DESIGN AND TECHNOLOGY

Paper 0445/11
Product Design

Key messages

Candidates who performed well demonstrated a good understanding of the question requirements and produced creative design work that was underpinned with sound technical understanding.

Candidates should be aware that the focus for **Question 1** is Resistant Materials, for **Question 2** Graphic Products and for **Question 3** Systems and Control.

Candidates should be advised to read each question carefully. They should follow the instructions for each individual question, especially the number of points, ideas, materials or methods that the question is asking for. This supports good time management when completing the question paper.

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 advised that in **part (e)** marks are specifically allocated for construction details and important dimensions.

General comments

Question 1 was the most popular question. Very few candidates attempted **Question 3** or **Question 2**.

The overall standard of work was good, with freehand sketching and knowledge of materials and processes being strengths for many candidates.

Some candidates may benefit from adopting a more structured approach in order to express their thoughts clearly in the written parts on the paper. 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) Almost all candidates managed to list four additional points about a device for transporting a small household pet that they considered to be important. Commonly seen answers often referred to the comfort of the pet, ventilation, ease of carrying the device, ease of cleaning the device or ways of making sure the pet had sufficient food and water. Some candidates referred to a specific type of household pet, such as a rabbit, but most considered the functions of a device that could be used for transporting a range of different household pets. Candidates should be advised against repeating points that are given in the question, such as the device must keep the pet safe, or giving generic points, such as cheap, that might apply to almost any product.

(b) Most candidates used sketches and notes to good effect to show two methods of attaching a door that could open and close. Commonly seen answers included hinges, sliding doors and fabric doors that were secured with zip fasteners or Velcro. The quality of sketches and notes were

usually of a very good standard. Candidates should be reminded that the question asks for sketches and notes and, therefore, just sketches will not be awarded full marks.

(c) A very good range of sketches with annotations was seen for this question, with almost all candidates producing the required three ideas. The strongest responses included annotations that referred to the design requirements and used a range of presentation techniques, including freehand exploded views and colour. Most design ideas were based upon a cage or box, but some candidates designed rucksacks that could be carried on the owners back. It is important that all design ideas fully meet the design requirements if candidates are to access the full range of marks.

(d) The evaluations of ideas were generally well reasoned, with candidates able to demonstrate a good understanding of the positive and negative features of their design proposals. Commonly seen answers often referred to how easy it would be to manufacture, store, transport or use the device. It is important that candidates evaluate their design proposals, rather than simply describe them, and do not repeat the same evaluation points for each idea. Almost all candidates chose one of their ideas to develop further, usually by giving the number of the idea, and provided a reasoned justification for their choice. The standard of written communication for this question was variable, and the use of bullet points or numbered points may have enabled some candidates to express their thoughts more clearly.

(e) Some very impressive responses were seen to this question, with freehand sketches and notes used to clearly show the full details of the final design proposal. Other drawing methods used included freehand 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 and included details of dimensions, materials, joining methods and finishes. 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 materials included pine, acrylic, specific textile materials such as nylon and stainless steel. Reasons for the choice of material often referred to the structural strength, transparent qualities or how easy it would be to shape or join the material. Candidates should be advised against giving generic names of materials such as metal, or consumables such as varnish, 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. Hand production methods, involving cutting and shaping materials, joining and applying a finish were commonly seen. Glued joints and welding were commonly seen joining methods. A small number of candidates described how parts could be designed on a computer and produced using a laser cutter. Some very good responses were seen to this question, but it is important that candidates include the correct names of tools and equipment if they are to access the full range of marks.

Question 2

(a) Most candidates managed to list four additional points about a package that would hold and display a toy for a pet animal that they considered to be important. Commonly seen answers included the package should be informative, colourful, safe for the pet and the purchaser, inexpensive to produce and the materials should be able to be recycled. Candidates should be advised against repeating points that are included in the question, for example the package must hang on a shop display rack, or giving generic points that might apply to almost any product.

(b) Most candidates used sketches and notes to good effect to show two methods hanging a package from a shop display rack. Commonly seen responses included holes and slots in the package and additional pieces of wire or string. In almost all cases the quality of the sketches and notes were sufficient to clearly communicate the method. Candidates should be reminded that the question asks for sketches and notes and, therefore, just sketches will not be awarded full marks.

(c) A good range of sketches with annotations was seen for this question, with colour generally used to good effect. Commonly seen design proposals included packages made from a folded sheet of card or from a vacuum formed plastic container. In some design proposals it was unclear what specific toy the package was designed for, even though additional features such as a container for treats had been added to the package. It is important that all ideas fully meet the design requirements if candidates are to access the full range of marks.

(d) The evaluations of ideas were generally sound, with candidates able to demonstrate an understanding of the positive and negative aspects of their design proposals. Commonly seen answers focused on how easy it would be to open the package or recycle the materials after use. It is important that candidates justify their evaluations rather than making general statements, such as it would work well, if they are to access the full range of marks. Almost all candidates chose one of their ideas to develop further, usually by giving the number of the idea, and justified their choice.

(e) Some very good responses were seen to this question, with a variety of methods used to show the full solution to the design problem. These methods included freehand orthographic drawings, freehand sketches, and developments (nets). Colour was generally used effectively to show the material or surface graphics. The question specifically asked for construction details and important dimensions but, particularly in the weaker responses, these were often missing. All candidates need to consider whether the information they provide 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 to make their design proposal and gave reasons for their choices. Card and thin polystyrene sheet were commonly named materials, with reasons often referring to specific properties such as easy to cut and fold, easy to form into complex shapes, easy to add surface graphics or the material can be recycled. Candidates should be advised against giving generic names of materials, such as plastic, 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, usually involving cutting out the material with a craft knife, were commonly seen but some candidates used vacuum forming or computer-controlled technology to produce parts for their design. It is important that all 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.

Question 3

(a) Very few candidates answered this question. Most candidates that did answer this question managed to list four additional points about the function of the device that would automatically dispense a set portion of dry pet food at regular times that they considered to be important. Commonly seen answers stated that the device would need to be reliable, programmable, easy to clean or store a large amount of food. Candidates should be advised against repeating points that were given in the question, for example it must be easy for the pet to access the food, as these responses are not awarded marks.

(b) Most candidates used sketches and notes to show two methods of dispensing a set portion of dry pet food. Some candidates showed electronic methods, that involved parts rotating and a set portion of food dropping from a hopper, whilst others showed mechanical devices that used a wind-up spring as a power source. In almost all cases the quality of the sketches and notes were sufficient to clearly communicate the method.

(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, one could visualise how the product would be used even though details of the components and case construction were sometimes less clear. A small number of candidates produced fewer than three ideas or three ideas that were very similar.

(d) The evaluations of ideas were often impressive, 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 device, how much food it could store or how easy it would be for the pet to access the set portion of food. It is important that candidates justify their evaluations rather

than making broad statements, such as it is the best idea, if they are to access the full range of marks. Almost all candidates chose one of their ideas to develop further, usually by giving the number of the idea, and justified their choice.

(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 freehand exploded sketches, freehand orthographic views, annotations, and materials lists. The question specifically asked for construction details and important dimensions but often in weaker responses these were unclear as only the external views of the device were shown. All candidates need to consider whether the information they provide 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 stainless steel, with the reason stated as it would be suitable for moulding into complex shapes, available in a range of colours or easy to clean. Candidates should be advised against giving generic names of materials such as plastic, or generic reasons such as 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 fabrication techniques using hand tools, injection moulding and the use of a 3D printer. The explanations of computer-controlled technology usually demonstrated a good understanding of the process. It is important that all 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 who performed well demonstrated a good understanding of the question requirements and produced creative design work that was underpinned with sound technical understanding.
Candidates should be aware that the focus for **Question 1** is Resistant Materials, for **Question 2** Graphic Products and for **Question 3** Systems and Control.

Candidates should be advised to read each question carefully. They should follow the instructions for each individual question, especially the number of points, ideas, materials, or methods that the question is asking for. This supports good time management when completing the question paper.

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 advised that in **part (e)** marks are specifically allocated for construction details and important dimensions.

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 the candidates from some centres described injection moulding or vacuum forming.

General comments

Question 1 was the most popular question, although there were more candidates who attempted **Question 3** than in previous years.

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. If the additional space on the last page was used, it was almost always as a continuation of the response to **part (g)**.

The strongest candidates produced a range of creative ideas for **part (c)** and in **part (e)** the drawings of their final solution demonstrated a high level of graphical skills and technical understanding.

Some candidates may benefit from adopting a more structured approach in order to express their thoughts clearly in the written parts of the paper. 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 unit to display cakes that they considered to be important. Commonly seen answers indicated that the display unit would need to be made from a material that would be easy to wipe clean, prevent flies or insects getting to the cakes, display information such as the prices of the cakes, provide easy access to the cakes

for both the customer and the shopkeeper or be lightweight so that it could be moved to a new position for refilling. Most candidates developed their points into short sentences, rather than giving just a one-word answer. Candidates should be advised against repeating points that are given in the question or giving generic points, such as cheap, that might apply to almost any product.

(b) Most candidates used sketches and notes to good effect to show two methods that would allow parts of a display unit to be easily joined and dismantled. Commonly seen answers involved the use of magnets, screw fittings, push fit dowels and slots, Velcro or knock down fittings. A small number of candidates showed a joint, such as a dovetail joint, that was glued together and could not be easily joined or dismantled. 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 racks or enclosed cases made from aluminium, brass or acrylic. Although some of the display units were square or rectangular in shape, other shapes such as cylinders or square based pyramids were seen. The strongest candidates added detailed annotations to their sketches that made it clear that they had fully considered how the cakes would be displayed and added or removed from the display unit. Most candidates designed a display unit that was freestanding, but a small number of candidates produced designs that would sit on a table. A very small number of candidates produced fewer than three ideas or three ideas that were very similar in form.

(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. Commonly seen answers referred to the how well the display unit would display the cakes, ease of use, stability, maintenance or safety. Some candidates found it difficult to express their thoughts clearly and concisely and may well have benefitted from using a more structured approach, such as bullet points. Almost all candidates chose one of their ideas, usually by giving the number of the idea, and justified their choice of idea for development. In the justification of the selection of their chosen idea candidates are required to do more than simply state that it is the best or it meets all the specification points.

(e) A variety of methods were used to show the full solution to the design problem. These methods included freehand orthographic drawings, exploded views, isometric views, and material lists. Colour, and enlarged drawings of details, were commonly used to add clarity to drawings. This question specifically asked for construction details and important dimensions but, particularly in weaker responses, these were often missing. The most successful candidates clearly indicated the materials, joining methods, dimensions, and finishes in their freehand sketches and notes. All candidates need to consider whether the information they provide 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 stainless steel, aluminium, pine, acrylic and melamine faced chipboard. The reasons for the choice of material often referred to the aesthetic qualities, working properties or structural strength of the material. Candidates should be advised against giving generic names of materials, such as plastic, as these responses are not awarded marks.

(g) Most candidates used a combination of sketches and notes to outline an appropriate method of manufacturing one part of their design proposal. Manufacturing methods, involving the use of marking out tools, saws, joints, and adhesives, were commonly seen. The use of computer technology, such as a laser cutter or 3D printer, to produce a part of the display unit was also commonly seen. Many excellent responses were seen to this question, but it is important that candidates include the correct names of tools and equipment if they are to access the full range of marks.

Question 2

(a) Most candidates were able to list four additional points about the function of the package for three lunch items that they considered to be important. Commonly seen answers referred to keeping the food fresh, ease of carrying, essential information for the customer, the use of colour or images to make the package attractive and selecting materials that could be recycled. Candidates should be advised against repeating points that are given in the question, for example the package must keep the food items separate, or giving generic points that might apply to almost any product.

(b) Most candidate used sketches and notes to good effect to show two methods that could be used to join thin sheet material without the use of an adhesive. Many candidates showed the use of slot fastenings, Velcro, screw fasteners or magnets. Some candidates did not show a complete understanding of the question and showed methods of joining thin sheet material that involved the use of an adhesive. The standard of written and visual communication for this question was almost always sufficient to communicate the method, and often of an excellent standard.

(c) An impressive range of sketches with annotations were seen for this question, with colour used to good effect to show the materials and surface graphics. Many candidates chose to use lightweight graphic materials, such as card, for their package. Some candidates considered the package to be a product that could be used over a prolonged period, and designed a container that was made from vacuum formed plastic or wood. Almost all the design ideas were clearly for the three food items given in the question but not all candidates considered how the items could be kept separate. It is important that all design ideas fully meet the design requirements if candidates are to access the full range of marks. A small number of candidates produced fewer than three ideas or three ideas that were very similar.

(d) The evaluations of ideas were generally very impressive with candidates able to clearly demonstrate an understanding of the positive and negative aspects of their design proposals. Commonly seen answers focused on how the package would be carried, how easy it would be to open or close the package, how well it would protect the contents, how easy it would be to manufacture or whether it could be recycled after use. It is important that candidates justify their evaluations rather than making general statements, such as that it would work well, if they are to access the full range of marks. Almost all candidates chose one of their ideas, usually by giving the number of the idea, and justified their choice of idea for development.

(e) A variety of methods were used to show the full solution to the design problem. These included freehand orthographic drawings, freehand exploded views, and isometric views. Many responses included a freehand three-dimensional (3D) sketch and a development (net), with supporting annotations. The highest scoring responses usually included details of the surface graphics for the package, such as a name, image or product information. This question specifically asks for construction details and important dimensions but, particularly in the weaker responses, these were often missing. Stronger candidates clearly showed the materials, dimensions and construction methods through their freehand sketches and notes. All candidates need to consider whether the information they provide 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. Card, corrugated cardboard and polypropylene sheet were commonly named materials. The main reasons for choosing these materials were often linked to the method of manufacture, such as cutting or joining, structural strength of the material or how easy it would be to recycle the material after use. Candidates should be advised against giving the generic names of materials, such as plastic, or generic reasons for choosing the material.

(g) Most candidates used a combination of sketches and notes to outline a method of manufacturing one part of their design proposal. Many candidates described how the parts for the package would be cut out by hand, using a craft knife, safety rule and cutting mat, and then folded and glued together. Some candidates explained how a computer numerically controlled (CNC) machine could be used to cut out the parts of their design proposal. It is important that all 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.

Question 3

(a) Candidates were usually able to list four additional points about the function of a handheld device that could be adjusted to cut slices of cake to different thicknesses that they considered to be important. Commonly seen answers referred to ergonomics, safety, being able to dismantle the product for cleaning or repair and ease of operation. Candidates should be advised against repeating points that are given in the question, for example the device must display the thickness of the slice being cut, or giving generic points that might apply to almost any product.

(b) Most candidates used sketches and notes to show two methods that could be used to display numbers on a handheld device. Commonly seen answers included 7-segment displays, LCD displays or mechanical displays that either rotated, like a micrometer, or moved in a linear fashion. The standard of written and visual communication for this question was not always sufficient to fully communicate the method.

(c) An impressive range of sketches with annotations were seen for this question, although it was not always clear that the candidate fully understood the details of how the device would work. For example, some design proposals did not fully consider how the device would be adjusted to cut slices of different thickness. Some candidates saw the device as a single handheld item, but others viewed it as a 'jig' that could be used with an existing knife. It is important that all design ideas fully meet the design requirements if candidates are to access the full range of marks. A small number of candidates produced fewer than three ideas or ideas that were very 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 how safe the device would be to use, the weight of the device, durability of the materials or the practicalities of dismantling for cleaning. It is important that candidates justify their evaluations rather than making broad statements, such as that it is the best design idea, if they are to access the full range of marks. Almost all candidates chose one of their ideas, usually by giving the number of the idea, and justified their choice of idea for development.

(e) A variety of methods were used to show the full solution to the design problem. These included freehand orthographic drawings, freehand exploded views, freehand isometric views, and materials lists. Most candidates made extremely good use of the space provided to answer the question, with one main drawing in the centre of the page and notes and drawings of details, such as materials or joining methods, around it. This question specifically asked for construction details and important dimensions but, particularly in the weaker responses, these were often only partly shown. Stronger responses included details of materials, construction details, finishes and dimensions. All candidates need to consider whether the information they present 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 stainless steel, aluminium and a range of specific polymers, with the reasons relating to the aesthetic qualities, weight or working properties of the material. Candidates should be advised against giving generic names of materials such as metal, or generic reasons such as it would be 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 manufacturing one part of their design proposal. Commonly seen manufacturing methods included injection moulding, cutting out parts with a laser cutter or 3D printing. Most candidates used sketches and notes, usually in numbered stages, to show the method of manufacture. It is important that all 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 0445/13
Product Design

Key messages

Candidates who performed well demonstrated a good understanding of the question requirements and produced creative design work that was underpinned with sound technical understanding.

Candidates should be aware that the focus for **Question 1** is Resistant Materials, for **Question 2** Graphic Products and for **Question 3** Systems and Control.

Candidates should be advised to read each question carefully. They should follow the instructions for each individual question, especially the number of points, ideas, materials, or methods that the question is asking for. This supports good time management when completing the question paper.

Candidates should 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, or 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 accurately measured drawings needs to be carefully considered against the time taken to produce such drawings.

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 the candidates from some centres described the same process.

General comments

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

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 and knowledge of materials and processes were real strengths.

Some candidates may benefit from adopting a more structured approach in order to express their thoughts clearly in the written parts of the paper. 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 wall-mounted storage unit for tools and small components that they considered to be important. Commonly seen answers included that the storage unit must be light enough to be lifted into position on the wall, it must be easy to wipe off oil or dust from the surfaces of the storage unit, the tools must be easily identified, and sharp tools must not be a danger to the user. Candidates should be advised against repeating points that are given in the question, such as the unit must be able to be modified to allow additional tools or components to be added, or giving generic points that might apply to almost any product, as these responses are not awarded marks.

(b) Most candidates used sketches and notes to good effect to show two methods of temporarily attaching hand tools to a wall unit. Commonly seen answers included holes to slot the tools into, pegs to hang tools on, hooks, straps and magnets. Candidates are reminded to read the question carefully. The question asked for methods of temporarily attaching hand tools to a wall unit, and some candidates described methods of attaching the storage unit to a wall. 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 involved places to hang the hand tools and drawers or compartments for the components. Most solutions were made from pine, MDF (medium density fibreboard), or mild steel tube. The highest achieving candidates added detailed annotations to their sketches that clearly showed the position of the tools and how they would be attached. It is important that all design proposals fully meet the design requirements if candidates are to access the full range of marks. For example, some candidates did not fully consider how the storage unit would be attached to a wall, and designed floor standing storage units. A small number of candidates produced fewer than three ideas or three ideas that were very similar.

(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. Commonly seen answers referred to ease of accessing the tools, strength required to support the weight of the tools, the method of attaching to a wall, the overall size of the storage unit or ease of manufacture. Some candidates may have benefitted from using a more structured approach, such as bullet points, to express their thoughts clearly and concisely. Almost all candidates chose one of their ideas, usually by giving the number of the idea, and justified their choice of idea for development.

(e) Many excellent responses were seen to this question. Methods used to show the full solution included freehand orthographic drawings, exploded views, isometric views, and material lists. Colour, and enlarged drawings of details, were commonly used to add clarity to drawings. This question specifically asked for construction details and important dimensions but, particularly in weaker responses, these were often missing. All candidates need to consider whether the information they provide 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 pine, MDF (medium density fibreboard) and mild steel. The reasons for the choice of material often referred to the structural strength of the material but aesthetics and cost were also sometimes considered. Candidates should be advised against giving generic names of materials, such as metal, as these responses are not awarded marks.

(g) Most candidates used a combination of sketches and notes, often arranged as numbered stages, to outline a method of manufacturing one part of their design proposal. Fabrication techniques, including wood joints and welding were commonly seen methods of manufacture. Many excellent responses were seen to this question, but it is important that candidates include the correct names of tools and equipment and ensure the manufacturing method is suitable for the solution they proposed in **part (e)**.

Question 2

(a) Most candidates were able to list four additional points about the function of the package for a pair of combination pliers that they considered to be important. Commonly seen responses referred to the importance of the package being eye-catching to attract customers, using materials that could be recycled or having space for images, product information or a bar code. A small number of candidates found the wording, a package for a pair of combination pliers, confusing and designed a package for two pairs of pliers. Candidates should be advised against repeating points that are given in the question, for example it must show the tool's common functions, or giving generic points that might apply to almost any product, as these responses are not awarded marks.

(b) Most candidate used sketches and notes to good effect to show two methods of securing the pliers to a package. Many candidates showed cable ties, string, slots in a card package or a plastic blister. Some candidates drew the full package, rather than concentrating on the method of securing the pliers to a package.

(c) An impressive range of sketches with annotations were seen for this question, with colour used to good effect to show the materials, construction methods and surface graphics. Most candidates chose to use lightweight materials, such as cardboard or plastic sheet, but a few used resistant materials, such as MDF or pine. The annotations often revealed a candidate's true understanding of how the package would show the main functions of the pliers. It is important that all ideas fully meet the design requirements if candidates are to access the full range of marks. A small number of candidates produced fewer than three ideas or three ideas that were very similar.

(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. Commonly seen answers focused on how easy it would be for customers to see and operate the combination pliers, the appeal of the package to customers, how environmentally friendly the package would be, or the cost of manufacturing. It is important that candidates justify their evaluations rather than making general statements, such as it would work well, if they are to access the full range of marks. Almost all candidates chose one of their ideas, usually by giving the number of the idea, and justified their choice of idea for development.

(e) A variety of methods were used to show the full solution to the design problem. Many responses included a freehand three-dimensional sketch and a development (net), with supporting annotations. Other methods used included freehand orthographic drawings and freehand exploded views. The stronger responses showed full details of the surface graphics to be used on the package. The question specifically asked for construction details and important dimensions but, particularly in the weaker responses, these were often missing. All candidates need to consider whether the information they provide 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 and specific types of thin plastic sheet, such as polystyrene, were commonly named materials. The main reasons for choosing these materials were often linked to the method of manufacture, such as printing, cutting out, folding, or joining, 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 their package would be marked out, cut out and then joined together using hand tools although some candidates used computer numerically controlled (CNC) machines to complete a similar process. Some candidates described how to vacuum form the plastic blister that was to be used in their package. It is important that all candidates include the correct names of tools and equipment to be used in the method of manufacture and do not describe just a stage in manufacturing, such as cutting out a hole for hanging, if they are to access the full range of marks.

Question 3

(a) Very few candidates chose to answer this question. Candidates that did answer this question were usually able to list four additional points about the function of a bench-mounted device that would temporarily hold materials that they considered to be important. Commonly seen answers often referred to ease of operation, durability of the materials used, not damaging the material being held or the effectiveness of the grip. Candidates should be advised against repeating points that are given in the question, for example it must securely hold the work, or giving generic points that might apply to almost any product, as these responses are not awarded marks.

(b) Most candidates used sketches and notes effectively to show two mechanisms that would hold materials securely to a flat surface. Many candidates showed variations on existing types of clamps, such as a G cramp, that involved screw mechanisms, springs or cams. The quality of the sketches and notes were usually sufficient to adequately show the mechanism. Candidates should be reminded that the question asks for sketches and notes and, therefore, just sketches will not be awarded full marks.

(c) Some impressive sketches with annotations were seen for this question, although it was not always clear that the candidate fully understood how the device would work. For example, some candidates should try to fully consider how the device would grip different thicknesses of materials or be mounted on the bench. Some candidates simply drew versions of existing clamping devices, such as spring clamps, belts or G cramps. It is important that all ideas fully meet the design requirements if candidates are to access the full range of marks. A small number of candidates produced fewer than three ideas or three ideas that were very 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. In weaker responses there was often a lot of repetition. Many responses referred to how easy it would be to use and manufacture the device. It is important that candidates justify their evaluations rather than making broad statements, such as it is the best design idea, if they are to access the full range of marks. Almost all candidates chose one of their ideas, usually by giving the number of the idea, and justified their choice of idea for development.

(e) A variety of methods were used to show the full solution to the design problem. These included freehand 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 materials or joining methods, around it. This question specifically asked for construction details and important dimensions but, particularly in the weaker responses, these were often only partly shown. All candidates need to consider whether the information they present 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 mild steel, and aluminium, with the reasons often based on the strength, or ease of shaping the material. Rubber was often named as a material to be used on the jaws of the device to prevent the device damaging the material being clamped. 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. Commonly seen manufacturing methods included using a heat process to join metal, such as brazing, casting or shaping parts with hand tools or a lathe. The most successful responses used sketches and notes to show a series of numbered points that outlined the method of manufacture. It is important that all 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 0445/02
School Based Assessment

Key messages

- Most coursework folios were very well presented for moderation. The folios of some candidates were lacking structure and often difficult for a moderator to follow. Candidates should ensure that they produce a clear, coherent, and fluent presentation of their process of designing through the various sections following the assessment criteria of the design folio.

- Research should be focused on the chosen situation or problem. A lot of irrelevant data is included by some candidates. Research could include the analysis of the features of existing products and gathering information and data such as ergonomic or environmental factors. Candidates are also expected to collect information directly relating to the user and the user's needs for the product.

- For Assessment Criterion 4, many candidates make good use of models to support their design development. Not all candidates go on to show reasoned decision making about the form, materials and construction of the final solution.

General comments

Some examples of work submitted were outstanding. Candidates had used a wide range of skills to present their design work in a way that was easy to follow. The approach to designing of many candidates showed a good integration of sketching, modelling and on-going evaluation, indicating mature and fluent design thinking. Many products were of an exceptionally high standard.

A few folios were exceptionally large. Candidates should ensure that they are making best use of each page available.

Teacher annotation of project work on the ICRC forms was generally very helpful to the moderator, explaining reasons why marks were awarded in particular sections.

Most projects submitted were appropriate and allowed full access to the assessment criteria. Some centres provided initial themes as starter points for exploration. When the themes are too tight and restrictive, candidates often produce very similar research, design, and practical outcomes. Centres are encouraged to allow sufficient scope for candidates to pursue individual projects.

Guidance for assessing coursework and other very useful support for 0445 can be found on the school support hub.

Comments on specific sections

Question 1

Identification of a need or opportunity with a brief analysis leading to a Design Brief

Most candidates covered this section well, describing in detail the problem or situation identified and the needs of the intended user/s in detail before producing a clear design brief.

Some candidates produced very brief responses with limited detail to access the full mark range. Candidates should consider, where does the problem exist? and who does it affect? as starting points.

Question 2

Research into the Design Brief resulting in a Specification

Many candidates researched appropriate information to assist their designing, however a significant number of candidates presented details of a wide range of materials, construction techniques and finishes, many of which would be inappropriate for the chosen brief. Some of this information could be better included in Assessment Criterion 4, Development of Proposed Solutions, where evidence of the testing and trialling about form, appropriate materials, constructions and finishes is required.

Investigating existing products to identify positive and negative features was evident in most folios.

Mood boards were included by some candidates but relatively few used them for inspiration when designing.

Candidates would benefit from applying more focus on the brief. For example, some candidates selected storage of items of clothing for their design brief but very few researched the types and sizes of the clothing items to be stored.

Question 3

Generation and exploration of Design Ideas

There were some outstanding examples of designing, exceptionally well-presented work with well annotated sketched ideas and imaginative design possibilities. The development and application of appropriate ICT and CAD skills was generally strong and well executed. Possible solutions generated were mostly original and appropriate to the type of environment they were designed for.

A significant number of Centres were slightly over generous in marks awarded for this assessment criteria. Some work submitted contained only CAD or downloaded images of a small range of possible ideas, often in the form of outline shapes, lacking detail. Other appropriate drawing techniques should also be used to convey ideas. Some of the best work seen was where candidates generated innovative and creative design ideas and possibilities and developed them through an integration of well-annotated freehand sketching, CAD drawings and modelling.

Question 4

Development of Proposed Solution

Many candidates used 3D modelling well to help visualize the design proposal and confirm proportions or functional aspects. Most went on to show clear evidence of the decision making required to ascertain final details about the form, appropriate materials, constructions and finishes.

A significant number of candidates did not make their design decision making clear. Some included limited or no information relating to the technical requirements of their final proposal, such as material choice, dimensions, constructional details and finish. There should be some indication of possible alternatives that have been considered and reasons for final decision making.

Question 5

Planning for Production

Planning for production must be done before commencing manufacture. Often the candidate may have to divert from their original plan when making, and they should include any such changes onto the original plan. A significant number of candidates created a log of operations, often supported by photographs, after the product had been made. The photographic log or diary should be presented in Assessment Criterion 6, Product Realisation.

Working drawings were generally accurate and detailed, a significant number of candidates did not include all dimensions necessary to be able to make the product.
An ideal plan for production is one that has all the detail required to enable a skilled person to make the final design proposal. It should include details of materials, components required, a fully dimensioned working drawing and a detailed sequence of operations for manufacture.

Question 6

Product Realisation

Assessment was generally accurate and consistent in this Assessment Criterion. Many products were of a very high standard. Some outcomes were made with high precision and accuracy and the requirements of the product specification were fully addressed.

Centres are reminded that photographic evidence of the stages of manufacture and the outcome must be included in the folder. Marks should not be awarded if there is no evidence submitted.

Question 7

Testing and Evaluation

It is important that candidates carry out testing of their product, preferably in the environment in which it is was designed for, and that clear photographic evidence is included in the folio. Many candidates had good evidence of the product in use in its intended environment, including comment from the intended user or client in the evaluation stage.

Candidates are reminded that after testing, they should clearly explain the strengths and weaknesses of the product and propose appropriate modifications. The modifications are best presented in the form of sketches and notes.

The evaluation must be of the product in use, as it performs against the specification. Some candidates focussed on personal performance which is not required.

DESIGN AND TECHNOLOGY

Paper 0445/31
Resistant Materials

Key messages

- Candidates are reminded to read the questions carefully before attempting to answer and try to focus on the key elements of each question. The marks allocation given to each question and the space provided to answer the question provides candidates with a clear indication of what is required.
- Candidates are recommended 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 processes and purposes.
- Candidates are recommended to improve their drawing skills. They should 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

The level of knowledge and understanding of the subject content shown by many of the candidates in their answers to both ***Sections A*** and ***B*** was limited.

Section A

In this section candidates need an all-round knowledge and understanding in order to answer all questions successfully in this section. Few candidates demonstrated 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

Most candidates gained one mark for stating that carbon fibre was lightweight or durable.

Question 2

No candidates were able to identify all three drill bits correctly. Most identified one drill bit only.

Question 3

(a) Most candidates achieved one mark for showing one pair of flaps on the mild steel development (net) correctly.

(b) Some candidates did achieve one mark for describing a safety feature, such as 'rounding the edges so that the user would not be hurt'.

Question 4

The were several very good 3D sketches showing a completed housing joint.

Question 5

(a) Only one candidate named PVC correctly. Some answers gave the names of materials that were not plastic.

(b) A few candidates named urea formaldehyde or ABS correctly.

(c) Most candidates recognised that the material used to make electrical fittings needed to act as an insulator.

Question 6

(a) None of the candidates named 'annealing' as the process used to heat brass and leave it to cool.

(b) Most candidates did recognise that the process in **part (a)** would result in the metal becoming softer or, as several stated, malleable.

Question 7

Most candidates drew a paint pot holder that could be made from a single piece of plastic, rather than fabricated by joining together three pieces of wood. Sometimes the clarity of sketches and the omission of important written notes meant that maximum marks could not be achieved.

Question 8

No candidates were able to name the casehardening process described in the table of stages and processes carried out.

Question 9

Only a few candidates recognised that the hardwood base could split but they needed to explain why this would occur.

Question 10

Only a few candidates were able to give benefits of the vacuum forming process used to make the food containers. The process has repetitive accuracy and produces little waste.

Section B

Question 11

(a) Candidates needed to show how a hole would be drilled for the blade of a coping or Hegner saw to be inserted so that the window could be cut out. Files could then be used to flatten and smooth the cut edges. Very few candidates were familiar with these techniques. Some candidates showed unsuitable saws being used to cut out the window, sometimes without a hole through which the saw blade could be inserted.

(b) Most candidates were able to provide at least one stage or process required to make the MDF case. Accurate answers this question included cutting the MDF to length and joining the lengths together. This required knowledge of logical practical workshop practice was limited in the majority of candidates.

(c) Very few candidates gained marks for this question. Some candidates did name a suitable material but were unable to describe how the shape of the case could be made using that material. Some candidates named generic materials such as 'sheet metal' or 'thermoplastic' when they needed to be more specific.

(d) (i) Only a few candidates showed how the Ø100 disc could be produced. The answers should follow a logical path: mark out the MDF, cut it out, use files or glasspaper to remove any sharp edges. This is another practical process that candidates should be familiar with.

(ii) Some candidates mentioned laser cutter in their response but further knowledge and understanding of CAD/CAM was limited.

(e) Only a few candidates were able to provide a practical method of preventing the discs from sliding along the mild steel rod. There were some attempts worthy of one mark.

(f) Generally, candidates demonstrated an extremely limited knowledge of working with metal. Answers showing how the length of aluminium could be bent to the shape of the foot could be improved.

Question 12

Insufficient candidates attempted this question to report.

Question 13

(a) (i) Most candidates named plywood correctly as a suitable manufactured board for the tray.

(ii) A few candidates stated that veneers gave manufactured boards an attractive appearance. Some candidates recognised that a drawback of using veneers was that they could peel off over time or that they could be damaged easily.

(b) Most candidates gave at least one benefit of covering the tray with a plastic laminate; the best answers included ‘attractive’, ‘protects the surface from damage’ and ‘waterproof’.

(c) (i) A coping saw was named by a few candidates as the most suitable saw to remove the hardwood waste. Other good answers included a jig saw and band saw.

(ii) Only a few candidates named one tool or item of equipment that could be used to make the sawn edges smooth. The most common correct answer was ‘sandpaper’ (glasspaper).

(d) Most candidates showed some kind of rails or sides that could be joined to the tray to prevent items sliding off. For maximum three marks candidates needed to give details showing how the sides or rails could be joined to the tray and the name of the material used.

(e) A few candidates were able to complete the drawing of the corner joint. The best method of joining the rails was a dowel joint. Sometimes the clarity of sketches and the omission of important written notes meant that maximum marks could not be achieved.

(f) In order for the legs of the tray to open and close, some sort of pivot was required. The simplest way was to use a metal pin, screw or nut and bolt. Only a few candidates provided this basic requirement.

(g) Only a few candidates drew a butt hinge screwed into the rail. Several candidates did not attempt to answer this question.

(h) Only a few candidates were able to provide a design solution showing how the tray could be tilted and locked at four different angles. These solutions included using some sort of adjustable ‘stay’ and the use of screws and nuts and bolts.

DESIGN AND TECHNOLOGY

Paper 0445/32
Resistant Materials

Key messages

- Candidates are reminded to read the questions carefully before attempting to answer and try to focus on the key elements of each question. The marks allocation given to each question and the space provided to answer the question provides candidates with a clear indication of what is required.
- Candidates are recommended 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 processes and purposes.
- Candidates are recommended to improve their drawing skills. They should 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 in this section. Many candidates demonstrated 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

Most candidates provided a sketch of two tenons that would fit into the two mortises. Maximum marks were awarded for showing two tenons drawn with the correct width, thickness and spacing. Candidates could gain at least one mark for showing two tenons, irrespective of their accuracy.

Question 2

Only a few candidates could state what was meant by all three items of information shown on the box of steel bolts. 'M' is metric, '10' is the diameter of the bolts and '50' referred to the length of the bolts. The most common correctly named item was the length of the bolts.

Question 3

Only a few candidates correctly identified what was meant by 'built-in obsolescence': i.e. a product that is designed and manufactured so that it can only be used for a limited time before it has to be replaced. The candidates who gave an example such as a mobile phone, were able to explain exactly what the term meant.

Question 4

(a) Many candidates gained one mark for naming correctly the digital or vernier caliper.

(b) Only a few candidates could correctly explain why the measurement taken by the outside caliper would be less accurate than that taken by the digital caliper. Most incorrect answers related to 'human error'. Since both calipers are prone to human error, this was not rewarded. Only a few candidates recognised that the outside caliper would need to be transferred from the round bar and set against a steel rule and that this could incur movement, whereas the digital caliper gave a direct readout.

Question 5

(a) The vast majority of candidates completed the composite material Carbon Fibre Reinforced Plastic.

(b) Fewer candidates completed the composite material Glass Reinforced Plastic than for Carbon Fibre Reinforced Plastic in **part (a)**.

Question 6

Many candidates recognised that the shape memory alloy, (SMA) would return to its original shape.

Question 7

(a) Many candidates completed the sentence with the correct term: 'annealed'.

(b) Apart from a few candidates who recognised the 'sand bag', the vast majority of candidates were unfamiliar with this item of equipment.

Question 8

The majority of candidates gained some marks for showing some form of 'stay' or linkage that would prevent the lid opening more than 60º. There were some very thoughtful, detailed answers gaining three marks and some very simple ideas such as the use of string or ribbon that gained only one mark. Very often, candidates denied themselves marks by not showing how their device could be fitted to the box and the lid - a requirement of the question.

Question 9

(a) The majority of candidates named polystyrene correctly.

(b) Most candidates gave two benefits for customers reusing their drinks cups; the most common answers related to less waste, less litter, landfill and less resources being used.

Question 10

There were some simple, practical solutions showing how the arm of the towel rack could be attached to the backboard and allowed to swing. The best solutions showed a kind of bracket into which the arm could sit, and the bracket screwed to the backboard. Candidates need to name the materials being used to gain more marks. Very often, the clarity of sketches was limited that it was difficult to determine exactly what was being proposed.

Section B

Question 11

(a) Most candidates named a suitable softwood, (from which there is large number to choose), for the toolbox.

(b) (i) Only a few candidates were able to identify a reason for joining two boards together rather than using one wide board. There were some good answers from these candidates. The best answers included reducing the possibility of warping and the fact that boards over 325 mm wide were difficult to obtain from softwood trees.

(ii) There were three marks available for this question. Candidates needed to show two or three cramps across the boards with sacrificial wood between the cramps and the boards. The type of cramps used included 'sash' and 'F' cramps. Only a few candidates achieve maximum marks with many using 'G' cramps that would not be suitable.

(iii) Many candidates did provide two checks to carry out after the boards had been glued and clamped together. The most common checks included the removal of excess glue and to check that the boards were lying flat.

(c) (i) Only a few candidates named both the butt and the tee hinge correctly.

(ii) Most candidates recognised that the tee hinge had one longer leaf but many needed to extend their answer to state how the greater surface area covered would make it more suitable than the butt hinge.

(d) Many candidates provided practical designs showing how a set of screwdrivers could be stored on the inside of the toolbox. Most candidates were able to access the five marks available. The best designs included an added rack into which the screwdrivers would fit and the rack would then be attached, using screws, to the inside of the toolbox. Although the question asked candidates:

'*Give details of all materials and constructions* used', many candidates did not address this part of the question for which there were specific marks available.

(e) Many candidates recognised that to secure the sides of the toolbox when it was carried some sort of clasp or lock would be required. The clarity of sketches did not always show how the design would work.

(f) (i) Most candidates named the dovetail joint correctly.

(ii) Candidates need to explain how the shape of the dovetail-jointed handle would provide strength when the toolbox was carried.

(g) Most candidates provided at least two advantages of using a toolbox made from plastic over a softwood toolbox. The most common correct answers included 'more lightweight', 'more durable' and 'more weather resistant'. The important phrase in this question was 'using a toolbox'. Many candidates provided answers that related to the manufacture of the toolbox rather than to the toolbox in use.

Question 12

(a) Most candidates named the square bar correctly but were less accurate when naming the flat strip.

(b) Many candidates named correctly brazing and welding that could be used to join the rail and legs of the desk. Some candidates named 'riveting' and while this is a permanent method of joining materials, it would not be suitable for joining the rail and legs of the desk.

(c) Only a few candidates answered this question well. Candidates need to make sure they take into account the dimensions of the rail and desk top. When joining the rail, which is 45 mm deep, it would be unsatisfactory to use a 50 mm long screw. An alternative method, provided by a few candidates was to use additional plates or brackets that could be joined to the rails and then secured to the desk top using screws of a much shorter length than 50 mm.

(d) There were some very good designs showing how the legs could be adjusted and locked in position. Unfortunately, most candidates did not read the question carefully and missed the important phrase: *'…**at any** height between 700 – 800 mm'*. Many sketches showed a series of holes drilled in the inner tube through which a pin or bolt would be inserted. This solution did gain some marks but did not allow access to maximum marks as it did not fulfil the requirements of the question. This is because it would secure the leg at a set number of positions and not at any height between 700 – 800 mm.

(e) (i) This question was well answered with candidates recognising that the plugs would make the ends of the tube more attractive, that they would prevent dirt and dust from entering the tube and that they would prevent sharp edges from inflicting possible injury.

(ii) Only a few candidates corrected named epoxy resin or 'Araldite' correctly as the adhesive that could be used to glue the plugs inside the tubes.

(f) There were many potentially good design solutions showing how a drawer could be supported below the desk top. Most candidates recognised the need for some wooden or metal supports onto which drawer runners or guides could be attached. Some candidates provided details showing a complete box attached to the underside of the desk top. Sometimes the clarity of sketches and the omission of important written notes meant that maximum marks could not be achieved.

(g) (i) Many candidates provided partially correct answers to this question. When using a palm sander on a veneered surface it is important to consider that the veneer is relatively thin and that undue pressure could result in the veneer being removed or that it could make the surface uneven.

(ii) Many candidates gave details about glasspapering and the preparation to the surface of the desk top rather than concentrating on the question: *'how a clear varnish could be applied…'*. Candidates are reminded to read the question carefully.

Two key answers were required: the use of a paintbrush and the even application of the varnish along the length of the desk top. Those candidates who referred to the application of multiple coats gained one mark.

Question 13

(a) The vast majority of candidates gave two properties of acrylic that made it suitable for the desk tidy. The most common properties included the variety of colours, that it was easy to work and bend to shape when heated.

(b) (i) Only a few candidates named the extrusion process used to manufacture plastic tube.

(ii) The majority of candidates named at least two of the three labels shown on the extrusion machine; granules, heater and die.

(c) There were some good designs for a sawing jig that could be used when cutting five different lengths of Ø40 tube. With six marks available, candidates had to make sure that they addressed all the bullet points in the question. The best designs showed the jig held securely in a vice and how different lengths could be sawn. As in previous questions requiring design solutions, the quality and clarity of sketches and notes was not always clear or accurate enough to secure maximum marks.

(d) Many candidates recognised that the draft angle on the mould enabled the vacuum formed plastic to be removed easily, but few candidates mentioned that the shape also prevented the plastic from thinning or spitting.

(e) (i) Most candidates followed the information shown in the press forming Figure and achieved at least two marks.

(ii) The majority of candidates recognised that vacuum forming would be faster and more accurate than press forming when making a batch of the bases.

(f) The disks could be made using four different methods: woodturning, use of a hole saw or a laser and cutting the disks from a hardwood board. The answers provided covered all four methods and the question gave candidates the opportunity to demonstrate their knowledge and understanding of any method. The answers generally were very good. The best answers showed a logical sequence to the processes involved, make clear sketches and added practical details including the names of tools and equipment used.

DESIGN AND TECHNOLOGY

Paper 0445/33
Resistant Materials

Key messages

- Candidates are reminded to read the questions carefully before attempting to answer and try to focus on the key elements of each question. The marks allocation given to each question and the space provided to answer the question provides candidates with a clear indication of what is required.
- Candidates are recommended 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 processes and purposes.
- Candidates are recommended to improve their drawing skills. They should 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 in this section. Many candidates demonstrated 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

Many candidates provided at least one advantage of plywood over chipboard. The most common correct answers included that it was more attractive and more durable.

Question 2

(a) Only a few candidates named the ball pein hammer correctly.

(b) Many candidates recognised that the hammer head would have a round shape. Only a few candidates were able to complete the drawing accurately for maximum two marks.

Question 3

Most candidates understood how two formers would be used to produce the curved shape on the 8 mm thick hardwood. Additional details including the hardwood being steam bent and the use of cramps were rewarded with maximum three marks.

Question 4

Most candidates gave information about line bending technique rather than focus on the flexible property of opening the stand to insert the menu card and its ability to close without it being damaged. Candidates are reminded to read the question carefully.

Question 5

Most candidates understood that an alloy was a mixture of two or more elements (metals) for one mark. For a second mark candidates needed to state that alloys create a metal with special properties not found in a single metal.

Question 6

Many candidates showed a practical modification to the lid. The most common solution was to glue a single narrower piece of wood to the underside of the lid that would fit inside the box. An alternative method was to add sides overlapping the lid. Those candidates who added essential dimensions or gave constructional details gained maximum marks.

Unfortunately, many candidates did not read the question carefully and made modifications to the box itself which was not rewarded.

Question 7

The best descriptions of thermochromic pigment to improve the function of a product included reference to an actual product. A popular example was a plastic spoon used with babies where the pigment alerted the user of temperature change. Many candidates simply repeated the stem of the question and gained no marks.

Questions 8

(a) and (b) The majority of candidates could not name the 'blow moulding' process nor show what would happen when the compressed air was blown from underneath the heated thermoplastic sheet.

Question 9

Only a very small few candidates were able to name all three types of screw head. The most common correctly named screw head was **C**, the countersunk head.

Question 10

Most candidates were not able to answer this question correctly. Many candidates incorrectly showed the metal held vertically in a vice. The correct method showed the brass sheet clamped flat on a table or work bench with the area to be sawn protruding over the edge of the table or work bench.

Section B

Question 11

(a) Many candidates stated at least one specification point for the trophy. The most common points referred to its appearance, clarity of the text on the award and the stability of a base. Some candidates denied themselves marks by stating 'items of research' rather than specification points.

(b) (i) The vast majority of candidates recognised that marking out with a template would be very accurate and that the template could be used repeatedly.

(ii) Many candidates demonstrated a good understanding of how the shape of the trophy could be cut out. Candidates had a choice of acrylic, brass or mahogany. Mahogany was the most popular choice. Most candidates showed how the workpiece could be secured while it was sawn, named a suitable saw (coping, Hegner or scroll saws), and used a combination of files and glasspaper to

make the edges smooth. Most candidates were able to achieve some of the four marks available for this question.

(iii) Many candidates achieved one mark for explaining that 'self-finishing' meant that no additional finish such as varnish or paint would be applied. Very few candidates expanded upon this answer by stating that the material could be enhanced by cleaning and polishing.

(c) Most candidates understood that sheet material had to be clamped securely to prevent it from spinning dangerously or snagging and creating an inaccurately drilled hole. Some candidates correctly stated that the material would need to be clamped when drilling through into a sacrificial board.

(d) Most candidates were not familiar with the use of taps and dies to cut screw threads in holes in metal or on round rod metal respectively. However, some candidates were able to provide responses that showed a clear understanding of this topic.

(e) There were many excellent answers to this question with many candidates confidently describing how the words 'D&T Award 2024' could be into the surface of the acrylic using CAD/CAM.

(f) There were some imaginative designs showing how the trophy could be mounted onto a base. Some of the best designs showed housings or grooves (often cut out using a router) into which the three materials would sit. It was essential that for maximum four marks that candidates needed to name the materials they would use and show all the constructional details.

(g) Only a few candidates were able to correctly answer this question about sustainability. Many answers described whether or not the materials were biodegradable. This is not concerned with sustainability. The best answers noted that mahogany trees can be replaced by replanting but that both brass and acrylic were derived from finite sources.

Question 12

(a) The majority of candidates understood that a ferrous metal contained iron.

(b) Most candidates were able to state two advantages of on-screen modelling over card modelling; the most common answers referring to the ease with which drawings could be edited and that files could be saved electronically and shared or downloaded to CNC machines.

(c) (i) Many candidates named the hacksaw correctly, but fewer recognised the tin snips.

(ii) Most candidates understood that the guillotine could only cut in straight lines, but only a few candidates went on to state how the guillotine would damage those shorter cuts into corners of the mild steel sheet.

(iii) A very small number of candidates answered this question well. One mark was awarded for naming a mallet to bend the metal, but details of how the sheet metal could be held securely or the use of formers around which it could be bent were lacking.

(d) (i) Only a few candidates understood that the purpose of the chamfer on the end of the mild steel rod was to make it easier to start cutting the screw thread.

(ii) The majority of candidates did recognise that cutting compound (grease) would help lubricate the tool and the metal, making it easier to cut the screw thread.

(e) This question asked candidates to show how additional materials could be used to join the steel tube to the base of the bird feeder. Most only gave information showing how it could be brazed or welded and did not address this part of the question There were some excellent answers showing brackets or metal plates to which the bird feeder could be joined.

(f) There were many good answers showing how the plastic tray could be produced. The best answers were those that gave details of the vacuum forming process. Other methods, such as cutting out separate sides and cementing them together, were successful, as was the use of a strip heater or line bender to fold the sides of a development (net) of the plastic tray.

Question 13

(a) Many candidates gave two specification points. The most common being that the material should be heat resistant and that the glue gun must be supported safely.

(b) (i) The majority of candidates understood that a 'manufactured board' was man-made but only a minority gave any indication how they were made. For example, plywood is constructed by compressing thin sheets of wood with an adhesive or that MDF was made by compressing pulp with an adhesive.

(ii) Most candidates named an alternative manufactured board for the stand. However, chipboard and blockboard would not be suitable for the stand.

(iii) Many candidates did gain one mark for stating that plywood would be cheaper than using hardwood, but only a few candidates could offer a second advantage. The most common correct answers referred to plywood being more stable and less likely to warp, twist or shrink.

(c) (i) Only a few candidates could name the forstner bit that would be used to drill the Ø30 hole in the base of the stand.

(ii) Most candidates achieved at least one mark for stating a check that should be made before switching on the drilling machine. The most common answers included making sure that the work piece was clamped securely, that the guard was in position and that the drill bit was secure in the chuck. Answers that related to the use of PPE were not rewarded.

(d) The best method of removing the waste wood was to drill a Ø30 hole first, then use a saw to remove the remaining waste, followed by the use of files and glasspaper to make the cut edges smooth. Many candidates gained some marks for relevant points made within incomplete answers.

(e) (i) The best method of making sure that the holes were drilled accurately in the base of the stand was to design and make a jig. The few candidates who attempted this method showed some excellent templates with sides that would locate against the plywood base, ensuring repetitive accuracy.

(ii) Only a few candidates answered this question well. There were some excellent designs using an existing bench hook that could be modified, with the 15 mm length either marked out, or a saw cut in which the correct length could be sawn off. Many candidates did not recognise that 15 mm is a very small length to be sawn and subsequently the designs that followed were often impractical.

(f) Many candidates showed a practical modification to the stand so that five spare glue sticks could be stored. The most common modifications showed drilled holes or grooves into which the sticks would locate or an added box or tray into five sticks could be stored.

DESIGN AND TECHNOLOGY

Paper 0445/41
Systems and Control

Key messages

- Clear, legible writing and annotation to sketches are vital. Where responses cannot be read no mark can be awarded.
- All questions in ***Section A*** should be read carefully to ensure that the requirements are understood.
- Candidates should be advised to read all ***Section B*** questions carefully before attempting to answer the chosen question. There were several instances of candidates attempting all three questions. When this happens the highest scoring question is used in the total and time spent on the other questions is wasted.
- In questions that require either a single answer or a set number of answers it is important that candidates do not enter additional answers; this will result in the Examiner not being able to give credit to a correct response because an incorrect one has also been offered. E.g. tables requiring ticks (✓) or items to be circled to identify the answer should not have more than the required number of ticks or circles.
- Use of generic terms such as 'strong,' 'weak' or 'easy' should be avoided unless they are justified by adding more information.
- In calculation questions units should be applied to the answer wherever possible. Any working should always be shown as it is possible to gain marks from this even if the eventual answer is incorrect.

General comments

Most questions in ***Section A*** proved to be accessible to candidates and there were only a few instances of question without any response. There was good knowledge and understanding demonstrated of the Key Content demonstrated by candidates.

In ***Section B*** the structures question was the most popular with 86 per cent of candidates answering this question. The split between the other two questions was close with marginally more candidates answering the mechanisms question.

It is always important that candidates read each question carefully, noting any important features that appear in bold type. This applies especially to the questions where the number of responses is denoted in bold type. If more than the required number are given there is a danger that the extra ones could be incorrect, resulting in no mark being awarded.

As noted in the **Key messages** there are still candidates who are attempting all three of the ***Section B*** questions. Candidates should be advised that this will result in time being lost that could have been put to better use on a single question.

Where extra space is needed for a response candidates should add a note to indicate where the response has been continued. Extra pages can be attached to the paper or space at the bottom of a page can be used.

Where sketches were required in the response good use had been made of the available space and relevant notes had been added where necessary.

Comments on specific questions

Section A

Question 1

(a) The frame structures in the illustration were correctly identified by most candidates.

(b) In almost all responses triangulation was identified as the method of keeping the structure rigid.

Question 2

(a) This question was well answered by the full range of candidates. Benefits for wood, steel and concrete when used in beams were familiar to most. When answering the last part on composites, a number of lower achieving responses were not related to a beam; giving benefits that were not related to the question.

(b) The load on the illustrated beam was at one end, and some distance away from the wall. In a few cases the answer incorrectly referred to shearing. At the distance given the beam would bend and experience tension on the top face with compression being applied to the bottom face. Shear force would only occur if the downward load was extremely close to the wall.

Question 3

(a) A high proportion of candidates were able to correctly state the class of levers shown. In each case the position of the fulcrum was marked which gave candidates a good starting point.

(b) Over 50 per cent of responses across the full range had placed the movement arrows in the correct positions, both pointing in towards lever **L2**.

Question 4

This question was answered correctly in most cases. Most referred to reduced wear and increased efficiency with slightly fewer mentioning the reduction in sound or heat generated.

Question 5

Better responses to this question were more precise when giving reasons for the use of spur gears. Increasing or decreasing speed and changing the direction of motion were seen in many cases. Lower achieving candidates had frequently used generic reasons such as ‘cheaper’ or ‘easier.’ As noted in the **Key messages,** this is not good practice unless further evidence is given.

Question 6

The safety symbols were all well-known and candidates were able to accurately state their meaning. Marks were awarded where candidates had given the consequence of not using the device shown in the symbol.

Question 7

Most responses corrected named an electrical insulator. Rubber was a frequent choice of insulator though it has been largely superseded by other plastic materials.

Any named thermoplastic or thermoset plastic would have gained the mark. Those who chose wood did not gain a mark. Dry wood can be in insulator but if the wood gets wet it will conduct.

Question 8

Very few errors were found in the table of electrical units. Where there were errors, it was mainly with the current and capacitance units.

Question 9

(a) The majority of higher achieving candidates were clear in stating that a reed switch is operated by placing a magnet close to the switch. In a few cases it was incorrectly stated that the switch itself was magnetic.

(b) Benefits of reed switches centred largely on the fact that they can be operated remotely or electronically. The lack of exterior moving parts was noted a in a few cases.

Section B

Question 10

(a) (i) Only a few candidates were able to correctly name all of the materials used in making concrete, resulting in a range of marks between 1 and 3. Most candidates gained at least one mark for knowing that sand and gravel were a key constituent. Higher achieving responses had in most cases added water to the list. Very few had mentioned cement powder, which is the material that binds it all together.

(ii) The force that concrete resists best is compression, which the majority of candidates knew.

(iii) This question resulted in some excellent annotated sketches from stronger candidates. The sketches showed clearly where the steel rods/reinforcing bars should be positioned to produce reinforced concrete. The notes explained why the reinforcement should be placed below the centre line, thereby making the concrete resist the tension that occurs below the centre line when a beam is loaded.

(iv) The stress calculation was generally completed accurately with any errors being in the first part of the calculation, namely, the cross-sectional area of the concrete pillar. Where this happened, an error carried forward was applied for the remaining two marks.

(b) (i) The meaning of equilibrium was well known to most candidates.

(ii) Calculation of reactions on the beam were completed accurately by over 50 per cent of candidates. Any rounding errors in the answers were allowed.

(iii) A few of the natural defects in timber were well known, e.g. termite damage and knots. Some of the other frequently found defects such as warping and bending rarely got mentioned. Most higher achieving candidates gained both marks.

(iv) Clear sketches and relevant notes were featured in many of the responses. Methods of joining the timber varied between traditional joints and those using nails or nail plates. Where traditional joints had been used very few had used a horizontal dowel to hold the joint in place. Adhesive very often named as ‘PVA’ was the method commonly mentioned. A full range of candidates achieved at least 2 marks for this question.

(c) Factor of Safety was not fully appreciated by weaker responses, where the approach commonly found was to use personal protective equipment (PPE) items.

The question asked for the explanation to be based around an example of equipment used in building construction, this guidance was often not followed. Where a question asks for examples, it will often lead to an improvement in the candidate response.

(d) Stronger candidates were able to give logical reasons for the use of each of the joining methods shown. Most candidates recognised that a nut and bolt is a temporary method that would allow parts of the structure to be disassembled or moved. In a structure it also allows for easy assembly of prefabricated parts with the minimum number of tools used.

The riveted joint was seen as being permanent and leaving a flush surface when the joint is complete. The welded joint was viewed as permanent with no additional materials being needed. There was a tendency with weaker candidates to give generic responses e.g. cheap or easy to do. These were not awarded marks.

Question 11

(a) (i) All candidates answering this question identified the mechanism as a crank and linkage.

(ii) Higher achieving responses were able to state the conversion of motion as being rotary to oscillating.

(iii) There was clear understanding of the benefits of grease in lubricating outdoor exercise equipment. Two marks were available for either two separate points in the explanation or for a single point fully explained. Most candidates went for the benefits that reflected outdoor use, e.g. less affected by temperature change.

(b) (i) The uses of different types of bearing differentiated well between the range of candidates. The choice of bearing for a wheelbarrow was in most cases correctly given as a plain bearing and for a cycle as ball bearing. Roller bearings, which imply heavier applications were often not chosen for the train.

(ii) Factors for consideration were described clearly by higher achieving candidates, many responses included reference to the rotational speed of the intended use.

Very few responses described both radial and axial loading which should be considered. If cost was chosen as a factor, it should have included suitable examples.

(c) (i) The higher-level responses mentioned the longer dwell associated with the pear shaped cam. Very few candidates had noted that the eccentric causes constant movement without any dwell. Where necessary marks were awarded for understanding shown, particularly where technical terminology had not been used.

(ii) Only a few higher-level responses recognised that the eccentric drives the follower in both directions whereas a cam relies on either a spring or gravity for the return movement.

(iii) Knowledge of reasons for loss of efficiency in a mechanism were generally well understood. Friction and the resulting conversion to other energy forms e.g. sound and heat were common responses.

(d) The calculation of driven gear speed was in most cases carried out systematically with each of the three individual reductions being identified before the overall reduction was given. Although the mark scheme allowed for the full 3 marks where there was no evidence of working this ruling was rarely used as working had been included.

(e) (i) The bell crank lever was correctly drawn in around 50 per cent of responses. Notes were used to good effect to show the resulting changes in movement in the links caused by the bell crank lever. Errors in sketches were based mainly in placing the bell crank fixed pivot on the wrong side of the two links, which would prevent any movement from taking place.

(ii) The illustration of an M10 × 1.5 was understood by under 50 per cent of the candidates. The ‘1.5’ was correctly identified as pitch more frequently than the ‘10’ was identified as outside diameter.

(iii) Torque was correctly given as the rotational force resulting from use of a spanner. This resulted in a mark for most candidates.

Question 12

(a) (i) In most cases the cathode or negative leg was correctly identified as being the shorter of the two legs. The alternative methods of identification, either a diode tester or by trial and error were rarely seen in responses.

(ii) Stronger candidates had noted that the protective resistor was a very high value. This would not have let enough current pass to light the LED.

(iii) In calculating the current limiting resistor, the first stage was deduction of the voltage drop. This was accurately completed in most cases. Rearrangement of the given ohms law formula was used

in the final part of the calculation. Candidates who had gained the first mark generally gained the remaining two marks.

(b) (i) Knowledge of the layout of a dual in line integrated circuit (IC) was generally good with pin numbers being correctly added to the drawing.

(ii) There were a few errors found in the identification of the power connections for the IC. A common error was to identify the two pins correctly but to apply the wrong polarity to them.

(iii) The logic IC used in the question was a quad NOR gate. If two inputs are connected on any one of the gates it will result in an inverted output, or NOT gate. Few candidates across the full range answered this part correctly.

(iv) The clue to this part was in the question, where it asked for a logic signal to be provided to one of the inputs. A logic signal will be either logic 1 or logic 0. Fig. 12.4 showed a resistor connected to 0 V, this was to ensure that when the input was not connected to a positive voltage it had to be connected to 0 V, meaning that the signal always has a logic level and is not left 'floating'.

(c) (i) The majority of candidates answering this question knew that reversal of polarity at the motor inputs will reverse the direction of the motor.

(ii) The principal from **part (c)(i)** was applied to this part of the motor circuit, with all of the relay connections being required. The two common terminals of the relay had to be connected to the supply rails for 1 mark. The remaining connections ensured that each motor terminal was connected to a supply voltage level that reversed upon activation of the relay. Most responses seen were correct.

(iii) Use of a diode to protect a transistor from back emf was known and understood in around 33 per cent of the responses. In the remainder of responses forward and reverse bias of the diode was mentioned without giving the reason for using each connection method.

(d) (i) This part tested practical knowledge of printed circuit production. The range of responses showed that the reason for using mirror writing was fully understood. In many higher-level responses, the term 'photoetching' was used, demonstrating that the process was familiar to candidates and had probably been put into practice by them.

(ii) Methods of strain relief were not well known to candidates. In a few cases plastic insulation tape was shown stretched across the power leads, which did little to hold them securely. The simplest practical method was to use a pair of holes for each power lead and thread the leads through and back again to the right side of the board. Familiarity with methods used in commercial production would allow candidates to see and evaluate a range of solutions.

(e) Candidates had to choose two components from five for producing a time delay. The key word in the question was **adjustable** this meant that one of the components used had to be adjustable; only the potentiometer fitted this description. The other component required from the list was a capacitor.

DESIGN AND TECHNOLOGY

Paper 0445/42
Systems and Control

Key messages

- In both sections of the paper candidates should be advised to read the questions carefully before attempting a response.
-
- In Section B, candidates had often attempted a few parts of one question before moving onto an alternative option.
- It is important for candidates to take note of any bold type which in many cases refers to the number of responses required.
- Clear, legible writing and annotation to sketches are vital for this paper to make sure responses are readable. For marks to be awarded examiners must be able to interpret the response.
- The space allowed for responses is matched to the type of question. For 'Discuss' and 'Explain' questions a more extended response is expected. For 'Give' or 'State' questions a short sentence is normally enough to gain the mark.
- Candidates who run out of space can either use extra pages attached to the paper or space next to the question can be used. If this is done an indication of where to find the response is advised.
- Any spare time should be used for candidates to check that all of the required questions have been attempted. Where there has been 'no response' it is a guaranteed 'no marks.'
- Use of generic terms such as 'strong,' 'weak' or 'easy' should be avoided unless they are justified by adding more information.

General comments

Questions in ***Section A*** proved accessible to the majority of candidates, with very few questions not being attempted. Confidence was visible in many of the responses, reflecting that candidates had been well prepared in the Key Content of the syllabus.

In ***Section B*** the electronics question was the least popular but where it had been answered it was clear that candidates had a good knowledge of the subject area. Most responses in ***Section B*** were for the structures question with slightly fewer candidates in this series choosing the mechanisms question.

Candidates should take note of any indication of where the responses are expected to go. This applies particularly to sketch responses.

It should be noted that aspects of the Key content and Common content from the syllabus may also appear in ***Section B*** questions.

Candidates should use any spare time to check that all of the required questions have been attempted. Where there has been no response it is a guaranteed no marks, whereas a question that has been attempted will always stand a chance of gaining marks.

Comments on specific questions

Section A

Question 1

(a) The frame structure used in all of the examples was recognised by most candidates.

(b) Reasons for the second structure being the least rigid correctly focussed on the lack of support at the outer edges. Better responses noted the effect of forces other than vertical, acting on the structure. The fact that the frame in this part was not triangulated featured in a large number of responses.

(c) Understanding of the way that the downward force would be spread between the two triangular frames could have been better explained in most cases, though the principle of spreading a load was generally understood.

Question 2

This question was answered well with clear understanding in most cases of what constitutes a static load. The stationary nature of the load was the feature generally noted.

Question 3

The question was generally answered correctly with most errors focussed on the properties of thermoplastics and thermoset plastics.

Candidates should be advised that in this style of question use of a ruler to draw the connecting lines is beneficial. Hardwood being a renewable/sustainable material and concrete being strong in compression were the responses that were most frequently correct.

Question 4

Understanding of levers was good and most candidates had provided additional evidence by writing down the relative positions of Load – Effort and Fulcrum.

Examples used were normally limited to the standard ‘textbook’ examples for first and third order. In a few cases candidates had provided answers that were correct though more obscure.

Where candidates had not followed the rubric by placing their response above the label they were given credit if the order of lever could be identified from the notes.

Question 5

Knowledge of gear systems was generally evident, with many candidates gaining all three marks. Understanding of the effect of an idler gear was frequently found. Marks were lost in a few cases by responses being too brief or too general.

Question 6

The conversion of motion from rotary to linear was correctly identified in most cases with very few candidates losing marks. Any who had used other recognisable descriptive terms for either of the movements were given credit.

Question 7

The fuse was the component symbol most frequently identified correctly.

The heater was often mistaken for a resistor. The polarised capacitor only gained a mark if it was identified as ‘polarised’ or ‘electrolytic.’

Question 8

(a) Around 60 per cent of the responses showed parallel connections to the two batteries correctly drawn.

(b) Responses were split between those who got it correct with no change to the +9 voltage of each individual battery and those who had added the voltages of each battery to give +18 V. Responses that omitted the '+' sign were still awarded the mark.

Question 9

This question was answered very well with over 80 per cent of responses gaining all three marks. Any errors generally occurred in the conversion from MΩ to Ω.

Section B

Question 10

(a) (i) The question required some knowledge of the principal behind suspension bridges in order to design a model. Higher achieving candidates were clear in how the towers at either end carry the cable that will suspend the bridge deck. These candidates frequently gained all of the five available marks. Full notes and clear sketches had been provided in almost all cases. Weaker candidates seemed to be unsure of the construction method and often relied on a single, centrally placed tower with no indication of how this tower would be supported. In some cases marks for design of the bridge deck were not awarded because there was no indication of the softwood strips being joined to provide a suitable length for the deck.

(ii) The force acting on the suspension wires was correctly identified by most candidates as tension.

(iii) The nature of moving loads acting on a bridge structure was accurately identified and a variety of valid examples were seen.

(b) (i) This part required knowledge of potential defects in natural timber. Termites and other insects were identified by a full ability range of candidates, items such as moisture content of the timber were rarely mentioned. As with many of the 'Explain' questions it was possible to pick up two marks for a single well explained point.

(ii) There appeared to be some confusion over the precise nature of a sustainable resource. Higher level responses frequently gave the example of timber, which can be replanted to provide a continuous source.

(iii) Alternative methods of joining a vertical piece of timber to a horizontal. The nailed method was generally seen as being weaker as it would not resist a tensile force. Very few responses noted that the nails were going into end grain, which would reduce their holding power and could cause splitting. Lower achieving candidates frequently saw the mortise and tenon as a temporary joint. The purpose of the wedges locking the joint in place not being fully understood. The best responses noted that a mortise and tenon has a greater surface area from each piece in contact, resisting torsional as well as tensile forces.

(iv) Reasons for adding braces to the mortise and tenon joint were generally well known. The fact that triangulation is introduced to the joint, leading to avoidance of distortion was noted in many of the better responses. Weaker responses noted that additional support is provided by braces but often could not give a second reason for their use.

(c) (i) The strut was a well-known structural member with successful responses giving clear notes on its use to support the sketches. In most cases the sketches showed an appropriate use of a strut.

(ii) The tie was not as well known to candidates with most failing to realise that the material used for the tie could be of a much reduced cross section.

(iii) Forces resisted by both a strut and a tie were known to a full range of candidates. Very few responses had named a force other than compression and tension.

(d) The formula for calculating for stress was known to higher achieving candidates, many of whom had laid out the working clearly before arriving at an answer. One common problem noted was the use of diameter instead of radius in calculating the cross sectional area of the wire. A number of candidates had missed out the calculation of area altogether and divided the force by the diameter.

Question 11

(a) (i) The garden tool lever shown had five possible choices for placing the load, fulcrum and effort. Many candidates got the position of the effort correct but then made errors with the placing of the fulcrum and load. The gear mechanism provided a second lever system which should have been ignored when naming the required points on lever **A**. The fulcrum was identified correctly by a higher number than had identified the load. The load was the transfer point between the two sets of gear teeth.

(ii) Many candidates had noted that the gear arrangement having a smaller gear rotating a larger gear provided a reduction in effort. The best answers noted that there was also an increase in torque provided by the gears.

(iii) The part played by friction in reducing efficiency was widely recognised, with candidates across the full range gaining the mark.

(b) (i) Reasons for using bevel gears were in many cases restricted to the different orientations of the gear axes. The question asked for examples to be used but only a few candidates achieved this. Some bevel gears will provide a change in velocity ratio by having a wide variation in the number of teeth on each gear. An example of this was the chuck key on a drilling machine; this was used by a number of higher achieving candidates.

(ii) Properties of a worm gear were well known, with many responses referring to the large reduction in speed provided. The self-locking/one way operation of the gear was also recognised by a wide range of candidates. As with the previous part examples of the use of a worm gear were often missing.

(iii) Rack and pinion gears were frequently associated with car steering systems. Other relevant examples would be any mechanism that requires a rise and fall such as a band saw or drill table. This part was often answered by giving the example rather than a description of the movement provided, which was a conversion from rotary motion to linear or reciprocating motion.

(c) (i) A high proportion of candidates gained the mark for stating that slippage is eliminated by a toothed belt.

(ii) The question related to damage to the motor; those candidates who recognised that the damage would be caused by the cutting blades jamming generally gained both marks. The prevention of damage was achieved by allowing the belt to slip; use of a vee belt would allow this to happen.

(iii) A number of reasons for the tension of the vee belt needing adjustment were recognised in the best responses. One reason that did not often appear was the replacement of a belt. Compensation for wear and prevention of slipping were popular reasons used.

(iv) The calculation of the speed of rotation of the final drive was carried out accurately by a full range of candidates. In a number of responses the working had been missed out and only the final answer appeared. This method of answering carries some risk as marks cannot be awarded for the interim stages if the answer is incorrect.

(d) (i) Knowledge of thread pitch was clear in many of the responses, with technical terms often being used correctly in the response.

(ii) The question asked for two ways of specifying a screw thread on a bolt. The outside diameter was frequently used with the length of the thread also being a popular choice. A few higher achieving candidates had mentioned different profiles that could be used, such as square, buttress, acme. The material used for the screw or bolt was rarely seen.

Question 12

(a) (i) The signal correctly identified from the graph was, in most responses, a monostable. A small number of candidates either failed to identify it or called it an astable signal.

(ii) Connections were accurately added to the circuit in most cases. The reset connection was allowed either as a separate connection to the positive rail or as joining the positive connection from pin 8.

(iii) Many of those who answered this question gained all three marks. The calculations were logically laid out and arrived at the correct answer. Where there were errors, it was often in the transposition of terms in the formula that caused a problem. Conversion of units did cause some lost marks. Candidates should be aware that the calculation can be carried out using ohms and farads or, in Megaohms and microfarads. The unit used in the final answer must be clearly stated in order to gain credit.

(iv) Candidates are reminded to read the question carefully which stated that VR_1 had been set to the calculated resistance. They then went on to give tolerance in the resistor as a possible problem. Any who did this but also suggested tolerance in the capacitor were awarded the mark for showing understanding of the part played by tolerance in component values.

(v) Higher achieving candidates showed a clear understanding of the benefits provided by programmable ICs (integrated circuits). Reasons given often mentioned the level of accuracy provided by a programmable delay. Other valid benefits were allowed such as reduced size of circuit board.

(b) (i) The function of a thermistor was widely understood with a range of candidates gaining the marks for knowing that it is a temperature sensor and the NTC (Negative Temperature Coefficient) thermistor operates by a decrease in resistance following a raise in temperature or an increase in resistance following a fall in temperature. In most cases both marks were awarded.

(ii) Clear understanding of how an OP AMP comparator operates was found in many of the responses. A number of candidates showed understanding that the output is close to but not equal to either supply voltage or 0 V.

(iii) The potential divider calculation was accurately completed in many cases, resulting with all three marks being awarded.

(iv) Use of a variable resistor to control the switching point of the circuit is common practice when using comparator circuits. This was explained clearly in over 50 per cent of the responses seen.

(v) There was in some cases a failure to understand that it is the current that needs to be increased rather than the voltage. A relay will often require far more current to switch its contacts than is available from the OP AMP output.

(vi) Understanding of relay contacts and how they control the switching was in most instances good. Those candidates who were clear on this had generally added the connections correctly. There were a few errors where the common terminal had been connected to +9 V rather than +12 V. The motor connections were correct in the majority of cases.

(c) A number of lower achieving candidates offered general safety measures rather than those specific to PCB manufacture and soldering; in most cases candidates gained at least one of the marks in this part.

DESIGN AND TECHNOLOGY

Paper 0445/43
Systems and Control

Key messages

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General comments

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Comments on specific questions

Section A

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(b) In almost all responses triangulation was identified as the method of keeping the structure rigid.

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(b) Over 50 per cent of responses across the full range had placed the movement arrows in the correct positions, both pointing in towards lever **L2**.

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This question was answered correctly in most cases. Most referred to reduced wear and increased efficiency with slightly fewer mentioning the reduction in sound or heat generated.

Question 5

Better responses to this question were more precise when giving reasons for the use of spur gears. Increasing or decreasing speed and changing the direction of motion were seen in many cases. Lower achieving candidates had frequently used generic reasons such as ‘cheaper’ or ‘easier.’ As noted in the **Key messages,** this is not good practice unless further evidence is given.

Question 6

The safety symbols were all well-known and candidates were able to accurately state their meaning. Marks were awarded where candidates had given the consequence of not using the device shown in the symbol.

Question 7

Most responses corrected named an electrical insulator. Rubber was a frequent choice of insulator though it has been largely superseded by other plastic materials.

Any named thermoplastic or thermoset plastic would have gained the mark. Those who chose wood did not gain a mark. Dry wood can be in insulator but if the wood gets wet it will conduct.

Question 8

Very few errors were found in the table of electrical units. Where there were errors, it was mainly with the current and capacitance units.

Question 9

(a) The majority of higher achieving candidates were clear in stating that a reed switch is operated by placing a magnet close to the switch. In a few cases it was incorrectly stated that the switch itself was magnetic.

(b) Benefits of reed switches centred largely on the fact that they can be operated remotely or electronically. The lack of exterior moving parts was noted a in a few cases.

Section B

Question 10

(a) (i) Only a few candidates were able to correctly name all of the materials used in making concrete, resulting in a range of marks between 1 and 3. Most candidates gained at least one mark for knowing that sand and gravel were a key constituent. Higher achieving responses had in most cases added water to the list. Very few had mentioned cement powder, which is the material that binds it all together.

(ii) The force that concrete resists best is compression, which the majority of candidates knew.

(iii) This question resulted in some excellent annotated sketches from stronger candidates. The sketches showed clearly where the steel rods/reinforcing bars should be positioned to produce reinforced concrete. The notes explained why the reinforcement should be placed below the centre line, thereby making the concrete resist the tension that occurs below the centre line when a beam is loaded.

(iv) The stress calculation was generally completed accurately with any errors being in the first part of the calculation, namely, the cross-sectional area of the concrete pillar. Where this happened, an error carried forward was applied for the remaining two marks.

(b) (i) The meaning of equilibrium was well known to most candidates.

(ii) Calculation of reactions on the beam were completed accurately by over 50 per cent of candidates. Any rounding errors in the answers were allowed.

(iii) A few of the natural defects in timber were well known, e.g. termite damage and knots. Some of the other frequently found defects such as warping and bending rarely got mentioned. Most higher achieving candidates gained both marks.

(iv) Clear sketches and relevant notes were featured in many of the responses. Methods of joining the timber varied between traditional joints and those using nails or nail plates. Where traditional joints had been used very few had used a horizontal dowel to hold the joint in place. Adhesive very often named as ‘PVA’ was the method commonly mentioned. A full range of candidates achieved at least 2 marks for this question.

(c) Factor of Safety was not fully appreciated by weaker responses, where the approach commonly found was to use personal protective equipment (PPE) items.

The question asked for the explanation to be based around an example of equipment used in building construction, this guidance was often not followed. Where a question asks for examples, it will often lead to an improvement in the candidate response.

(d) Stronger candidates were able to give logical reasons for the use of each of the joining methods shown. Most candidates recognised that a nut and bolt is a temporary method that would allow parts of the structure to be disassembled or moved. In a structure it also allows for easy assembly of prefabricated parts with the minimum number of tools used.

The riveted joint was seen as being permanent and leaving a flush surface when the joint is complete. The welded joint was viewed as permanent with no additional materials being needed. There was a tendency with weaker candidates to give generic responses e.g. cheap or easy to do. These were not awarded marks.

Question 11

(a) (i) All candidates answering this question identified the mechanism as a crank and linkage.

(ii) Higher achieving responses were able to state the conversion of motion as being rotary to oscillating.

(iii) There was clear understanding of the benefits of grease in lubricating outdoor exercise equipment. Two marks were available for either two separate points in the explanation or for a single point fully explained. Most candidates went for the benefits that reflected outdoor use, e.g. less affected by temperature change.

(b) (i) The uses of different types of bearing differentiated well between the range of candidates. The choice of bearing for a wheelbarrow was in most cases correctly given as a plain bearing and for a cycle as ball bearing. Roller bearings, which imply heavier applications were often not chosen for the train.

(ii) Factors for consideration were described clearly by higher achieving candidates, many responses included reference to the rotational speed of the intended use.

Very few responses described both radial and axial loading which should be considered. If cost was chosen as a factor, it should have included suitable examples.

(c) (i) The higher-level responses mentioned the longer dwell associated with the pear shaped cam. Very few candidates had noted that the eccentric causes constant movement without any dwell. Where necessary marks were awarded for understanding shown, particularly where technical terminology had not been used.

(ii) Only a few higher-level responses recognised that the eccentric drives the follower in both directions whereas a cam relies on either a spring or gravity for the return movement.

(iii) Knowledge of reasons for loss of efficiency in a mechanism were generally well understood. Friction and the resulting conversion to other energy forms e.g. sound and heat were common responses.

(d) The calculation of driven gear speed was in most cases carried out systematically with each of the three individual reductions being identified before the overall reduction was given. Although the mark scheme allowed for the full 3 marks where there was no evidence of working this ruling was rarely used as working had been included.

(e) (i) The bell crank lever was correctly drawn in around 50 per cent of responses. Notes were used to good effect to show the resulting changes in movement in the links caused by the bell crank lever. Errors in sketches were based mainly in placing the bell crank fixed pivot on the wrong side of the two links, which would prevent any movement from taking place.

(ii) The illustration of an M10 × 1.5 was understood by under 50 per cent of the candidates. The ‘1.5’ was correctly identified as pitch more frequently than the ‘10’ was identified as outside diameter.

(iii) Torque was correctly given as the rotational force resulting from use of a spanner. This resulted in a mark for most candidates.

Question 12

(a) (i) In most cases the cathode or negative leg was correctly identified as being the shorter of the two legs. The alternative methods of identification, either a diode tester or by trial and error were rarely seen in responses.

(ii) Stronger candidates had noted that the protective resistor was a very high value. This would not have let enough current pass to light the LED.

(iii) In calculating the current limiting resistor, the first stage was deduction of the voltage drop. This was accurately completed in most cases. Rearrangement of the given ohms law formula was used

in the final part of the calculation. Candidates who had gained the first mark generally gained the remaining two marks.

(b) (i) Knowledge of the layout of a dual in line integrated circuit (IC) was generally good with pin numbers being correctly added to the drawing.

(ii) There were a few errors found in the identification of the power connections for the IC. A common error was to identify the two pins correctly but to apply the wrong polarity to them.

(iii) The logic IC used in the question was a quad NOR gate. If two inputs are connected on any one of the gates it will result in an inverted output, or NOT gate. Few candidates across the full range answered this part correctly.

(iv) The clue to this part was in the question, where it asked for a logic signal to be provided to one of the inputs. A logic signal will be either logic 1 or logic 0. Fig. 12.4 showed a resistor connected to 0 V, this was to ensure that when the input was not connected to a positive voltage it had to be connected to 0 V, meaning that the signal always has a logic level and is not left 'floating'.

(c) (i) The majority of candidates answering this question knew that reversal of polarity at the motor inputs will reverse the direction of the motor.

(ii) The principal from **part (c)(i)** was applied to this part of the motor circuit, with all of the relay connections being required. The two common terminals of the relay had to be connected to the supply rails for 1 mark. The remaining connections ensured that each motor terminal was connected to a supply voltage level that reversed upon activation of the relay. Most responses seen were correct.

(iii) Use of a diode to protect a transistor from back emf was known and understood in around 33 per cent of the responses. In the remainder of responses forward and reverse bias of the diode was mentioned without giving the reason for using each connection method.

(d) (i) This part tested practical knowledge of printed circuit production. The range of responses showed that the reason for using mirror writing was fully understood. In many higher-level responses, the term 'photoetching' was used, demonstrating that the process was familiar to candidates and had probably been put into practice by them.

(ii) Methods of strain relief were not well known to candidates. In a few cases plastic insulation tape was shown stretched across the power leads, which did little to hold them securely. The simplest practical method was to use a pair of holes for each power lead and thread the leads through and back again to the right side of the board. Familiarity with methods used in commercial production would allow candidates to see and evaluate a range of solutions.

(e) Candidates had to choose two components from five for producing a time delay. The key word in the question was **adjustable** this meant that one of the components used had to be adjustable; only the potentiometer fitted this description. The other component required from the list was a capacitor.

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**. More candidates chose to answer **Question B5** than **Question B4**. A small number of candidates did not follow the rubric instruction and answered all questions. Candidates are reminded that they should read the rubric carefully.

The standard of work was the same as that of the previous year.

There are areas of the syllabus for some candidates where further improvements are needed. The drawing of sectional views and orthographic views are areas where many candidates did not perform well. Techniques such as constructing an ellipse and thick and thin line drawing were not evidenced by many candidates. Questions requiring knowledge of vacuum forming and CAD/CAM equipment were also not answered well.

Comments on specific questions

Section A

Question A1

Headphone package

Candidates were asked to complete the half scale orthographic views of the headphones package.

(a) Candidates were required to complete the plan view of the headphones package by adding the hexagonal outline, speaker symbol and sound wave arcs. Many candidates drew a hexagon but some drew hexagons that were irregular or of the incorrect size. The best responses used a compass to draw a circle or radius 60 mm using the given centre lines as the centre point, then, starting on the vertical centre line, scribed arcs of the same radius onto the circle to locate the remining parts of the hexagon. Many candidates drew the rectangular part of the speaker to the wrong size or off centre and lost marks. Many candidates drew the sound wave arcs to the correct radius but drew them too long or short.

(b) Candidates were required to draw the side view of the headphones package by adding the outline and the equilateral triangle. Candidates were expected to project lines from the plan to plot the sides of the package and use the given dimensions on the image of the package to draw the outline. Only a few candidates did this correctly. Many candidates drew the outline to the correct height but incorrect width. Most candidates drew the equilateral triangle correctly and achieved both marks.

(c) Candidates were required to draw the front view of the headphones package by projecting lines across from the side view and down from the plan. Very few candidates achieved full marks on this question. Many candidates drew the outline the same size as the side view. Many also drew the height different from the side view.

Question A2

Styrofoam insert

This question required candidates to complete the full-size sectional view through the headphone package insert.

Very few candidates attempted this question. Very few candidates achieved high marks on this question. Candidates were expected to draw the two identical rectangles to show where one of the headphone speakers would fit, then mirror this for the other side using half the 208-dimension given as the line of reflection. Many candidates drew the outline to the incorrect size. Some candidates completed the partly given rectangle but drew the rest of the view incorrectly. Candidates were given credit for correctly 'mirroring' what they had drawn. A small number of candidates added hatching.

Question A3

Making the Styrofoam insert

(a) This question required knowledge of Styrofoam and its properties. Candidates were required to state one reason why Styrofoam is a suitable material for the insert. The best responses referred to the properties and how this made the material suitable. A common correct response was the impact resistance of the material which means that the headphones are protected from damage.

(b) Candidates were required to name one item of CAD/CAM equipment that could be used to cut out the Styrofoam pieces for the insert. Only a few candidates answered this question. Most responses gave 'laser cutter' as the answer. Very few candidates named a suitable CAD/CAM device. Laser cutter was accepted as Styrofoam can be cut using a laser cutter but this is not usually recommended due to the risk of fire and the release of hydrogen cyanide given off when it melts.

(c) Candidates were asked to name one adhesive that could be used to join the pieces of Styrofoam together. Many candidates gave hot glue or solvent based glues such as superglue which are unsuitable as they melt the foam. Trade names of adhesives were given by a considerable number of candidates. Suitable trade named adhesives were accepted, however candidates and centres should be careful when doing this as some trade names such as 'Gorilla glue' make a variety of adhesives which are not all suitable. The best responses were PVA glue or double-sided tape.

Question B4

Headphone stand

(a) Candidates were required to complete the exploded isometric view of the headphones stand to a scale of 1 : 2 using the information given on the orthographic views of the assembled headphone stand. Only a few candidates who attempted this question gained high marks. Many candidates drew the base as a thin rectangle with no sloping sides by simply extending the edges of the given front face. Most were also able to add 10 mm thickness to the base. Fewer candidates attempted the top part. Very few candidates completed it correctly. Some candidates were able to draw the square top surface around the dowel but drew other faces to incorrect sizes. The best responses followed the information given on the orthographic views carefully and used the given parts of the drawing as start points and reference points. By doing this, candidates were able to apply isometric drawing techniques to construct the missing individual parts of the exploded view using the dimensions provided on the orthographic views.

The ability to be able to interpret and transfer information from one style of drawing to another is a key factor in achieving good marks on this paper and this question was a good example of this.

(b) (i) This question required candidates to complete the parts list for the headphone stand by drawing the individual part of the headphone stand to a scale of 1 : 2 using the information given on the isometric drawing. Most candidates attempted this question and gained some of the marks. Many candidates were able to draw the outer shape of the upright along with the top cutout and semi-circular side cutout. Fewer were able to correctly draw the slots in the bottom edge to the correct size and in the correct positions.

(ii) On this question candidates were required to name a suitable graphic material that could be used to make a half scale model of the headphone stand. Candidates were expected to use their knowledge of graphic materials to select a sheet material of suitable thickness (3 mm) that can be cut to shape easily to make a model. Many candidates gave paper, card or cardboard as a response and did not achieve a mark. The best responses chose rigid graphic materials available in 3 mm thickness such as foamboard, corrugated cardboard or corrugated plastic.

(c) (i) This question required candidates to complete the HEADPHONES lettering by adding the missing letters in a style consistent with the existing lettering. Candidates were expected to use the 30° angle of the lettering and the thickness of the letters as a guide. Most candidates were able to draw the outline of the missing letters to the correct height, position and angle and gain some of the marks. Fewer candidates copied the style of the existing letters and projected parts of these across to help form parts of the letters such as the horizontal central section of the letter 'A'.

(ii) On this question candidates were required to describe how thermochromic ink works. Very few candidates achieved full marks on this question. Many candidates mentioned the use of heat and gained one mark but described the heat being used as an aid to help sticking items together. Only a small number of candidates were able to correctly describe the way the ink changes colour according to the temperature.

Question B5

Earbuds package

(a) Candidates were required to complete the full-size isometric view of the assembled earbuds package. Many candidates were able to complete the front, side and top faces of the package correctly along with the hanging tab, but very few candidates were able to construct the shape of the clear window. The candidates who carefully studied the development (net), read the necessary dimensions and projected lines in isometric from the given start points achieved the best results.

(b) This question required candidates to construct an ellipse Major axis 70 mm, Minor axis 50 mm in the centre of the given outline of the earbud package front. Candidates can use several different methods to do this task. Marks were awarded for the correct major and minor axis points and for the number of correct points plotted along the ellipse. Many candidates made a good attempt and achieved most of the marks available. Few candidates plotted enough points to allow them to draw a smooth ellipse to the correct size.

(c) (i) On this question candidates were required to apply thick and thin line technique to the given insert. Many candidates showed some understanding of the technique and drew the outer edges of the insert in thick gaining them a mark. Fewer candidates were able to add thick lines to the relevant edges inside the insert. On a significant number of candidate's responses there was very little difference between the thick and thin lines shown making it difficult to see which lines candidates showed as thick or thin. It would benefit candidates to make this clearer in future. The best responses used clear thick lines drawn with a ruler.

(ii) This question required the candidate to show knowledge of plastics and name a suitable thin sheet plastic for the insert. Many candidates named suitable plastics such as high impact polystyrene sheet (hips) and achieved the mark.

(d) This question required the candidate to show knowledge of the vacuum forming process and vacuum forming machine. Candidates were required to label the parts of the vacuum forming machine shown. Very few candidates achieved any marks on this question and only a very small number of candidates achieved the full four marks.

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**. More candidates chose to answer **Question B5** than **Question B4**. A small number of candidates did not follow the rubric instruction and answered all questions. Candidates are reminded that they should read the rubric carefully.

The standard of work was the same as that of the previous year.

There are areas of the syllabus for some candidates where further improvements are needed. The drawing of planometric views and orthographic views are areas where many candidates did not perform well. Techniques such as textural rendering and thick and thin line drawing were not evidenced by many candidates. Questions requiring knowledge of graphic materials and use of computers to capture, store and manipulate images were also not answered well.

Comments on specific questions

Section A

Question A1

Gym membership card

Candidates were asked to complete the drawing of the gym membership card to a scale of 2 : 1.

(a) Candidates were required to complete the outline of the card by adding the top, bottom and right-hand side along with the 10 mm × 10 mm angles at 45º on each corner. Many candidates drew the outline to the correct size. Some candidates drew the angles at the incorrect angle.

(b) Candidates were required to draw the isosceles triangle to the sizes given and in the correct position. Most candidates drew the triangle correctly. Some candidates drew the triangle to the sizes on the given drawing without scaling up.

(c) Candidates were required to draw the heart shape from the given start point and using the given centre lines. The vast majority of candidates did this correctly and achieved both marks on this question. Some candidates drew a freehand heart of an incorrect size and only achieved some or none of the marks.

(d) Candidates were required to complete the drawing of the weights by mirroring the given left side to complete the right side. The vast majority of candidates completed the weights correctly and achieved both marks. The best responses projected the top and bottom edges of each weight horizontally across then measured the individual distances of the vertical lines from the given centre line to draw the vertical edges.

(e) Candidates were required to complete the title outline by extending the given top and bottom lines across horizontally then constructing the semi-circular end in the correct position. Many candidates drew the semi-circular end correctly but in the incorrect position.

(f) Candidates were required to draw the octagonal shape on the given centre lines. Many candidates did this correctly and achieved the full three marks. Some candidates constructed a regular octagon but of an incorrect size or orientation. The best responses drew a square 80mm wide by 80mm high and constructed the octagon inside using a compass to scribe arcs marking the corner points.

Question A2

Production of the gym membership card

This question required candidates to show knowledge of image capture, storage and manipulation using desktop publishing and properties of graphic materials.

(a) Only a few candidates achieved high marks on this question. Candidates were expected to describe the capture of the photographic image by a suitable method, followed by how it would be transferred to a computer and manipulated on screen into the membership card template. Many candidates described printing the image out, then sticking it onto the card but gave no detail of how it would be captured or transferred to computer.

(b) (i) This question required candidates to show knowledge of thin sheet plastic. Many candidates gave one-word responses that stated a property but needed to show why the use of thin plastic for the cards would be beneficial. The best responses gave a property of the plastic and why this would be beneficial.

(ii) This part of the question required candidates to name a suitable thin sheet plastic that could be used to make the membership cards. Many candidates named plastics that were too flimsy such as acetate or too brittle such as acrylic. The best responses showed knowledge by giving a plastic with similar thickness and flexibility to a credit card such as polystyrene.

Question A3

Membership card wallet

This question required candidates to complete the development (net) of the membership card wallet using the dimensions given. Many candidates were able to complete the front face of the wallet along with the right-hand side and flap to match the left side. Some candidates omitted the semi-circular cut-out or drew it to an incorrect radius. Some candidates drew the back edge and lid to the correct size but omitted the 5mm wide base and lost marks. Many candidates lost marks because they drew fold lines with the incorrect line convention.

Question B4

Planometric views of the gym changing room.

(a) Candidates were required to complete the planometric view of the gym changing room to a scale of 1 : 20 using the information given on the orthographic views. Many candidates were able to draw the bench to the correct size and in the correct position and achieve three marks. Fewer candidates drew the lockers correctly or in the correct positions. Many drew the lockers directly behind or on top of the bench. Only a small number of candidates drew the edges of the floor correctly. Many omitted them all together. The best responses used a 45º set square to draw the vertical and 45º angle lines to construct the outer shapes of the bench and lockers before adding the inner details.

(b) This question required candidates to show knowledge of rendering techniques and demonstrate their skill in these techniques by rendering the parts of the hanging rail to look like hardwood and aluminium.

(i) Most candidates drew grain lines to show the wood and a suitable wood colour and achieved two of the three available marks. Very few candidates showed appropriate end grain matched to the grain on the top and side edges.

(ii) Most candidates added grey shading to the hook and achieved at least one mark. Many showed some variation in tone on the different faces of the hook and achieved the second mark. Few candidates showed any reflection of light and produced a high-quality response worthy of the full three marks.

(c) This question required candidates to complete the estimated two-point perspective view of the hanging rail using the given start points and vanishing points. Many candidates correctly projected the end corners of the rail to construct the top and front face. Many candidates drew the vertical right-hand end of the rail in an unsuitable position and lost marks. Fewer candidates correctly projected lines from the given parts of the hooks to the corresponding vanishing points to construct the remaining hook correctly.

Question B5

Gym weight

(a) Candidates were required to complete the orthographic views of the gym weight to a scale of 1:5 using the given isometric view and front view. The vast majority of candidates who attempted this question did not achieve high marks. Candidates were expected to project lines vertically from the front view to construct the hexagonal base and top surfaces of the weight on the plan view. Many candidates constructed hexagons on the given centre lines but to incorrect sizes or in the wrong orientation. To complete the side view candidates were expected to project lines from the plan and front views to construct the outer shape and handle of the weight. Many candidates projected lines horizontally from the front view but drew the sides and inner vertical edges of the weight in the incorrect positions. Many candidates drew the handle too thick or too thin. Many candidates omitted the hidden detail of the indent or drew it to the incorrect size.

(b) (i) On this question candidates were required to apply thick and thin line technique to the model gym weight. Many candidates showed some understanding of the technique and drew the outer edges of the two end weights and two sides of the centre tube correctly achieving two marks. Fewer candidates added thick and thin line to the protruding tube end correctly. On a significant number of candidate's responses there was very little difference between the thick and thin lines shown making it difficult to see which lines candidates showed as thick or thin. It would benefit candidates to make this clearer in future. The best responses used clear thick lines drawn with a ruler.

(ii) This question required the candidate to show knowledge of tools and equipment used to model products in graphic materials. Many candidates named knives such as craft knives and Stanley knives which have blades too small for the cutting of thicker Styrofoam and did not achieve the mark. Many candidates gave hot glue or solvent based glues such as superglue which are unsuitable as they melt the foam. Trade names of adhesives were given by a considerable number of candidates. Suitable trade named adhesives were accepted, however candidates and centres should be careful when doing this as some trade names such as 'Gorilla glue' make a variety of adhesives which are not all suitable. Many candidates gave double-sided tape. Whilst this is usually suitable for fixing Styrofoam and card, in this case the tape would peel off the tube when it is inserted into the end block. The best responses gave a suitable non-solvent based adhesive such as PVA glue.

(c) On this question candidates were required to complete the sectional view A-A through the model of the gym weight to a scale of 1 : 2. Candidates were expected to complete the tube to the correct length and width before adding the two weights and hatching. Many candidates achieved five of the six marks available but lost out on the sixth mark by not adding hatching correctly. Many candidates also drew the weights in front of the tube instead of behind and lost a mark. The best responses completed the tube and left-hand weight using the given start points and dimensions provided. They then mirrored the right-hand weight to the left at the appropriate distance before adding hatching the weights and walls of the tubing.

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**. More candidates chose to answer **Question B5** than **Question B4**.A small number of candidates did not follow the rubric instruction and answered all questions. Candidates are reminded that they should read the rubric carefully.

The standard of work was the same as that of the previous year.

There are areas of the syllabus for some candidates where further improvements are needed. The drawing of sectional views and planometric views are areas where many candidates did not perform well. Questions requiring knowledge of CAD/CAM equipment and commercial processes were also not answered well. The use of different line and shading conventions such as hidden detail, fold lines and hatching are also areas of the specification that many candidates did not appear to have good subject knowledge.

Comments on specific questions

Section A

Question A1

Items of school equipment

Candidates were asked to complete the full-size drawings of the school equipment.

(a) Candidates were required to complete the full-size drawing of the 45° set square to the sizes given. Many candidates drew the set square correctly and achieved all three marks. Some candidates drew the inner or outer triangles incorrectly and lost marks. Almost all candidates drew the base and sides of the triangle spaced 15 mm apart as shown on the drawing and achieved at least one mark. The best responses extended the given start lines to the correct length then used a 45° set square to complete the outlines.

(b) Candidates were required to draw the full-size drawing of the glue bottle to the sizes given.

(i) Candidates were expected to project lines from given start point to complete the outer rectangle then construct the shoulders of the bottle using a compass set at 15 mm. Most candidates drew the outer rectangle to the correct height and width but many drew the shoulders of the bottle to an incorrect radius or a freehand curve with no uniformity.

(ii) Candidates were required to draw the nozzle of the glue bottle. Most candidates drew the nozzle to the correct height and with the correct base width and achieved both marks.

(iii) Candidates were required to draw the hexagon on the given centre lines to the size given. Most candidates did this correctly and achieved full marks. Some candidates drew irregular hexagons or other polygons with more than six sides and lost marks. The best responses drew a circle on the given centre lines with a radius of 30 mm, then starting from the centre line scribed arcs of the

same radius around the circle to plot the remaining corners of the hexagon before joining with a ruler.

(c) Candidates were required to complete the scissors by mirroring the existing details along the horizontal centre line using the dimensions given. The majority of candidates drew the inner and outer circles of the handles correctly but many drew the straight section of the handle in the wrong position. Many candidates drew the blades to an incorrect thickness or shape and lost marks

Question A2

Pencil sharpener

This question required candidates to complete the orthographic views of the pencil sharpener to a scale of 5 : 1 using the information given.

Many candidates completed this question correctly and achieved all seven marks. Many candidates drew the rectangular outline of the sharpener for the plan correctly but drew the radius on the left incorrectly. Many candidates drew the side view as a rectangle rather than with a sloping top face or did not project the edges of the radius correctly from the plan. Most candidates drew the front view correctly. The best responses drew the plan, then projected lines using the correct orthographic techniques to construct the front view and side views.

Question A3

Rendering the pencil sharpener

This question required candidates to show knowledge of rendering techniques and demonstrate their skill in these techniques by rendering the pencil sharpener to look like aluminium. Most candidates added grey shading to the sharpener and achieved at least one mark. Many showed some variation in tone on the different faces of the sharpener and achieved the second mark. Few candidates showed any reflection of light and produced a high-quality response worthy of the full three marks.

Question B4

Desk tidy

(a) Candidates were required to complete the planometric view of the desk tidy to a scale of 1 : 2 using the information given on the orthographic views. Only a few candidates who attempted this question achieved high marks. Many candidates were able to draw the left side face and vertical front face of the desk tidy. Few candidates were able to draw the right hand open top or sloping faces of the desk tidy. Some candidates added 5mm thickness to the left front edges to form the tray, but many drew the tray too deep or shallow. The best responses followed the information given on the orthographic views carefully and used the given parts of the drawing as start points and reference points. By doing this, candidates were able to apply planometric drawing techniques to construct the missing parts of the desk tidy using the dimensions provided on the orthographic views.

The ability to be able to interpret and transfer information from one style of drawing to another is a key factor in achieving good marks on this paper and this question was a good example of this.

(b) (i) This question required candidates to explain why an image would be used instead of written text. Many candidates gave answers relating to the image being understandable by people who could not read the text due to being very young or unfamiliar with English language. Other candidate responses related to the image making the desk tidy more attractive and appealing to children.

Most candidates were able to score at least one mark on this question by just stating a reason. The best responses fully explained the reason why an image would be more suitable.

(ii) This question required candidates to sketch a design for a suitable image that could be used on the desk tidy instead of the DESK TIDY text. Candidates were expected to draw items of stationary that may be stored in the desk tidy such as pens, pencils, rubbers etc. Many candidates drew a desk and achieved marks. Many candidates wrote the desk tidy text in a different font rather than drawing an image and did not achieve any marks.

(iii) This question required candidates to explain how a computer could be used to help create an image for the desk tidy. Many candidates stated the use of the internet to find a picture or named a suitable software package that could be used and gained one mark. Very few candidates explained how the internet or software could be used to help create the image. The best responses described how the image could be sourced or created and then edited or manipulated to suit.

(c) This question required candidates to complete the estimated two-point perspective view of the drawer using the given start points and vanishing points. Many candidates correctly projected the upper and lower edges of the drawer to VP1 to construct the front face of the drawer. Many candidates drew the vertical left-hand end of the drawer in an unsuitable position and lost marks. Most candidates also projected lines from the front and side to construct the top edges of the back two faces. Fewer candidates correctly projected the internal lines to construct the inner edges of the drawer.

Question B5

Pen container development (net)

(a) This question required candidates to complete the development (net) of the pen container to a scale of 1 : 2 using the information and start point given. Many candidates completed this question correctly and scored full marks. Most candidates were able to draw the left-hand side face to the correct height but lost marks because they drew the radius to an incorrect size or in the wrong position. Many candidates drew the height of the front correctly but drew the angled sections incorrectly. Most candidates were able to mirror the right-hand side from their existing left hand one and complete the back section. Many candidates drew the base too small or missed off the necessary glue flaps required to assemble the development (net) correctly. A significant number of candidates lost marks because they used the incorrect convention for fold lines.

The best responses used the dimensions given to complete the left-hand face and front face then projected lines from the left face to construct the right hand face by mirroring along the centre of the front face. Candidates then extended the base line to create the start point for the back section using the given euroslot as a gauge for if the shape and position were correct.

(b) On this question candidates were expected to show knowledge of the tools and processes needed to create a card model from a development (net). Candidates were required to name the tools/items of equipment and processes used in the making of the prototype. Most candidates were able to name a suitable tool for cutting out the development (net) such as a craft knife. Many candidates did not name a process for the scoring tool and rule part on the table and lost marks. Most candidates were able to name an appropriate glue for joining the development (net) together.

(c) This question required candidates to show knowledge of equipment used in different production methods.

(i) Candidates were asked to name one item of CAD/CAM equipment that could be used to produce a batch of 30 developments (nets). Only a few candidates answered this question well. Many candidates did not respond to this question. Many candidates named printers such as laser printers rather than tools that could be used to cut out the developments (nets).

(ii) Candidates were asked to name a suitable method of producing the developments (nets) in quantities of 10000. This question was also only answered well by a few candidates. Many candidates gave laser cutter as an answer to this instead of die cutter. Other students named printing methods suitable for high quantities such as lithography instead of methods for cutting out the developments (nets).

(d) This question required candidates to complete a sectional view through the tape dispenser along the given line A-A. Many candidates did not answer this well and achieved only some of the marks available. Most candidates were able to construct the outline of the dispenser showing the 5 mm thickness of the acrylic. Fewer candidates were able to show the back line, holes and hidden detail correctly. Very few candidates correctly added hatching.

(e) On this question, candidates were required to complete the full-size side view of the tape dispenser by adding the roll of tape and the end cover. Candidates were required to show hidden detail and

existing hidden detail was shown on the given drawing to emphasise this. Most candidates drew the two circles for the tape roll along with the end cover and achieved two of the three marks available. Most candidates also showed the appropriate parts of the two large circles as dotted lines to denote the hidden detail.