DESIGN AND TECHNOLOGY

Paper 0445/11
Product Design

Key messages

All candidates should be carefully briefed on the requirements of each part of the paper. For example, in **Part (e)** marks are specifically allocated for construction details and important dimensions but some candidates appeared to be unaware of this requirement.

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)**.

Candidates should be advised that in **Part (d)** they should evaluate their design proposals, not simply describe them.

Candidates should be encouraged to plan their use of time 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)**.

General comments

Candidates responded well to the 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 that they considered to be important for the storage unit for money. Many answers related to the durability of the storage unit, aesthetics of the storage unit, the amount and type of money to be stored or how to remove the money from the unit. Candidates should be advised against repeating points that are given in the question or giving generic points, such as that it looks nice, that might apply to almost any product.

(b) Most candidates used sketches and notes well to show two methods of inserting coins into a building shaped storage unit. Answers included slots, round holes, sliding mechanisms or even throwing the coins into a funnel shaped opening. The standard of written and visual communication for this question was usually of a very high standard. Candidates should be reminded that the question asked for sketches and notes and therefore just sketches could not be awarded full marks.

(c) A good range of sketches with annotations was seen for this question, with almost all candidates producing the required three ideas. The strongest candidates added annotations that referred to the design requirements to their sketches and used a range of presentation techniques, including freehand exploded views. Some candidates' ideas did not fully meet the requirement for the storage unit to be in the shape of a building that would be familiar to a child. It was important that all design ideas fully met the design requirements if candidates were to access the full range of marks.

(d) The evaluations of ideas were generally good, with candidates able to demonstrate a good understanding of the positive and negative features of their design proposals. Answers referred to how the storage unit for money would be used, where it would be positioned in a room or how easy it would be to make. It was important that candidates evaluated their design proposals rather than simply describing them and did not repeat the same evaluation points for each idea if they were 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, freehand exploded views, freehand isometric views and material lists. Colour was usually used to add clarity to drawings. Stronger responses provided sufficient information for a skilled third-party to make the product. Weaker responses were often missing construction details or important dimensions.

(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 medium density fibreboard (MDF) and acrylic. Reasons for the choice of material included MDF being available in large sheets and acrylic in a range of colours. Candidates should be advised against giving generic names of materials such as wood or consumables such as an adhesive, as these responses are not awarded marks.

(g) Most candidates used a combination of sketches and notes to outline a method to manufacture one part of their design proposal. Commonly seen methods included the use of a line bender to fold acrylic or fabrication techniques using screws, nails or an adhesive. Some very good responses were seen to this question, but it was important that candidates included the correct names of tools and equipment if they were to access the full range of marks.

Question 2

(a) Candidates generally managed to list four additional points about the advertising display that they considered to be important that would be placed on the pavement outside a bank. Answers explained that the display should not blow away in the wind, the materials should be weatherproof, the advertising display should easily be moved back into the bank at the end of the day or the information on the advertising display should be easy to change. Candidates should be advised against repeating points that are included in the question, for example “should encourage children to open savings accounts”, or giving generic points that might apply to almost any product.

(b) Most candidates used sketches and notes well to show two methods of attracting children’s attention to the advertising display. Responses included large lettering, colourful images, strips of light emitting diodes (LEDs), moving parts or the use of speakers to play music.

(c) A good range of sketches with annotations was seen for this question, with colour generally used well. Design proposals included advertising displays made from a folded sheet material, such as Corriflute (corrugated plastic sheet), or a fabricated frame made from tubular mild steel with a plywood information board. The annotations often revealed candidates’ true understanding of how the design proposal would function. It was important that all ideas fully met the design requirements if candidates were to access the full range of marks.

(d) The evaluations of ideas were generally good, with candidates able to demonstrate an understanding of the positive and negative aspects of their design proposals. Answers focused on the safe use of the advertising display, how long the advertising display would last or the cost of making the advertising display. It was important that candidates justified their evaluations rather than making general statements, such as that it would work well, if they were to access the full range of marks.

(e) Some good responses were seen to this question, with a variety of methods used to show the full solution to the design problem. These included orthographic drawings, freehand sketches, and materials lists. Colour was generally used effectively to show the material or surface finish. Many responses included an exploded three-dimensional (3D) sketch of the artefact with supporting annotations. The 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 their design proposal and gave reasons for their choices. Corriflute (corrugated plastic sheet), mild steel,

plywood and medium density fibreboard (MDF) were commonly named materials, with reasons often referring to specific properties of the material such as strength or rigidity. Candidates should be advised against giving generic names of materials, such as plastic or wood, as these are not awarded marks.

(g) Most candidates were able to use sketches and notes to outline a method that would be used to manufacture one part of their design proposal. Hand production techniques involving the use of a saw, drill and screwdriver were commonly seen but some candidates focused on the use of a laser cutter or a welding process. It was important that candidates included the correct names of tools and equipment to be used in the method of manufacture if they were to access the full range of marks.

Question 3

(a) Candidates often appeared unsure as to whether they were required to design the savings box as well as the system that produced a response when coins were dropped into it. Most candidates managed to list four additional points about the function of the system that they considered to be important. Answers related to the durability of the system, reliability of the system, cost of manufacturing the system or properties of the materials to be used to make the system. Candidates should be advised against repeating points that are given in the question, for example that the coin must produce a response, as these responses are not awarded marks.

(b) Most candidates used sketches and notes well to show two forms of response that would be suitable when a coin is placed in a savings box. Most candidates showed either a mechanical response, for example a part moving, or an electrical response, for example an LED lighting.

(c) A good range of sketches with annotations were seen in response to this question. Colour was generally used appropriately to improve the visual impact of the design proposals and in most cases the path of the coin could clearly be seen. However, it was important that all ideas fully met the design requirements if candidates were to access the full range of marks. For example, some candidates did not fully consider the size, weight, or shape of the coin to be used. A small number of candidates produced fewer than three ideas or three ideas that were similar.

(d) The evaluations of ideas were generally good, with candidates able to demonstrate an understanding of the positive and negative aspects of their design proposals. Many responses focused on the reliability of the system, ease of operating or cost of manufacture. It was important that candidates justified their evaluations rather than making broad statements, such as that it is the best idea, if they were to access the full range of marks.

(e) Responses to this question were generally good with a variety of methods used to show the full solution to the design problem. These methods included exploded freehand sketches, orthographic views, annotations, 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 acrylic, medium density fibreboard (MDF) and aluminium, with the reasons often relating to strength of the material or its appearance. Candidates should be advised against giving generic names of materials such as metal, or generic reasons such as that it is easy to work with, as these are not awarded marks.

(g) Most candidates used a combination of sketches and notes to outline a method of manufacture of one part of their design proposal. Answers included drilling and joining materials with nuts and bolts or cutting out acrylic parts with a laser cutter. 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.

DESIGN AND TECHNOLOGY

Paper 0445/12
Product Design

Key messages

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.

Stronger candidates combined creativity and technical knowledge to produce excellent design proposals. Some weaker candidates produced design proposals that did not fully meet the design requirements.

Candidates should be encouraged to view the paper as a holistic design exercise, rather than several individual tasks. For example, the materials named in **Part (f)** and the method of manufacture outlined in **Part (g)**, must be evident in the solution proposed in **Part (e)**.

Candidates should be encouraged to plan the use of their time 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)**.

Candidates should be advised against spending a large amount of time producing highly detailed orthographic views for **Part (e)** and then having insufficient time to complete **Parts (f)** and **(g)**. Many candidates achieved high marks for **Part (e)** by using just freehand sketches and annotations.

General comments

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

Candidates should be advised that in **Part (d)** they must evaluate their design proposals, not simply describe them, or repeat the same evaluation point for all three ideas.

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 were able to list four additional points about the function of a storage unit for toys that they considered to be important. Answers related to the safe use of the storage unit, how the toys would be stored in an organised manner, how easy it would be to access the toys or how the storage unit would be moved around the room. Candidates should be advised against repeating points that are given in the question, for example that the design must be based on a cartoon character, or giving generic points that might apply to almost any product.

(b) Most candidate used sketches and notes well to show two methods of attaching a lid or door to a storage unit. Answers involved the use of hinges, magnets, catches or grooves for sliding doors. The standard of written and visual communication for this question was often excellent but candidates needed to note that this question required sketches and notes. Full marks were not awarded for just sketches.

(c) An impressive range of sketches and notes was seen for this question. Many solutions were based on a fabricated wooden box or a moulded plastic shape. The strongest candidates added detailed annotations to their sketches and used a range of presentation techniques including freehand exploded views. Weaker candidates often presented three ideas that were similar in form and did not fully meet the design requirements. It was important that all ideas fully met the design requirements if candidates were to access the full range of marks. A small number of candidates produced fewer than three ideas.

(d) The evaluations of ideas were usually very detailed, with candidates able to clearly demonstrate a good understanding of the positive and negative features of their design proposals. Answers referred to the appeal of the design to children, ease of accessing the toys, ease of manufacture or how much room the storage unit would take up in a playroom. It was important that candidates justified their evaluations rather than making general statements, such as that it would work well, if they were to access the full range of marks.

(e) Responses to this question were usually very impressive, with a variety of methods used to show the full solution to the design problem. These methods included orthographic drawings, freehand exploded views and material lists. Colour was used appropriately to add clarity to drawings. This question specifically asked for construction details and important dimensions but, particularly in weaker responses, these were often missing. Candidates should be advised to consider if the information they have presented would be sufficient to allow a skilled third-party to make the product.

(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 materials included medium density fibreboard (MDF), acrylic and pine. Reasons for the choice of material often related to the aesthetic qualities of the material, the strength of the material or how easily it could be cut and joined. Candidates should be advised against giving generic names of materials, such as wood, as these responses are not awarded marks.

(g) Most candidates used a combination of sketches and notes to outline a method that could be used to manufacture one part of their design proposal. Fabrication techniques including the use of glue, screws and dowels were commonly seen methods of manufacture. Candidates that used plastics in their design proposals often described blow moulding or injection moulding processes. Candidates that chose acrylic often focused on the process of cutting out the parts with a laser cutter and then using a line bender to fold to shape. Many excellent responses were seen to this question, but it was important that candidates included the correct names of tools and equipment if they were to access the full range of marks.

Question 2

(a) Most candidates were able to list four additional points about the function of a child's pop-up birthday card that they considered to be important. Answers related to the visual impact of the pop-up card, the message to be written on the card, ability of the material to be folded without tearing or using materials that could easily be recycled. Candidates should be advised against repeating points that are in the question, such as that the pop-up card must include a cartoon character, as these responses are not awarded marks.

(b) Most candidates used sketches and notes appropriately to show two methods that could be used to produce a pop-up feature on a birthday card. Commonly seen responses included V folds, floating layers, springs or pull tabs. Many excellent responses were seen to this question but in a small number of responses it was unclear how the pop-up feature would work. Candidates should be advised that this question required sketches and notes and that full marks were not awarded for just sketches.

(c) An impressive range of sketches and notes were seen for this question and colour was generally used well. A sketch of the development (net) of the pop-up card and a three-dimensional (3D) sketch of the fully assembled pop-up card were the most popular methods of communicating a design proposal. The accompanying annotations often revealed a true understanding of how the design proposal would be constructed. A small number of candidates produced fewer than three ideas, ideas that were similar in form or ideas that did not fully meet the design requirements. It

was important that all ideas fully met the design requirements if candidates were to access the full range of marks.

(d) The evaluations of ideas were generally very impressive with candidates able to clearly demonstrate an understanding of the positive and negative features of their design proposals. Answers focused on ease of manufacture, appeal of the card to children, how well the pop-up card would function or performance of the materials over time. It was important that candidates justified their evaluations rather than making general statements, such as that it would work well, if they were to access the full range of marks.

(e) A variety of methods were used to show the full solution to the design problem. Responses often included an isometric sketch and a development (net) with supporting annotation. This question specifically asked for construction details and important dimensions but, particularly in weaker responses, these were often missing. Candidates should be advised to consider if the information they have presented would be sufficient to allow a skilled third-party to make the product.

(f) Most candidates were able to name two specific materials that would be used in their design proposal and gave reasons for their choices. Paper, card and polypropylene sheet were commonly named materials. The reasons for the choice of the material often related to the working properties of the material or how easy it would be to add surface graphics. Candidates should be advised against giving generic names of materials, such as plastic, as these are not awarded marks.

(g) Most candidates used a combination of sketches and notes to outline a method used to manufacture one part of their design proposal. Hand fabrication methods, usually involving the use of a craft knife and adhesive, was commonly seen but some candidates outlined the use of Computer Aided Design (CAD) and Computer Aided Manufacture (CAM). Many candidates would have benefitted from outlining their method of manufacture in a series of numbered stages. It was important that candidates included the correct names of tools and equipment in each of these stages.

Question 3

(a) Candidates were able to list four additional points that they considered to be important about the function of a device that would return a ball once it has hit a target. Answers related to appeal of the device to children, ease of assembly of the product on site or prolonged use of the device in an outside environment. Candidates should be advised against repeating points that are given in the question, for example that the device must include a cartoon character, or giving generic points that might apply to almost any product.

(b) Most candidates used sketches and notes well to show two methods that could be used to propel a ball. Many candidates showed spring devices, catapult type devices or surfaces that would spring back once hit by the football. A common misconception was that foam could be used to effectively propel a football.

(c) An impressive range of sketches with annotations was seen for this question with colour generally used well. However, it was important that all ideas fully met the design requirements if candidates were to access the full range of marks. For example, some candidates did not really consider how the cartoon character would contribute to the design or how the device would attach to the goal posts or the ground. A small number of candidates produced fewer than three ideas or three ideas that were similar in form.

(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 propel the ball back at the wrong angle, the reliability of the propulsion mechanism or that the device would rust in the rain. It was important that candidates justified their evaluations rather than making broad statements, such as that this was the best idea, if they were 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, freehand exploded views, isometric views and materials lists. In some responses, the details of how the propulsion method would work were unclear and these responses would have benefitted from additional drawings of details of the design. The question specifically asked for construction details and important dimensions but, particularly in weaker

responses, these were often only partly shown. Candidates should be advised to consider if the information they have presented would be sufficient to allow a skilled third-party to make the product.

(f) Most candidates were able to name two specific materials that would be used in their design proposal and gave reasons for their choices. Commonly named materials included mild steel, stainless steel, aluminium, and pine, with the reasons relating to the working properties of the material or the ability of the material to withstand the weather. Candidates should be advised against giving generic names of materials, such as metal, as these are not awarded marks.

(g) Most candidates used a combination of sketches and notes to outline a method used to manufacture one part of their design proposal, with the use of welding or a laser cutter being the most common processes, but hand fabrication methods were also proposed. It was important that candidates included the correct names of tools and equipment to be used in the method of manufacture if they were to access the full range of marks.

DESIGN AND TECHNOLOGY

Paper 0445/13
Product Design

Key messages

Candidates responded well to the design situations and the standard of work was comparable with previous years. Some outstanding work was seen with candidates demonstrating a very high level of creativity and technological understanding.

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.

Candidates should be advised that in **Part (d)** they should evaluate their design proposals not simply describe them and should not repeat the same evaluation point for all three ideas.

Many candidates achieved high marks for **Part (e)** using just freehand sketches and notes. The benefits of using very detailed, measured drawings needs to be carefully considered against the time taken to produce such drawings.

Candidates should be encouraged to plan the use of their time 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)**.

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)**. For example, in **Part (g)** almost all candidates from some centres described injection moulding.

General comments

Almost all candidates answered all the parts of their chosen question within the spaces provided and very few candidates used the additional space on the last page.

For most candidates freehand sketching was a real strength. 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 were able to list four additional points that they considered to be important about the function of a storage unit that would hold modelling equipment. Answers related to the stability of the storage unit when cutting, how easy it would be to access the equipment, ease of moving the unit around a workshop or how easy it would be to clean if the glue were spilt. Candidates should be advised against repeating points that are given in the question or giving generic points, such as that must be aesthetic, that might apply to almost any product.

(b) Most candidates used sketches and notes well to show two methods of holding items when being stored. Answers involved the use of hooks, hanging equipment on pegs, cut out shapes for specific pieces of equipment, shelves and racks. The standard of written and visual communication for this question was often of an excellent standard.

(c) An impressive range of sketches with annotations was seen for this question. The most common solutions were made from medium density fibreboard (MDF) or pine, but some candidates also incorporated plastics and metals into their design proposals. The strongest candidates added detailed annotations to their sketches and used a range of presentation techniques, including freehand exploded views. It was important that all design proposals fully met the design requirements if candidates were to access the full range of marks. For example, some candidates did not fully address the requirement for there to be a flat surface for cutting materials. A small number of candidates produced fewer than three ideas.

(d) The evaluations of ideas were generally very impressive, with most candidates able to clearly demonstrate a good understanding of the positive and negative features of their design proposals. Answers referred to how easy it would be to access the equipment, stability when cutting materials or ease of moving the storage unit around the room. Some candidates struggled to express their thoughts clearly and concisely and may well have benefitted from using a more structured approach.

(e) A variety of methods were used to show the full solution to the design problem. These included freehand orthographic drawings, exploded views, isometric views and material lists. Colour, and enlarged drawings of details, were often used to add clarity to drawings. The most frequently seen drawing methods were freehand isometric sketches with annotations. This question specifically asked for construction details and important dimensions but, particularly in weaker responses, these were often missing. All candidates needed to consider whether the information they provided would be sufficient for a skilled third-party to make the product.

(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 materials included medium density fibreboard (MDF), pine and acrylic. The reasons for the choice of material often referred to the aesthetic qualities or structural stability of the material. Candidates should be advised against giving generic names of materials, such as wood, as these responses are not awarded marks.

(g) Most candidates used a combination of sketches and notes to outline a method of manufacture of one part of their design proposal. Fabrication techniques including screws, nuts and bolts or dowel joints were commonly seen methods of manufacture. Many excellent responses were seen to this question, but it was important that candidates included the correct names of tools and equipment if they were to access the full range of marks.

Question 2

(a) Most candidates were able to list four additional points that they considered to be important about the function of the collection unit into which small offcuts of any three different materials could be collected. Answers related to the size or shape of the containers, ease of emptying the containers, methods of identifying which materials should go into each container or where the unit would be positioned in the graphics studio. Candidates should be advised against repeating points that are in the question, for example that the unit should be delivered in a flat-pack form, or giving generic points that might apply to almost any product.

(b) Most candidates used sketches and notes well to show two temporary methods of joining lightweight materials. Many candidates showed slotted joints, locking tabs, screw mechanisms or the use of Velcro. Many excellent responses were seen to this question, but a small number of candidates showed permanent joints rather than temporary joints.

(c) An impressive range of sketches with annotations was seen for this question with colour used well to show materials and surface graphics. Many candidates chose to use lightweight materials, such as plastic sheet or foamboard, for their collection unit but a few used resistant materials such as wood. The annotations often revealed a true understanding of how the design proposal would be constructed. It was important that all ideas fully met the design requirements if candidates were 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. Answers focused on how easy it would be to identify the containers for different materials and ease

of emptying the containers or stability. It was important that candidates justified their evaluations rather than making general statements, such as that it would work well, if they were 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, freehand exploded views and isometric views. Many responses included a freehand isometric sketch and a development (net) with supporting annotations. The question specifically asked for construction details and important dimensions but, particularly in the weaker responses, these were often missing. All candidates needed to consider whether the information they provided would be sufficient for a skilled third-party to make the product.

(f) Most candidates were able to name two specific materials that would be used in their design proposal and gave reasons for their choices. Cardboard, corrugated cardboard, foamboard and Corriflute (corrugated sheet plastic) were commonly named materials. The main reasons for choosing these materials were often linked to the method of manufacture, such as joining with screw clips, the range of colours available or how the material could be recycled after use. 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 used a combination of sketches and notes to outline a method of manufacture of one part of their design proposal. Many candidates described how the development (net) for one of the containers in their design would be cut out by hand using a safety rule, craft knife and cutting mat. Some candidates used computer numerically controlled (CNC) machines, such as a laser cutter to cut out the parts of their design proposal. It was important that candidates included the correct names of tools and equipment to be used in the method of manufacture if they were to access the full range of marks.

Question 3

(a) Most of the candidates who answered this question were able to list four additional points that they considered to be important about the function of a device that would produce a shallow indentation on cardboard where it is to be folded. Answers related to the comfort of the user when holding the device, ease of operation, how it might be guided to produce a straight-line indentation or durability of the device. Candidates should be advised against repeating points that are given in the question, for example, producing a shallow indentation, or giving generic points that might apply to almost any product.

(b) Most candidates used sketches and notes effectively to show two methods of producing an indentation on cardboard. Many candidates showed a device with a suitably shaped end that could be pressed into the cardboard by the user or a device that could be forced into the cardboard by use of a screw mechanism.

(c) An impressive range of sketches with annotations was seen for this question, but it was not always clear that candidates fully understood how the device would work. A few responses did not fully consider how the amount of force or shape of the part of the device making the indentation would impact on the cardboard. In some cases, it was likely that the device would cut the cardboard in two rather than make an indentation. It was important that all ideas fully met the design requirements if candidates were to access the full range of marks. A small number of candidates produced fewer than three ideas or ideas that were similar.

(d) The evaluations of ideas were generally very good 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 position of the indentation might not be able to be accurately controlled by the user or that the device might cut completely through the material. Some candidates also focused on the ergonomics or aesthetics of the device. It was important that candidates justified their evaluations rather than making broad statements, such as that it is the best design idea, if they were 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, freehand exploded views, isometric views and materials lists. Most candidates made extremely good use of the space provided to answer this question, with one main drawing in the centre of the page and notes and drawings of details such as joints around it. This question specifically asked for construction details and important dimensions but, particularly in weaker responses, these were often only partly shown. All candidates needed to consider whether the information they presented would be sufficient for a skilled third-party to make the product.

(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 acrylic and aluminium, with the reasons relating to the aesthetic qualities or working properties of the material. 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 used a combination of sketches and notes to outline a method of manufacture of one part of their design proposal. Commonly seen manufacturing methods included using heat processes to bend or join metal or cutting out parts with hand tools or a laser cutter. Some candidates accurately described the use of taps and dies to cut threads in metal. It was important that candidates included the correct names of tools and equipment to be used in the method of manufacture if they were to access the full range of marks.

DESIGN AND TECHNOLOGY

Project 0445/02
School Based Assessment

Key messages

- Candidates would benefit from a focus on both the design need and the needs of the intended users in detail before producing a clear design brief for Assessment Criterion 1.
- Candidates should ensure that the plan for making is produced before commencing manufacture. The plan can be updated if there are any changes required during making.
- Candidates should remember to provide annotated photographic evidence of the testing of the final product.

General comments

Centres continue to prepare candidates well for the Project.

Centres provided all the necessary paperwork with the samples.

The inclusion of Individual Candidate Record Cards was helpful in indicating why marks have been awarded.

Overall, work submitted was well structured and fully covered the assessment criteria. It would help candidates, teacher marking, and moderation if each section were clearly labelled against each of the assessment objectives.

Some of the work submitted was creative and innovative with many candidates producing exceptionally high-quality functional outcomes.

Some candidates focused on architectural model making and there were a number of excellent folders presented. When choosing to design and make an architectural concept model of a building, candidates need to communicate that they are making a model in the design brief. They need to focus on designing the model, making the model, and evaluating the success of the model, not the building itself.

Centres are reminded that if after internal moderation a different total mark is inserted on the Coursework Assessment Summary Form, it is helpful to Moderators if it is made clear on the form where any changes in marks to particular assessment criteria have been made.

Comments on specific questions

Question 1

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

Candidates need to consider both the design need and the needs of the intended users in detail before producing a clear design brief for Assessment Criterion 1. It is helpful if candidates cover the 5W's. Who is the product designed for? What are the main functions of the product? Why is the product important? Where will the product be used? When will the product be used? This type of approach and other similar methods can help to provide the start of a clear structure for the rest of the design and make challenge.

Question 2

Research into the design brief resulting in a specification

Whilst most candidates focused on the situation chosen, a significant number of candidates produced extensive detail of a wide range of materials, finishes and tools used for designing and making. Candidates should only include information relevant to the situation and explain the research that they have found in more detail and its suitability for the product being designed and made. 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. Materials, processes and finishes could be included in the design section, Assessment Criterion 3, and when making decisions about the form, materials, and construction of the final solution in Assessment Criterion 4.

The use of investigating existing products was generally informative. The analysis of existing products should lead to information and key points to take forward to the next stage of designing, for example, what features to include and what features to avoid. 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. Many candidates selected storage of a particular item for their design brief but very few researched the types and sizes of items to be stored.

Question 3

Generation and exploration of design ideas

There were a number of outstanding examples of well-presented work showing a natural progression of design and development. However, some centres were lenient in the marking of this section, particularly the award of marks in the highest mark range. To achieve the higher mark range, candidates should produce a wide range of imaginative solutions which are conceptually different. Ideas should be developed and clarified with reference to the specification.

Candidates should use appropriate drawing techniques and present work clearly. Annotations should explore the technical aspects of each idea and include consideration of possible materials and constructions.

Candidates ought to use the specification points to evaluate proposals and explain why one design is better than another. Candidates would benefit from exploring material and constructional possibilities, aesthetic considerations, and experimentation with proportions before going onto the next concept. Reasoning and justification are important in deciding upon a proposal to develop further.

Question 4

Development of proposed solution

Many candidates produced clear evidence of the testing and trialling about form, appropriate materials, constructions and finishes. Candidates use of 3D models was helpful to visualise the size, shape and proportions of the design proposal.

Some candidates did not make their design decision-making clear. A significant number made limited or no clarification of the technical specifications of the product to be manufactured, such as functions, dimensions and constructional details. Practical workshop experimentation can inform the suitability of materials and construction methods.

Question 5

Planning for production

Most candidates produced detailed and comprehensive plans for making, clearly showing a full sequence of stages required to manufacture their product. A significant number used a photographic diary of making as their plan which is not acceptable. Planning for production must be done before commencing manufacture. In many cases, the candidate may divert from the original plan when making and can record any such changes onto the original plan.

Working drawings were generally accurate and detailed. A significant number of candidates did not include all the dimensions necessary to be able to make the product.

Question 6

Product realisation

Assessment was generally accurate and consistent in this section. Some marks awarded in the higher mark range tended to be slightly generous. Marks allocated to making should reflect the overall complexity of the product, the level of skill demonstrated by the candidate, and the quality of the making of the final product.

Centres are reminded that photographic evidence must be included in the folder. Marks should not be awarded if there is no evidence submitted. Some of the practical work produced was of a very high standard.

Question 7

Testing and evaluation

This section was marked slightly leniently by some centres. It is important that candidates include photographic evidence of the testing of the product in its intended environment if possible. Tick lists are inappropriate when evaluating against the specification. Justified evaluative comment is required to give detail of how the final product performed against the specification.

After testing, candidates should clearly explain the strengths and weaknesses of the product and propose modifications. Modifications are best presented in the form of sketches and notes.

Some candidates had evidence of third-party testing and feedback which helped to identify strengths and weaknesses of their product.

DESIGN AND TECHNOLOGY

Paper 0445/32
Resistant Materials

Key messages

- Candidates need to read the questions carefully before attempting to answer and should 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. In order 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

In this section candidates need an all-round knowledge and understanding in order to answer all questions successfully. Many candidates demonstrated at least a basic understanding of the processes, tools and equipment required.

Section B

This section always has questions with large mark allocations that require a combination of clear and accurate sketches supported by detailed written notes. It is essential that candidates attempt all parts of the question otherwise they deny themselves possible marks.

Comments on specific questions

Section A

Question 1

(a) The majority of candidates identified either aluminium or stainless steel correctly.

(b) Only a minority of candidates identified an appropriate plastic for the swimming pool steps. The most common correct materials were polypropylene, ABS and HDPE.

Question 2

(a) Only stronger candidates were able to give a benefit of using a contact adhesive. Most answers referred vaguely to its strength, while the best answer was that it dried on impact or contact.

(b) There were many misconceptions about drawbacks when using a contact adhesive. Many answers referred to the adhesive not being waterproof. Stronger candidates described how the instant bond meant that there was no room for minor adjustment or how difficult it was to remove excess adhesive.

Question 3

There were many good benefits given for using card to make a model of the adjustable lamp. Some candidates described how testing and adjustments could be made or that it prevented the wastage of materials later.

Question 4

Very few candidates selected all three materials correctly**.** Many candidates were able to select only one or two from those listed. Identification of materials as ferrous or non-ferrous metals or as thermoplastic or thermosetting plastics is basic subject knowledge.

Question 5

Many candidates described a use for the digital micrometer. The majority of candidates recognised that it was a measuring device and many were able to state that one of its primary uses was to measure thin sheet material or the diameter of rod or tube.

Question 6

(a) Many candidates provided benefits of blister packaging. Stronger responses included the see-through feature, the protection it gave to the product or that it could be manufactured easily.

(b) There were many good answers describing environmental problems caused by blister packaging. Most answers referred to the plastic being non-biodegradable, that it could be thrown away and described the subsequent problems including litter and landfill. Other excellent answers included the fact that plastics are made from oil which is a finite resource.

Question 7

Only stronger candidates produced a drilling jig that would locate on at least two sides of the hardwood. The most common design, which was awarded one mark, was a template showing two holes drilled that could be placed on top of the hardwood.

Question 8

Methods of joining different materials is essential basic knowledge required when designing and making products. Only a minority of candidates stated correct methods for joining the materials listed in the question.

Question 9

Most candidates gained at least one mark for showing some sort of runner or guide on which the drawer could slide. The strongest answers showed an additional support below the desktop and the use of pre-manufactured runners. There was a large space provided for candidates to show their designs but many candidates needed to improve on their drawing skills as sketches were very small and difficult to understand.

Question 10

Most candidates identified geothermal as the renewable energy resource from the list provided. However, many candidates selected coal, natural gas or crude oil as renewable energy resources.

Section B

Question 11

(a) Most candidates gained at least one of the three available marks for completing the cross-halving joint. Clear and accurate sketches are essential when answering this type of question.

(b) Most candidates named and sketched an appropriate construction, but only a minority achieved maximum marks. The most common constructions named and sketched were a mortise and tenon joint or a dowel joint. The butt joint was not considered appropriate. Stronger answers showed the leg and rail in the correct orientation and drawn in good proportion.

(c) (i) The majority of candidates named two machine saws correctly. The most common saws named included a circular or table saw, jig saw, scroll saw or band saw.

(ii) Most candidates selected faceplate turning as the correct method of woodturning used to produce the tabletop.

(iii) Most candidates could not provide checks to be carried out after setting up the hardwood on the woodturning lathe. The most common correct answers stated that the hardwood should be rotated by hand to ensure it was clear of the lathe, that the tools should be sharp or that the speed of the lathe was set correctly.

(d) (i) There were many good answers stating advantages of using the palm sander rather than a cork block and glasspaper. Most advantages provided included speed, ease of use and a more even finish.

(ii) Most candidates explained that a clear finish would allow the hardwood surface to be seen and enjoyed. There were some excellent descriptions relating to the natural beauty of the grain that would be hidden if an opaque finish was applied.

(iii) Many candidates named two clear finishes that could be applied. The most common finishes included varnish, sealer, lacquer and wax. Oil, without a specific type stated, was not accepted.

(e) Only a small minority of candidates showed the shrinkage plate in the correct position and orientation screwed to the top of the rail.

(f) Many candidates achieved some marks for showing a shelf in the correct position but few achieved maximum marks. However, the majority of candidates did not take note of the important dimensions in the drawing showing that the shelf was Ø390 and the gap or space into which the shelf would fit was 400 mm. Most answers showed some sort of cut-out or recess into the legs into which the shelf could fit. Unfortunately, this would not work as the gap was too great. There were some excellent answers showing the use of wooden blocks or brackets joined to the legs on which the shelf would sit.

Question 12

(a) (i) Most candidates recognised that over time the card would become worn and distorted and therefore would not provide accurate making out.

(ii) The majority of candidates correctly named a scriber, chinagraph pencil, felt tip marker (or similar) to mark around the templates.

(b) Most candidates understood that to remove the waste acrylic they would need to drill a hole through which the detached blade of an appropriate saw could be threaded. The waste could then be removed. The most common correctly named saws included coping, jig, Hegner and scroll.

(c) Many candidates named at least one correct type of file that could be used to smooth the sawn edges produced in **(b)**. There are specific types of files, for example, half round, round or rat tail, flat and hand. However, many candidates simply stated the shape of the file that could be used rather than the actual specific type.

(d) Only a small minority of candidates showed a method of batch producing the book stands. One method was to tape two pieces of acrylic together and cut as one piece. Another method involved the use of CNC machines.

(e) (i) The majority of candidates named a suitable non-ferrous metal for the book stand. Aluminium and brass were common correct answers.

(ii) Many candidates correctly selected malleability as the term to describe the ability of a metal to be shaped without breaking.

(iii) Many candidates achieved some marks for some parts of this question. Only a small minority achieved the maximum five marks. To bend a single length of Ø5 non-ferrous metal required the metal to be heated to soften it so that it could be bent to shape. A bending jig or former would be

required as well as a method of force used to actually bend the metal. In addition to this, candidates needed to name the tools and equipment used to carry out the process.

(iv) Only a minority of candidates could name the process, annealing, by which the metal would become softer.

(v) Most candidates provided benefits for using a clear lacquer finish on the non-ferrous metal. The most common choices included having an attractive finish, preventing corrosion and being easier to clean.

(f) Only stronger candidates answered this correctly. Candidates were asked to describe one good design feature for each book stand. Some good answers for the acrylic stand included being adjustable to take different size books and that it could be taken apart for storage. For the metal stand, answers included making good use of minimal material, having an attractive metal finish and being stackable.

Question 13

(a) The majority of candidates named some of the four materials correctly. Most named an appropriate hardwood and manufactured board correctly. Fewer candidates named an appropriate non-ferrous metal and even fewer named an appropriate plastic for the football players.

(b) (i) Most candidates named the mitre joint shown as the joint at the corner of the football game.

(ii) A very small minority of candidates achieved two marks for this question. Very few candidates knew how to strengthen the mitre joint. Some excellent answers showed additional wooden blocks inside the corner or an angled bracket. A corrugated metal fastener was also an excellent method.

(c) The majority of candidates did not relate their answers to settings that should be made to the power router, such as setting the depth stop to the required depth or the fence to the required width.

(d) Only the strongest candidates answered this correctly. Many potentially good answers involved the construction of some sort of box but lacked constructional detail including how the box would be fitted to the game cabinet. Many candidates did not address the last part of the question requiring details of materials, fittings and constructions used.

(e) (i) Most candidates selected injection moulding as the correct method of manufacture of the players.

(ii) A minority of candidates correctly named epoxy resin or Araldite as a suitable adhesive to join the players to the metal rods.

(f) (i) Only stronger candidates showed a secure knowledge of heating the acrylic, (use of a line bender or strip heater) and bending the acrylic, (use of a former) to produce the shape of the slider.

(ii) It was evident from answers to this question, that many candidates needed to be more aware of the practical applications of CAD/CAM. There were some relevant processes given, including “data transferred to CNC machine”, “position acrylic on bed of CNC machine” and “set tool parameters”.

(g) Many candidates achieved one mark for showing how the table football game could be protected when the rods were pushed and pulled. Few candidates achieved maximum marks. The most common methods involved the use of rubber or similar impact resistant materials added to either the rods or to the game cabinet itself.

DESIGN AND TECHNOLOGY

Paper 0445/33
Resistant Materials

Key messages

- Candidates need to read the questions carefully before attempting to answer and should 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. In order 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

In this section candidates need an all-round knowledge and understanding in order to answer all questions successfully. Many candidates demonstrated at least a basic understanding of the processes, tools and equipment required.

Section B

This section always has questions with large mark allocations that require a combination of clear and accurate sketches supported by detailed written notes. It is essential that candidates attempt all parts of the question otherwise they deny themselves possible marks.

Comments on specific questions

Section A

Question 1

The majority of candidates named at least one appropriate tool used with the fastenings. Only a minority named the tool used with an allen key.

Question 2

Most candidates recognised the need to drill a hole through which the blade of an appropriate saw, (for example, jig, scroll or Hegner) would be inserted. After sawing out the waste, a file could be used to smooth the edges.

Question 3

(a) The strongest answers referred to the hardwood not splitting or splintering. There were many qualities such as hardwearing, dense and strong were not specific enough for the skittles.

(b) Only a minority of candidates named external, (outside calipers) or vernier caliper. Many candidates simply used a measuring tape or steel rule which would not give an accurate measurement of the diameter of the skittles.

Question 4

(a) The vast majority of candidates recognised that oak provided protection against weather, that it was water resistant and long lasting.

(b) The most appropriate finish that could be applied to the steel tubes was electroplating or galvanising and this was only stated by a minority of candidates. Many candidates named a finish that is often used with steel: dip or plastic coating. However, this finish would not be hardwearing or appropriate for the cycle rack.

Question 5

Only stronger candidates showed the correct positions for **A**, (the four jaw chuck) or **B**, (the lathe centre). Many candidates incorrectly added the labels **A** and **B** to all five possible positions on the lathe diagram.

Question 6

There were some excellent drawings of the tenon that would fit into the mortise. Candidates were able to achieve one mark for each of three features shown correctly: the thickness, height and length of the tenon.

Question 7

(a) The vast majority of candidates gave a benefit of the spoon being supplied with the yoghurt pot.

(b) There were many excellent answers describing the negative impact on the environment of supplying the spoon. The strongest answers referred to the consequences of the spoon being thrown away and that plastic is made from a finite resource.

Question 8

Most candidates showed a handle attached to the barbecue in an appropriate position for one mark. Those candidates who provided some additional detail, for example, giving a named material or method of construction, gained a second mark.

Question 9

(a) Most candidates correctly identified injection moulding as the process used to manufacture the plastic counters.

(b) There were three stages involved in bending the metal rods to the same shape: heating the metal to make it softer, the use of a former around which the metal could be shaped and the actual method of bending. Most candidates described at least one of the stages.

Question 10

Most candidates gave at least one benefit of using recycled plastic rather than softwood for the picnic bench. Some excellent answers described the environmental benefits such as reusing a material rather than cutting down trees. Other answers focused on the more durable properties of the plastic over softwood which, over time, would need to be replaced.

Section B

Question 11

(a) Covering a manufactured board with veneer would improve its appearance and make the material look like more expensive solid wood. The majority of candidates stated that veneer protected the surface of the manufactured board or made it waterproof.

(b) (i), (ii) and (iii) Candidates were given the opportunity to provide practical information about the dowels used to connect the top and base to the sides of the cabinet. Most candidates gave correct answers for at least one or two of the requirements.

(c) The majority of candidates stated correctly that PVA adhesive would provide a strong bond for the dowel joint.

(d) There were some good answers stating that chipboard could crumble or split apart when sawing or drilling through it and then providing practical solutions to avoid the damage. Most correct answers described the use of scrap wood, often clamped to the chipboard as a practical solution.

(e) Only stronger candidates showed the correct positions of the cam lock, knock-down (KD) fitting. Many sketches were not large or clear enough to determine the actual positions. There were some excellent answers where candidates not only drew the parts of the cam lock accurately but went on to describe how the joint would be locked by means of a screwdriver.

(f) (i) Many candidates achieved some marks for showing a very basic design for a handle. Very often the shapes shown would not have been practical in the materials chosen. The question also asked candidates to show how the handle could be joined to the drawer front. Many candidates did not attempt this part of the question.

(ii) There were some very good answers showing how the drawer could be supported inside the cabinet. Many answers showed use of a single batten or bead on which the drawer could slide or the use of pre-manufactured runners. Candidates needed to improve on their drawing skills for this question because they were provided with half a page of space for their answers, but many sketches were small and the poor quality of the sketches often made it difficult to understand how the drawer was supported.

(g) Some sort of groove, rebate or applied bead was required so that the edges of the 4mm thick hardboard were not visible. Candidates needed to improve on their knowledge for this question because very few candidates provided practical methods and many showed an inappropriate use of dowels, nails and screws.

(h) This question gave candidates the opportunity to carefully consider the sizes of all the components of the cabinet in order to fit inside a box and to provide three dimensions for the box: its length, width and depth. Most candidates provided at least one or two accurate dimensions.

Question 12

(a) (i) Most candidates stated at least one property of acrylic. The most common answers included being easy to clean, having an attractive range of colours and being easy to bend to shape.

(ii) The majority of candidates understood that the purpose of the thin backing film on acrylic sheet was to prevent the polished surface from becoming scratched.

(b) Many candidates stated items of research that a designer would consider when designing the tray. The strongest answers referred to the type of items that would be carried, the number of these and their sizes. Other good research focused on the user and ergonomic requirements.

(c) Most candidates understood the purpose of the open corners of the tray was to allow liquids to drain away, to make it easier to clean and to make the bending of the sides of the tray easier.

(d) Most candidates understood what was meant by the term ergonomics and referred to the size and shape of the hand hold or to the weight of the items so that the tray could be carried easily and comfortably.

(e) (i) Many candidates gave one benefit of using CAD to design the development (net) of the tray. The most common benefit was ease of editing. Other good answers included the capability of data from CAD drawings downloaded to CNC machines and the opportunity to save and send files electronically.

(ii) There were fewer drawbacks of CAD than the benefits. Drawbacks given included the high cost of buying and setting up a computer, the risk that files could become corrupted and that training in their use would be required.

(f) (i) Most candidates named an appropriate machine saw that could be used to cut out the shape of the development (net) of the tray. The most common responses included a band saw, jig saw, scroll saw and Hegner saw. Some candidates named router and while this could be used, it is not classified as a machine saw.

(ii) Many candidates named a hand saw that could be used to cut out the shape of the development (net) of the tray. The most appropriate responses included a coping saw, hacksaw and tenon saw. Candidates needed to be clear about the terms machine and hand when asked to identify tools for specific purposes.

(g) Only stronger candidates named the correct file, 'hand', from the list provided.

(h) Although the majority of candidates achieved some marks for this question**,** overall, the responses for this question were weak. To heat and bend the acrylic to the shape of the tray required several stages. The acrylic needed to be heated by means of a strip heater or line bender. The use of an oven would have made the bending extremely difficult since the whole area would have become too pliable and floppy. A simple former would be used to assist the bending and some form of clamping to retain the shape while the acrylic cooled down. Many candidates achieved marks for providing some of the stages but only a minority managed to show all of them.

(i) Most candidates achieved at least one or two marks for this question. Many showed the handles extended to the sides of the tray and joined with screws or nuts and bolts. The remaining parts of the question were often not attempted or the sketches and notes were very difficult to understand. The last part of the question asked candidates to give two important sizes. This part of the question was not attempted by many candidates.

Question 13

(a) The majority of candidates stated at least one item of research that the designer would need to consider when designing the jewellery stand. The most common answers referred to the type of jewellery being stored, the materials the jewellery was made from and specific sizes of different types of jewellery.

(b) (i) Many candidates named the mitre square or the sliding bevel. Only a minority of candidates named both correctly.

(ii) Only stronger candidates answered this correctly. The main issue for clamping the sides of a tray using mitre joints is that commonly used sash and G cramps would not work. A few candidates described how a ratchet strap or mitre cramps could be used and there were some innovative methods including string cramps with scrap wood inserted to tension the string and the use of large rubber bands.

(c) The majority of candidates gained two or three marks from the five available by showing how the space in the tray could be divided into three unequal parts and included some details showing how the partitions could be joined to the sides of the tray. However, some candidates needed to improve on their drawing skills as often in sketches, details were unclear or the added notes were not technically accurate.

(d) (i) There were many tools or items of equipment that could be used to mark out the centres and bend lines on the brass strip including steel rule, try square, scriber and fine tipped marker. Most candidates named at least one appropriate marking out tool.

(ii) The question related to precautions that would be taken before drilling the brass strip. The question stated clearly not to include personal protective equipment, (PPE). Many candidates ignored this and stated precautions relating to PPE such as wearing safety glasses and making sure that hair and loose clothing was tied back. The strongest answers referred to securing the workpiece, checking the drill speed and removing the chuck key from the machine.

(iii) Most candidates achieved only one or two marks for this question. There was no need to anneal, (soften) the brass strip before bending as it would be soft enough to bend without heat. For three marks, candidates needed to show the strip held securely in a vice with sketches and notes describing how a former could be used (or the vice itself), while the brass was struck with a mallet or by using a hammer with scrap wood to prevent damage to the surface of the brass.

(e) (i) Only stronger candidates named wet and dry, (silicon carbide) paper as the abrasive paper used to finish the brass strip. There were many answers naming emery cloth which would be too coarse and sandpaper (glasspaper) that is used with wood, not metal.

(ii) Many candidates understood the importance of using the correct grade of abrasive paper since a coarse grade would scratch the surfaces and too fine a grade would have minimal effect on the surfaces.

(f) One of the key points of the question was that the parts of the jewellery stand would be assembled by customers using only basic tools. Many candidates ignored this and showed permanent methods of construction such as glued joints. There were some very good answers showing the use of screws, nuts and bolts and dry dowel joints to join the parts of the jewellery stand.

DESIGN AND TECHNOLOGY

Paper 0445/42
Systems and Control

Key messages

- All compulsory questions in ***Section A*** should be attempted. Only **one** question from ***Section B*** should be attempted.
- Candidates should read all ***Section A*** questions carefully, taking note of any words in bold type, before starting a response. In ***Section B*** candidates should be advised to read all three questions carefully before making a choice of which one to answer.
- In calculation questions, the answer units should include units or sub-units used.
- Working should always be shown as it is possible to gain marks from this even when the final answer is incorrect.
- Clear, legible writing and annotation to sketches are vital; responses that cannot be read cannot not be awarded marks.
- Candidates should take care not to repeat facts that are given in the question as part of their own response.

General comments

In ***Section A*** all questions were attempted by all candidates. The key content was generally familiar to candidates. Stronger responses were found in the structures-based questions as this was the area chosen for ***Section B*** by most candidates.

In ***Section B*** there were several examples of candidates responding to all three questions. This practice should be avoided as it does not result in higher overall marks for the candidate, taking time that would be better spent on checking the ***Section A*** responses.

Where additional space was needed for a response the blank pages at the back of the booklet can be used. If this is necessary, it is useful for candidates to indicate on their answer booklet that part of a response has been added to a blank page.

Comments on specific questions

Section A

Question 1

(a) A range of acceptable responses were seen with most candidates referring to the ease of reusing a glass milk bottle.

(b) Functional reasons for the use of plastic bottles were generally correct. Those candidates who responded with a generic answer such as, ‘easy to use’, did not gain a mark.

(c) A high proportion of candidates knew that both types of bottle were made from shell structures.

Question 2

The skeleton leaf was generally recognised as a frame structure. Several responses did not gain the mark because they defined it as a natural structure, rather than as an example of a frame structure that could be classified as natural.

Question 3

The durability of steel and the ease of obtaining it were two responses that gained marks. One commonly seen incorrect response was that steel is a good conductor of electricity. Although this is a valid property of steel it is not the reason for using steel to manufacture pylons.

Question 4

Clear drawings were seen for the first order lever, with most having the load, fulcrum and effort noted in the correct positions. The most popular example of a third order lever was a shovel or spade. Those who had correctly noted that the effort appeared between the load and fulcrum gained the mark. There were several candidates who drew a recognisable shovel but failed to indicate the position of the fulcrum. No mark was awarded for these as it is possible to use a shovel as a first order lever.

Question 5

This question proved challenging for many candidates. The generic answers, 'fast', 'easy to use', 'cheap', did not gain marks. What was required was reasons that showed the spur gear as different to other methods of transmitting motion. These could have been the inability to slip, potential for changing the output speed or changing the direction of motion.

Question 6

(a) A high proportion of candidates did not gain marks because they did not read the question accurately. Responses should have referred to the method shown, not to the general benefits of lubrication. Stronger candidates referred to the ability to provide constant lubrication over a long period of time.

(b) This question was very well answered with nearly all candidates gaining marks. The principle that lubrication will reduce the effects of friction was commonly understood.

Question 7

Alternative formats for electrical measurements were familiar to many candidates.

Question 8

(a) The microswitch shown had the three terminals clearly marked. This should have resulted in a circuit symbol for a single pole double throw (SPDT) switch. In many cases the switch symbol drawn was of a single pole single throw (SPST) switch. A few candidates redrew a side view of the switch shown rather than a circuit symbol. There are variations of the symbol in common usage, and any non-standard variations were given benefit of doubt.

(b) Explaining how a microswitch works proved to be the most difficult question in ***Section A***. The principle that a common terminal is changed from connecting to a normally closed terminal to a normally open terminal was only understood by the strongest candidates.

Question 9

This question was answered well with all stronger candidates showing understanding of the difference between PTM and PTB switches.

Section B

Question 10

(a) (i) The majority of candidates answering this question gained at least one mark for correctly identifying the areas of the bow where specific forces were acting.

(ii) The benefits of using composite laminated materials were understood by almost all candidates.

(iii) Properties of adhesives were familiar to stronger candidates, who generally recognised that the adhesive should be waterproof or it should withstand tension. Weaker candidates gave properties that the bow would be unlikely to encounter, such as 'high heat resistance'.

(iv) Names of composites were better known than the constituent materials. Carbon fibre was an example where very few candidates recognised that the carbon fibres must be bonded by a resin.

(b) (i) The question required a tie and strut to be identified on the given illustration. Most responses correctly identified one of the steel rods as being a tie. Very few recognised the horizontal steel tubes as being struts, choosing instead to pick another of the steel rods.

(ii) The answer expected was a method using threads to extend or reduce the length of the tie. Several candidates gained the marks for showing guy ropes on a tent and their method of adjustment.

(c) (i) Only the strongest candidates achieved both marks for this question. The greater depth of the web on beam **A** was generally not commented on, nor was the part played by the top and bottom flanges in supporting the web.

(ii) The calculation was carried out accurately by stronger candidates. In nearly all cases the working was clearly shown. Weaker candidates used the intermediate distance between the loads rather than the distances from $\mathbf{R_1}$ to each of the loads.

(iii) Understanding the contribution of Factor of Safety to a design was only shown by the strongest candidates. A frequent fault was to describe safety features in general, not recognising that the Factor of Safety will over-compensate for conditions that will be found in use.

Question 11

(a) (i) Almost all candidates who answered this question gained marks for knowing the conversion of motion that takes place when using a screw thread.

(ii) The benefits of using a standard thread size were generally well known.

(iii) The pitch of the thread was recognised as being part of the standard size of the thread. The second dimension was in some cases given as the core diameter, rather than the outside diameter.

(b) (i) All candidates answering the question gained a mark for identifying the fulcrum on peg **A**.

(ii) The compression spring on peg **B** was more widely recognised than the torsion spring on peg **A**.

(iii) Only stronger candidates could identify a valid reason for peg **A** being viewed as more sustainable than peg **B**. Correct responses focused mainly on the renewable nature of the wood used in peg **A**.

(c) (i) One purpose of a derailleur gear mechanism was correctly identified as being to move the chain between different sprockets. The second purpose, that of tensioning the chain, was not recognised in most cases.

(ii) The fact that dealing with individual ball bearings during maintenance would be very time consuming was given by stronger candidates. Sealed ball bearings making it more difficult for grit to enter the bearing and cause damage was not widely recognised.

(iii) In most cases the driver and driven gears were correctly identified. Errors came when the formula was incorrectly applied, using Driven (rear sprocket)/Driver (chainwheel) rather than the correct response of Driver/Driven.

(iv) Those who carried out the velocity ratio calculation were able to accurately calculate the speed of the rear wheel.

(v) This question was answered well by stronger candidates who showed a clear understanding of how efficiency in a mechanism can be reduced. Those who gave a fully justified single point gained both of the available marks.

(d) (i) Although this question was not answered by all candidates, those who did answer it were clear on the benefits of using grease to lubricate parts of the linkage that are open to the elements.

(ii) This question tested the ability of candidates to visualise the result of operating the mechanism. In some cases this proved difficult. The result of rod **B** moving to the right, in the opposite direction to rod **A** was noted by stronger candidates. No candidates mentioned the part played by the bell cranks in the process.

Question 12

(a) (i) The logic gate symbols were well known by those candidates answering the question.

(ii) Understanding of the function of a NOT gate was good, with clear descriptions being given.

(iii) Stronger candidates were able to use one of the two universal gates, NOR or NAND, to make a NOT gate.

(iv) The purpose of three of the four components was in most cases correctly stated. In nearly all cases the current limiting resistor for the transistor was accurately described, the inverter symbol was recognised and the purpose of the transistor in amplifying the input current was correctly described.

Component **R2** was rarely recognised as a pull up resistor which gave a 5 V or logic 1 output signal when the transistor was not switched on.

(b) (i) Inputs to the op-amp were recognised from their description in nearly all cases and the correct connections were made on the circuit diagram.

(ii) There were three marks available for the description of the light dependent resistor function and its effect on the inverting input voltage. Weaker candidates generally gained one of the marks.

The result of falling light level was generally recognised along with the subsequent increase in resistance. This caused the voltage at **X** to decrease. Those who only noted that there was a change in resistance, without stating if it was an increase or a decrease only gained a single mark.

(iii) The calculation for the resistance setting of VR2 was not attempted by any candidates. The formula was given so it might have been expected that candidates would attempt to substitute the known values into the formula as this would have gained them a single mark. Candidates should be advised that not responding to a question will guarantee them no marks. If they make an attempt to respond it will always give the possibility of some marks being awarded.

(c) (i) Numbering the pins on an 8-pin comparator IC was accurately completed by all candidates for the left-hand side, pins 1 – 4 but on the right-hand side weaker candidates reversed the correct order, showing pin 5 at the top right position.

(ii) The reason for bending the pins over when soldering an IC holder was given accurately by all candidates.

(iii) Health and safety procedures while soldering were well known by stronger candidates. A few weaker candidates did not give an answer to this question.

DESIGN AND TECHNOLOGY

Paper 0445/43
Systems and Control

Key messages

- All compulsory questions in ***Section A*** should be attempted. Only **one** question from ***Section B*** should be attempted.
- Candidates should read all ***Section A*** questions carefully, taking note of any words in bold type, before starting a response. In ***Section B*** candidates should be advised to read all three questions carefully before making a choice of which one to answer.
- In calculation questions, the answer units should include units or sub-units used.
- Working should always be shown as it is possible to gain marks from this even when the final answer is incorrect.
- Clear, legible writing and annotation to sketches are vital; responses that cannot be read cannot not be awarded marks.
- Candidates should take care not to repeat facts that are given in the question as part of their own response.

General comments

In ***Section A*** all questions were attempted by all candidates. The key content was generally familiar to candidates. Stronger responses were found in the structures-based questions as this was the area chosen for ***Section B*** by most candidates.

In ***Section B*** there were several examples of candidates responding to all three questions. This practice should be avoided as it does not result in higher overall marks for the candidate, taking time that would be better spent on checking the ***Section A*** responses.

Where additional space was needed for a response the blank pages at the back of the booklet can be used. If this is necessary, it is useful for candidates to indicate on their answer booklet that part of a response has been added to a blank page.

Comments on specific questions

Section A

Question 1

(a) A range of acceptable responses were seen with most candidates referring to the ease of reusing a glass milk bottle.

(b) Functional reasons for the use of plastic bottles were generally correct. Those candidates who responded with a generic answer such as, ‘easy to use’, did not gain a mark.

(c) A high proportion of candidates knew that both types of bottle were made from shell structures.

Question 2

The skeleton leaf was generally recognised as a frame structure. Several responses did not gain the mark because they defined it as a natural structure, rather than as an example of a frame structure that could be classified as natural.

Question 3

The durability of steel and the ease of obtaining it were two responses that gained marks. One commonly seen incorrect response was that steel is a good conductor of electricity. Although this is a valid property of steel it is not the reason for using steel to manufacture pylons.

Question 4

Clear drawings were seen for the first order lever, with most having the load, fulcrum and effort noted in the correct positions. The most popular example of a third order lever was a shovel or spade. Those who had correctly noted that the effort appeared between the load and fulcrum gained the mark. There were several candidates who drew a recognisable shovel but failed to indicate the position of the fulcrum. No mark was awarded for these as it is possible to use a shovel as a first order lever.

Question 5

This question proved challenging for many candidates. The generic answers, 'fast', 'easy to use', 'cheap', did not gain marks. What was required was reasons that showed the spur gear as different to other methods of transmitting motion. These could have been the inability to slip, potential for changing the output speed or changing the direction of motion.

Question 6

(a) A high proportion of candidates did not gain marks because they did not read the question accurately. Responses should have referred to the method shown, not to the general benefits of lubrication. Stronger candidates referred to the ability to provide constant lubrication over a long period of time.

(b) This question was very well answered with nearly all candidates gaining marks. The principle that lubrication will reduce the effects of friction was commonly understood.

Question 7

Alternative formats for electrical measurements were familiar to many candidates.

Question 8

(a) The microswitch shown had the three terminals clearly marked. This should have resulted in a circuit symbol for a single pole double throw (SPDT) switch. In many cases the switch symbol drawn was of a single pole single throw (SPST) switch. A few candidates redrew a side view of the switch shown rather than a circuit symbol. There are variations of the symbol in common usage, and any non-standard variations were given benefit of doubt.

(b) Explaining how a microswitch works proved to be the most difficult question in ***Section A***. The principle that a common terminal is changed from connecting to a normally closed terminal to a normally open terminal was only understood by the strongest candidates.

Question 9

This question was answered well with all stronger candidates showing understanding of the difference between PTM and PTB switches.

Section B

Question 10

(a) (i) The majority of candidates answering this question gained at least one mark for correctly identifying the areas of the bow where specific forces were acting.

(ii) The benefits of using composite laminated materials were understood by almost all candidates.

(iii) Properties of adhesives were familiar to stronger candidates, who generally recognised that the adhesive should be waterproof or it should withstand tension. Weaker candidates gave properties that the bow would be unlikely to encounter, such as 'high heat resistance'.

(iv) Names of composites were better known than the constituent materials. Carbon fibre was an example where very few candidates recognised that the carbon fibres must be bonded by a resin.

(b) (i) The question required a tie and strut to be identified on the given illustration. Most responses correctly identified one of the steel rods as being a tie. Very few recognised the horizontal steel tubes as being struts, choosing instead to pick another of the steel rods.

(ii) The answer expected was a method using threads to extend or reduce the length of the tie. Several candidates gained the marks for showing guy ropes on a tent and their method of adjustment.

(c) (i) Only the strongest candidates achieved both marks for this question. The greater depth of the web on beam **A** was generally not commented on, nor was the part played by the top and bottom flanges in supporting the web.

(ii) The calculation was carried out accurately by stronger candidates. In nearly all cases the working was clearly shown. Weaker candidates used the intermediate distance between the loads rather than the distances from $\mathbf{R_1}$ to each of the loads.

(iii) Understanding the contribution of Factor of Safety to a design was only shown by the strongest candidates. A frequent fault was to describe safety features in general, not recognising that the Factor of Safety will over-compensate for conditions that will be found in use.

Question 11

(a) (i) Almost all candidates who answered this question gained marks for knowing the conversion of motion that takes place when using a screw thread.

(ii) The benefits of using a standard thread size were generally well known.

(iii) The pitch of the thread was recognised as being part of the standard size of the thread. The second dimension was in some cases given as the core diameter, rather than the outside diameter.

(b) (i) All candidates answering the question gained a mark for identifying the fulcrum on peg **A**.

(ii) The compression spring on peg **B** was more widely recognised than the torsion spring on peg **A**.

(iii) Only stronger candidates could identify a valid reason for peg **A** being viewed as more sustainable than peg **B**. Correct responses focused mainly on the renewable nature of the wood used in peg **A**.

(c) (i) One purpose of a derailleur gear mechanism was correctly identified as being to move the chain between different sprockets. The second purpose, that of tensioning the chain, was not recognised in most cases.

(ii) The fact that dealing with individual ball bearings during maintenance would be very time consuming was given by stronger candidates. Sealed ball bearings making it more difficult for grit to enter the bearing and cause damage was not widely recognised.

(iii) In most cases the driver and driven gears were correctly identified. Errors came when the formula was incorrectly applied, using Driven (rear sprocket)/Driver (chainwheel) rather than the correct response of Driver/Driven.

(iv) Those who carried out the velocity ratio calculation were able to accurately calculate the speed of the rear wheel.

(v) This question was answered well by stronger candidates who showed a clear understanding of how efficiency in a mechanism can be reduced. Those who gave a fully justified single point gained both of the available marks.

(d) (i) Although this question was not answered by all candidates, those who did answer it were clear on the benefits of using grease to lubricate parts of the linkage that are open to the elements.

(ii) This question tested the ability of candidates to visualise the result of operating the mechanism. In some cases this proved difficult. The result of rod **B** moving to the right, in the opposite direction to rod **A** was noted by stronger candidates. No candidates mentioned the part played by the bell cranks in the process.

Question 12

(a) (i) The logic gate symbols were well known by those candidates answering the question.

(ii) Understanding of the function of a NOT gate was good, with clear descriptions being given.

(iii) Stronger candidates were able to use one of the two universal gates, NOR or NAND, to make a NOT gate.

(iv) The purpose of three of the four components was in most cases correctly stated. In nearly all cases the current limiting resistor for the transistor was accurately described, the inverter symbol was recognised and the purpose of the transistor in amplifying the input current was correctly described.

Component **R2** was rarely recognised as a pull up resistor which gave a 5 V or logic 1 output signal when the transistor was not switched on.

(b) (i) Inputs to the op-amp were recognised from their description in nearly all cases and the correct connections were made on the circuit diagram.

(ii) There were three marks available for the description of the light dependent resistor function and its effect on the inverting input voltage. Weaker candidates generally gained one of the marks.

The result of falling light level was generally recognised along with the subsequent increase in resistance. This caused the voltage at **X** to decrease. Those who only noted that there was a change in resistance, without stating if it was an increase or a decrease only gained a single mark.

(iii) The calculation for the resistance setting of VR2 was not attempted by any candidates. The formula was given so it might have been expected that candidates would attempt to substitute the known values into the formula as this would have gained them a single mark. Candidates should be advised that not responding to a question will guarantee them no marks. If they make an attempt to respond it will always give the possibility of some marks being awarded.

(c) (i) Numbering the pins on an 8-pin comparator IC was accurately completed by all candidates for the left-hand side, pins 1 – 4 but on the right-hand side weaker candidates reversed the correct order, showing pin 5 at the top right position.

(ii) The reason for bending the pins over when soldering an IC holder was given accurately by all candidates.

(iii) Health and safety procedures while soldering were well known by stronger candidates. A few weaker candidates did not give an answer to this question.

DESIGN AND TECHNOLOGY

Paper 0445/51
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 and further improvements are needed. 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, what its limitations are and the advantages/disadvantages of using it. The drawing of sectional views and the construction of ellipses are areas where many candidates did not perform well and need further improvement along with textural representation of different materials.

Comments on specific questions

Section A

Question A1

(a) Candidates were required to draw the missing base of the tree by constructing a rectangle 20 mm x 10 mm in the correct position. Most candidates drew the overall size correctly and in the correct position. Some candidates drew the rectangle too big or off centre.

(b) Candidates were required to draw the two missing triangles on the tree by constructing two equilateral triangles. The vast majority of candidates completed this successfully and achieved all three marks. A significant number of candidates drew the bottom triangle incorrectly resulting in an isosceles triangle and did not get the first mark.

(c) Candidates were required to draw the missing parts of the plant pot. Most candidates drew the plant pot to the correct size and gained both marks. Some candidates drew the base of the plant pot to the wrong length or in the wrong position and did not achieve the first mark. Despite this, they were still able to achieve the second mark by adding the sides of the plant pot correctly to their own solution.

(d) Candidates were required to draw the missing leaf in the correct position by constructing two arcs. Many candidates did not draw the leaf to the correct size or shape and others did not draw the leaf in the correct position. The strongest candidates drew a horizontal line at the correct height on the plant stem, then used the existing leaf as a guide of the length required before using a pair of compasses to scribe arcs which located the centre of the leaf's edge radius.

(e) Candidates were required to draw the missing head of the flower by constructing two circles, then to draw straight lines through the centre at the required angles to construct the petals. Most candidates drew the two circles correctly and achieved at least two marks. Many candidates struggled with constructing the petals correctly and drew lines that did not go through the centre of

the flower head or at incorrect angles resulting in petals of incorrect sizes. Few candidates were able to draw all six of the petals correctly.

(f) Candidates were required to draw the missing outer hexagon of the logo using the given centre lines. Many candidates drew hexagons that were irregular and only achieved one mark. Some candidates drew regular hexagons to the wrong size. The strongest candidates used a compass set at 120 mm radius to draw a circle and then scribe arcs to locate the six corners or drew lines at 60º from the centre point and edge to locate corners.

Question A2

(a) This question required candidates to construct an ellipse with Major axis 140, Minor axis 80 on the given centre lines. A wide variety of construction methods were seen for this question. Many candidates used a suitable method to plot a number of points which were then joined up into a smooth ellipse shape. Many candidates plotted sufficient points accurately but joined some of the points with straight lines resulting in an irregular shaped ellipse. A significant proportion of candidates did not attempt this question.

(b) This question required candidates to draw the two sides of the plant pot by drawing straight lines from the ends of the given half ellipse to the correct points on the major axis of the top ellipse. Many candidates drew the lines to the ends of the horizontal centre line and did not achieve the mark.

Question A3

This question required knowledge of the vacuum forming and/or blow moulding processes that are used to create products from thin plastic. Many candidates correctly named one of these methods and achieved the mark.

Question B4

(a) Candidates were required to complete the planometric view of the garden container to a scale of 1:5 using the information given on the orthographic views. Many candidates constructed the two corner legs of the container to the correct sizes but in the incorrect positions due to drawing the sides to the wrong length. Many candidates were able to construct the two missing back sides of the container in the correct position and to the corresponding length to the front ones. However, many did not allow for the base of the container and drew the sides too deep. Few candidates correctly constructed the inside of the container. The strongest candidates drew the container to the correct overall sizes and internal depth with good accuracy.

(b) This question asked candidates to apply thick and thin line technique to the garden container. 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 applied the technique correctly and achieved all four marks. Many other candidates showed some knowledge of the technique and gained marks but could have improved on the use of this technique. A significant number of candidates applied thick lines to the entire container or applied hatching to the different parts of the container which achieved no marks.

(c) This question asked candidates to complete the estimated two-point perspective view of the tray. Candidates were required to project lines to the relevant vanishing points and use the existing given parts of the drawing to complete the perspective view. Many candidates were able to project the relevant lines to the correct vanishing points for the sides of the tray. Fewer candidates were able to draw the vertical corner edges of the tray in proportion resulting in a tray that was slightly too wide. Many candidates did not project the corners of the given handle to the opposite side of the tray to correctly draw the missing handle.

Question B5

(a) Candidates were required to complete the orthographic views of the garden lantern to a scale of 1:2. This question was not generally well answered by the majority of candidates. Many candidates did not complete the plan view by adding the centre square or diagonal corner edge lines and could not be awarded these three marks. A significant number of candidates did not project the roof width correctly from the plan or drew the side and windows in the correct position but to incorrect sizes.

Candidates who carefully studied the isometric view, read the necessary dimensions and drew accurately from the given start points achieved the best results.

(b) This question required candidates to demonstrate their knowledge and skill of textural representations by rendering the given drawing to look like glass. The strongest candidates used light blue pencil crayon to create parallel, diagonal shine lines across the drawing. Many candidates applied some appropriate rendering using grey pencil and achieved one mark. Some candidates simply shaded the piece of glass.

(c) Candidates were required to complete the sectional view A-A through the assembled lantern. Many candidates who chose this question did not attempt this part of the question. Very few candidates achieved all eight marks on this question. The strongest candidates drew the tube inside the given lid section to the correct height and thickness. They then drew the bottom tube and base sections to the correct sizes and applied hatching to the separate parts correctly. Some candidates completed parts of the sectional view correctly but applied hatching incorrectly.

(d)(i) This question required knowledge of laser cutters (CAM) and their applications. Candidates were asked to explain why only the base of the lantern could be made using a laser cutter. Candidates were expected to know and explain that laser cutters can only cut out 2D shapes from flat sheet materials so making the tube shaped sections would not be possible. Candidates need to improve on their knowledge for this question as very few achieved any marks.

(ii) Candidates were asked to state a suitable type of adhesive that could be used to join the acrylic parts of the lantern together. The best responses gave solvent-based adhesives specifically for acrylic such as Tensol cement. Many candidates gave inappropriate adhesives such as PVA.

(iii) This question required knowledge of standardised symbols used on products. Candidates were required to draw a symbol to show that something is toxic. Many candidates drew a skull and/or crossbones and achieved at least one mark. The best responses included high quality skulls and crossbones. Many candidates drew radio-active symbols or hazard symbols.

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 and further improvements are needed. 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, what its limitations are and the advantages/disadvantages of using it. The drawing of sectional views and the construction of ellipses are areas where many candidates did not perform well and need further improvement along with textural representation of different materials.

Comments on specific questions

Section A

Question A1

(a) Candidates were required to draw the missing base of the tree by constructing a rectangle 20 mm x 10 mm in the correct position. Most candidates drew the overall size correctly and in the correct position. Some candidates drew the rectangle too big or off centre.

(b) Candidates were required to draw the two missing triangles on the tree by constructing two equilateral triangles. The vast majority of candidates completed this successfully and achieved all three marks. A significant number of candidates drew the bottom triangle incorrectly resulting in an isosceles triangle and did not get the first mark.

(c) Candidates were required to draw the missing parts of the plant pot. Most candidates drew the plant pot to the correct size and gained both marks. Some candidates drew the base of the plant pot to the wrong length or in the wrong position and did not achieve the first mark. Despite this, they were still able to achieve the second mark by adding the sides of the plant pot correctly to their own solution.

(d) Candidates were required to draw the missing leaf in the correct position by constructing two arcs. Many candidates did not draw the leaf to the correct size or shape and others did not draw the leaf in the correct position. The strongest candidates drew a horizontal line at the correct height on the plant stem, then used the existing leaf as a guide of the length required before using a pair of compasses to scribe arcs which located the centre of the leaf's edge radius.

(e) Candidates were required to draw the missing head of the flower by constructing two circles, then to draw straight lines through the centre at the required angles to construct the petals. Most candidates drew the two circles correctly and achieved at least two marks. Many candidates struggled with constructing the petals correctly and drew lines that did not go through the centre of

the flower head or at incorrect angles resulting in petals of incorrect sizes. Few candidates were able to draw all six of the petals correctly.

(f) Candidates were required to draw the missing outer hexagon of the logo using the given centre lines. Many candidates drew hexagons that were irregular and only achieved one mark. Some candidates drew regular hexagons to the wrong size. The strongest candidates used a compass set at 120 mm radius to draw a circle and then scribe arcs to locate the six corners or drew lines at 60º from the centre point and edge to locate corners.

Question A2

(a) This question required candidates to construct an ellipse with Major axis 140, Minor axis 80 on the given centre lines. A wide variety of construction methods were seen for this question. Many candidates used a suitable method to plot a number of points which were then joined up into a smooth ellipse shape. Many candidates plotted sufficient points accurately but joined some of the points with straight lines resulting in an irregular shaped ellipse. A significant proportion of candidates did not attempt this question.

(b) This question required candidates to draw the two sides of the plant pot by drawing straight lines from the ends of the given half ellipse to the correct points on the major axis of the top ellipse. Many candidates drew the lines to the ends of the horizontal centre line and did not achieve the mark.

Question A3

This question required knowledge of the vacuum forming and/or blow moulding processes that are used to create products from thin plastic. Many candidates correctly named one of these methods and achieved the mark.

Question B4

(a) Candidates were required to complete the planometric view of the garden container to a scale of 1:5 using the information given on the orthographic views. Many candidates constructed the two corner legs of the container to the correct sizes but in the incorrect positions due to drawing the sides to the wrong length. Many candidates were able to construct the two missing back sides of the container in the correct position and to the corresponding length to the front ones. However, many did not allow for the base of the container and drew the sides too deep. Few candidates correctly constructed the inside of the container. The strongest candidates drew the container to the correct overall sizes and internal depth with good accuracy.

(b) This question asked candidates to apply thick and thin line technique to the garden container. 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 applied the technique correctly and achieved all four marks. Many other candidates showed some knowledge of the technique and gained marks but could have improved on the use of this technique. A significant number of candidates applied thick lines to the entire container or applied hatching to the different parts of the container which achieved no marks.

(c) This question asked candidates to complete the estimated two-point perspective view of the tray. Candidates were required to project lines to the relevant vanishing points and use the existing given parts of the drawing to complete the perspective view. Many candidates were able to project the relevant lines to the correct vanishing points for the sides of the tray. Fewer candidates were able to draw the vertical corner edges of the tray in proportion resulting in a tray that was slightly too wide. Many candidates did not project the corners of the given handle to the opposite side of the tray to correctly draw the missing handle.

Question B5

(a) Candidates were required to complete the orthographic views of the garden lantern to a scale of 1:2. This question was not generally well answered by the majority of candidates. Many candidates did not complete the plan view by adding the centre square or diagonal corner edge lines and could not be awarded these three marks. A significant number of candidates did not project the roof width correctly from the plan or drew the side and windows in the correct position but to incorrect sizes.

Candidates who carefully studied the isometric view, read the necessary dimensions and drew accurately from the given start points achieved the best results.

(b) This question required candidates to demonstrate their knowledge and skill of textural representations by rendering the given drawing to look like glass. The strongest candidates used light blue pencil crayon to create parallel, diagonal shine lines across the drawing. Many candidates applied some appropriate rendering using grey pencil and achieved one mark. Some candidates simply shaded the piece of glass.

(c) Candidates were required to complete the sectional view A-A through the assembled lantern. Many candidates who chose this question did not attempt this part of the question. Very few candidates achieved all eight marks on this question. The strongest candidates drew the tube inside the given lid section to the correct height and thickness. They then drew the bottom tube and base sections to the correct sizes and applied hatching to the separate parts correctly. Some candidates completed parts of the sectional view correctly but applied hatching incorrectly.

(d)(i) This question required knowledge of laser cutters (CAM) and their applications. Candidates were asked to explain why only the base of the lantern could be made using a laser cutter. Candidates were expected to know and explain that laser cutters can only cut out 2D shapes from flat sheet materials so making the tube shaped sections would not be possible. Candidates need to improve on their knowledge for this question as very few achieved any marks.

(ii) Candidates were asked to state a suitable type of adhesive that could be used to join the acrylic parts of the lantern together. The best responses gave solvent-based adhesives specifically for acrylic such as Tensol cement. Many candidates gave inappropriate adhesives such as PVA.

(iii) This question required knowledge of standardised symbols used on products. Candidates were required to draw a symbol to show that something is toxic. Many candidates drew a skull and/or crossbones and achieved at least one mark. The best responses included high quality skulls and crossbones. Many candidates drew radio-active symbols or hazard symbols.

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 **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 and further improvements are needed. 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, what its limitations are and the advantages/disadvantages of using it. The drawing of sectional views, the textural representation of different materials and vacuum forming are areas where many candidates did not perform well and need further improvement in their skills and knowledge.

Comments on specific questions

Section A

Question A1

(a) Candidates were required to draw the missing parts of the tent symbol by constructing an equilateral triangle in the correct position using the given base line. Most candidates drew the triangle to the correct size and in the correct position with the 10 mm extension also added. Some candidates drew the triangle to the wrong height or width resulting in an equilateral triangle smaller than required or an isosceles triangle.

(b) Candidates were required to draw the missing parts of the caravan symbol. The vast majority of candidates completed the wheel and wheel arch to the correct radius. Many candidates drew the floor of the caravan to an incorrect length. Most candidates drew the sides of the caravan to the correct size and position but many did not draw the roof to the correct radius. Most candidates drew the missing window to the correct size and 10 mm away from the side of the caravan. Many candidates did not complete the tow hitch. The strongest candidates carefully constructed the different aspects shown using the information given.

Question A2

This question required candidates to construct a regular octagon 220AF around the symbols using the centre lines given. Many candidates did not attempt this question. A significant number of candidates were able to draw an octagon but with sides and angles that were irregular and did not therefore achieve any marks on this question.

Question A3

(a) This question required candidates to demonstrate their knowledge and skill of textural representations by rendering the given drawing to look like softwood. The strongest candidates

used light brown pencil crayon to create grain lines along the length of the top and sides, with occasional knots shown and appropriate curved lines showing the end grain on the cut out and sloping end. Many candidates applied some lines along the length of the top and sides but did not show any knots or end grain. Many candidates simply shaded the drawing in pencil or brown crayon and did not show any grain lines.

(b) Candidates were required to complete the plan of the stand to a scale of 1:4 using the information given on the isometric view in **(a)** and the given front view. Many candidates drew a side view of the stand instead of a plan. Many candidates projected parts of the front view but did not use these correctly to construct the plan view resulting in legs of incorrect lengths and thicknesses. The strongest candidates projected lines from the legs shown on the front view to construct the base, then projected the lines from the top edges of the octagon-shaped sign to complete the drawing.

Question B4

(a) Candidates were required to complete the development (net) of the tent model to a scale of 1:2 using the information given on the orthographic views. Many candidates constructed the partly completed given side of the development (net) and the front window correctly. However, many candidates did not include the front overhang of the model tent when drawing the roof parts. Most candidates added appropriately sized glue flaps in the correct positions on the development (net) but very few used the correct dotted and dashed fold line convention and could not be awarded marks as a result. The strongest candidates drew the development (net) and glue flaps to the correct overall sizes using the appropriate convention on fold lines only.

(b) (i) This question required knowledge of CAD and its advantages compared to drawing by hand. Candidates were asked to describe one advantage of using CAD to draw the development (net) compared to drawing it by hand. Many candidates stated that using CAD was quicker or more accurate than drawing by hand but did not provide a detailed enough description of why this was the case to achieve both marks.

(ii) This question required knowledge of CAM equipment. Candidates were asked to name one piece of CAM equipment that could be used to cut out the development (net) of the model tent from thin card. Many candidates named a laser cutter and gained the mark. A significant number of candidates gave scissors or craft knife as their answer which did not achieve a mark.

(iii) Candidates were asked to state a suitable type of adhesive that could be used to assemble the development (net). The best responses were non-solvent based adhesives such as PVA which are ideal for this purpose. Many candidates gave inappropriate adhesives such as contact adhesive.

(c) This question asked candidates to complete the one-point perspective of the assembled model tent. Candidates were required to use the information given on the orthographic views in **(a)**. Many candidates were able to draw the front view of the tent correctly including the door. Many candidates also projected lines from the front view and correctly drew the right-hand side wall and window correctly. Very few candidates projected the lines from the vanishing point through the apex of the roof to complete the roof overhang sections on the front of the tent. The strongest candidates used the information given on the front and side views of **(a)** to construct the relevant parts of the tent and project the lines to the correct lengths.

Question B5

(a) Candidates were required to complete the isometric view of the picnic table to a scale of 1:10 using the information given on the orthographic views. The vast majority of candidates were able to complete the table top and front legs correctly using the given start points. Some candidates drew the two side benches too long or to the wrong thickness. Many candidates struggled to complete the cross bars on either end to the correct height or show the appropriate thickness. The strongest candidates completed the front end of the table using the information given on the orthographic front view then projected 30º lines back from the appropriate points to construct the side benches and end section.

(b) (i) This question required candidates to demonstrate knowledge of different drawing methods and techniques. Candidates were asked to name the drawing method used to show the different component parts of the bench joint. Most candidates did not correctly identify the drawing method as an exploded view.

(ii) Candidates were required to complete the half-size sectional view through the assembled bench joint. Many candidates did not attempt this part of the question. Most candidates who did attempt the question correctly drew in the outline of the leg and added a nut or washer to the correct side. Very few candidates added hatching correctly to either of the sections.

(c) This question required knowledge of the vacuum forming process and use of moulds in this process.

(i) Candidates were required to state two features of the mould shown that make it easy to remove after vacuum forming. Very few candidates stated the sloping sides (draft angle) or rounded corners of the mould. Some candidates described the use of a lubricant as a release agent to prevent the mould sticking which was allowed. Many candidates did not respond to this part of the question.

(ii) Candidates were then asked to describe one disadvantage of using a vacuum formed blister pack for the bolts, nuts and washers instead of a box made from thin card. Most correct answers related to the environmental impact of plastics compared to card and how card is much easier to recycle. Some candidates stated that once opened, blister packs are difficult to re-seal but did not describe in sufficient detail why this would be a disadvantage.