DESIGN AND TECHNOLOGY

Paper 6043/12
Product Design

Key messages

Many candidate responses demonstrated a good understanding of the design context, with a high degree of creativity and excellent technical knowledge.

Candidates should be encouraged to thoroughly read the question to ensure that they avoid repeating points given in the question in their answers.

The benefits of using accurately measured drawings for **part (e)** needs to be carefully considered in terms of the time taken. Many candidates achieved high marks for this part of the paper by using just freehand sketches and notes.

In some cases, the responses to individual questions appeared to be disconnected. For example, the materials named in **part (f)** and the manufacturing method described in **part (g)**, were not evident in the solution proposed in **part (e)**.

General comments

Creativity and materials knowledge was clearly demonstrated through freehand sketching with annotations.

Some candidates were unable to clearly express their thoughts in the written parts of the paper and may benefit from working on past papers to improve their writing skills.

Comments on specific questions

Question 1

(a) Most candidates were able to list four additional points about the function of the desktop stand that they considered to be important. Commonly seen responses related to stability, how the mobile phone would be mounted, whether the screen would be visible or whether the mobile phone could be charged whilst it was in the stand. Candidates should be advised against repeating points that are given in the question or giving generic points that might apply to almost any product.

(b) Most candidates used sketches and notes to good effect to show two methods of supporting an object an angle. Many candidates showed angled surfaces, such as a block of wood that the mobile phone could be propped up against or structures, such as a metal frame, that supported the mobile phone at an angle. Some candidates used different sized slots, sometimes in the surface of the desk, that the mobile phone could be placed in.

(c) Freehand sketches, with annotations and colour, were commonly seen methods used to show design ideas. Whilst a wide range of appropriate design ideas were seen, in some cases the solutions did not fully meet the requirements of the question with features, such as the method of folding flat either unclear or not considered at all. It is important that all design ideas fully meet the design requirements if candidates are to access the full range of marks.

A small number of candidates produced less than three design ideas and were awarded marks accordingly.

(d) Candidates were able to clearly demonstrate an understanding of the positive and negative features of their design proposals. Commonly seen answers focused on the functions of the stand, such as its stability or folding mechanism, or how securely the mobile phone would be held in position. It is important that candidates justify their evaluations, rather than making broad statements, if they are to access the full range of marks. Almost all candidates were able to choose one idea and justify their choice.

(e) A variety of methods were used to show the full solution to the design problem. These included orthographic drawings, exploded views, isometric views and materials lists. The best responses included drawings with sufficient information for a skilled person to make the product. Candidates should be advised against redrawing the design idea presented in **part (c)** and focus on the construction details, dimensions and finishes. Many high scoring candidates showed a design made from acrylic sheet that was then cut and folded to shape. In most responses, these candidates produced a three-dimensional view of the stand and a two-dimensional drawing of the development (net). Weaker responses often did not include construction details or important dimensions.

(f) Most candidates were able to name two specific materials that would be used to make their design proposal and give reasons for their choices. Aluminium, acrylic and pine were commonly seen materials, with reasons usually referring to the working properties or aesthetic qualities of the material. Candidates should be advised against giving generic names of materials such as wood, or generic reasons, such as easy to work with, as these are not awarded marks.

(g) Most candidates were able to identify and outline a method used to manufacture one part of their design. The use of a strip heater for line bending acrylic sheet was a commonly seen response. If candidates are to access the full range of marks, it is important that the method is appropriate, and the correct names of tools and equipment are used. Generic names, such as a heater, are not awarded marks. The most successful responses used a combination of sketches and notes to outline a method of manufacture. In a small number of cases, candidates outlined inappropriate manufacturing methods, such as cutting MDF with an angle grinder.

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Paper 6043/02
School Based Assessment

Key messages

- In Assessment Criterion 1, Identification of a need or opportunity with a brief analysis leading to a Design Brief, candidates would benefit from looking at the needs and expectations of the selected user group in more detail. It would be useful to consider the type of environment in which the designed product will be used and highlight key issues.
- In Assessment Criterion 2, Research into the Design Brief resulting in a Specification, an analysis of existing products should help to identify strengths and weaknesses that could be considered during the initial design stage.
- Centres are reminded that practical outcomes and three-dimensional prototype models should not be forwarded with the sample for moderation.

General comments

Centres continue to prepare candidates well for the Project.

Most centres applied marks consistently and accurately. Assessment Criterion 1, Identification of a need or opportunity with a brief analysis leading to a Design Brief, Assessment Criterion 4, Development of the proposed solution and Assessment Criterion 7, Testing and evaluation, tended to be marked slightly generously by some centres.

The choices of projects were generally realistic and appropriate to the demands of the assessment criteria. For some centres, future submissions would benefit from candidates dividing their work into titled sections that follow each of the seven assessment objectives.

Some project folders were very bulky. Paper, printing, and postage costs could be significantly reduced by limiting font size to 12 or 14 and making sure that each A3 sheet is filled with relevant information.

For new centres, or teachers new to the specification, guidance for assessing coursework and other very useful support for 6043 can be found on the Cambridge Assessment International Education website.

Comments on specific sections

1

Identification of a need or opportunity with a brief analysis leading to a design brief

- Many candidates used questionnaires to gain information on the needs of the user. Some questionnaires were limited in scope. Candidates would benefit from looking at the needs and expectations of the selected user group in more detail. It would be useful to consider the type of environment in which the designed product will be used, to highlight key issues.

2

Research into the design brief resulting in a specification

Most candidates researched existing products in this section. The research should analyse the existing products in more detail to identify strengths and weaknesses that could be considered during the initial design stage. Candidates should also gather other relevant information and data such as ergonomic or environmental factors and the type, size and shape of items to be used with the product.

Any information about materials or processes must be analysed for suitability for the product being designed and made. Generic text about a range of materials and processes will not gain marks.

Some research presented was too brief, candidates need to explain the information that they have found in more detail. They should make final conclusions from their investigations by explaining what they have found out and what they intend to take forward. This will help to produce a detailed specification for the product to be designed.

For some candidates, specifications were limited and generic. The points need to be focused on the specific brief and justified to direct designing. They are vital in providing check points for evaluation in the designing, developing and testing sections.

3

Generation and exploration of design ideas

There were a number of examples of creative and innovative design work. The quality of presentation was generally good. However, a number of candidates did not produce an appropriate range of possibilities, focussing on a single idea.

To gain a high mark in Assessment Criterion 3 a wide range of imaginative ideas should be considered. Candidates ought to use the specification points to evaluate proposals and explain why one design is better than another. Reasoning and justification is important in deciding upon a proposal to develop further. A number chart or a tick box table to evaluate ideas on its own will not access the middle or high range marks.

4

Development of proposed solution

Some centres were slightly too generous in their assessment of this section. Some candidates made good use of three-dimensional modelling to help visualise the size, shape and proportions of the design proposal.

To access the higher mark ranges candidates should show evidence of trialling and experimentation, to make informed decisions about the materials, construction possibilities and finishes for the product they wish to make.

5

Planning for production

This section was assessed accurately by the majority of centres. Most candidates produced a clear dimensioned working drawing and a detailed plan of the stages for manufacture.

This plan should include an effective sequence of operations and should state what they intend to do rather than a retrospective diary, which was evident in some folders.

6

Product realisation

Wherever possible, candidates fully completed the manufacture of a practical outcome. There were many good quality products presented by candidates, with appropriate manufacturing, assembly and finishes applied.

Photographic evidence of the key stages of manufacture of the product, emphasising key features and the quality of construction was generally excellent.

7

Testing and evaluation

Where possible, candidates carried out some form of testing of their product and produced an evaluation. Some candidates did not have a detailed specification to generate a detailed and meaningful evaluation against the specification. Tick lists with no explanation are not appropriate without additional evaluative comment.

Some candidates did not consider improvements or modifications. It is important that after testing, candidates should identify the main strengths and weaknesses of the product and use sketches and notes to suggest proposals for further improvement or further development.

The focus of the evaluation should be on the success of the outcome and not on the candidate's individual journey through the designing and making process.

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Paper 6043/32
Resistant Materials

Key messages

- Candidates need to read the questions **carefully** before attempting to answer and try to focus on the key elements of each question. The marks allocation given to each question and the space provided to answer the question provides candidates with a clear indication of what is required.
- Candidates need to improve their knowledge and understanding of the practical processes and techniques required to 'work' the resistant materials, wood, metal and plastic. To achieve this, candidates need to be able to 'match' tools and equipment to specific purposes.
- Candidates need to improve their drawing skills. They must try to provide clearly drawn sketches when attempting questions that begin with the statement: *Use sketches and notes to....* In addition, notes should enhance and make clearer what they have drawn and not simply state the obvious.

General comments

Section A

Candidates need an all-round knowledge and understanding to answer all questions successfully in this section. Most candidates did not demonstrate a basic understanding of the processes, tools and equipment required.

Section B

This section always has several questions with large mark allocations requiring a combination of clear and accurate sketches supported by detailed written notes. It is essential that candidates attempt **all** parts of the question to gain access to all possible available marks.

Comments on specific questions

Section A

Question 1

Many candidates stated an appropriate safety precaution for the two processes. The most common correct answers for the pillar drill referred to securing the material to be drilled and the use of eye protection. The use of a mask to prevent dust inhalation was a good answer when using a sanding disk.

Question 2

Most candidates were unable to identify high carbon steel as the material that could be hardened.

Question 3

There were ***some*** excellent answers with candidates showing a clear sketch of a recognisable KD (Knock-Down) fitting. However, many candidates were not familiar with KD (Knock-Down) fittings and provided sketches showing the use of dowels, nails, or screws with an adhesive.

Question 4

(a) Very few candidates named both the claw hammer and the pincers. More candidates identified the claw hammer than the pincers. Some variations such as 'pinchers' was accepted.

(b) Most candidates understood the purpose of the scrap wood positioned below the hammer: to protect the wood from being damaged.

Question 5

(a) and (b) Very few candidates could name the machine vice or the lathe process to produce the 'grip' on the handle of the machine vice. The machine vice is the best method of securing materials when using a drilling machine to drill holes. 'Knurling' is the lathe process used to provide the 'grip' on the handle of the machine vice.

Question 6

(a) Only a few candidates were able to state what the term 'fabricated' meant.

There were *some* excellent answers that included the key phrase, 'to join parts together'.

The bracket was made by joining together three separate parts.

(b) The bracket could be made or 'moulded' using one piece of material. Casting, sand casting and die-casting were the correct answers provided by only a few candidates.

Question 7

Very few candidates provided a practical design for a jig that could be used when bending acrylic sheet. There were ***some*** excellent designs that showed some form of 'stay' joining the fixed and adjustable boards while allowing for adjustment and locking in position. Many designs did not allow for adjustment or locking in position.

Question 8

Most candidates gained marks for correctly identifying the uses for a chinagraph pencil, scroll saw and hand file. Many candidates could not provide a correct use for the buffing machine. The most common incorrect answer referred to the buffing machine being used to bend the acrylic.

Question 9

Most candidates stated correctly that Shape Memory Alloy is a 'smart' material that reacts to temperature.

Question 10

(a)(b) and (c) This question tested the candidates' knowledge and understanding of solid wood and how it 'behaves' when it dries out or is exposed to varying conditions. Only a few candidates appeared to understand that solid wood will shrink when it dries, that this creates 'movement' in the wood and if allowance is not made for this, the wood can warp, twist, 'cup' or split. 'Movement' is a very important practical issue when designing and making products using solid wood.

Section B

Question 11

(a) Many candidates gave at least one property of oak that made it suitable for the stool. The most common properties were durability, attractive appearance and toughness.

(b) Most candidates were not familiar with a sliding bevel or how a sliding bevel could be used when marking out one of the legs.

(c) (i) There were ***some*** excellent sketches showing a through housing joint. However, there were some inaccurate sketches that were unrecognisable and could not be awarded credit. Many candidates showed the joint drawn in the step (which was impractical) rather than in the leg shown in Fig. 11.2.

(ii) Most candidates did not identify the portable power tool as a router.

(iii) Many candidates provided an appropriate safety precaution to be taken when using portable power tools; the most common relating to checking the electrical connections to the tool, no trailing leads and to make sure that the work piece was secured. Although the question stated clearly that the precautions must be 'other than PPE (Personal Protection Equipment)' many candidates described the use of various items of eye and ear protection.

(d) This question was well answered by many candidates. Many candidates drew two dowels in the ends of each leg, stated an appropriate diameter for the dowel and either stated or showed appropriate spacing.

(e) This question was well answered by many candidates Most 'strengthening' solutions showed a 'brace' that could be joined to the legs of the stool, (usually by nails or screws and glue), or a wedge of solid wood inserted between the legs.

(f) (i) Many candidates simply gave a general advantage for applying a finish rather than the specific advantage of an oiled finish over a painted finish. The most common correct answer stated that an oiled finish enabled the natural grain of the wood to be seen. Other correct answers included an oiled finish would be easier to apply or that it would not chip and peel like a painted finish.

(ii) The answers to this question highlighted the need for candidates to read questions carefully.

Most answers simply informed Examiners why glasspaper is used. The question required candidates to give benefits of glasspapering the step '***before'*** it was glued to the legs.

When working with constructions using wood it is good practice to glasspaper the parts before they are assembled because it makes the process more efficient and much easier to carry out.

(g) Many candidates achieved some of the six marks available for this question. Marks were awarded for specific details stated in the question. The purpose of bullet points, especially in questions with high allocations of marks, is to help the candidates to focus on what needs to be recorded. There were ***some*** very good designs showing an appropriate comfortable hand-hold that was fixed to the stool at the required height. However, candidates needed to improve on the constructional details given as these were the weakest part of many answers.

Question 12

(a) Many candidates stated correctly that the use of CAD was more accurate than traditional drawing methods. Fewer candidates provided a second advantage The best answers related to ease of editing, the sharing of CAD files and the facility to transfer files to CNC machines for CAM (Computer Aided Manufacture).

(b) Most candidates achieved at least one mark for providing one benefit of using aluminium for the chassis of the car; the most common answers being that it was lightweight, corrosion resistant and easy to work/bend.

(c) (i) Very few candidates achieved maximum two marks for this question with many achieving only one mark. The most common correct features of the mould were that it must have draft angled sides, rounded edges and a smooth surface.

(ii) Most candidates attempted this question. However, in many cases, answers needed to be more clearly expressed. The reasons why polystyrene needed to be heated to the correct temperature when vacuum forming were that if it was not heated enough it would not form and if it was overheated there was a risk of the plastic melting and stretching.

(iii) Most candidates gained marks for completing at least some of the stages of the flow chart outlining the vacuum forming process.

(d) (i) Many candidates were able to name one hand tool that could be used to cut out the shape of the aluminium chassis. The most appropriate tools were a hacksaw and tinsnips. Use of a guillotine and a piercing saw were also accepted. Many candidates selected hand tools that are used with wood rather than metal, for example, a coping saw and a tenon saw.

(ii) Most candidates recognised that a file could be used to make the cut edges of the aluminium smooth and safe to handle. For a second mark the edges needed to be finished with an abrasive paper such as silicon carbide, ('wet and dry') paper.

(iii) Many candidates stated correctly that the aluminium wheel supports could be bent to shape using a hammer or mallet and gained one mark. For maximum three marks candidates needed to show how the metal would be secured, (in a vice or clamped to a work bench) and use of some sort of former over which the metal could be shaped.

(e) (i) While many candidates named injection moulding correctly as the process used to manufacture the plastic wheel, the majority of candidates named an inappropriate process such as extrusion or blow moulding.

(ii) The majority of candidates achieved at least one mark for showing some form of axle. Subsequent marks were available for showing how the wheel could be fitted to the axle and how it could be allowed to rotate freely. Very often the sketches necessary to show the practical details were unclear or not provided.

Question 13

(a) (i) Most candidates recognised that the reason for removing the corners of the mahogany would make it easier and/or safer to 'turn' the shape.

(ii) There were some excellent answers stating checks that should be carried out before switching on the woodturning lathe. The most common checks included making sure that the mahogany was held securely and that the 'fork centre', (not usually accurately named), was secure. Checks relating to personal safety such as wearing eye protection were not considered to be relevant.

(iii) Many candidates provided a variety of tools and equipment that could be used to check the diameter of the mahogany when it was 'turned'. The most appropriate tools included outside, (external'), calipers, vernier calipers and a digital micrometer.

(iv) Very few candidates were able to name an appropriate lathe tool. The most common correctly named lathe tool was a chisel. Some candidates named a gouge and a scraper which were excellent answers. The use of files was not appropriate.

(b) There were many good answers to this question with candidates describing how scrap wood could be used to prevent damage to the brass tubes when held in an engineer's vice. An alternative answer stating that the vice should not be overtightened was also accepted.

(c) (i) Most candidates understood the purpose of the brass caps. The most common correct answers stated that they made the product more attractive or prevented damage or splitting to the ends of the mahogany.

(ii) Most candidates understood the advantages of using pre-manufactured components and stated at least one advantage over making them in a school workshop. The best answers included that it would save time or that the components would be of a higher quality than those made in a school workshop.

(d) (i) Most candidates named at least one correct marking out tool. There were many marking out tools available from which to choose, including a pencil, steel rule and a try square.

(ii) There were only two acceptable methods by which the mitre could be produced. One method involved the use of a jack or smoothing plane and the second method involved use of a mitre saw.

Most candidates were unable to provide sketches and notes describing either of these methods but concentrated on the inappropriate use of saws, files and chisels that would not produce an accurate mitre.

(e) There were six marks available to candidates for showing a drawer that would fit into the base of the jewellery stand. It was vital that candidates provided good sketches and accurate legible notes. Questions of this type always ask candidates to provide details of 'the constructions and materials used'. Many candidates achieved some of the six marks available, but many denied themselves marks by not addressing the key points of the question.

Many candidates did work out, or attempt to work out, the overall sizes of a drawer that would fit inside the base. Many candidates attempted to show at least some of the constructions, but few gained maximum marks for the question.

(f) Most candidates could not describe how the 1 mm thick brass strip could be cut and shaped to produce a handle that could be attached to the front of the drawer. Candidates needed to have knowledge and understanding of some basic tools, equipment and processes that could be employed to produce the handle made from brass strip.