of the shape in 7.1, there were allowances in the mark scheme that still enabled them to access three out of the four marks (method marks) where they had provided an incorrect answer for 7.1.
- Where there were inaccuracies in the final answer, it was often due to students incorrectly calculating the circumference of a circle, instead using the formula for calculating the area of the shape.
- Students were generally familiar with how to calculate the time taken to engrave and cut elements of the shapes and often achieved the relevant method marks for both of these elements of the question.

Question 8

Students were asked to describe why pewter is often used for casting in a school workshop.

- Although the context was familiar to many, there was a distinction between those students who had experienced the process first hand and those who had been taught the process theoretically or through demonstrations.
- Many students were aware that the material has a lower melting point than other metals commonly cast in schools, but the subsequent justifications and explanations were often quite general and made inaccurate statements such as “students won’t get burnt”.
- The most popular misconception was that pewter is a cheap material, with students perhaps trying to use the school context to identify relevant points.
- Some of the better responses did successfully link the material to the school environment, referencing the speed at which the material cools, making it suitable for short lessons, and also correctly referencing the range of materials that can be used for the manufacture of the moulds.

Question 9

Students were asked to explain why plastazote foam is an appropriate material for the manufacture of an exercise mat.

- Another familiar product and clear product image helped support some excellent responses from students.
- Most students referred to the material being lightweight and flexible, enabling it to be stored and easily transported.
- Fewer students focused on thermal property or the closed cell construction.
- There was often confusion between whether the material was absorbent or impermeable to liquids.

Question 10

Students were asked to compare the use of pop rivets and nuts and bolts for attaching two thin sheets of aluminium.

- It was clear that nuts and bolts were the more familiar joining method and for some students there was confusion between a pop rivet and traditional cold rivet.
- Lower level responses referred to ease of application, and the permanent nature of a pop rivet, with most identifying that nuts and bolts could be fitted and removed or tightened.

- Higher achieving students understood that pop rivets were particularly suitable for installation from one side of the joint, and many provided excellent examples to help illustrate their response.

Question 11

Students were asked to explain the benefits of a manufacturing simulation when making a component on a CNC router.

- This was a challenging question, and it was common for students to focus on either explaining the benefits of a CNC router or on FEA.
- Lower-achieving students tended to refer to it being used to identify issues with the design by making reference to the tool path and the layout of the parts on the available material.
- Higher level responses included some excellent detail about calculating time, checking the order of manufacture of the design, and identifying the correct selection of the cutter.
- Some referred to simulations in other manufacturing processes such as 3D printing. Centres should encourage students to highlight key words and contexts from each question before structuring their response.

Question 12

Students were asked to calculate the diameter of a torch body, having been provided with the volume of the internal battery.

- This was the most challenging of the maths questions and it was clear that students were less familiar with how to manipulate the information given in the question.
- Common errors seen throughout the question tended to be confusion between diameter and radius and students often did not recognise that they needed to factor in the value of the wall thickness on both sides of the torch.
- As with all the maths questions, students can achieve marks for showing the correct methodology and calculation throughout the question and should be encouraged to structure their answer in a clear and logical manner.
- It is good practice not to round answers unless specifically requested to do so in the question (or if a given context requires a whole number from a practical standpoint).

Question 13

Students were asked to analyse and evaluate the method of manufacture used to create the textured surface on two handles.

- Many students found this question challenging and often their response tended to focus on the user interaction of the grip and ergonomic factors instead of the methods of manufacture.
- Lower-level responses tended to refer to the number of stages needed for each of the handles and linked these to time and cost.
- It was clear that students were very familiar with injection moulding, even dual shot manufacture, whereas their knowledge of blow moulding tended to be limited to the fact that it is hollow, with only the most able referring to how the wall thickness related to the grip.

Question 14

Students were asked to describe the techniques a company may use throughout design and manufacture to reduce material waste.

- This was an accessible question and most students confidently provided extended responses.
- Students referred more frequently to techniques that could be used in the manufacturing stages rather than the design stages.
- Lower-achieving students structured their response around the 6 'R's and often referred to reusing and recycling waste.
- It was pleasing to see that this is being delivered effectively in centres as many students referred to moving away from wastage techniques to redistribution methods of manufacture.
- Higher-achieving students provided detailed responses that clearly outline how FEA could be used in the design stage; it was evident that computer modelling is becoming more familiar to students.

Question 15

Students were asked to interpret a pie chart referring to sustainability.

- It was clear that this was an accessible question with a large proportion of students scoring highly.
- Where students didn't access the full mark range, it was common for them to have correctly calculated the total number of people that reduce their consumption and for them to calculate the angle of reduce and reuse.
- Many annotated the pie chart itself and marks were awarded in these cases.

Question 16

Students were asked to state four measured that an employer may consider to ensure that they are meeting the Health and Safety at Work Act (1974).

- Although an accessible question, there was a wide variety of answers that often lacked clarity or were not specific enough to have been worthy of credit.
- The most popular responses referred to the provision of PPE, undertaking risk assessments and providing training to employers.

Question 17

Students were asked to analyse and evaluate two cook book stands, focusing on the materials used and methods of manufacture.

- A familiar format of question which was illustrated by the structure of students' responses.
- It was clear that both cast iron and the sand-casting process were less familiar to students than the timbers and CNC manufacture of figure 11.
- It was common for students to focus on density of the cast iron and most linked this appropriately to the context, but there was much confusion about the material rusting and the material not melting in the heat of a kitchen.

- Higher level responses explained the limitations of the sand-casting process, and many understood the rough surface that would be produced and suitability for batch production.
- When referring to figure 11, popular responses focused on the ability of MDF to have a surface finish and referred to how moisture or liquids may affect both the beech and MDF.
- When commenting on the method of manufacture responses were less detailed with most just referring to the speed and accuracy of CNC routing.
- As in previous series with this style of question, the successful students had engaged with all the requirements of the question and ensured that their response covered all materials provided in the images and table of data.

Question 18

Students were asked to discuss the implications to a company of rebranding.

- Although one of the higher tariff questions in the paper, this was well answered by students and the familiar context clearly helped support their responses.
- Lower-level responses were fairly general and referred to a company needing a new logo, people not recognising the company and linking it to cost and sales.
- Higher achieving students produced extensive responses that identified a wide range of factors. These were often backed up by clear exemplification and illustration.
- It was noted that many students tended to see the process as more negative than positive.

Questions 19.1, 19.2 and 19.3

Students were asked to identify a material property from a graphical image.

- These questions were well answered, with almost all students providing responses.
- The material property ‘Hardness’ was the most well known, followed by ‘Toughness’ and then ‘Tensile strength’.
- Many students confused ‘Tensile strength’ with ‘Elasticity’.

Question 20

Students were asked to explain why screen printing was suitable for a low volume production run.

- Printing processes remain a less familiar area of the specification, with the majority of students having only a basic level of knowledge and understanding.
- Lower-level responses tended to focus on the low set up cost and the manual nature of the process, linking this to the low volume of production.
- Higher-level responses were often very detailed, referring to the individual-coloured screens and how this impacted the speed of production.

Question 21

Students were asked to explain the factors that should be considered before forming a curved piece of timber by steam bending.

- It was encouraging to see how well this question was answered by many students, with it clearly being a process that is being well covered in centres.
- Low level responses tended to be based around the suitability of the material, size, grain structure and how the cross section may impact the process.
- Students awarded the higher marks provided detailed responses about how the structure affects absorbency and how the bend would need a jig, clamps and a period of time to dry, with many identifying the fact that there would be a degree of shrinkage,
- There did seem to be some confusion about steam bending of manufactured boards.

Mark Ranges and Award of Grades

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