



## **General Certificate of Education**

# **Design and Technology: Product Design (3-D Design) 1551**

PROD1 Materials, Components and Application

## **Report on the Examination**

*2009 examination – January series*

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## **General:**

In this first examination for the new Product Design (3-D Design) Specification, after only one term of study, a small entry of 1182 candidates performed satisfactorily with a mean mark of 40. The majority of candidates were able to complete the paper and the overall level of demand seems to have been as expected.

## **Section A**

### **Question 1**

- (a) (i) and (ii) A number of candidates found this question challenging giving mechanical properties of polymers such as tensile strength or references to cost, rather than the ease of calendering to form the film required and ease of recycling.
- (b) (i) and (ii) Most candidates did well with this question with the majority understanding the function of bio-batch additives and being able to identify at least one disadvantage.

### **Question 2**

- (a) (i) and (ii) This part was well answered, with most candidates correctly naming a timber based composite and able to give at least one advantage.
- (b) (i) and (ii) This question posed some difficulties with many candidates giving standard polymers rather than polymer composites. Where glass reinforced plastic or carbon fibre reinforced plastic was given in part (i), many candidates stated that these materials give good impact resistance rather than referring their ability to be formed or their lightness and resulting speed/fuel saving.

### **Question 3**

- (a) This was very well answered with some good definitions of ferrous and non-ferrous metals being given.
- (b) Many candidates found this difficult and simply gave two different types of metal such as cast iron or aluminium rather than stock forms.
- (c) (i), (ii) and (iii) This was very well answered. A popular response for part (ii) being stainless steel being used in cutlery and then appropriate reasons for its use in part (iii).

#### Question 4

This question was the more popular of the two optional questions with 630 candidates attempting it, compared to 552 attempting question 5.

- (a) Almost 36% of candidates were able to give relevant properties for HDPE used in tool handles and therefore scored full marks in this part.
- (b) Candidates tended to miss the point with this question. Many referred to generic properties of timber rather than sustainability issues associated with FSC certified timber. This resulted in 49% of candidates gaining no marks for this question part.
- (c) This part was quite well answered with 28% of candidates gaining full marks as they made good reference to functional aspects or manufacturing of food packaging and card.
- (d) There were some good answers for this question with 24% of candidates gaining full marks with relevant properties of polypropylene sheet and linking them to the product function or manufacture.
- (e) This was difficult for many candidates. A large proportion discussed bone replacements rather than bone fixings and, therefore, the explanations tended to be confused. Reasons for use tended to be rather vague or obvious and missed the point; that is SMAs contract in response to heat which when in the body would pull fractures together. As a result, only 7.8% of candidates were awarded full marks.

#### Question 5

This was a less popular question with candidates, perhaps suggesting that they were less confident with a question dealing with metals and forming metals.

- (a) This was well answered with 93% of candidates who attempted question 5, correctly giving a suitable metal for the toaster.
- (b) Responses to this part were mixed. Some candidates made good use of relevant properties linked to the function or manufacture of the toaster, whilst others gave very weak responses with irrelevant properties such as 'stainless steel is lightweight' or vague terms such as 'shiny'. 22% of candidates gained full marks and a similar percentage gained at least half marks.
- (c) Candidates struggled with this part. Only a small number were able to correctly and fully describe an appropriate manufacturing process such as piecing and blanking followed by press forming. Only 6% of candidates gained a mark of 5 or over.
- (d) This part was quite well answered with almost 27% of candidates gaining full marks. Candidates were clearly knowledgeable about the relevant properties of thermosets.

## Question 6

On the whole, this compulsory question was answered satisfactorily with standard materials and components questions at the start allowing a comfortable lead in for most candidates, whilst parts (c) and (d) provided differentiation. This enabled the best candidates to demonstrate the breadth of their subject knowledge.

- (a) (i) 64% of candidates were able to give an appropriate polymer for the toothbrush and the mark scheme allowed for a wide range of possibilities. Marks were not awarded for polymers that are known to have toxicity issues or for those more obviously suited to other purposes such as thermosets.
- (ii) Candidates gained good marks in this section where they linked relevant properties to the function or manufacture of the toothbrush. 43% gained full marks for this part.
- (iii) A very small number of candidates correctly named TPE. The majority simply gave an alternative polymer but if this was suitable, it was given credit. 30% of candidates gave an unsuitable polymer such as 'rubber', 'PVC' or thermosets such as urea formaldehyde.
- (v) Diagrams for injection moulding were varied in quality with some missing major components. Many candidates used incorrect terminology when labelling diagrams or in their written description of the process. 17% of candidates gained 4 marks and only 4% gained the full 6 marks. Some candidates gave incorrect processes such as compression moulding or extrusion blow moulding.
- (b) This was quite well answered with 33% of candidates gaining full marks. Most candidates were able to give at least one or two relevant safety features. Some confused ergonomic issues with safety.
- (c) Responses to this part were very mixed. Most candidates stated the obvious ergonomic points about the position of the wheels on the handle and how this would affect grip, and the size of the head of the brush being suitable for children. Only a very small number of candidates were able to discuss the more subtle aspects such as flex in the neck of the brush, smaller and softer bristles and the use of textures on the handles. The majority of candidates gained around half marks for this part.
- (d) At the top end, there were some excellent answers with some novel uses of smart materials such as thermochromic pigments revealing a pattern or colour indicating the desired brushing time has elapsed or the use of polymorph or SMAs to customise the handle shape to the user. Again, the majority of candidates gained around half marks.

### ***Mark Ranges and Award of Grades***

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