

DESIGN AND TECHNOLOGY

Paper 0445/12 Product Design

Key messages

Candidates should be encouraged to plan the use of their time wisely so that they complete all parts of the question that they have chosen to answer. A small number of candidates did not complete **parts (f) and (g)** of their chosen question.

Candidates should be encouraged to thoroughly read their chosen question to ensure that they avoid repeating points given in the question in their answers to **part (a)**, and produce design proposals that meet all the design requirements.

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 question using just freehand sketches and notes.

Candidates should be encouraged to view the paper as a holistic design exercise. A small number of candidates built their design proposals around largely pre-prepared answers for **parts (a), (f) and (g)**.

General comments

Question 1 was the most popular question. Very few candidates attempted **Question 3**.

The standard of work was good, with creativity and materials knowledge clearly demonstrated through freehand sketching with annotations.

Some candidates were unable to express their thoughts clearly in the written parts of the paper and may have benefitted from adopting a more structured approach. For example, in **part (d)** candidates may have found it beneficial to use a series of bullet points rather than continuous text.

Comments on specific questions

Question 1

- (a) Most candidates managed to list four additional points about the function of the storage unit that they considered to be important. Commonly seen answers related to the construction, materials, use or location of the storage unit. 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 candidate used sketches and notes to good effect to show two methods of protecting products from the weather. Many candidates showed roof structures, or enclosures with doors, but some candidates interpreted the question as requiring a method of protecting a material, such as varnish.
- (c) Freehand sketches with annotations and colour were the most frequently seen methods used to show design ideas. A wide range of appropriate design ideas were seen, but in some cases the solutions did not fully meet the requirements of the question with features such as the method of removing excess amounts of mud missing. 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 fewer than three design ideas.

- (d) The evaluations of ideas were generally impressive, with candidates able to clearly demonstrate an understanding of the positive and negative features of their design proposals. Commonly seen answers focused on the materials being particularly suitable for the environment or the ease of accessing the boots. It is important that candidates justify their evaluations rather than making broad statements if they are to access the full range of marks.
- (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 strongest 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 should focus on the construction details, including materials, methods of joining the materials and finishes. 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 gave reasons for their choices. Aluminium, acrylic and teak 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 being 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. It is important that candidates include the correct names of tools and equipment to be used in the method of manufacture if they are to access the full range of marks. Generic terms such as a saw are not awarded marks. The most successful responses used a combination of sketches and notes to outline a method of manufacture.

Question 2

- (a) Most candidates managed to list four additional points about the function of the advertising stand that they considered to be important. Commonly seen answers related to the construction, use or location of the advertising stand. Many candidates also considered the fragile nature of eggs in their responses. 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 effectively to show two methods of introducing movement to the advertising stand. Many candidates used electric motors or wind power to add movement to a feature of the advertising stand, but some candidates added wheels so that the advertising stand could be moved. Both interpretations of the question were considered appropriate methods of introducing movement to the advertising stand.
- (c) An impressive range of sketches with annotations were seen for this question. Commonly seen responses included using the outline shape of a chicken for the advertising stand and light emitting diodes to attract attention. It was sometimes unclear how some of these imaginative design ideas would work or if they were suitable for an outdoor environment. It is important that all ideas fully meet the design requirements if candidates are to access the full range of marks. A small number of candidates produced fewer than three ideas.
- (d) The evaluations of the ideas were generally very impressive with candidates able to clearly demonstrate an understanding of the positive and negative features of their design proposals. Candidates often focused on the weather conditions, stating such things as that the stand would blow away in the wind or the materials would not be waterproof. It is important that candidates justify their evaluations rather than making broad statements if they are to access the full range of marks.
- (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. Colour was frequently used to give clarity to drawings. Construction details were often shown quite clearly through the drawing of a development (net) and labels identifying the materials and joining methods. This question specifically asked for construction details and important dimensions but, particularly in weaker responses, these were often not included in the drawings.
- (f) Most candidates were able to name two specific materials that would be used to make their design proposal and gave reasons for their choices. Commonly seen materials were foam board and MDF, with the reasons relating to the weight or structural stability of the material. Candidates

should be advised against giving generic names of materials such as wood, or generic reasons such as being 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 proposal. Cutting out of sheet materials and vacuum forming were commonly seen responses to this question. It is important that candidates include the correct names of tools and equipment to be used in the method of manufacture if they are to access the full range of marks. The most successful responses used a combination of sketches and notes to outline a method of manufacture.

Question 3

- (a) Most candidates managed to list four additional points about the function of the system to release the chickens automatically that they considered to be important. Commonly seen answers related to the construction or use of the system but some candidates focused on the safety of the chickens. Candidates should be advised against repeating points that are given in the question, such as that the system must automatically release the chickens each morning, 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 opening and closing the entrance. Many candidates showed a door that opened on hinges or a hatch that slid up and down. A small number of candidates produced two methods that were very similar or lacked sufficient detail to show how the entrance would open and close.
- (c) An impressive range of imaginative sketches with annotations were seen for this question, but some candidates focused on the entire hen house rather than the system that would automatically release the chickens each morning. It was sometimes unclear how the design ideas would work, with pulleys and motors commonly seen but with little real understanding demonstrated of how they would be combined to create a system to release the chickens. It is important that all design proposals fully meet the design requirements if candidates are to access the full range of marks. A small number of candidates produced fewer than three ideas.
- (d) The evaluations of the ideas were generally impressive with candidates able to clearly demonstrate an understanding of the positive and negative features of their design proposals. Points that focused on the safety of the chickens, especially avoiding them getting trapped, were commonly seen. It is important that candidates justify their evaluations rather than making broad statements, such as that the design would not work well, if they are to access the full range of marks.
- (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. Colour was frequently used to add clarity to the drawings. Most candidates used drawings to show the construction of the individual parts of their design proposal but sometimes omitted to clearly show how these joined together to make a product. This question specifically asked for construction details and important dimensions but, particularly in weaker responses, these were often missing.
- (f) Most candidates were able to name two specific materials that would be used to make their design proposal and gave reasons for their choices. Commonly seen materials were MDF, acrylic and steel with reasons for selection relating to the physical properties of the materials. Candidates should be advised against giving generic names of materials such as wood, or generic reasons such as being 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. Commonly seen answers included the use of a laser cutter or 3D printer. It is important that candidates include the correct names of tools and equipment to be used in the method of manufacture if they are to access the full range of marks. The most successful candidates used a combination of sketches and notes to outline a method of manufacture.

DESIGN AND TECHNOLOGY

Paper 0445/13 Product Design

Key messages

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Candidates should be encouraged to thoroughly read their chosen question to ensure that they avoid repeating points given in the question in their answers to **part (a)** and produce design proposals that meet all the design requirements.

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 question using just freehand sketches and notes.

Candidates should be encouraged to view the paper as a holistic design exercise. A small number of candidates built their design proposals around largely pre-prepared answers for **parts (a), (f) and (g)**.

General comments

Question 1 was the most popular question. Very few candidates attempted **Question 3**.

Candidates responded well to the given design situations and the standard of work was good, with creativity and materials knowledge particularly well demonstrated through freehand sketching with annotations.

Some candidates were unable to express their thoughts clearly in the written parts of the paper and may have benefitted from adopting a more structured approach. For example, in **part (d)** candidates may have found it beneficial to use a series of bullet points rather than continuous text.

Comments on specific questions

Question 1

- (a) Most candidates managed to list four additional points about the function of the portable unit that they considered to be important. Commonly seen answers related to the construction, use or location of the portable unit. 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 candidate used sketches and notes well to show two methods of securing long-handled items. Commonly seen answers involved clips or holes in a shelf but other methods involving magnets and Velcro were seen. The standard of written and visual communication for this question was excellent.
- (c) An impressive range of sketches with annotations was seen for this question. The most common solutions were based on trolleys with wheels and units with handles for lifting, but some more creative solutions were seen. The strongest candidates added detailed annotations to their sketches and used a range of presentation techniques, including exploded views. It is important that all ideas fully meet the design requirements if candidates are to access the full range of marks. A small number of candidates produced fewer than three ideas.

- (d) The evaluations of ideas were generally very impressive with candidates able to clearly demonstrate a good understanding of the positive and negative features of their design proposals. Commonly seen answers referred to making sure the cleaning products were stored safely or ease of accessing the cleaning equipment. It is important that candidates justify their evaluations rather than making general statements, such as stating that it would work well, if they are to access the full range of marks.
- (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 material lists. Colour was commonly used to add clarity to drawings. The most frequently seen drawing methods were isometric sketches with annotations. This question specifically asked for construction details and important dimensions but, particularly in weaker responses, these were often missing.
- (f) Most candidates were able to name two specific materials that would be used in the construction of their design proposal and gave reasons for their choices. Commonly named resistant materials included aluminium, acrylic and mild steel. Candidates should be advised against giving generic names of materials such as wood, or generic reasons such as being easy to work with, as these responses are not awarded marks.
- (g) Most candidates were able to identify and outline a method used to manufacture one part of their design proposal. Fabrication techniques, including welding and joining plywood sheets, were commonly seen methods of manufacture. Some excellent responses were seen but it is important that candidates include the correct names of tools and equipment if they are to access the full range of marks. Most candidates used a combination of sketches and notes to outline a method of manufacture.

Question 2

- (a) Most candidates managed to list four additional points about the function of the display unit that they considered to be important. Commonly seen answers related to the construction, use or location of the display unit. Candidates should be advised against repeating points that are in the question, for example that the display unit must feature a particular type of animal, or giving generic points that might apply to almost any product.
- (b) Most candidate used sketches and notes well to show two methods of holding leaflets. Many candidates showed a freestanding box and a wall mounted tray, but other methods that used clips, magnets or Velcro were seen. Many excellent responses were seen to this question.
- (c) An impressive range of sketches with annotations were seen for this question and colour was generally used well. The annotations often revealed candidates' true understanding of how the design proposal would be constructed. It is important that all ideas fully meet the design requirements if candidates are to access the full range of marks. A small number of candidates produced fewer than three ideas.
- (d) The evaluations of ideas were generally very impressive with candidates able to clearly demonstrate an understanding of the positive and negative aspects of their design proposals. Commonly seen answers focused on stability or the number of leaflets that could be held in the display unit. It is important that candidates justify their evaluations rather than making general statements, such as that it would work well, if they are to access the full range of marks.
- (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. Colour was generally used effectively. Many responses included an isometric sketch and a development (net) with supporting annotation. The question specifically asked for construction details and important dimensions but, particularly in the weaker responses, these were often missing.
- (f) Most candidates were able to name two specific materials that would be used in their design proposal and gave reasons for their choices. Corrugated cardboard and polypropylene sheet were commonly seen materials. Candidates should be advised against giving generic names of materials such as plastic, or generic reasons such as being 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 proposal. The use of CAD equipment and a laser cutter were commonly seen responses to this question. It is important that candidates include the correct names of tools and equipment to be used in the method of manufacture if they are to access the full range of marks. Most candidates used a combination of sketches and notes to outline a method of manufacture.

Question 3

- (a) Most candidates managed to list four additional points about the function of the hand-operated device to collect items that had been accidentally dropped into the enclosure that they considered to be important. Commonly seen answers related to the construction and the needs of the user. Candidates should be advised against repeating points that are given in the question, for example that the device must be hand-operated, or giving generic points that might apply to almost any product.
- (b) Most candidates used sketches and notes effectively to show two methods of grabbing items. Many candidates showed a net, a hook or a device with jaws. The quality of sketches and notes was usually sufficient to show the overall idea but often lacked sufficient detail to show the operating mechanism used for the jaws.
- (c) An impressive range of sketches with annotations was seen for this question. Colour was generally used well. It is important that all ideas fully meet the design requirements if candidates are to access the full range of marks. For example, in some cases candidates did not consider the range of items that might be dropped into the animal enclosure. A small number of candidates produced fewer than three ideas.
- (d) The evaluations of ideas were generally very impressive with candidates able to clearly demonstrate an understanding of the positive and negative aspects of their design proposals. Many responses focused on the fact that the device might damage the item being retrieved. It is important that candidates justify their evaluations rather than making broad statements such as that it is the best design idea if they are to access the full range of marks.
- (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 question specifically asked for construction details and important dimensions but, particularly in the weaker responses, these were often only partly shown.
- (f) Most candidates were able to name two specific materials that would be used in their design proposal and gave reasons for their choices. The most common materials named were plywood and aluminium, with the reasons relating to structural stability and weight. Candidates should be advised against giving generic names of materials such as wood, or generic reasons such as that it is 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 proposal. It is important that candidates include the correct names of tools and equipment to be used in the method of manufacture if they are to access the full range of marks. Most candidates used a combination of sketches and notes to outline a method of manufacture.

DESIGN AND TECHNOLOGY

Paper 0445/02 School Based Assessment
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Key messages

- Most coursework portfolios were well presented but some were not easy to follow. A more structured approach following the assessment criteria is recommended for all candidates.
- To achieve high marks for Assessment Criterion 1, candidates need to look at the needs and expectations of the selected user group in more detail before producing a clear design brief.
- 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 exceptionally well for the project.

The majority of centres applied marks consistently and accurately. Assessment Criterion 3: Generation and exploration of ideas and Assessment Criterion 4: Development of the proposed solution, tended to be marked slightly generously by a number of centres.

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

Comments on specific sections

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

This section was generally assessed accurately but a significant number of candidates made limited or no reference to the needs and expectations of the selected user.

2. Research into the design brief resulting in a specification

The research into the design brief should lead to information and key points to take forward to the design stage. As well as researching the features of existing products, candidates should be encouraged to gather other relevant information and data such as ergonomic or environmental factors, the size and shape of items to be used in or with the product being developed.

Some specifications were full and detailed. Many were very brief and generic giving a limited indication of key aspects required. Specification points needed to be focused on the brief and justified to direct the design stages and to provide check points for evaluation.

3. Generation and exploration of design ideas

There were some examples of very high quality presentations of creative design possibilities. However, a number of centres were generous in their assessment of this section.

To gain a high mark in Assessment Criterion 3, a wide range of ideas should be considered that will answer the design problem. These ideas should be annotated and presented using a range of drawing techniques. The ideas should be analysed against the specification and a final idea selected which can be developed in the following section. This section requires candidates to present their own ideas and not insert images of existing products or the item that they have made. Such evidence should feature in the appropriate assessment criteria strand.

4. Development of proposed solution

This section was generally well covered but some centres were too generous in their assessment. There was clear evidence of many candidates carrying out three-dimensional modelling to help visualize the size, shape and proportions of the design proposal.

With first-hand experience of trialling and experimentation, candidates should be able to make informed decisions about materials, construction possibilities and finishes for the product they wish to make. All decisions need to be communicated in the folder either through notes and/or photographic evidence. This section should conclude with a clear drawing or CAD model of the product that is going to be constructed.

5. Planning for production

This section was assessed accurately by most centres. Most candidates produced a dimensioned working drawing with many including a cutting list and health and safety considerations.

Some candidates did not produce a detailed, logical sequence of the stages of manufacture.

6. Product realisation

Where possible, candidates fully completed the manufacture of a practical outcome and there were many good quality manufactured products presented.

Most candidates used clear photographic evidence during the key stages of manufacture of the product to emphasize particular features and the quality of making.

7. Testing and evaluation

Where possible, candidates carried out a test of their product and produced a brief evaluation. Some candidates produced an outline of evaluation against the original specification but many specifications did not have sufficient detail for this to be helpful. Tick lists with no explanation were not appropriate.

After testing, candidates should identify the strengths and weaknesses of the product, and use sketches and notes to suggest proposals for further improvement or further development.

DESIGN AND TECHNOLOGY

Paper 0445/32 Resistant Materials
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Key messages

- Candidates should be reminded to read the questions carefully and not attempt to answer before they are absolutely clear about what they have been asked to do. Too often, candidates provided answers that did not relate in any way to the questions asked. Candidates should try to focus on the key elements of each question. The mark 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 required to work the resistant materials: wood, metal and plastic. Many candidates named tools or described processes that were totally unsuitable for specific materials.
- Candidates should be advised to focus on their communication 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

Many candidates lacked the all-round knowledge and understanding required to answer all questions in this section.

Section B

This section always has a number of questions with large mark allocations requiring a combination of clear and accurate sketches supported by detailed written notes. Many candidates did not understand how to work the materials.

Comments on specific questions

Section A

Question 1

Most candidates were able to state the possible damage that could occur when clamping two pieces of softwood with a G cramp. The most common correct answers referred to the cramp crushing, marking or denting the surfaces and that this could be prevented by placing scrap wood blocks between the cramp and the softwood blocks.

Question 2

Only stronger candidates answered the question correctly by stating the generic use for each of the tools rather than stating how each of them could be used when making the hardwood stand shown in the figure. Generally, few candidates could state the purpose of the sliding bevel, often referring to it as a measuring tool rather than a marking out tool.

Question 3

Many candidates correctly identified 'hard' as the term to describe steel that contains a high amount of carbon. However, a sizeable number of candidates gave an incorrect answer to this question.

Question 4

Most candidates attempted some form of tee-halving joint but the accuracy and clarity of sketches was extremely varied. Many candidates did not know what a tee-halving joint was and some candidates did not provide an exploded view that was required by the question.

Question 5

Only the strongest candidates gave reasons for the webbing that occurred in the vacuum formed plastic sheets. For sheet **A** the mould was too deep or high. For sheet **B** the moulds were too close together.

Question 6

There were many incorrect answers to this question. Candidates did not appear to understand the difference between the terms 'temporarily' and 'permanently' when considering types of fastening that could be used to join the two pieces of 5 mm thick mild steel strip. Stronger candidates provided correct answers.

Question 7

- (a) Most candidates could not name the correct types of drill bit required to drill different size diameters of hole. Only a very small minority of candidates were able to name suitable types of drill bit for all three holes.
- (b) Few candidates could state a danger that could occur when drilling thin plywood. Very few stated that the plywood could splinter as the drill cut through the material or that the drill could snag, causing the plywood to spin.

Question 8

Very few candidates were able to state the manufacturing processes for both the model car and the guttering, die casting and extrusion respectively. However, some candidates were able to identify one of the manufacturing methods correctly.

Question 9

Only stronger candidates provided accurate drawings of both a rebate and a groove.

Question 10

- (a) Most candidates recognised the process as 'anodising', 'electroplating' or 'electrolysis'.
- (b) The vast majority of candidates gave 'to resist corrosion' correctly as a reason for applying a finish to a product made from metal.

Section B

Question 11

- (a) Many candidates provided two reasons why oak was suitable for the table. There were many misconceptions about oak, including that it was easy to work. Many candidates stated that oak was weather resistant and while this is true, it was totally irrelevant to the table that candidates needed to focus on in the question.
- (b)(i) Only a minority of candidates understood that the reasons for constructing the table top from three boards rather than one board was because 500 mm boards are not available or that they would be too expensive. Some candidates correctly stated that three boards would be more stable and less likely to warp than a single board 500 mm wide.

- (ii) Only stronger candidates explained correctly why the three boards had been arranged as shown in the figure.
- (c) Candidates demonstrated little or no understanding of the ways in which movement in products made from solid wood has to be taken into account.
- (d)(i) The majority of candidates understood that the grooves in the dowel would allow the glue to make a stronger joint, provide more grip or allow air or glue to escape from the hole.
- (ii) The majority of candidates understood that the chamfer allowed the dowel to enter the hole more easily.
- (e)(i) Many candidates named two tools that could be used to mark out the development (net) made from 1 mm thick mild steel sheet. The most common correctly named tools included a scribe, steel rule, (often referred to as a 'ruler') and a try square. However, there were many 'marking knives', 'pencils' and 'marker pens' that were not appropriate when marking out mild steel.
- (ii) Most candidates understood the purpose of a centre punch was that it would prevent a drill from slipping or that it provided a small dent into which the drill would be guided.
- (iii) Only stronger candidates were able to provide accurate technical details showing how the development (net) could be cut out. Many candidates named tools that would be used to cut wood as being appropriate with metal. For example, tenon and coping saws were common incorrect answers.
- (iv) Details relating to the bending of the mild steel sheet to make the jig were generally inaccurate, highlighting gaps in candidates' understanding of working with sheet metal.
- (f) Most candidates could not provide any relevant stages to describe how a laser cutter could be used to cut out the shape of the magazine rack. CAD/CAM is an increasingly important aspect of D&T work and it is essential that candidates are given the opportunity to become conversant with CNC machines including the laser cutter.
- (g) Many candidates gained only one mark for showing how the Ø12 curves could be produced in the acrylic sheet. To access three marks candidates needed to show some type of former, (usually a dowel or metal rod) and a method of heating and softening the acrylic. Most candidates did not show all the details required to achieve three marks.

Question 12

- (a) The majority of candidates provided two benefits of using acrylic for the bathroom storage unit. The most common correct answers included the ability to be shaped easily, the attractive appearance and the range of colours available.
- (b) Many candidates stated at least one important piece of information obtained by modelling the storage unit. The most common correct answers included to check the size/dimensions, the overall appearance and the facility to check for errors and make possible modifications.
- (c) Generally, the performance of candidates answering this question was not strong. The comments made for **Question 11(f)** apply to the performance of candidates answering this question. Candidates were required to describe how CAD and CAM could be used to produce the slots in the acrylic shelves. This gave candidates an opportunity to describe how they could produce the design using CAD then transfer the data of the CAD drawing to an appropriate CNC machine, set it up and cut out the slots.
- (d) Very few candidates provided any benefits of using a scroll saw to cut out the slots. Most answers simply stated that it was accurate. Scroll saws are not easy to use but they can be controlled while keeping the acrylic flat on the saw table. The most common benefit was that a scroll saw had a thin blade which allowed it to cut intricate shapes.
- (e)(i) Many candidates named two hand tools that could be used to produce the shelf. Candidates had a wide range of tools from which they could choose. The most common correctly named tools were specifically named saws and files.

- (ii) Only stronger candidates were able to clearly explain why the acrylic sheet would be heated in an oven rather than using a line bender or strip heater. There were some good answers that stated that the line bender or strip heater only heated a narrow line while the oven heated the entire piece.
- (iii) The best method of holding the acrylic edging against the front edge of the shelf involved the use of male and female formers. Few candidates gave this response. Some candidates were awarded partial credit for attempting to clamp the edging in two directions, a method that had some potential.
- (iv) Most candidates gave a safety precaution that must be taken when using acrylic cement. The most common precautions were the wearing of a mask or gloves and a well-ventilated area in which to work.
- (f) Few candidates provided clear sketches and legibly written notes explaining how their design solution would work. When answering design-type questions that carry a large mark allocation, (6 marks), it is essential that candidates read the question carefully so that they are clear about the main points they have to address. Often, the last sentence in this type of question states: *'Give details of materials and constructions used'*. Where a question has this statement, there will be specific marks awarded for providing this information. Very often candidates did not address the instructions in this statement.

There were some innovative ideas involving the use of bearings and pivots that could have been potentially successful but often candidates were unable to present their ideas clearly enough to be credited. Candidates were rewarded for showing some form of additional base with some method of rotation which was supported with practical details naming the materials used and their construction.

Question 13

- (a) The vast majority of candidates named a suitable hardwood for the adjustable lamp.
- (b) Most candidates provided two items of information that could be obtained by designing a computer-generated model of the adjustable lamp.
- (c) (i) This question proved challenging for many candidates. There were many confusing answers relating to saws and other inappropriately named tools.
 - (ii) Most candidates provided a sketch showing the hardwood held securely in a vice. There were some excellent sketches that showed the hardwood angled slightly so that the waste could be planed off horizontally.
- (d) (i) Many candidates described the use of glasspaper, (often referred to as 'sandpaper') and wiping off the dust as valid stages when preparing the hardwood to take a finish. Marks were also awarded to those answers that related to the use of different grades of glasspaper.
 - (ii) Most candidates named varnish, French or white polish, teak oil and wax as an appropriate clear finish.
 - (iii) Many candidates achieved only one mark for this question by stating that a clear finish allowed the natural colour and grain markings of the hardwood to be seen.
- (e) Many candidates achieved at least one or two marks for showing the threaded rod through the body and tail and tightened by some type of nut. The strongest answers included a hand-tightening method required in the question. Often, the poor quality of sketches and illegible notes made it difficult to interpret the candidates' design solutions.
- (f) (i) Most candidates gained at least one mark for this question. Veneered plywood was not considered to be easier to work.
 - (ii) Only stronger candidates showed completely practical methods of construction of the lampshade. The question highlighted the word 'only' when referring to the 4 mm thickness of the veneered plywood. This should have alerted the candidates to the fact that the plywood was too thin to be

nailed or screwed together and that an alternative method was required. The strongest answers involved the use of additional strips glued to the sides which provided some thickness for nails or screws to be added.

- (g) A minority of candidates provided a practical modification to the lampshade so that the neck could be adjusted. Most candidates did not take into account the fact that a bulb holder and light bulb would be fitted inside the lampshade. Therefore, the majority of solutions showed a slot in the lampshade so that the neck could be inserted. What was required was some form of bracket that could be attached to the underside of the lampshade to which the neck could be joined.

DESIGN AND TECHNOLOGY

Paper 0445/33 Resistant Materials
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Key messages

- Candidates should be reminded to read the questions carefully and not to attempt to answer before they are absolutely clear about what they have been asked to do. Too often, candidates provided answers that did not relate in any way to the questions being asked. The marks allocation given to each question and the space provided to answer the question should provide candidates with a clear indication of what is required.
- Candidates need to improve their basic knowledge and understanding of the materials: wood, metal and plastics and the processes involved in working these materials with appropriate tools and equipment.
- Candidates need to improve their communication 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

Many candidates lacked the all-round knowledge and understanding required to answer all questions in this section.

Section B

This section always has a number of questions with large mark allocations requiring a combination of clear and accurate sketches supported by detailed written notes. Many candidates did not understand how to work the materials.

Comments on specific questions

Section A

Question 1

Only stronger candidates were able to complete a drawing to show how blockboard was constructed. While many candidates gained some marks for showing the top and bottom plies or an arrangement of blocks, some candidates made no attempt at all.

Question 2

Most candidates gave 'composite' as the correct answer. However, there were many incorrect answers to this question.

Question 3

Many candidates did not understand that warping is caused by exposure of wet or green timber to the drying effects when it is placed in warmer conditions. Answers that related to incorrect seasoning or poorly seasoned wood gained credit as did references to poor storage or the wood not being stacked properly.

Question 4

Many candidates showed the digital caliper being used to measure internal and external diameters of tube and rod respectively. Other correct uses included the thickness measurement of materials. A few candidates indicated a correct use for the depth gauge. The most appropriate way to answer this question was to simply add a sketch to each of the jaws of the digital caliper. Many candidates wrote notes rather than providing sketches.

Question 5

Many candidates referred to the accuracy of the surface plate and scribing block, (which was stated in the question), without actually stating why they provided accuracy. The strongest answers referred to the flat surface of the surface plate and the fact that the scriber, fixed in position, provided an accurate marked line. or to the fine adjustments that could be made to the scriber while it was held in the scribing block.

Question 6

- (a) Only a minority of candidates named polyester resin as the substance used with glass reinforced plastic (GRP).
- (b) Many candidates gave at least one advantage of GRP over steel for car bodies. The most common correct answers included its resistance to corrosion and that it was lighter than steel. However, there were many misconceptions about GRP. It is not cheaper to manufacture, nor is it more impact resistant.

Question 7

Very few candidates were able to complete the drawing to show a hasp and staple fitting. Candidates needed to have knowledge of a variety of pre-manufactured components including catches.

Question 8

Only stronger candidates were able to demonstrate an understanding of the steam bending process used to form the hardwood leg. Some candidates gained marks for stating that the wood was placed in a steam chest (often incorrectly named as a 'steam machine' or 'steam oven'), that it involved the wood absorbing steam so that it could be bent and clamped around a former.

Question 9

Most candidates correctly stated that the acrylic would break or snap, (not crack), and that it should be lowered in the vice or supported with scrap wood. Many candidates correctly stated that the surface of the vice jaws could scratch the acrylic and that some sort of protective pad should be inserted in the vice.

Question 10

- (a) The majority of candidates answered this question correctly, demonstrating a good understanding of the design of the former used when vacuum forming.

The most common advantages of using MDF rather than oak included being easier to work, having no grain marking, being more stable and cheaper than oak.
- (b) The most common features of the former included rounded edges and corners, smooth surfaces and draft angles. Those answers that described the use of air holes did not gain any marks as the question referred specifically to the former and not the base on which the former would be placed.

Section B

Question 11

- (a) Most candidates gained at least one mark for providing a benefit of using acrylic for the adjustable mirror. The most common correct answers related to the attractive appearance, the variety of colours available and the ability of acrylic to be bent to shape easily. Answers such as being lightweight and easy to work were not accepted.

- (b)(i) Many candidates gained at least one mark for stating a relevant stage when using a laser cutter to produce the development, (net) of the acrylic stand. However, it was clear from the vast majority of answers that few candidates had any experience of using a laser cutter. This should not stop candidates from answering similar questions relating to CAD/CAM.
- (ii) Most candidates gained at least one mark for stating that the laser cutter would be accurate, cost effective and that it provided a clean finish.
- (c) Most candidates demonstrated a good understanding of the basic bending techniques used with acrylic.
- (d) In answers to this question many candidates showed a pivot, usually a dowel or metal or plastic rod, but with little or no details showing how it could be fixed or how it could be used to tighten and lock the mirror in position. Often, the poor quality of sketches combined with a lack of practical knowledge resulted in the majority of candidates gaining few marks for this question.
- (e) Many candidates confused the techniques of working with acrylic with those required for metal. The question clearly stated that the stand could be made from 1.6 mm mild steel sheet, but many candidates described the use of tools and equipment that would be used with acrylic.
- (f)(i) Many candidates were unable to name a suitable abrasive paper that could be used with mild steel sheet. The most common incorrect answers referred to sandpaper or glasspaper. These are used with wood.
- (ii) Most candidates recognised that spray painting was quicker than a brush application and that it could produce a more even finish without the appearance of brush strokes.

Question 12

- (a) Most candidates provided at least one specification point for the folding stool.
- (b) Most candidates provided some correct technical details but very few covered all the points required in the question. Most showed the rail held in a vice or clamped securely and many named an appropriate saw, (often a coping saw or Scroll saw), but did not name a half round or round file to complete the curved shape. Chisels, planes and glasspaper were often used to finish the curve. These were not considered appropriate.
- (c) Only stronger candidates achieved maximum marks for this question. Many candidates named and sketched a mortise and tenon or dowel joint environment. Housing and biscuit joints were inappropriate. Many candidates' sketches lacked the technical accuracy to gain the maximum marks available.
- (d)(i) Many candidates named the sash cramp correctly but others referred to the sash cramp as an F cramp which, although used for a similar purpose, was not the type of cramp illustrated in the question.
- (ii) Most candidates named an appropriate adhesive that could be used outdoors.
- (iii) Many candidates showed the sash cramp under the centre of the rail with the jaws of the cramp gripping the legs. Only a minority of candidates gained the second mark for showing the use of scrap wood blocks, (used to protect the wood), between the jaws of the cramp and the legs.
- (iv) The majority of candidates gave at least one check that would be made when clamping the legs and rails. The most common answers included to check that the legs and rails were aligned, (were square) and that excess glue had been removed as well as making sure that the cramps were not overtightened.
- (e) Most candidates gained only one mark for stating that the coach bolt would allow the legs of the stool to fold or be disassembled. For two marks candidates needed to look carefully at the design of the coach bolt to recognise that the square shank under the head of the coach bolt prevented it from turning and becoming loose when the legs were folded.

- (f) Many candidates provided two properties of aluminium that made it suitable for the stool. The most common properties included being corrosion resistant, easily bent to shape and lightweight.
- (g) Most candidates understood that the plastic foot would increase stability or grip, prevent the tube from digging into the ground or from scratching the surface.
- (h) The vast majority of candidates achieved some marks for showing a moulded plastic seat that could be removed to allow the stool to be folded and carried. Many candidates showed a hinged seat that would fold but unfortunately would not support the weight of the user. However, the remaining marks were often achieved for showing some type of clip, (as an integral part of the seat) that allowed the seat to be removed. Many candidates named an appropriate plastic from which the moulded seat could be made.

Question 13

- (a) (i) Most candidates named a suitable softwood for the nesting box and the most common correct answer was pine.

(ii) Most candidates could not give a valid reason for choosing a softwood. Stronger answers suggested the named softwood being suitable for outdoor use, its durability or that it was relatively cheap. Being cheap, lightweight and easy to work were not accepted.

Those candidates who named a hardwood in (i) rather than a softwood, could still achieve one mark for a valid reason.
- (b) (i) Most candidates gained at least one mark for stating that the saw teeth had thickness, that this would affect the length of the wood or that it would provide space for errors.

(ii) Many candidates named an appropriate machine saw that could be used to cut the sides of the nesting box to length. Jig, band and Scroll saws as well as circular and table saws were the most common correct answers.

(iii) This question proved challenging for many candidates. The amount of waste remaining on the wood shown was too small to be sawn off. The use of files and glasspaper would not produce a flat and square end. Candidates needed to understand that the purpose of glasspaper is to prepare surfaces to take a 'finish' rather than be used to remove waste wood. The waste should be removed by planing the end grain or by placing the wood flat on the table of a sanding disc and exerting pressure against the disc to achieve the flat and square end.
- (c) (i) The majority of candidates could not give the recognised name of a suitable nail that could be used to join the sides of the nesting box.

(ii) Most candidates named an appropriate adhesive that could be used outdoors.
- (d) Most candidates incorrectly stated that the reason the corners of the floor of the nesting box had been removed was related to safety. A minority of candidates recognised that the removal of the corners allowed for easier cleaning or that it allowed rainwater to drain.
- (e) (i) Very few candidates named a suitable drill bit that could be used to drill a Ø40 hole in the front of the nesting box. Some candidates named correctly a forstner bit, a flat bit or a hole saw.

(ii) This part of the question was answered better with candidates showing the wood clamped, using a G cramp and the use of a sacrificial board under the wood that was being drilled.
- (f) The majority of candidates were able to show two recognised, (and sometimes correctly named), hinges in the correct position that would allow the roof to open and close.
- (g) Most candidates did not provide completely successful jigs to assist with the cutting and assembling of parts of the nesting boxes when batch produced. However, there were some innovative jigs that achieved at least a limited number of marks. The best cutting jigs incorporated some form of designated space for the different lengths of sides which could then be cut to length without the need for marking out. There were some equally innovative jigs to assist assembly.

Some included the use of a box with pre-drilled holes, into which the sides could fit so that the positions for the nails could be drilled before the glue was applied.

- (h) Most candidates provided at least one factor that needed to be considered when designing products to be used outdoors. The most common factors included weather conditions, corrosion resistance, stability and being easy to be kept clean. A consideration of the environment in which the product would be used was an excellent answer.

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Key messages

- Candidates should be reminded to read each question to ensure that the information required in the response is understood.
- If a question requires sketches and notes, both should be used in the response.
- Explanations and descriptions should be given in sentences rather than in short notes. Writing needs to be clear so that it can be read without misinterpretation.
- In calculation questions, units should be applied to the answer wherever it is appropriate.
- Any working should always be shown as it is possible to gain marks from this even if the final answer is incorrect.

General comments

The questions in **Section A** were attempted by all candidates. In most cases the answers given were clear and showed that the Key content had been covered. It should be noted that Key content can also be used in **Section B** questions.

In **Section B** the electronics question was the most popular followed by the structures question. No candidate attempted the mechanisms-based question. No candidates attempted more than one **Section B** question, but there was evidence of a few starting a question and then changing to a different question. Candidates should read all question carefully before making a choice to ensure they do not waste time doing this.

Comments on specific questions

Section A

Question 1

The renewable energy sources were generally well known. Some candidates mistakenly included natural gas or nuclear power.

Question 2

- (a) A range of computer-controlled machinery was seen in the responses and most examples were correct. 3D printer was the example seen most frequently.
- (b) The benefits of CNC machines were well known. Those who did not gain both marks had often repeated the first benefit but with slightly different words.

Question 3

The difference between open and closed loop systems was generally known, with feedback being the distinguishing feature. Some candidates did not include examples to illustrate the differences.

Question 4

- (a) Most candidates recognised the oscillating nature of the door handle movement. Some weaker candidates identified it as rotary motion. The motion that resulted in the retraction of the latch was frequently identified as linear, rather than reciprocating.
- (b) The question required identification of a different mechanism, followed by the conversion of motion involved. In several responses, the mechanism chosen was not suitable because it was a component rather than the complete mechanism.

Question 5

- (a) Responses showed that some candidates had not looked closely enough at the parts of the mechanism in the illustration. With both the input and output gears having the same number of teeth the output speed would be the same. Use of an idler gear was to ensure that both input and output rotated in the same direction. Terms such as 'increasing efficiency' or 'stronger output' were not defined clearly enough to gain the marks.
- (b) This part of the question referred to two different sized spur gears connecting an input and output shaft. Of the three possible answers, reference to the increase in torque on the output was the least frequently seen. In some cases only a single result was given.

Question 6

The majority of candidates knew that the safety symbol was referring to PPE and protection of the ears.

Question 7

Reasons for providing lubrication in a machine were well known, with most candidates referring to reduction of friction or prevention of heat build-up.

Question 8

The unit for capacitance was the least well known. Almost all candidates gained the marks for resistance and current units.

Question 9

Placing the multiple and sub-multiple units of voltage in the correct order was completed accurately by most candidates. The error most frequently seen came from confusion between mV and MV.

Section B

Question 10

- (a) (i) The structure illustrated was recognised by most candidates as being a frame structure.
- (ii) Stronger responses referred to the insulation and weather proofing properties of the cladding material.
- (iii) The general concept of stationary and moving loads on a structure was clearly understood. Some of the examples given were not clearly defined or were not suitable, this included birds as a moving load. On a very small structure, birds could have a measured impact but on the building in the question they would not.
- (b) In this question one of the marks required knowledge of the nature of a gusset and the second mark required indication of a suitable joining method between the gusset and the steel box section. The shape of a gusset plate was generally correct but suitable joining methods were often missing or incorrect.
- (c) (i) Knowledge of suitable joints for a wooden cabinet was required. A recognisable drawing and suitable fixing method were needed to access all the marks.

- (ii) Responses needed to refer to natural defects rather than those introduced at a later stage in the process.
- (d)(i) A clear definition of equilibrium was needed. To gain the mark the terms 'balanced' or 'not moving' should have featured somewhere in the response.
- (ii) In most cases the extending legs at the side of the crane and the use of a counterweight were given to gain marks. Very few responses mentioned how the use of safe working load information could help to maintain equilibrium.
- (iii) Examples of compression and tension in the crane components were generally correct. Mention of torsion because of the crane turning, or the effect of strong wind was not often seen.
- (e) The calculation question was generally answered well but there were sometimes basic errors in arithmetic. The method of calculation by taking moments was widely known.

Question 11

This question was not attempted by any candidates.

Question 12

- (a)(i) The majority of candidates placed the production stages for an electronic circuit in the correct order and gained all the marks available.
- (ii) Of the two soldering faults shown, the correction to the solder flowing across and bridging two pads was generally answered better. Most candidates indicated that a desoldering tool should be used after the solder had been melted. In the second fault, the cause of the problem, not enough heat on the pad, was not widely recognised. The need to add more solder to the joint was the most common response.
- (b)(i) The component names, variable resistor and thermistor were in most cases given correctly. Some errors were seen where the variable resistor was named as a light dependent resistor.
- (ii) The potential divider calculation was carried out accurately in most cases. Working for the calculation was generally presented in the stages needed. As usual with this type of question, those candidates who did not show the working and relied on their answer being correct did get full marks. Candidates should be advised that they should always show all working.
- (iii) Answers to this question were usually correct with candidates recognising that when cooled a thermistor's resistance will increase and in this case the output voltage would also increase.
- (iv) The answer that was being looked for was the protective nature of the resistors, in terms of limiting current entering the base of the transistor and controlling the light output of the LED. It was not enough to say that the current would be limited, the reason why was needed for the marks to be awarded.
- (v) In most cases the correct name for the type of transistor was given as 'NPN'.
- (c)(i) The type of logic used was widely recognised, for both circuits.
- (ii) Reasons for choosing a logic IC rather than discrete components generally fitted with the answers in the mark scheme. An example of a reason that did not gain credit was where the reliability of the circuit was questioned. It is quite possible for both types of circuit to operate reliably. The size, cost and number of components were what should have been referred to.
- (iii) Completion of the truth table was generally carried out without any errors.
- (iv) Those candidates who completed the truth table correctly were able to identify the final output as being that of an AND gate.

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Key messages

- All questions in **Section A** should be read carefully to ensure that the requirements are understood.
- Candidates should be advised to read all **Section B** questions carefully before attempting to answer a question. There were several instances of candidates attempting all questions in **Section B**.
- Clear, legible writing and carefully drawn sketches are important.
- If a question requires sketches and notes, both should be used in the response.

General comments

The questions in **Section A** were attempted by all candidates. In most cases the answers given were clear and showed that the Key content had been covered by centres. It should be noted that Key content can also be used in **Section B** questions.

In **Section B Question 10**, the structures question, was the most popular, followed by **Question 11**, the mechanisms question. No candidates attempted the electronics question.

Almost all candidates completed their responses in the correct response area on the paper.

Comments on specific questions

Section A

Question 1

Most candidates knew that strength in compression is a property of concrete. Strength in tension was the most common response for steel. For softwood, the answers given were wider ranging and included the fact that it is renewable and easily obtainable. Several responses were not precise enough to gain the mark as the property given e.g., being tough could have been applied to any of the materials.

Question 2

Most candidates knew the meaning of triangulation but in many cases the way that triangulation had been used to prevent a window frame from distorting was not precise enough for both marks to be given. Those candidates who represented triangulation with a single line were only awarded one mark.

Question 3

- (a) The general understanding of levers was very good, resulting in only a few errors. In most cases the error was to label the hanging loop as the fulcrum. In a few cases all four available boxes had been filled and this resulted in a maximum of two marks.
- (b) Understanding of the three orders of lever was good with many candidates gaining both marks. Stronger candidates noted that a third order lever does not give any mechanical advantage. The most common response was that the effort is between the fulcrum and load with a third order lever.

Question 4

- (a) In a lot of cases material properties were given that were true but would not influence the choice of material for the given function, spur gear.
- (b) 'Shear', was the applied load required in the response. Stronger candidates gained the mark but there were several incorrect suggestions given by other candidates.

Question 5

Understanding of ergonomics was generally good with most candidates gaining at least one mark. Those who gave features relating to weight or where the moisture meter would be used did not gain the mark.

Question 6

Stronger candidates generally gained both marks for understanding the purpose of a specification. Weaker candidates referred to the use as a checklist. Very few noted the use of a specification when evaluating a product.

Question 7

Benefits of CNC machines were familiar to most candidates and few mistakes were made in providing two benefits.

Question 8

The battery and switch symbols were well known but the motor symbol was interpreted as a meter or in some cases the answer given did not relate to the 'M' in the symbol.

Question 9

Many candidates did not explain that the toggle switch remains in position once it has been changed. Stronger responses had noted that there were three connections meaning that the switch was single pole double throw. In a few cases the correct names had been applied to the terminals, with a description of which terminals would be connected for each of the switch positions.

Section B

Question 10

- (a) (i) Nearly all candidates gained both marks for identifying the stationary loads on the star structure. Some candidates suggested birds landing on the structure. Although in theory this is correct, in practice birds would not be heavy enough to affect the stability of the structure.
- (ii) Most candidates gained the marks for stating the forces resisted by a tie and a strut.
- (iii) There were more responses that gained a mark for an advantage of using a strut than those who could identify a disadvantage. Very few candidates noted that the increased size, and therefore the weight, of using struts would add significantly to the total weight of the structure.
- (b) (i) The structural joint was shown with three bolts holding the steel strips together. Most candidates realised that with a single bolt the joint could rotate. Those who went on to state that a second or third bolt would prevent rotation and help in alignment gained the second mark.
- (ii) The calculation was carried out accurately by all candidates who had used the extension rather than the total length of the bolt.
- (iii) This question proved difficult for those who were unsure of the two forces involved. Torsion, if the bolt is over-tightened, will cause the head of the bolt to break away from the body. When this happens, the threads will be subjected to shear force, causing them to break away, leaving nothing to hold the bolt in position. For each force there were two marks available, one for the effect and

one for what had caused the effect. Many candidates only provided a very simple statement with no justification.

- (iv) There was a range of acceptable answers for giving possible reasons for using bolts and nuts rather than welding. The most frequently used was that the joint would be temporary and could be taken apart if necessary.
- (c) (i) The majority of candidates stated that the joint would be used because a longer beam was needed. Very few candidates offered the alternative that shorter beams were used to overcome limited access. They would then need to be joined.
- (ii) Weaker candidates generally used the fact that the plates had more bolts to hold them, and the plates also provided increased lateral strength. Stronger candidates noted that the method involving cutting a joint, while strong, was very time consuming.
- (iii) The requirement was for sketches and notes to show a laminated beam. In many cases only two laminations were shown and this did not allow staggered joints to be used. The minimum number of laminations was three and the joints should have been staggered for both marks to be awarded.
- (d) Several responses made no mention of the fact that two people will be using the see-saw and it is quite unlikely that they will be of equal weight. Another factor often ignored was the part played by the hard rubber spring in continuing any motion as a result of compressing and then releasing the spring.

Question 11

- (a) (i) There were a few responses that failed to gain marks due to lack of clarity in sketches. Weaker candidates were often not aware of the meaning of 'dwell' in a cam.
- (ii) This question was very well answered with clear descriptions of the cam movement in each rotation.
- (iii) Almost all candidates were able to identify a single benefit of a roller cam. Most used the fact that friction is reduced.
- (b) (i) Some very clear descriptions of the operation of a ratchet and pawl were seen. The point that was frequently missed was that the pawl will drop into place through either spring or gravity action.
- (ii) The sketches of the tool were generally of reasonable quality and could be followed. However, in several cases the orientation of the tool was incorrect with a long handle featuring a square on the end in line with the handle rather than at 90° to the handle. In some cases, the proportion of the width of the tool relative to the square hole was unsuitable.
- (iii) Very few correct responses were given for the reason for the taper on the square head. A few responses referred to the ease of fitting the tool to the square head. None referred to the locking ability of the taper and the fact that it could easily be released.
- (iv) Most candidates realised that the pawl had to be lifted before the tension could be released but very few noted that a slight increase in tension would be necessary to allow free movement of the pawl.
- (c) (i) Those candidates who understood how a compound pulley operates were generally successful in gaining all marks in the calculation. Almost all candidates knew that there would be a reduction in the speed of the output. In some cases, the reduction of only one part of the compound pulley was applied to the calculation.
- (ii) This question proved difficult for many candidates. Stronger candidates noted that the slots allowed for movement of the motor, and some candidates understood that they could be used for tensioning the belt between motor and pulley.
- (d) (i) In most cases the bevel gear used on the drill chuck was correctly identified.

- (ii) Only stronger candidates showed full understanding of the two features providing mechanical advantage. In many responses a single feature was identified but the precise nature of how the advantage was provided was not clear. The advantage from the bevel gears was referenced in more cases than the leverage provided by the chuck key.
- (iii) A single reason for using a worm gear was frequently seen but in many cases candidates could not identify a viable second reason. The large reduction in speed offered was the response most frequently seen.

Question 12

This question was not attempted by any candidates.

DESIGN AND TECHNOLOGY

Paper 0445/52 Graphic Products

Key messages

The focus of this assessment is Graphic Products. Future candidates would benefit from practical activities based on the questions contained in this paper with a focus on drawing accurately using instruments.

General comments

Candidates were required to complete all questions in **Section A (A1, A2 and A3)** and then go on to answer either **Question B4** or **B5** from **Section B**. An equal number of candidates chose to answer **Question B4** and **B5**. A small number of candidates did not follow the rubric instruction and answered all questions.

There are areas of the syllabus where some candidates did not generally perform well. With the increased use of computers in graphic design and graphic products, candidates need to be aware of CAD/CAM equipment, how it is used and the advantages of it. The drawing of 3D shapes in planometric view and constructing ellipses are areas where many candidates did not perform well.

Comments on specific questions

Section A

Question A1

- (a) Candidates were required to draw the screen outline on the front view of the mobile phone. Candidates could have improved on their responses as the given sizes were not always drawn correctly or accurately onto the front view.
- (b) Candidates were required to draw the on/off button onto the front view of the mobile phone. The given sizes were not always drawn correctly or accurately onto the front view.
- (c) Candidates were required to project the side view of the mobile phone from the given plan and front views. Many candidates projected from the front view and drew the view to the dimensions given. Candidates who projected from the plan and front views achieved a better result.

Question A2

- (a) Candidates were required to draw the isosceles triangle to complete the email icon. Most candidates achieved full marks.
- (b) Candidates were required to draw the radius lines and end angles. The radius sizes were not always drawn correctly or accurately. Some candidates drew the angles at 30° instead of 45°.
- (c) Candidates were required to draw the circle and regular hexagon to the sizes given. Many candidates drew irregular hexagons with different side lengths and angles.
- (d) Candidates were required to construct the ellipse. Many candidates did not achieve full marks on this question. Some candidates used incorrect construction methods or joined the plotted points of the ellipse with straight lines rather than a smooth elliptical shape. Where a trammel is used for constructing an ellipse, this must be attached or drawn adjacent to enable marks for construction to be awarded.

Question A3

In this question, candidates were asked to explain why icons are used instead of written instructions on mobile phones.

A full explanation was required for full marks. Candidates who explained that icons can be universally understood by people all around the world because no written words or language are used achieved full marks. Some candidates also explained that the icons take up less space than written words. Some candidates did not achieve full marks on this question as although they stated that icons were easier to understand, they did not give a detailed explanation.

Section B

Question B4

- (a) Candidates were required to complete the drawing of the development (net) to a scale of 1:2. Candidates needed to add the back and front sections including the cut-out. All fold lines needed to be added to the correct convention. Many candidates drew the back and front sections to the correct length but with incorrect sloping sides.
- (b) Candidates were asked to show a method of preventing the tongue from coming out of the slot in the development (net). There was a wide range of responses. Candidates who clearly sketched a method that would work effectively achieved full marks.
- (c) (i) This part of the question asked candidates to apply thick and thin line technique to the mobile phone holder. The principle is that where only one edge is seen producing the corner, a thick line is applied. All edges where two sides are seen producing the corner are left as thin lines. Many candidates showed some knowledge of the techniques and gained marks but could improve on the use of this technique.
 - (ii) Candidates were required to render the mobile phone holder to look like Styrofoam. Shading that showed a texture representative of Styrofoam achieved full marks.
- (d) (i) Candidates were asked to complete the exploded isometric view by adding the missing side piece of the mobile phone holder. Candidates who projected lines from the corners of the right-hand side at 30° achieved the best marks.
 - (ii) Candidates were required to name a suitable adhesive for joining the Styrofoam blocks together. Candidates who named a specific type of glue or tape achieved the mark. Candidates who named solvent-based glues did not achieve a mark as these are unsuitable for Styrofoam.

Question B5

- (a) Candidates were required to complete the planometric view of the point of sale display to a scale of 1:2. Some candidates did not attempt this part of the question. Many candidates achieved some of the marks available but did not draw parts of the point of sale display to the sizes given or accurately enough to achieve full marks. Candidates who correctly read the orthographic views and worked from the given corner achieved the best results.
- (b) (i) This part of the question required candidates to name three suitable tools or items of equipment they would use when cutting the foamboard to shape. Suitable tools or items of equipment included named types of craft knife, cutting mats and metal or safety rulers.
 - (ii) The lettering on the mobile phone display stand was produced using a computer. Candidates were asked to describe a method of transferring the lettering for the point of sale display from the computer to the point of sale display. Many candidate responses described printing methods used on paper or printing directly onto the foamboard which were unsuitable due to the rigid nature of the material.
- (c) This part of the question asked candidates to complete an estimated two-point perspective view of a package based on the given details. Candidates were required to show knowledge of two-point perspective drawing. Candidates who projected lines to the respective vanishing points and maintained appropriate proportions for the parts of the package achieved the best results.

DESIGN AND TECHNOLOGY

Paper 0445/53 Graphic Products

Key messages

The focus of this assessment is Graphic Products. Future candidates would benefit from practical activities based on the questions contained in this paper with a focus on drawing accurately using instruments.

General comments

Candidates were required to complete all questions in **Section A (A1, A2 and A3)** and then go on to answer either **Question B4** or **B5** from **Section B**. An equal number of candidates chose to answer **Questions B4** and **B5**. A small number of candidates did not follow the rubric instruction and answered all questions.

There are areas of the syllabus where some candidates did not generally perform well. With the increased use of computers in graphic design and graphic products, candidates need to be aware of CAD/CAM equipment, how it is used and the advantages of it. Understanding and drawing of sectional views and constructing ellipses were areas where candidates did not perform well.

Comments on specific questions

Section A

Question A1

- (a) Candidates were required to draw the outline of the package. Candidates could have improved on their responses by projecting sizes and angles of the corners from the given one.
- (b) Candidates were required to draw a circle to the given radius. The radius was not drawn accurately onto the front by some candidates.
- (c) Candidates were required to draw a regular hexagon to the sizes given. Many candidates drew irregular hexagons with different side lengths and angles.
- (d) Candidates were required to draw the isosceles triangle to the sizes given. This was done correctly by most candidates.
- (e) Candidates were required to add the missing letters in the same style and proportions. Most candidates achieved full marks.

Question A2

- (a) Candidates were required to draw the two sides of the sleeve. The sides were often drawn in the correct positions and to the correct width but were not always drawn to the correct depth.
- (b) Candidates were required to draw the back face of the sleeve. Many candidates drew the sleeve to the correct width but to incorrect length and without using the correct conventions for fold lines.
- (c) Candidates were required to draw the glue flap on the end of the sleeve. Some candidates drew the glue flap on the wrong end of the development (net).

Question A3

Candidates were asked to show a method of preventing the plastic tray from falling out of the sleeve. There was a wide range of responses from candidates. Candidates who clearly sketched a method that would work effectively achieved full marks.

Section B

Question B4

- (a) Candidates were required to complete the sectional view of the ready meal tray to a scale of 1:2. Many candidates drew the tray to the correct depth but with the individual sections of inaccurate widths.
- (b) This part of the question asked candidates to apply thick and thin line technique to the mould for the plastic tray. The principle is that where only one edge is seen producing the corner, a thick line is applied. All edges where two sides are seen producing the corner are left as thin lines. Many candidates showed good knowledge of this technique and gained high marks.
- (c) (i) Candidates were asked to complete the exploded view of the ready meal container. Most candidates completed the plastic lid correctly.
(ii) Candidates were asked to add the clear protective film. Most candidates drew the film to the correct size and in the correct position between the tub and lid.
- (d) (i) Candidates were asked to describe how CAD/CAM could be used to produce the label. Many candidates described drawing the design on computer and printing but did not provide sufficient detail of the processes involved in completing this.
(ii) This part of the question required candidates to explain one benefit of using a computer to design the label. Full explanations were required for full marks.

Question B5

- (a) (i) This part of the question required candidates to draw the side view of the box. Many candidates achieved full marks for this but the accuracy of some responses was not strong.
(ii) This part of the question required candidates to complete the side view of the ready meal box. Candidates who projected the front view from the side view achieved the best results.
(iii) Candidates were required to construct the ellipse. Many candidates did not achieve full marks on this question. Some candidates used incorrect construction methods or joined the plotted points of the ellipse with straight lines rather than a smooth elliptical shape. Where a trammel is used for constructing an ellipse, this must be attached or drawn adjacent to enable marks for construction to be awarded.
- (b) This part of the question asked candidates to complete an estimated one-point perspective view of the ready meal box based on the given details. Candidates were required to show knowledge of one-point perspective drawing. Candidates who projected lines to the respective vanishing points and maintained appropriate proportions for the parts of the package achieved the best results.
- (c) This question required candidates to complete process boxes to show the tools or equipment they would use to carry out the two processes. Candidates who gave specific types of knives and adhesives achieved the best results.