A-LEVEL

# DESIGN AND TECHNOLOGY: PRODUCT DESIGN

7552/1 Paper 1

Report on the Examination

7552/1

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## General Comments

This examination series sees a return to normal examination arrangements and no advance information or formula booklets were provided.

All questions were compulsory for all students 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(s). Where additional pages are used, or where students are using a word processor, it is important to clearly label their responses.

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.

As students become more familiar with the style of the extended response questions and use of level of response mark schemes, the quality of their written responses is improving. It is worth highlighting however, that many students still appear to structure their responses to these questions 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 mark band.

It remains clear that students are more familiar with workshop processes than industrial manufacturing processes and procedures.

Students need to be able to successfully identify command words in the question and ensure that they link their response to any provided context.

## Maths specific comments

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. In addition to the formulae, there is an expectation that students will be familiar with dimensioning conventions as found in working drawings.

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

Care should be taken to identify in the question if a specific number of decimal places are required, or if there is a requirement to show all of their workings.

**Question 1**

Students were asked to state an appropriate wood joint for two joints labelled on an illustration of a drawer.

- It was clear that students had limited practical experience of these construction techniques.
- Dowel, finger and housing joint were the most popular answers and few students provided the same response for Joint A and Joint B.
- Many students suggested inappropriate joints, with Mortice and Tenon and glue or screws being the most frequent incorrect response.

**Question 2.1**

Students were asked to describe how a piezo electric material functions.

- This question examined knowledge and understanding of one of the less well-known smart materials, but it was clear that it is being covered in centres.
- The majority of students who answered the question correctly understood that, when compressed or deformed, piezo electric materials created a small electrical charge.
- Fewer students had sufficient understanding to describe how the material behaves when exposed to an electrical current.
- Common inaccuracies tended to refer to the material changing colour or being an insulator.

**Question 2.2**

Students were asked to give a specific example of where a piezo electric material may be used.

- Most students attempted this question: car airbags, musical cards and some kind of product with a source of ignition were the most popular responses as suggested in the indicative content.
- There were lots of non-specific answers where students had suggested an application such as an ‘electronic product’ which was not deemed specific enough.

**Question 3**

Students were asked to calculate the volume of a given component using the dimensions given in a working drawing.

- The maths skills covered in this question were of low demand and made the question accessible for most students.
- Where students had not accessed all of the available marks, many picked up marks for correctly establishing the volume of the various elements.
- The most common error came from students not interpreting the orthographic drawing correctly causing inaccuracies in the calculation of the volume of the corner of the component.
- As in previous series there were a significant number of students who were not clear on the difference between a diameter and a radius.

**Question 4**

Students were asked to compare the suitability of ABS and PLA for the manufacture of a 3D printed component.

- It was clear that students were familiar with both the materials and the context of the question. Some top band responses were exceptional, providing detailed information about the 3D printing context such as heated build plates, shrinkage and the need for extraction.
- Most students focused on the biodegradable nature of PLA vs the oil-based polymer ABS; fewer however managed to link these properties to the 3D printing context.
- Lower-level responses tended to simply describe the properties of the polymers without drawing any comparison between the two.
- Often students confused the properties of the polymers, referring to ABS as having a lower melting point than PLA, or PLA being tougher than ABS. Many also thought that ABS was a thermosetting polymer.

**Question 5**

Students were asked to explain why HIPS was an appropriate material for the manufacture of a protractor.

- This was a well answered question, with the vast majority of students providing a relevant answer.
- Most students focused on the optical property of the HIPS and successfully linked this to being able to see the diagram etc through the protractor. Other common answers referred to it being hard and shatterproof. Higher-level responses included reference to rigidity and level of production.
- Many students were able to suggest broad applications for the protractor, but unable to link these correctly to the HIPS physical and working properties; instead, being guided by their first-hand experience of use of the product.

**Question 6.1, 6.2 & 6.3**

Students were asked to calculate the distance of a support bar, the angle of an A-frame and the distance between the legs of the A-frame using a range of data provided in a given dimensioned drawing.

- It was clear that the use of Pythagoras is a more challenging maths skill to apply, although many students successfully established the length of the support bar accurately whilst clearly laying out their efficient methodology.
- There were two possible routes students could take when interpreting the diagram for **6.1**, with some students identifying the location of the support bar at 600mm vertically from the apex of easel, and others 600mm along the hypotenuse of the easel. Both methods, if calculated correctly, were equally rewarded.
- Common errors resulted from incorrect Pythagoras equations being used, or more commonly, students not identifying the right-angled triangle and as a result using the incorrect angle in their equation.
- Parts **6.2** and **6.3** continued to require students to rearrange the equations and use subsequent data to calculate new lengths and distances. Those confident in the application of Pythagoras equations completed each of the tasks accurately. As with part one, errors tended to be with incorrect data being used.

- 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 also good practice not to round answers unless specifically requested to do so in the question.

**Question 7**

Students were asked to analyse and evaluate the suitability of rotational moulding for the manufacture of a child's art easel.

- It was clear that many students were very familiar with the polymer redistribution process in rotational moulding.
- High level responses included a wide range of appropriate features of rotational moulding that were both directly linked to the easel context and included perceptive evaluative comments.
- The most common answers made reference to the hollow, lightweight nature of rotational moulding with better responses referring to the wall thickness achievable.
- Many students referred to pigmentation, but often this was a descriptive statement and not linked to the easel context.

**Question 8**

Students were asked to describe how a designer would interpret the results from an FEA diagram of a bracket provided.

- This was a familiar form of computer modelling and many students were able to describe in a huge amount of detail the role of FEA, with those top band responses outlining how a designer may adjust the design, reinforce the bracket or simulate the test using alternative materials.
- Low level responses tended to be able to describe FEA, with most understanding that it was a simulation of how a component would react to a force being applied.

**Question 9**

Students were asked to discuss the advantages and disadvantages surrounding the use of software updates in order to maintain electronic products.

- A well answered question with a context that was clearly familiar to most students. High level responses referred to a wide range of relevant points that were often presented in detail and illustrated using first hand examples.
- Common advantages referred to developments in functionality and security of devices, with common disadvantages referring to lack of storage, downtime and forced obsolescence.
- It was not uncommon for some students to focus on the software update element of the question and not relate it to an electronic product. This tended to limit their ability to reach the middle or upper mark bands.

**Question 10**

Students were asked to explain why teak is an appropriate material for the manufacture of a sun lounger.

- A familiar type of question which was illustrated by the structure of student responses.
- Teak appeared to be a familiar timber to most students and many correctly referred to its natural oils and linked that successfully to the sun lounger context.
- High level responses made reference to the grain structure and hardness of the material.
- Low level responses included some inaccuracies and often made quite general statements about strength and weight.
- As with other knowledge and understanding questions, many students continue to use technical terms or material properties inaccurately. This was commonly seen when referring to properties such as tough, hard and durable.

**Question 11**

Students were asked to calculate the volume of a hemisphere and subsequently correctly order a range of hardness specimens.

- Students were provided with the formula for a sphere. Most successfully used the formula to establish the volume of a sphere and realise that only half of the sphere was indented into the test specimen.
- Common errors tended to be with students taking the diameter measurement from the figure and not correctly establishing the radius value.
- The last part of the question examined students' understanding of material hardness. The order of specimen hardness was often found to be in the wrong order.
- Students who had incorrectly calculated the volume of the sphere were still able to achieve a mark using their calculated indentation value.

**Question 12**

Students were asked to describe how the critical assessment of an existing product could influence the work of designers and manufacturers.

- Although often referred to as product analysis, students were clear about the activity of critical assessment and understood how it influences the work of designers and manufacturers.
- Most students referred to the identification of strengths and weaknesses and tended to make reference to redesigning the product based on feedback.
- Higher level responses also made reference to information about the use of materials or investigation into manufacturing techniques and how this could influence the manufacturer as well as the design.

**Question 13**

Students were asked to explain why anodising would be an appropriate finish for an aluminium torch.

- Another familiar product helped support some excellent responses from students.

- High level responses were directly related to the torch context and made reference to protection from corrosion and pigmentation, and also understood that the finish would add minimal thickness to the torch body therefore not affecting the knurled features.
- Low level responses tended to make limited reference to protection and aesthetics and often made general statements about wear and tear.

**Question 14**

Students were asked to explain why three paper and board finishing techniques had been used on three different products.

- Paper and boards remain a less familiar area of the specification, with the majority of students having a basic level of knowledge and understanding, but with few able to provide detailed explanations of any of the three finishing techniques.
- Embossing was the most familiar finishing technique with most understanding that it produced a raised pattern.
- Foil blocking and spot varnishing were less well known, with many responses simply drawing observations from the images provided.

**Question 15**

Students were asked to state two reasons why a low carbon component may be case hardened.

- Many students were familiar with case hardening and understood that the process applied specifically to the outer surface of the component.
- It was also common to see reference to an increase in carbon content improving the components' resistance to wear and corrosion.
- Few students made reference to the ability to maintain a tougher core to the component.

**Question 16.1**

Students were asked to state the material classification of gold.

- A well answered question by the majority of students.

**Question 16.2**

Students were asked to describe two physical properties of gold.

- Although properties of materials are clearly being delivered effectively in centres, few students understood the differences between physical properties and working properties.
- Many responses referred to mechanical properties that were often applicable to gold, but were incorrect in this instance.

**Question 17**

Students were asked to provide three reasons why a gel coat would be used when laminating a GRP product.

- Where students were familiar the use of a gel coat they often provided detailed reasons for its use. The most popular responses tended to refer to its use to provide a smooth surface that could be pigmented, and its hardness and associated benefits. Some of the better responses also referred to its role in the moulding process.
- Where students failed to have enough specific knowledge, they often provided reasons such as aesthetics and protection.
- It was common to see students confuse the gel coat with the polyester resin used to bond the fibres.

**Question 18**

Students were asked to analyse and evaluate the impact that 'open design' had had on traditional product development.

- The vast majority of students were familiar with the concept of open design which enabled them to respond in a good level of detail to this higher tariff question.
- Higher level responses provided both analysis and evaluation of a range of factors including the ability to share and develop designs freely, with a good level of detail about the benefits and opportunities for product development that open design provides.
- Many students had detailed understanding of the related copyright and IP issues, and this often enabled them to access the top mark band.
- Lower level responses tended to be limited to an awareness of the sharing of designs for the greater good and were very much descriptive in nature.

**Question 19.1**

Students were asked to calculate the width of a series of planks from a cross section image of a log.

- Many students found it challenging to identify the correct methodology for successfully calculating the answer, with a variety of responses evident.
- The key dimension of the diameter of the log was often missed, but where students had identified the correct method for calculating the length, they did so successfully for both 'Plank A' and 'Plank D'.
- Where students had not provided evidence of their calculation method, they were unable to be awarded marks, as many had tried to estimate the length of the plank based on other available information.
- It is good practice for students to show their working in all maths questions, but working **must** be shown when asked for in the stem of the question.

**Question 19.2**

Students were asked to subsequently calculate the percentage of timber that could be converted into planks from the tree trunk.

- Students' calculation from 19.1 were needed to successfully calculate this question, although they were able to access three out of the four marks without having accurate answers for 19.1.
- Students were more confident and successful in calculating area and converting a value into a percentage.

- It was not uncommon to see students confuse diameter and radius which often caused them to calculate the total area of the cross section. It was also not uncommon to see students only calculate the planks from one half of the trunk.

**Question 20**

Students were asked to explain why a manufacturer may choose to use a vertical in-house production system.

- It was clear that modern industrial and commercial practice models remain an area of the specification where students are less confident.
- Many students' responses featured elements that were correct, but many simply listed all they knew about scales of production.
- High level responses were well structured and logical, clearly outlining the manufacturing model and providing detailed understanding of its advantages to the company. It was common to see reference to the manufacturer being responsible for the supply of all components and how this impacts areas such as costing, supply and quality control.
- Lower level responses tended to focus on supply benefits, but often showed some confusion with the just in time model.
- Where students had failed to access any of the marks, their response often suggested that vertical in-house manufacture was in a tall factory that took up little space.

**Question 21**

Students were asked how a manufacturer of children's toys would ensure that their product is safe for the consumer.

- Students were familiar with the context, with some excellent responses being seen. Along with observations about the shape and surface finish of the toys, many students provided detailed answers and outlined a wide range of testing that may occur.
- The most common safety testing suggested was related to small parts testing to prevent choking, but also reference to flammability and toxicity were regularly seen. In addition to this, higher level responses also included specific standards that should be adhered to and labelling and guidance that should be provided for consumers.
- Lower level responses tended to focus on 'no sharp edges' and the use of 'non-toxic' materials.

**Question 22**

Students were asked to name a specific application for a series of composites.

- This question was well answered, with most students being familiar with the composites named. Fibre Cement was the least well known.
- Most students provided specific applications, although when not totally confident on the material, general responses such as 'construction' were often seen.

**Question 23**

Students were asked to describe the stages required to produce a vacuum formed polymer product.

- It was clear from the level of detail provided and fluency of the descriptions, that vacuum forming is a well taught process, with many students referring to their first-hand experience of the process.
- High level responses gave detailed descriptions of each stage in the process from mould manufacture through to the completion of the vacuum formed product. Excellent detail was often shown including reference to tapered sides on the mould, through to the polymer sheet needing to be tightly clamped before heating.
- Lower level responses often missed out important stages or presented the stages in an incorrect order.

**Mark Ranges and Award of Grades**

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