DESIGN AND TECHNOLOGY

Paper 0445/11
Product Design 11

Key messages

Candidates responded well to the design scenarios, with many demonstrating high levels of creativity and sound technical knowledge.

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 aware that the focus for **Question 1** is Resistant Materials, for **Question 2** Graphic Products and for **Question 3** Systems and Control. A small number of candidates answered **Question 2** from a Resistant Materials perspective.

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.

It is not necessary for centres to fasten the two response sheets together, with staples or string, or include the question paper with the response sheets.

General comments

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

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

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

Comments on specific questions

Question 1

(a) Most candidates managed to list four additional points about the function of the device for cooking on a beach that they considered to be important. Commonly seen answers related to the suitability of the materials, ease of assembling the device, use of the device when cooking, cleaning the device after use or how the device would be carried from a vehicle to the beach. Candidates should be advised against repeating points that are given in the question or giving generic points, such as nice, that might apply to almost any product.

(b) Most candidates used sketches and notes to good effect to show two methods that would enable the device to stand on different types of terrain. Commonly seen answers included legs with spikes on the end, legs with screw mechanisms for height adjustment or large pads on the end of the legs. A small number of candidates had difficulty understanding the word terrain and showed methods of making products stand in an upright position. 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 to their sketches and used a range of presentation techniques, including freehand exploded views. Some candidates could improve on fully encompassing the requirements for the cooking device to be for an open fire, used on a beach and collapsible for transportation. 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 referred to the heat resistant properties of the materials used, how easy it would be to manufacture the device, assembly of the device, stability, how easy it would be to cook on the device or its suitability for outdoor weather conditions. It is important that candidates evaluate their design proposals, rather than simply describing them, and avoid repeating 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 justified their choice.

(e) Some very impressive responses were seen to this question, with freehand sketches and notes clearly showing 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 usually 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 mild steel, stainless steel, and aluminium. Reasons for the choice of material included mild steel is relatively cheap and heat resistant or stainless steel will not rust. Candidates should be advised against giving generic names of materials such as metal, or consumables such as paint, as these responses are not awarded marks.

(g) Most candidates used a combination of sketches and notes to outline a method to manufacture one part of their design proposal. Commonly seen methods involved the processes of marking out, cutting out or shaping parts and then joining them together using welding, nuts and bolts or rivets. Most responses involved hand production techniques. Some candidates used a lathe, milling machine or computer-controlled equipment. Some very good responses were seen to this question. It is important that candidates include the correct names of tools and equipment to access the full range of marks.

Question 2

(a) Most candidates managed to list four additional points about the display board that they considered to be important. Commonly seen answers included the display board should not blow away in the wind, the materials should be weatherproof, the information on the display board must be easy to understand and there should be the capacity to store many litter bags. Candidates should be advised against repeating points that are included in the question, for example the display board should be floor-standing, or giving generic points that might apply to almost any product.

(b) Most candidates used sketches and notes to good effect to show two methods of dispensing litter bags. Commonly seen responses included a roll of litter bags, a stack of litter bags, litter bags that could be pulled out of a tube and electronically operated dispensers activated by hand movement. A small number of candidates had difficulty understanding the term dispensing litter bags, and showed how one litter bag could be fastened into a litter bin. 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 was seen for this question, with colour generally used to good effect. Commonly seen design proposals included display boards made from a folded sheet material, such as Corriflute, or a fabricated frame made from tubular aluminium or softwood strips. The annotations often revealed the candidate's true understanding of how the design proposal would function in a beach environment. It is important that all ideas fully meet the design requirements if candidates are to access the full range of marks. Some candidates included a litter bin and place to store full bags of litter in their design, rather than a method of dispensing litter bags.

(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 the durability of the display board, how effectively the display board communicated the information, ease of setting up the display board or features of the litter bag dispensing mechanism, such as reliability. 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 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 materials lists. Colour was generally used effectively to show the material or surface finish. Many responses included an exploded three-dimensional (3D) sketch of the artefact, with supporting annotations. The question specifically asked for construction details and important dimensions. Weaker responses could be improved by including these. All candidates should 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. Corriflute (corrugated plastic sheet), aluminium tubes and softwood strips were commonly named materials, with reasons often referring to specific properties of the material, such as waterproof, available in a range of colours or can easily be printed on. Candidates should be advised against giving generic names of materials, such as plastic or wood, as these are not awarded marks.

(g) Most candidates were able to use sketches and notes to outline a method that would be used to manufacture one part of their design proposal. Hand production techniques, involving such tools as a craft knife, saw, drill and screwdriver were commonly seen but some candidates used computer-controlled technology to produce self-adhesive vinyl lettering or parts for their design. It is important that candidates include the correct names of tools and equipment to be used in the method of manufacture 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 protect people from the wind that they considered to be important. Commonly seen answers often referred to the structural strength of the materials used to make a frame, the colour and patterns on fabrics used, practicalities of setting up the device or ease of moving the device from a vehicle to the beach. Candidates should be advised against repeating points that are given in the question, for example the device must be portable, as these responses are not awarded marks.

(b) Most candidates used sketches and notes to good effect to show two mechanisms that would make a device collapsible and adjustable. Most candidates showed screw clamping mechanisms, a small tube that slid inside a larger tube and then locked with a spring-loaded button, folding hinged parts or pegs that slotted into a series of holes. 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 easily visualise how the device could potentially be used on a beach to protect people from the wind. It is important that all ideas fully meet the design requirements if candidates are to access the full range of marks. For example, candidates should consider how the device

would be assembled on a beach. A small number of candidates produced fewer than three ideas or three ideas that were very similar.

(d) The evaluations of ideas were often very 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 mechanisms, ease of transporting the device or visual appeal in terms of the design on the fabric used to make the device. It is important that candidates justify their evaluations rather than making broad statements, such as that 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 very 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. Weaker responses could be improved by including more of these. All candidates should 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 aluminium tube, stainless steel and nylon, with the reasons often relating to the weight of the material or its ability to withstand different weather conditions. Candidates should be advised against giving generic names of materials such as metal, 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 answers included marking out, cutting, drilling and joining materials with nuts and bolts or by welding. A small number of candidates outlined the use of computer-controlled technology, such as a laser cutter or 3D printer, to manufacture part of their design. The explanations of computer-controlled technology usually demonstrated a very 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 to access the full range of marks.

DESIGN AND TECHNOLOGY

Paper 0445/12
Product Design 12

Key messages

Candidates responded well to the design situations and some outstanding design work was seen. Many candidates demonstrated very high levels of creativity and technological understanding.

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, and not repeat the same evaluation point for all three ideas.

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 vacuum forming or steam bending timber to produce a curved shape.

Centres should not fasten the two response sheets together, with staples or string, or include the question paper with the response sheets.

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 understanding of how materials and processes could be used to create a design were real strengths. The range of creative ideas produced for **part (c)** and the details of the final solution in **part (e)** often demonstrated a very high standard of design skills and technical knowledge.

Some responses for the written parts of the paper may have benefitted from adopting a more structured approach in order to express the ideas more clearly. 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 display unit for model cars that they considered to be important. Commonly seen answers referred to how easy it would be to view the cars, ensuring the cars did not roll off the display unit, using materials that could easily be cleaned, the aesthetics of the display unit or the structural stability of the materials. A few candidates considered a method of illuminating the cars when on display in the unit important. 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 of joining modular display units together. Commonly seen answers involved the use of dowels, Velcro, woodscrews, dovetail shaped fittings, hooks, and push fittings. Most candidates interpreted the question as a temporary joining method but permanent joining methods, for example the use of an adhesive, were also awarded marks. The standard of written and visual communication for this question was often of an excellent standard.

(c) An impressive range of sketches with annotations was seen for this question. The most common solutions were made from acrylic, glass, pine, aluminium, brass, or stainless steel. The strongest candidates added detailed annotations to their sketches that made it clear that they had fully considered how the cars would sit on the display unit and how the display units would fasten together. Most candidates designed a display unit for six cars that would join with identical display units. Some candidates interpreted the question as a display unit for one, two or three cars that would join with identical display units. Both approaches were considered acceptable as they met the design requirements for the question. 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 the how easy it would be to join the display units together, stability when units were joined together, the effectiveness of the method used to prevent the cars rolling off the display unit, the cost of the materials used to make the display unit or the aesthetics of the display unit. Some candidates may have benefited from adopting a more structured approach to express their ideas more clearly, such as the use of 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.

(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. Weaker responses could be improved by including these. 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, and acrylic. 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 the parts of a display unit that would slot together was also commonly seen. Many excellent responses were seen to this question. It is important that candidates include the correct names of tools and equipment to be used in the method of manufacture 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 replica ancient coins that they considered to be important. Commonly seen answers referred to the properties of the materials to be used to make the package, the size or shape of the package, the method of displaying the coins or the cost of producing and transporting the package. Candidates should be advised against repeating points that are given in the question, for example the package must hold three coins, or giving generic points that might apply to almost any product.

(b) Most candidate used sketches and notes to good effect to show two methods of protecting products during transportation. Many candidates showed the use of corrugated cardboard, Corriflute (corrugated sheet plastic), foamboard, expanded polystyrene, bubble wrap, vacuum formed trays or sponge as the method of protecting a product during transportation. 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 materials, such as corrugated card or polypropylene sheet, for their package but a few used resistant materials, such as acrylic or pine. Almost all the design ideas clearly showed how the three coins would be protected during transportation but in some designs the display aspect was either omitted or unclear. 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 difficult it would be to manufacture the package, the cost of transporting the package, how long it would last as a display or whether it could be recycled after use. To access the full range of marks, candidates should aim justify their evaluations more and avoid using general statements, such as that it would work well. 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. This question specifically asked for construction details and important dimensions. Weaker responses could be improved by including these. 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. Expanded polystyrene, corrugated cardboard and Corriflute (corrugated sheet plastic) were commonly named materials. The main reasons for choosing these materials were often linked to the method of manufacture, such as joining with an adhesive or double-sided tape, the range of colours available, 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 development (net) 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 computer numerically controlled (CNC) machines, such as a laser cutter, 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) 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 container for storing and sorting marbles that they considered to be important. Commonly seen answers related to how the marbles would be put in and taken out of the container, how the device might be carried, the durability of the materials or the performance of the sorting mechanism. Candidates should be advised against repeating points that are given in the question, for example the container must include a method of sorting the marbles by size, or giving generic points that might apply to almost any product.

(b) Most candidates used sketches and notes effectively to show two methods of sorting objects by size. Many candidates showed a sheet of material with different size holes, tapered tubes, or a series of different size doors. Some more ingenious methods focused on the idea that the larger marbles would be heavier and therefore used the weight as a means of sorting marbles by size. Some candidates showed methods of storing different size marbles, for example containers with small, medium and large written on them, rather than a method of sorting objects by size. 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, although it was not always clear that the candidate fully understood how the device would work. For example, some design proposals needed to better consider how the marbles would be put in and taken out of the container. The container, in some respects, appeared to be an enclosed game. 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 the durability of the materials, how easy it would be to manufacture the container, how convenient it would be to carry the container or the performance of the sorting mechanism. 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 the joints for the container, around it. This question specifically asked for construction details and important dimensions. Weaker responses could be improved by including these. Stronger candidates included details of materials, construction, finishes and dimensions in their sketches and notes. 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 acrylic and pine, with the reasons relating to the aesthetic qualities or working properties of the material. Candidates should be advised against giving generic names of materials such as wood, or generic reasons such as that it is easy to work with, as these are not awarded marks.

(g) Most candidates used a combination of sketches and notes to outline a method of manufacturing one part of their design proposal. Commonly seen manufacturing methods included the use of heat processes to shape acrylic or cutting out parts with hand tools or a laser cutter. Most candidates used sketches and notes, usually with 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 13

Key messages

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

Candidates should be 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, and not repeat the same evaluation point for all three ideas.

Many candidates achieved high marks for **part (e)** using just freehand sketches and notes. The benefits of using 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.

Centres should not fasten the two response sheets together, with staples or string, or include the question paper with the response sheets.

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 responses for the written parts of the paper may have benefitted from adopting a more structured approach in order to express the ideas more clearly. 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 the bicycle storage solution that they considered to be important. Commonly seen answers referred to the method of attaching the solution to the wall or ceiling, ease of use, aesthetics, amount of space it would take up in the apartment, or use of materials that would ensure the storage solution would be strong enough to hold a bicycle. Some candidates identified that the design should prevent the walls or floor of the apartment becoming damaged by wet or muddy bicycle tyres. Candidates should be

advised against repeating points that are given in the question or giving generic points, such as it must be inexpensive, that might apply to almost any product.

(b) Most candidates used sketches and notes to good effect to show two methods of mounting items off the floor. Commonly seen answers included hanging an item on a hook, placing an item on a shelf or rack, attaching an item to a bracket with a screw fastener or the use of magnets or Velcro to hold an item in place. Some methods involving the use of suction and mechanical clamps were also seen. 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 attached to the wall or ceiling but there were also several floor mounted storage solutions that allowed a bicycle to be mounted off the floor. Some of the floor mounted solutions could maximise space better, as they would most likely take up space in a room or block a corridor. Most solutions were made from aluminium tube or stainless steel, but some candidates also incorporated plastic and wood into their design proposals. The strongest responses had detailed annotations added to their sketches and clearly showed how the bicycle would attach to the storage solution. 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 should fully consider how the user would take the bicycle on and off the storage solution. 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 use, strength of the materials, making sure the storage solution would not damage the bicycle or accommodating bicycles of different sizes. Some responses for the written parts of the paper may have benefitted from adopting a more structured approach to express their ideas better, 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.

(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. Weaker responses could be improved by including these. 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 aluminium and mild steel but rubber and sponge were often used to ensure the solution did not damage the frame of the bicycle. The reasons for the choice of material often referred to the weight of the material or structural strength of the material but aesthetics was 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 rivets, nuts and bolts or welding were commonly seen methods of manufacture. Many excellent responses were seen to this question. It is important that candidates include the correct names of tools and equipment to be used in the method of manufacture to access the full range of marks 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 point-of-sale display that they considered to be important. Commonly seen answers related to how the twelve packages would fit on the point-of-sale display, how customers would interact with the point-of-sale display, the materials to be used or information to be included on the point-of-sale display. A small number of candidates designed a package for the computer whereas the requirement to design a point-of-sale. Candidates should ensure they read the question and requirements carefully. Candidates should be advised against repeating points that are in the question, for example it must

hold twelve bike trip computer packages or giving generic points that might apply to almost any product.

(b) Most candidate used sketches and notes to good effect to show two temporary methods of joining lightweight graphic materials. Many candidates showed locking tabs, screw connectors or the use of Velcro or lightweight magnets. Many excellent responses were seen to this question. A small number of candidates showed methods of permanently joining resistant materials, such as wood. Whilst these responses were credited it should be noted that the question did state a method of joining lightweight graphic materials together.

(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. Many candidates chose to use lightweight materials, such as corrugated cardboard, plastic sheet or foamboard, for their point-of-sale display and a few used resistant materials, such as MDF or pine. The annotations often revealed a candidate's true understanding of how the design proposal would be constructed and used in a shop. 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 interact with the point-of-sale display, stability, how environmentally friendly the unit would be or ease of accessing the packages. 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. This question specifically asked for construction details and important dimensions. Weaker responses could be improved by including these. 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, corrugated cardboard, foamboard and Corriflute (corrugated sheet plastic) were commonly named materials. The main reasons for choosing these materials were often linked to the method of manufacture, such as joining with screw clips or double-sided tape, the wide 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 parts of their point-of-sale display would be marked out, cut out by hand using a craft knife, safety rule and cutting mat and then joined together. Some candidates used computer numerically controlled (CNC) machines, such as a laser cutter, 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, such as drilling a hole, 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 device that would hold a bicycle in an upright position that they considered to be important. Commonly seen answers referred to ease of operation, durability of the materials used, weight of the device or how the device would be attached to a bicycle. Candidates should be advised against repeating points that are given in the question, for example hold a bicycle in an upright position, or giving generic points that might apply to almost any product.

(b) Most candidates used sketches and notes effectively to show two methods of providing an extending or folding mechanism. Many candidates showed hinges, sliding tubes, pivoted joints, or screw fixings. The quality of the sketches and notes were usually sufficient to adequately 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) An impressive range of sketches with annotations was seen for this question, although it was not always clear that the candidate fully understood how the device would work. For example, some candidates could better consider how the device would attach to the bicycle or rest on the ground to improve stability. Some candidates designed a rack for many bicycles, rather than a device that allows a bicycle to be stored in an upright position and should be advised to read the question and requirements carefully if they 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. Many responses referred to the stability of the bicycle, whether the device would damage the bicycle or how easy it would be to store when not in use. Some candidates focused on the ergonomics or aesthetics of 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 joints, around it. This question specifically asked for construction details and important dimensions. Weaker responses could be improved by including these. 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, mild steel, and aluminium, with the reasons relating to the aesthetic qualities, strength or weight of the material. 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 heat processes to join metal, such as welding, or shaping parts with hand tools or a lathe. Some candidates accurately described the use of taps and dies to cut threads in metal. 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 candidates describe a design need and generate a design brief. To access the higher mark range, they need to consider both the design need and the needs of the user in more detail. Many candidates identify a client who can provide useful information and feedback throughout the project. This is to be encouraged wherever possible.

  Candidates would benefit from applying more consideration to the environment in which the product is to be used.

- The assessment criteria for manufacturing relates to both the selection of materials and the skills and processes used during the manufacturing process. If candidates do include the use of CAM they should show how they have set up the machine and chosen the settings for the respective task in relation to the materials they are using.

- Many candidates make good use of models in design development which helped visualize the size, shape and proportions of their design proposal. Candidates should then consider the appropriate materials for construction and make informed decisions about construction possibilities and finishes for the product they wish to make.

General comments

The Individual candidate record cards provided by teachers were very helpful in the moderation process. Centres are reminded that they are only required for candidates included in the sample.

When candidates select to design and make an architectural concept model of a building, it would be beneficial for them to communicate that they are making a model in the design brief. They should investigate existing models, focus on designing the model, experiment with model making materials, construct the model, and evaluate the success of the model alongside the suitability of the building itself.

Some folders are excessively large. Many pages had very limited content and could have been presented more effectively. Candidates are encouraged to make the best use of each available page.

It was very pleasing to see a significant number of centres entering candidates for the first time.

For new centres, or teachers new to the specification, guidance for assessing coursework and other very useful support for 0445/02 can be found on the teacher's support hub.

https://schoolsupporthub.cambridgeinternational.org

Comments on specific sections

Question 1

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

Many candidates presented a comprehensive investigation and full analysis of the design need. They identified the intended users and detailed their particular needs and produced a full and clear design brief.

Some responses were relatively brief and needed more detail to access the higher mark ranges. It is important that candidates apply a detailed consideration of both the design need and the intended user(s).

Question 2

Research into the Design Brief resulting in a Specification

As well as researching the particular 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. This is often done through the use of interviews, surveys, letters, e-mails, and internet research.

Some candidates include many pages of research on a wide range of materials, tools and manufacturing methods. Candidates should ensure all research is appropriate to the design brief.

Much of this information could be used to support design decision making in Assessment Criterion 4: Development of Proposed Solution

Question 3

Generation and exploration of Design Ideas

Marking in this section was generally consistently applied but many centres were slightly lenient in awarding marks, particularly in the higher mark range.

To gain a high mark in Assessment Criterion 3 candidates need to generate a wide range of ideas appropriate to the design problem and show some imagination and originality. Candidates should clearly annotate their work to show their design thinking.

Some of the design work produced was of a very high standard. Some candidates explored a wide range of imaginative sketched ideas and design possibilities, showing a natural progression of design and development. The appropriate application of CAD and modelling skills was strong and well executed.

Question 4

Development of Proposed Solution

More candidates are fully completing all requirements in this section. A significant number of candidates use sketches to show changes and improvements and formulate a final proposal. Candidates should then go on to give evidence to support decision making relating to form, materials, fixings and construction methods. Having established which design is to be made, candidates should decide upon suitable construction materials. It is important that they explain why these specific materials have been selected. The number of components and their sizes need to be established and decisions made about appropriate finish.

Many candidates find model making very helpful at this stage. Seeing their design in 3D helps to make sure items will fit or products will be stable or of correct proportions. Many candidates practice possible construction and finishing techniques before making final decisions.

Question 5

Planning for Production

Working drawing of the proposed solution were generally detailed and accurate; most were fully detailed. Some candidates made very good use of CAD, a number presented detailed 3D views of the final solution. Dimension details were missing in some cases and should be added.

Many candidates produced fully detailed production plans showing a clear sequence of the stages of manufacture and including material lists, components required and specific finish to be applied.

Question 6

Product Realisation

Some of the work presented was of outstanding quality; innovative designing and products constructed to a very high standard.

Detailed photographic logs were well used by most candidates and clearly supported the marks awarded by the centre for the practical outcomes. They give clear evidence of the skills and techniques used and highlight the quality of construction.

Where CAM is used in the manufacture of the product, screen shots of appropriate CAD work and a description of the set up procedures for the CAM equipment should be included in the photographic evidence of manufacture.

Centres are reminded that the candidates should have ownership of their coursework – including the manufacture of the product. Any external help outside of usual teacher/technical assistance must be acknowledged on the Individual Candidate Record Card, and the marks adjusted accordingly.

Marking of this section was generally accurate. Some centres were slightly generous in the award of marks at the top level. Marks allocated to making should reflect the overall complexity of the product, the level of skill demonstrated by the candidate, and the precision, accuracy and the ability to function of the final product.

Question 7

Testing and Evaluation

Many candidates carried out appropriate testing and were able to identify the strengths and weaknesses of their product. Most used the initial specification to evaluate the product.

Many candidates made good use of clients or potential product users to provide valuable evaluative comment,

Most candidates tested their products against their original specification. The testing could be improved by suggesting proposals for further development if they had the opportunity. A critical analysis would result in suggested design or manufacturing improvements.

It is important that after testing their product, candidates should draw meaningful conclusions that will lead to proposals for further development or improvement. Modifications are best presented in the form of sketches and notes.

DESIGN AND TECHNOLOGY

Paper 0445/31
Resistant Materials 31

Key messages

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

General comments

Section A

In this section candidates need an all-round knowledge and understanding in order to answer all questions successfully 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 to access the full mark range.

Comments on specific questions

Section A

Question 1

Most candidates provided good ergonomic features of the cordless drill. The most common features included "the shape to fit hand", "ridges on chuck to grip" and "easy to press trigger".

Question 2

Most candidates showed how the butt joint could be strengthened. Methods included additional corner blocks, use of a recognised KD fitting, dowels, pin and glue or screw and glue.

Question 3

More candidates achieved one mark for naming the cold chisel (often referred to as 'chisel') than for recognising the tinsnips or shears.

Question 4

Very few candidates understood the purpose of the datum face. The datum face is a perfectly flat face from which accurate measurements could be taken.

Question 5

(a) Most candidates selected PVC correctly from the list given, as the material used for window frames and guttering.

(b) Most candidates selected phenol formaldehyde from the list given, as the material used for dark electrical fittings and for saucepan and kettle handles.

Question 6

Most candidates drew a form of a strut that could be joined diagonally to the bracket and received some credit. For maximum marks, information about how the strut could be joined to the bracket was required. Welding was named as an appropriate method of joining.

Question 7

Some candidates drew a butt hinge showing sufficient detail and accuracy to gain three marks. Butt hinges have two leaves with two or three screw holes drilled in each leaf.

Question 8

Only a minority of candidates named the correct manufacturing processes for both components A and B shown in the question. Component A could be manufactured using 3D printing or injection moulding. Component B could be manufactured using die casting.

Question 9

Most candidates named welding or brazing correctly.

Question 10

Very few candidates understood the term ‘flush door’ and subsequently did not achieve more than one mark for showing four strips that could be used to join to the hardboard.

There were a few excellent drawings showing four strips of wood joined to the hardboard sheet with details stating the method of joining the strips at the four corners.

Section B

Question 11

(a) (i) Most candidates provided only one valid property of MDF used to make the sweet dispenser.

The most common properties included “easy to work”, “relatively cheap” and “widely available”.

(ii) Most candidates named plywood correctly as an alternative to MDF for the sweet dispenser.

(iii) There was a variety of plastics that could be used for the window other than acrylic. Good answers included PVC, ABS, polycarbonate and polyethylene.

(b) Most candidates were able to provide at least one reason for making a card model of the sweet dispenser before making it from MDF. The best reasons included “to check sizes and appearance” and “to save costs if mistakes were made”.

(c) Most candidates were able to access some marks for using sketches and notes showing how the plastic could be marked out, sawn to shape and the edges made smooth. Most candidates stated an appropriate safety precaution that would be taken during manufacture.

(d) Candidates tended to answer this question in one of two ways. The first method involved the marking out of the wheels on a sheet of 10 mm thick MDF, followed by cutting the shape and finishing by means of a disk sander. The wheels would also have been drilled using an unsuitable twist drill.

The second method was by using a hole saw. To access the maximum marks available using this method meant that candidates needed to provide more detailed information about the hole saw than only stating its name. Very often, added details were not provided.

(e) (i) Most candidates gave a benefit of using contact adhesive; the most common being that it was a quick method of joining.

Many candidates gave the drawback that contact adhesive was not as strong as conventional adhesives such as PVA or that it was messy. Another drawback was that contact adhesive did not allow for adjustments to be made when joining.

(ii) Not many candidates could describe how to apply contact adhesive to the parts to be joined together. Many candidates included details about clamping the parts together which is not necessary.

(f) There were several practical solutions showing a lid for the sweet dispenser.

The designs included the use of hinges and clips to allow for opening and closing.

Unfortunately, most candidates were unable to communicate their ideas effectively, either because sketches were poorly presented, or that they lacked the supporting details of the constructions used and two important sizes.

Question 12

(a) Very few candidates gave the correct answer. The main advantage of making the stand from a thermoplastic rather than a thermosetting plastic is that thermoplastics can be reshaped. Thermosetting plastics cannot be reshaped.

(b) (i) Most candidates named a rule or try square rather than a tool or item such as a scriber, chinagraph pencil or marker pen that would make the actual mark on the surface of the acrylic.

(ii) Some candidates did name an appropriate saw, including coping, Hegner and scroll.

(c) Several answers showed the acrylic clamped securely for one mark and the use of sacrificial wood either under the acrylic or under the feet of the G cramp for a second mark. The question stated that precautions must not include the use of PPE. Some candidates referred to the use of safety glasses which is an item of PPE.

(d) (i) Most candidates recognised and named the strip heater correctly.

(ii) Very few candidates achieved maximum three marks for this question. Sketches and notes were required to show the acrylic heated, bent over a former and clamped in position while the material cooled.

(e) Designs showing how the support of the stand could be adjusted and locked at different angles were weak. Sketches were often unclear and lacked technical details. Candidates achieved very few of the key points required.

(f) (i) Most candidates were unable to identify the properties of stainless steel. The material is extremely hardwearing and has an attractive appearance.

(ii) All the candidates who attempted this question were unable to show much knowledge or understanding of the working properties of stainless steel and could not provide any relevant details relating to shaping and bending.

(g) Some candidates did understand that using CAD to design the stand could result in greater accuracy than paper and pencil drawings, that it was quicker and that the data for the design could be transferred to a CNC machine.

Question 13

(a) Most candidates provided at least one relevant item of research; the most common being the items to be stored, their sizes and the location for the organiser.

(b) Most candidates read the results of the pie chart correctly.

(c) (i) The benefits of using a template were clear to candidates. Templates are quick to use and give repetitive accuracy.

(ii) The purpose of the 5 mm waste wood is to allow for the thickness of the saw kerf and not to prevent mistakes occurring. When a saw cut is made, the blade removes a narrow channel of wood.

The 5 mm waste takes the cut out channel into account.

(iii) Appropriate machine saws were named by most candidates. These included band, jig and Hegner saws.

(d) (i) Candidates did achieve at least one mark for describing how the sawn edge could be made smooth. The most appropriate methods included a combination of a disk sander, files and glasspaper.

(ii) Candidates were unable to demonstrate any knowledge or understanding of the methods used to plane the end grain of solid wood, or give details of how to prevent it from splitting.

(e) Some candidates were able to show a suitable method of joining the partition to the end of the organiser. The most appropriate methods include a mortise and tenon or dowel joint.

(f) Most candidates attempting this gained at least one or two marks for showing some sort of drawer.

Additional marks were available for making sure it fitted the space given and the constructions used to make the drawer. Most candidates did not address the part of the question requiring constructional details.

(g) (i) Most of the clear finishes provided were appropriate, including wax, teak oil, tung oil and lacquer.

(ii) A minority of candidates recognised the benefit of using a cork rubber with glasspaper; that a cork rubber provided even pressure and would be faster than just using fingers.

(iii) Glasspapering solid wood across the grain tends to scratch the surface of the wood. Some of the candidates showed some awareness that the surface could be damaged in some way.

(h) There were some good answers to the question of how to evaluate the success of the design; including interviews and feedback from third parties and an analysis of the results.

DESIGN AND TECHNOLOGY

Paper 0445/32
Resistant Materials 32

Key messages

- Candidates need to read the questions carefully before attempting to answer and try to focus on the key elements of each question. The marks allocation given to each question and the space provided to answer the question provides candidates with a clear indication of what is required.

- Candidates need to reduce their dependence on answering 'laser cutter' as the solution to many practical D&T processes.

  CAD/CAM is one part of the Common Content: '*Use of technology in design and making*'.
  The vast majority of processes carried out within the Resistant Materials option do not require the use of CNC machines, but rather the use of the materials, tools, equipment and processes listed on Pages 13 – 16 of the syllabus.

- Candidates need to improve their knowledge and understanding of the practical processes and techniques required to work the resistant materials, wood, metal and plastic. In order to achieve this, candidates need to be able to match tools and equipment to specific purposes.

- Candidates need to improve their drawing skills. They must try to provide clearly drawn sketches when attempting questions that begin with the statement: "*Use sketches and notes to....".* In addition, notes should enhance and make clearer what they have drawn and not simply state the obvious.

General comments

Section A

In this section candidates need an all-round knowledge and understanding in order to answer all questions successfully 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 to access the full mark range.

Comments on specific questions

Section A

Question 1

Most candidates gave at least one specification point for the design of the remote control; the most common answers included "comfortable to hold" and "easy to read buttons".

Question 2

Only a minority of candidates recognised both types of grain shown on the hardwood: 'end' and 'short', These are basic terms used when referring to the grain of solid wood.

Question 3

Many candidates achieved at least one or two marks for naming parts of the injection moulding machine correctly.

Only a minority of candidates could name all three injection moulding machine components.

Question 4

Many candidates gained one mark for showing the shape of the plug but very few added the dowel pegs that would locate the plug onto the yoke.

Very few candidates showed the completed plug.

Question 5

The majority of candidates identified aluminium as the pure metal.

Question 6

Although many candidates did achieve at least one mark for this question, the overall quality of answers was very poor. Cutting out the keyhole shape in 1 mm thick brass sheet would be achieved by drilling a small hole, followed by use of a piercing or abrafile saw and finished by filing. Very often, a saw was named but without a hole being drilled, this would be impossible to achieve. Many candidates used a laser cutter which is not a suitable tool or equipment.

Question 7

(a) The majority of candidates named aluminium as a suitable non-ferrous metal for the table number stand with brass and copper also correctly named.

(b) A simple template or stencil could be used to replicate the marking out of twenty number stands on a sheet of metal with the use of an appropriate marking out tool such as a scriber or fine felt tip marker pen. As in **Question 6** many candidates used a laser cutter which not suitable.

Question 8

Many candidates gained at least one mark for describing the correct use of one tool used to produce the through housing joint.

Question 9

The majority of candidates identified hardboard correctly as a material that is biodegradable.

It is clear from the many incorrect answers that the term ‘biodegradable’ is a term with which many candidates are unfamiliar.

Question 10

Candidates were required to provide three stages to engrave text on the acrylic trophy.

They were given a first stage where the trophy had been designed and the final stage of starting the CNC machine. Unfortunately, many candidates repeated either or both of these stages and gained no marks. The best answers referred to the transfer of data to the CNC machine, placing the acrylic in the CNC machine and setting the machine parameters.

Despite having identified the use of a laser cutter inappropriately in previous questions, students struggled to demonstrate workable knowledge of the CNC machine in this question.

Section B

Question 11

(a) Most candidates gave two good specification points for the guitar stand. The best answers referred to the stability of the stand, ease of access and protection of the guitar from possible damage.

(b) There was a wide variation in the quality and accuracy of the sketches and notes to show how a leg could be joined to a foot of the stand. The most appropriate constructions were a dowel joint and a mortise and tenon joint. Housing joints, while common answers, gained only partial marks as they would not be as strong as the dowels etc. It is essential that candidates make their sketches as large and clear as possible.

(c) Many candidates wasted valuable time by providing sketches which showed a hinge joined to the legs of the stand. The question stated: "Sketch and name a suitable hinge…". The majority of candidates did not name an appropriate hinge: a 'butt' or 'back flap' hinge.

(d) (i) Only a minority of candidates stated the correct property of beech that made it suitable for woodturning: namely that it is "close-grained" and "not liable to split or splinter". Properties stated such as "strong" were too vague to gain any reward.

(ii) The purpose of the saw-cut in the end of the length of beech was to secure and support the hardwood while it was turned on the lathe. Most candidates were unable to state the purpose of the saw-cut.

(iii) Most candidates failed to correctly identify that the application of candle wax to the end of the length of beech provided lubrication and prevented burning.

(iv) Only a minority of candidates recognised that if the tool rest was not set at the correct height there was a danger that the length of beech could strike the tool rest and not only risk damaging the wood but become a danger to personal safety.

(e) Few candidates knew how the length of Ø6 mm aluminium rod could be formed by bending it to shape. Most marks were gained for heating the metal and naming a hammer as the method of force for achieving the shape. The vast majority of answers omitted the use of practical formers and many used techniques that would only be appropriate when working with plastics rather than metal and therefore did not gain many marks.

(f) There were some innovative, partially successful, designs showing how the legs of the guitar stand could be locked apart. Some candidates used a connecting strip at the base of the stand while others showed two connecting strips, each fastened to a leg and locked together by means of some sort of pin or peg. Very often the designs lacked details such as the naming of materials or clarifying the constructions used in order to achieve the maximum marks available.

In addition, sketches needed to be large and clear.

(g) Most candidates were unable to correctly interpret the term 'sustainable'.

Only a minority of candidates explained why beech is a more sustainable material than aluminium: that beech trees can be replaced and replanted while aluminium, bauxite, is a finite resource.

Question 12

(a) Many candidates did not consider the thicknesses of the front and sides of the coin box when giving the correct dimensions.

(b) (i) Most candidates showed the MDF held securely in a woodwork vice for one mark. A second mark was available for showing the smoothing plane in position. Very few candidates showed or described how the waste could actually be removed. Some candidates showed the wood clamped flat onto a work bench which would not allow the smoothing plane to be used effectively.

(ii) The majority of candidates named a try square or engineer's square correctly and many showed the tool in the correct position when checking for squareness.

(c) Many candidates named the machine correctly: a router or mortising machine.

The use of various saws was not considered appropriate.

(d) (i) Only a small minority of candidates named a 'panel pin' as the suitable type of nail.

(ii) Many candidates stated an appropriate length of nail: 20 – 25 mm or the imperial equivalent, ¾″ – 1″.

(iii) Most candidates showed the positions for 3 – 6 nails correctly.

(e) (i) Very few candidates recognised that the purpose of the paper glued between the MDF disks would allow the two disks to be separated after they had been shaped.

(ii) The majority of candidates described, through sketches and notes, how the holes in the disk could be produced rather than what the question stated:
"Use sketches and notes to show how the disks could be cut out and shaped from the sheets of MDF".

Candidates are advised to read the questions carefully.

(f) (i) Only a minority of candidates recognised the forstner bit correctly.

(ii) The majority of candidates achieved marks for this question. However, a considerable number of candidates described checks carried out that included the use of PPE even though the question specifically stated "…other than Personal Protective Equipment (PPE)". The best answers included "the bit tightened securely", "workpiece clamped securely" and "the safety guard in position".

(g) There were some potentially very good answers showing how a 'back' could be fitted to the coin box.

However, some important details, including the choice of materials and constructions were not always provided. This meant that candidates were not able to gain the maximum marks available.

Question 13

(a) The majority of candidates provided two benefits of using acrylic for the bird feeder; the most common correct answers included "easy to work or shape", "variety of colours available" and "water or weather resistant".

(b) (i) Many candidates named one appropriate marking out tool: a scriber or marker pen/felt tip pen. The question stated clearly "…. that could be used to mark the bend lines on the surface of the acrylic sheet". Many answers included the names of equipment that could be use with the scriber etc. such as a rule or try square but these would not make the actual mark as required by the question.

(ii) Many candidates showed a simple former that could be used when bending the acrylic to shape.

(iii) Most candidates demonstrated a good knowledge of bending the acrylic, describing how the acrylic could be heated, bent to shape and the shape retained while the acrylic cooled.

(c) (i) Most candidates showed the acrylic clamped to a work bench or table with a sacrificial board under the acrylic and scrap pieces under the feet of a G cramp to provide even pressure and reduce the risk of marking the acrylic.

(ii) Dividers would be used to mark out the arc section of the shape to removed. Many candidates named compasses, scriber and odd-leg calipers incorrectly.

(iii) Many candidates recognised that to cut out the shape in the front of the bird feeder that a hole needed to be drilled, through which a saw blade could be inserted and then the area could be

removed. Finishing the shape could be achieved by using a round (rat tail) or half-round file and wet and dry (silicon carbide) paper.

(d) (i) Most candidates gained at least one mark for recognising that acrylic cement was toxic, flammable, and an irritant to skin.

(ii) The majority of candidates use G cramps and scrap wood to show how the front and back of the bird feeder could be held while the acrylic cement set.

(e) Many candidates achieved at least one mark for showing how the bird feeder could be suspended from the branch of a tree. However, modifications to the bird feeder tended to be simple and minimal skill, with many solutions showing holes drilled in the top of the bird feeder and a length of string or rope hooked over the branch of a tree.

DESIGN AND TECHNOLOGY

Paper 0445/33
Resistant Materials 33

Key messages

- Candidates need to read the questions carefully before attempting to answer and try to focus on the key elements of each question. The marks allocation given to each question and the space provided to answer the question provides candidates with a clear indication of what is required.

- Candidates need to reduce their dependence on answering 'laser cutter' as the solution to many practical D&T processes.

  CAD/CAM is **one** part of the Common Content: '*Use of technology in design and making*'.

  The vast majority of processes carried out within the Resistant Materials option do not require the use of CNC machines, but rather the use of the materials, tools, equipment and processes listed on Pages 13 – 16 of the syllabus.

- Candidates need to improve their knowledge and understanding of the practical processes and techniques required to 'work' the resistant materials, wood, metal and plastic. In order to achieve this, candidates need to be able to 'match' tools and equipment to specific purposes.

- Candidates need to improve their drawing skills. They must try to provide clearly drawn sketches when attempting questions that begin with the statement: *Use sketches and notes to....* In addition, notes should enhance and make clearer what they have drawn and not simply state the obvious.

General comments

Section A

In this section candidates need an all-round knowledge and understanding in order to answer all questions successfully 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 to access the full mark range.

Comments on specific questions

Section A

Question 1

The majority of candidates provided at least two valid specification points for the camping chair. The most common correct answers included, "lightweight to carry", "easily stored and packed", "made from corrosion resistant material" and "safe to use".

Question 2

The majority of sketches gained some of the three marks available for completing the tee bridle joint. Only a minority of candidates failed to produce a recognisable construction.

Question 3

(a) Very few candidates were familiar with the folding bars (sometimes referred to as bending irons).

(b) Most candidates understood that the rawhide mallet would not damage or dent the mild steel sheet. The mallet also provided more surface area when striking the mild steel sheet.

Question 4

(a) The majority of candidates identified a suitable plastic for the watering can.

(b) Some candidates gave an incorrect method of manufacture for the watering can, stating injection moulding. The correct methods were blow moulding and rotational moulding.

(c) There was a common misconception that the ribs indicated the water levels in the watering can. The purpose of the ribs was to increase the structural rigidity of the watering can.

Question 5

(a) The majority of candidates correctly named 'lamination' or 'steam bending' for construction **B.**

(b) There were some good answers to this question. Common advantages to a manufacturer included fewer processes, therefore faster production and higher profit. Other advantages included fewer materials used therefore less waste.

Question 6

Many candidates identified at least one way by which a designer had considered anthropometric data when designing the mountain bike. To gain marks, the features had to be linked to a part of the body; for example, the seat could be adjusted depending on the height of the person using it. Many candidates simply stated the different parts of the bike without reference to a part of the body.

Question 7

(a) The answers to **parts 7(a)** and **7(b)** were often confused. The method of manufacture of the coat rack was extrusion and not injection moulding which was given by many candidates.

(b) The sliders would be produced by means of injection moulding.

(c) The main reasons for making the sliders from plastic rather than wood were that the sliders would move more smoothly and could be produced in large quantities quicker and more effectively than sliders made of wood.

Question 8

Most candidates recognised the symbol for aluminium. Fewer candidates recognised the symbol for polystyrene and only a minority of candidates recognised the symbol for steel. Many answers stated ferrous metal or iron for symbol **C** and gained no marks as this symbol stands for steel only.

Question 9

The majority of candidates named beech correctly.

Question 10

Many candidates named thermochromic ink correctly as the smart material. This is a relatively new material with which candidates should become familiar.

Section B

Question 11

(a) Most candidates selected at least one of two hardwoods that would be suitable from which to make the photo stand. While 'balsa' is a hardwood, it would not be a suitable choice due to its properties. The two suitable hardwoods, teak and oak, were not recognised by more candidates.

(b) Most candidates gave only one advantage of MDF over plywood for the frame of the photo stand. The most common advantages were that was easier to work, had no grain pattern and that it was cheaper than plywood. There were some misconceptions about MDF, including that it was lighter in weight.

(c) There was a wide variety of answers to the modified bench hook becoming a sawing jig. The strongest responses for the jig designs showed clearly that two different lengths could be sawn, and that the hardwood could be held securely while it was sawn. For maximum marks, candidates needed to address the final part of the question and provide the name of the material used for the jig and the necessary constructions.

Questions of this type do require sketches that are as large and clear as possible.

(d) Many candidates simply repeated the question as their answer: "the dowel joint is stronger than the pin and glue construction". The strongest responses referred to the larger gluing area provided by the dowel and the increased thickness (diameter) of the dowel as well as the dowels being less likely to twist and break.

(e) There were a few strong responses presented. Many candidates accessed marks for this question; for example, a simple template with two holes drilled achieved one mark. The addition of locating sides or edges to the jig gave access to more marks.

(f) Only a minority of candidates provided two valid checks to make before using the power router. The most common checks being the correct type and size of cutter, that the cutter was fitted securely and set to the correct depth and width required. Many candidates described the use of PPE which was irrelevant to the question.

(g) With six marks available for this question it was important that candidates read what was required very carefully before answering. The majority of candidates did attempt to modify the frame and show how the photographs could be changed. Some good modifications showed the top and/or sides removed so that the photos could be slid into position. However, methods were often unclear and needed more technical detail. Additional details relating to named materials and constructions were often either unclear or not provided.

(h) Most candidates provided at least one benefit of applying a clear polished finish for the hardwood stand. Some candidates highlighted the fact that clear meant that the natural beauty of the grain would be visible, while other gained a mark for stating that the finish would preserve or protect the hardwood.

Question 12

(a) Standard metal forms have specific terms to describe their shape and section. Variations of the terms are not accepted. Candidates should be familiar with these terms when selecting a particular shape or section of metal. Only a minority of candidates named "round tube" and "angle" correctly.

(b) Most candidates were able to recognise and name the scriber and try square correctly. Some candidates referred to the "engineer's try square" or "engineer's square" which are both correct answers.

(c) (i) Many candidates named the "sash cramp" or "F cramp" correctly.

(ii) The materials or equipment used to prepare the mild steel for brazing included files, emery cloth, wet and dry (silicon carbide), paper and steel wool. Only a minority of candidates provided two of the materials or items of equipment.

(iii) This question was well-answered by only a minority of candidates.

To braze the tube effectively depended on the mild steel being heated sufficiently for the brazing rod (brass spelter) to melt and form a joint. If the mild steel was not heated to the correct temperature the brazing rod would not melt and form a good joint.

(d) (i) Some of the strongest responses stated that wide boards were not available, that three boards joined would be cheaper or that three boards provided a more stable tabletop. These answers were provided by a minority of candidates.

(ii) This question required a knowledge and understanding of movement in solid timber. The majority of candidates gave an incorrect reason for the slotted holes when screwing the mild steel tube to the tabletop. Many candidates thought that this allowed the screws to be inserted more easily. The reason for the slots was that when the screws were inserted and the hardwood tabletop expanded or shrank, the whole screwed joint would be allowed to move without the hardwood splitting.

(e) There were some strong repsonses for a modified design of table to accommodate a shelf. However, these were in the minority. There were three bullet points for candidates to focus upon in the question. The best designs showed a shelf fitted below the tabletop with its length and width stated. Candidates needed to refer very closely to the dimensions provided in Figure 12.1. To secure maximum marks, the additional materials and their construction were required. Many candidates were able to access some marks but only a minority gained the maximum six marks available.

(f) (i) Most candidates understood what was required to improve the appearance of the ends of the mild steel tube and showed some sort of plug or cap that could be fitted into or onto the tube.

(ii) Many candidates named a suitable construction when replacing the mild steel tube with hardwood of the same section, 50 × 20. The most common constructions included a mortise and tenon or dowel joint. The variation in marks awarded reflected the technical accuracy demonstrated by candidates when providing sketches showing their chosen construction.

Question 13

(a) Many candidates gave at least one benefit of using CAD to design the paint palette. The most common benefits referred to speed and accuracy, the editing tools available, useful on-screen modelling and the ability to transfer files electronically.

(b) (i) The majority of candidates understood that if the hole was not cut out of the acrylic before it was bent, it would be very difficult to achieve afterwards.

(ii) Many candidates did not provide the correct name for a file that could be used to remove the waste acrylic. Files used with resistant materials have specific names. For example, a curved shape is referred to by its proper name: half-round. Therefore, the only appropriate files that could be used to remove the waste material around the edge of the acrylic were a half-round or round, also referred to as a rat-tail file.

(iii) There were two possible causes of damage when securing acrylic sheet in the jaws of an engineer's vice. Many candidates recognised that the jaws of the engineer's vice could scratch the surface of the acrylic and that to prevent this, vice jaws made from 'softer' and smoother material could be inserted. The second possible damage was that when sawing acrylic secured in an engineer's vice there was a danger that the acrylic could snap if it was placed too high in the vice. Prevention could be achieved by lowering the acrylic in the vice or by supporting the acrylic with scrap wood.

(c) Many candidates achieved at least one mark for providing one safety precaution when using the buffing/polishing mop. The most common correct answers referred to making sure that loose clothing and/or long hair was tied back. Other strong responses included knowing where the emergency stop button was located and correct positioning of the work piece against the polishing mop itself.

Although the question stated: "…other than the use of PPE", many candidates stated items of PPE to be used such as safety glasses.

(d) The vast majority of candidates recognised that turning the acrylic frequently would avoid burning the surfaces.

(e) Many candidates achieved at least one mark for showing one part of the acrylic clamped in position.

Clamping of the acrylic was required in two places: against the vertical and horizontal surfaces.

(f) (i) Many candidates identified MDF as the most suitable wood for making a mould to be used when vacuum forming.

(ii) Most candidates indicated the correct position of the draft angle on the mould.

(iii) Few candidates could state the purpose of the draft angle. The purpose being so that the mould could be released from the vacuum formed plastic after it was formed.

(g) Very few candidates selected both correct methods of woodturning, ‘faceplate’ and ‘between centres’. Many candidates did achieve one mark for naming one of the methods correctly.

(h) (i) Many candidates demonstrated a very good understanding of the vacuum forming process and used sketches and notes to achieve high marks.

(ii) The majority of candidates achieved at least two or three marks for showing how the waste on the acrylic sheet could be removed by cutting it, using a wide variety of saws, or use of a craft knife or ‘Gerbil’ equipment. Further cleaning up using files and glasspaper or wet and dry (silicon carbide) paper would complete the formed shape.

DESIGN AND TECHNOLOGY

Paper 0445/41
Systems and Control 41

There were too few candidates for a meaningful report to be produced.

DESIGN & TECHNOLOGY

Paper 0445/42
Systems and Controls

Key messages

- All questions in Section **A** should be read carefully to ensure that the requirements are understood.
- Candidates should be advised to read all Section **B** questions before attempting to answer a question. There were a few instances of candidates attempting more than one question in Section **B**.
- In questions that require either a single answer or a set number of answers it is important that candidates do not enter additional answers.
- Clear, legible writing and carefully drawn sketches with annotation where necessary are important.
- 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 final answer is incorrect.

General comments

The questions in **Section A** proved accessible to candidates with most being able to provide a response. In most cases the responses were clear, giving evidence that each area of the key content in the syllabus had been covered. It should be noted that Key content and Common content from the syllabus may also appear in **Section B** questions.

In Section **B** more candidates answered question 11, the mechanisms question. The number answering the structures question had fallen compared to previous years; in contrast, more candidates answered the electronics question than in previous years.

Only a few candidates had failed to follow the rubric by answering more than one question in **section B**. Candidates are advised to read the rubric carefully.

In almost all cases candidates completed their responses in the correct area on the paper, with a small number using the extra space at the back of the answer booklet. If this space is used candidates must remember to write the question number clearly next to their response.

It is 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 required is written in bold type.

Questions requiring sketches as part of the response generally resulted in a balanced approach with both sketches and notes included. There were a few examples where the notes could have been expanded to provide a clearer answer.

If a question asks for advantages or disadvantages the response should reflect this and provide reference to the items being compared. If the question asks for benefits and drawbacks, no reference to other items is needed.

Comments on specific questions

Section A

Question 1

Knowledge of fossil fuels was evident in most responses. A small number of candidates had used 'geothermal' as one of the responses, none had used 'hydroelectric' or 'solar.'

Question 2

Knowledge of products with a limited lifetime was varied. Weaker candidates had concentrated on the cost aspects without being clear on who benefited. Stronger candidates had related it to providing an ongoing market for products.

Question 3

In most cases the type of structure illustrated was correctly identified.

Question 4

The forces shown were both correctly identified by stronger candidates. Force **A**, which was torsion, was the one that was incorrectly identified by weaker candidates.

Question 5

(a) The reciprocating motion of link **C** was mistaken for oscillating motion in some responses.

(b) There were fewer candidates who correctly identified the oscillating movement of link **D**, most errors identified the movement as rotary motion.

Question 6

Almost all candidates recognised that the driven gear would rotate in the opposite direction. Weaker candidates could improve responses by stating the direction change and not just that one gear was driving the other.

Stronger candidates were able to provide the results of rotating the spur gears, noting that as the gears had the same number of teeth there would be no change in relative speed or torque.

Question 7

The three circuit symbols were correctly identified by a high proportion of candidates, with errors mainly around the capacitor symbol being identified as a battery or cell.

Question 8

(a) The key feature of a toggle switch is that it locks into position when operated.

In weaker responses this was not clearly stated, and the function given in the response could have been applied to any type of switch.

The fact that the switch will bring two contacts into contact was the second point required.

(b) (i) Almost all responses referred to a doorbell requiring a switch that automatically releases when not held down so that the doorbell does not ring continuously.

(ii) The type of switch required should have been identified as a 'press to make switch' (PTM).

A few weaker candidates had given 'push switch' as their answer. This did not gain a mark as the same description could be applied to a 'press to break' switch.

Question 9

Knowledge of the sub units applied to capacitance was limited in weaker candidates. Most had placed the 'F' in the correct position, but weaker responses confused the pF, nF and μF positions. Stronger candidates gained all the available marks.

Section B

Question 10

(a) (i) There were 4 possible design features that could have been referred to. The most common were the sliding pin, which locked the height position, and the brackets which prevented sliding of planks. Reference to the support provided by the trestle legs also gained credit.

(ii) This question required knowledge of how mild steel can be protected from corrosion. Weaker candidates responses were restricted to painting, which was enough to gain the mark. Galvanising and dip coating were rarely mentioned.

(iii) Benefits of removable legs on the trestle were recognised by stronger candidates, particularly in the area of packing flat and making transport easier.

(iv) The two areas of knowledge required for this question were, methods of reinforcing a joint and fixing the reinforcement in position. Stronger candidates were able to sketch a gusset plate in the correct position, showing a suitable method of fixing. For the fixing method, notes on the sketch were advisable. The strut was frequently confused with a tie, particularly by weaker candidates. Responses needed to give more detail of fixing methods.

(v) Few candidates had understood that what was required was a single foot allowing vertical adjustment to compensate for uneven ground. Responses were seen that showed the complete foot being replaced by a flexible material. This would not provide the adjustment needed. What was expected was a threaded adjustment method that could extend the position of the foot.

(vi) Stronger candidates had no difficulty in carrying out the calculation; many showing each stage of the calculation in a clearly laid out way. This approach allows the marks to be awarded at different stages of the calculation even if there are errors later or in the final response. Weaker candidates had often got the formula for each reaction incorrect. Either $\mathbf{R_1}$ or $\mathbf{R_2}$ could have been calculated first and then the result subtracted from the total load of 1150N to give the second reaction.

(b) (i) General benefits of the hollow steel lintel were understood by stronger candidates. Reference to the steel lintel being lighter in weight than concrete was frequently seen. Those who had referred to comparative cost were not given credit. If a question does not provide any information on cost of materials, candidates should be advised to not bring this into their response.

(ii) This part provided difficult for all except the strongest candidates. Understanding that the bonding of the brickwork provides an angled line of weight distribution was not evident in many cases. An approach that could have been used was to imagine the shaded area of bricks being removed and then noting that the remainder would be supported by the bricks on either side.

(c) (i) This question gave the opportunity to use annotated sketches to illustrate the method of tensioning the wire. It was common to find that weaker candidates had got the basic principle correct but had failed to develop the solution. Very few solutions referred to threaded tensioning devices, relying instead on a method that initially pulled the wire tight but had no method of securing it.

(ii) Only the strongest candidates completed the stress calculation successfully.

Most candidates lost marks by failing to accurately calculate the cross sectional area of the wire.

Tolerance is given to the numerical answer on any calculations involving Pi. In calculating the cross sectional are of the wire it was important for candidates to use the radius of the wire, not the diameter.

Question 11

(a) (i) The stronger candidates identified both correct lubrication positions, **B** and **C**.
Weaker candidates had identified position **A** on the chain, which was a rivet head, very few had incorrectly identified position **D**.

(ii) The correct answer for the lubricant suitable for a chain was oil. Grease would be too thick to reach all parts and would provide drag which would decrease efficiency of the bicycle.

(iii) When the bicycle is being pedalled the top portion of the chain will be in tension, the bottom portion will have no force applied to it, many candidates understood this. It should be noted that although response lines extend right across the page it is not always necessary to use the whole line. This was one such case, where the single word 'tension' gained the mark.

(iv) The advantage of a chain over spur gears is mainly in the distance between sprockets and reduced need for accurate spacing that a chain drive supplies. Candidates should be aware that in the case of a comparison being asked for, reference to both items in the question should be given. Ease of maintenance of a chain system, though a valid advantage, was not often given.

(b) (i) The cam outline gave four definite areas in the profile and this was understood by a large number of candidates. The direction of rotation was critical for getting the positions correct which many weaker candidates should take note of it to gain the marks.

(ii) Different types of cam follower were widely known, the most frequently seen being a roller follower and a knife edge follower. Accurate sketches were seen with relevant annotation.

(iii) The snail cam was generally known. Its alternative name, drop cam, was also accepted.

(iv) The result of rotating a cam at high speed was generally appreciated. The action of the follower bouncing and losing contact with the cam surface was the point most frequently made. A few more valid points around the area of component wear also gained credit.

(c) (i) The difference between the two types of load that a bearing is subject to was only understood by the strongest candidates. In some cases the sketches were not easy to understand.

(ii) The illustration showed three arrangements of ball bearing. Stronger candidates were able to give a benefit for each type shown. Weaker candidates generally only gained credit for identifying a benefit for bearing **A**, where the balls were fixed in a cage. These candidates often did not mention the benefit of bearing **C** being sealed for life and requiring no maintenance. Benefits related to cost were not accepted.

(d) (i) The velocity ratio calculation provided a challenge for many candidates, particularly in calculating the distance moved by the effort, which required the circumference of a circle with a radius of 60mm being calculated. Those who had successfully calculated the effort distance were generally able to complete the calculation.

(ii) The conversion of motion caused by operating a screw thread was well known to a high proportion of candidates.

Question 12

(a) (i) Benefits of LEDs for lighting were appreciated by all but the weakest candidates.

Reduced current draw compared to filament lamps and the small size available from LEDs were the most frequently seen responses.

(ii) The type of circuit required was 'astable,' which was known to the stronger candidates.

(iii) This question required interpretation of a graph of the output signal. The X axis being set in milliseconds caused problems for a few candidates. All candidates should be aware of sub units for a range of values.

(iv) Stronger candidates were aware of both the 555 IC and the microcontroller. Other formats of programmable IC, along with named commercial products, were also credited. With questions of this type candidates should be advised to use the generic term 'microcontroller' rather than a specific commercial variety.

(v) The parallel connection of the circuit was recognised by a high proportion of candidate.

(vi) Stronger candidates accurately completed the calculation of a current limiting resistor value. Others lost a mark through not using the given voltage drop in the calculation.

The first stage of the calculation should have been to deduct 2.0 V from the +5 V supply.

(b) (i) Hazards whilst soldering were well known with fumes and solder spatter being the most frequent examples given. The precautions were in most cases suitable for the given hazard.

Protective measures should be specific to the hazard rather than of a general nature.

(ii) The table in this question was accurately completed by almost all candidates, reflecting their practical ability and knowledge of populating a PCB with components.

(c) There were a number of approaches to this logic gate question. Either OR gates, NOR gates or NAND gates could have been used. The solution that was most frequently seen was the simplest, using two, 2 input OR gates.

(d) (i) The circuits provided in the question showed a transistor switch and a mechanical switch. Candidates familiar with mechanical switches were able to identify a single difference from the many differences that were acceptable. The need for human intervention in the case of the mechanical switch was frequently used.

(ii) The stronger candidates clearly understood the importance of accurate identification of component position and the position of individual component legs. This could then be related to the need for accuracy in batch production, where less skilled operators could be used.

DESIGN & TECHNOLOGY

Paper 0445/43
Systems and Controls

Key messages

- All questions in Section **A** should be read carefully to ensure that the requirements are understood.
- Candidates should be advised to read all Section **B** questions carefully before attempting to answer a question. There were several Instances of candidates attempting all questions in Section **B**.
- In questions that require either a single answer or a set number of answers it is important that candidates do not enter additional answers.
- Clear, legible writing and carefully drawn sketches are important.
- 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

The questions in **Section A** proved accessible to candidates with most being able to provide a response. In most cases the responses were clear providing evidence that each area of the key content in the syllabus had been covered. It should be noted that Key content and Common content from the syllabus may also appear in Section **B** questions.

In Section **B** approximately 69% of candidates answered **Question 10**, the structures question. The remaining 31% answered **Question 11** the mechanisms question. No candidates attempted the electronics question.

It was noticed that very few candidates failed to follow the rubric by answering more than one question in the section. Candidates are advised to read the rubric carefully.

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

It is 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 required is written in bold type.

Questions requiring sketches as part of the response generally resulted in a balanced approach with both sketches and notes included. There were a few examples where the notes could have been expanded to provide a clearer answer.

If a comparison is required, for example, in a question asking for advantages, the response should reflect this and provide reference to the items being compared.

Comments on specific questions

Section A

Question 1

(a) Knowledge of natural structures was generally good with most candidates gaining a mark for providing a valid example of each of the three types of structure.

(b) A variety of man-made mass structure examples were seen with the majority clearly recognisable from the sketch.

Question 2

(a) Stronger candidates did well on this question with most recognising that 'bending' was the force involved. Weaker candidates provided a range of incorrect forces with 'compression' being the most frequently seen.

(b) The conversion of motion was correctly given by over 50% of candidates. Errors generally occurred where candidates failed to recognise the reciprocating motion of the diver on the springboard.

Question 3

(a) Marks were gained by most candidates, with a wide range of valid benefits of using CAD/CAM being offered.

(b) A high number of responses focussed on the initial cost of equipment and the time taken in setting up the equipment. In a few cases, candidates failed to consider the scale of production; giving general drawbacks that could have been applied to all levels of production.

Question 4

Knowledge of spur gear arrangements was evident across the full range of candidates, with many gaining full marks.

Question 5

Reasons for lubricating steel spur gears were well known, reducing wear and reducing friction being the responses most frequently encountered.

Question 6

Those candidates who answered question 5 correctly were able to provide one result of **not** lubricating a mechanism. There were a few inaccurate responses given by weaker candidates relating to the mechanism 'breaking down' rather than specifying an exact cause of the breakdown.

Question 7

(a) Almost all stronger candidates gained the mark for this part. An example of a response that was not precise enough was, 'in case you need to switch the machine off in an emergency.' This response did not reflect that although it will switch the machine off, the main purpose is to prevent the machine being switched on with the door open.

(b) A high proportion of responses correctly described that the switch is pressed to operate it, causing the contacts to touch.

Question 8

The series and parallel connections in the circuits were correctly identified in most cases.

Question 9

The resistor symbol was widely recognised, this was followed by the fuse symbol, which in some cases was labelled as another resistor. The reed switch symbol was less frequently identified. Many of the incorrect responses correctly identified it as a switch but failed to include the type of switch.

Section B

Question 10

(a) (i) Stronger candidates correctly identified tension as the force that the reinforcing rods were resisting.

(ii) In the case of weaker candidates, the explanation was often restricted to a single basic point, gaining only 1 mark. Any single points that were fully explained gained 2 marks.

(iii) The calculation required rearrangement of the given formula. Most candidates were able to complete this successfully. The numerical part was accurately completed by those who rearranged the formula correctly. The answer was acceptable in either millimetres or metres.

This question was an example of the importance of including all of the working.

(iv) Stronger candidates could explain clearly why the top face was marked, gaining both marks for the question. Many of the weaker explanations knew that the marking was to ensure that the beam was installed the correct way up but needed to mention the result of incorrect installation to gain more marks.

(b) (i) Those candidates who related the methods of joining lengths of timber to the forces being resisted provided clearer benefits. For method **A** the strength of steel was frequently mentioned and the fact that the joint can be taken apart if required. Only a few of the stronger candidates noted that bolts can be tightened later if necessary to allow for shrinkage occurring.

For method **B** nailing was recognised as a method that provided a larger surface area in contact between the lengths. Many responses also mentioned that it is a permanent method.

Stronger candidates realised that method **C** was the most labour intensive and required the most skill and time to produce. A few responses noted that it would also resist a high compressive force.

(ii) Drawbacks for each method were at times technically correct but unlikely to occur in the given situation, e.g. ‘the glued joint should not be subject to hot temperatures.’ Candidates should be advised to restrict their answers to the situation given in the question.

(iii) Responses should have been restricted to the fittings on the joints, steel plates, bolts and screws. Use of stainless steel was a valid response that was not often seen. Most responses referred to plating, painting or galvanising.

(c) (i) Each reinforcement method required a sketch and notes. In several cases there were no notes to accompany the sketch. The gusset plate was well known to all candidates and many had drawn a plate in position with the fixing method shown. Ribs were shown in several cases on food packaging, clearly illustrated and technically accurate. The brace caused most problem, as it was frequently confused with a tie.

(ii) The force acting on the dowels when a tensile force was applied to the horizontal piece was ‘shear’ Stronger candidates gained the mark for this.

(iii) Methods of securing the joint without using screws, nails or dowels were only seen in the stronger responses. A traditional method would be to use wedges that turn the joint into a dovetail; this approach was not often seen. Use of PVA/specialist wood glue or bolts was accepted. Use of any other type of glue or a generic glue was not accepted.

Question 11

(a) (i) There were 5 given circles which could have been used to identify the Load, Fulcrum and Effort on the operating lever. Errors were only seen in the weaker responses; in a few cases the incorrect / spare circles were used in addition to the correct ones. Where this occurred the mark was restricted to a maximum of 1 where both spare circles were used.

(ii) Weaker candidates needed to explain the precise meaning of mechanical advantage. Where some understanding was shown it resulted in 1 mark being awarded.

(iii) The most common method given for increasing the mechanical advantage was to increase the length of the lever. The other accepted method was to move the load closer to the fulcrum.

(iv) Weaker candidates struggled to identify the class of lever but in most cases the mark was awarded for correctly identifying the lever as class 2.

(b) (i) The most frequently seen point found in the explanations related to the loss of friction encountered when ascending or descending a slope. Having made this point candidates could have gone on to the rack and pinion being a positive form of drive, where slipping of the drive wheels was not a factor. Very few candidates noted that using the conventional system that relied on friction would use less fuel than when using the rack and pinion. Any other valid points were given credit.

(ii) This part was answered well, particularly by the stronger candidates. A range of valid examples of rack and pinion use were found.

(iii) The use of link rods rather than gears or belts was understood to some degree in all responses. The better examples made use of comparison between different drive methods. Weaker candidates noted that link rods do not require the wheels to be close together but did not go on to compare it with systems such as gears that do require close proximity of shafts being driven.

(iv) Results of having out of balance drive wheels were only fully considered by the strongest candidates. The link between less weight and increased efficiency was frequently made but very few responses commented on the solid areas of the wheel balancing out the extra weight on the opposite side of the wheel caused by the link pin.

(c) (i) This question required candidates to look at the ratchet and pawl mechanism to understand that the square shaft had to be turned anti-clockwise. A clear indication of this had to then be added to the enlarged view.

A number of candidates did not attempt the question.

(ii) The ratchet and pawl is one of a limited number of methods in the syllabus used for converting motion; few of the weaker candidates recognised the ratchet and pawl mechanism.

(iii) This part required understanding of the ratchet and pawl and realising that as the winding mechanism is operated it is vital that it does not immediately unwind. The pawl catching in the ratchet prevents this from happening. Partial understanding of the mechanism and reason for its use was frequently found. Only the strongest candidates mentioned that it is the pawl sticking in the ratchet that prevents unwinding.

(d) The calculation was accurately completed by most candidates. Calculation of gear ratios in simple compound gears was carried out without difficulty. The first stage was to calculate the ratio of individual parts of the gear train, the first part between gears **A** and **B** giving a ratio of 2 : 1, the second part between gears **B** and **D** giving a ratio of 2:1, providing an overall reduction of 4 : 1, with gear **C** acting only as an idler and not affecting the overall ratio. Having arrived at the overall ratio this could be applied to the given input speed to arrive at the driven gear speed of 84 rpm.

Question 12

There were too few answers to this question to make comment appropriate.

DESIGN AND TECHNOLOGY

Paper 0445/51
Graphic Products 51

Key messages

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

General comments

Candidates were required to complete all questions in ***Section A*** (***A1***, ***A2*** and ***A3***) and then go on to answer either **Question B4** or **B5** from ***Section B***. An equal number of candidates chose to answer **Question B4** and **B5**. However, a small number of candidates answered all questions and are advised to read the rubric carefully.

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

There are areas of the syllabus where some candidates underperformed, and further improvements are needed. The drawing of 3D shapes in one-point perspective, and planometric, sectional views and the correct use of line conventions are areas where many candidates can make improvements.

Comments on specific questions

Section A

Question A1

Board game card

Candidates were asked to complete the drawing of the front and back of the card to a scale of 2:1 to the dimensions given by constructing and combining basic geometric shapes and adding lettering consistent with the existing given letters.

(a) (i) Candidates were required to draw a circle to the size given and on the correct centre lines. Most candidates had drawn the circle on the centre lines and to the correct diameter. Some had drawn the circle in the correct position but with an incorrect diameter.

(ii) Candidates were required to draw the regular hexagon to the sizes given. Many candidates had drawn irregular hexagons with different side lengths and angles.

(iii) Candidates were required to draw the pentagon to the sizes given. Many candidates had drawn irregular pentagons with different side lengths and angles.

(b) (i) Candidates were required to draw the rectangular border onto the front of the card to the correct size and in the correct position. Most candidates had drawn the rectangle to the correct size and in the correct position.

(ii) Candidates were required to draw the square to the correct size and in the correct position. Most candidates had achieved this. Some candidates had drawn the square to the incorrect size or not on the given centre lines.

(iii) Candidates were required to draw the equilateral triangle with three equal sides. Many candidates completed this correctly. A significant number had drawn isosceles triangles, with only two equal sides.

(iv) Candidates were required to complete the lettering by adding the missing letters. Many candidates completed them to a high standard and achieved both marks. However, some had drawn the lettering to the incorrect size or thickness which did not match the existing style.

To achieve higher marks in this question, candidates should ensure they know how to construct basic geometric shapes using the correct methods. They should also make sure they draw accurately to the dimensions given.

Question A2

Game card holder

This question asked the candidate to complete the one-point perspective view of the game card holder.

Candidates were required to draw the front view of the card holder by constructing a rectangle 100 mm wide × 50 mm high. Candidates were given one side of the rectangle from which to project the top and bottom edges of the rectangle. From this they could then project lines from the relevant corners to the given vanishing point, then construct the rest of the game card holder.

Many candidates had drawn the front of the card holder at a 30º angle to the given side and then projected lines in the opposite direction also at 30º and had drawn the card holder in isometric instead of one-point perspective. Many candidates projected some lines back to the vanishing point but had drawn the front, back and inside edges at 30º instead of horizontally resulting in a mixture of isometric and one-point perspective drawing. Few candidates used the correct one-point perspective drawing technique but those who did achieved high marks on this question.

Question A3

(a) Candidates were required to render the block to look like softwood. Candidates were expected to apply lines to show the grain of the wood, knots to two sides of the block and end grain to one side in an appropriate orientation. Many candidates applied some tonal shading to the sides of the block and some curved lines but needed to represent wood grain more sufficiently to achieve the marks. Many candidates used appropriate colour for the wood but were missing grain lines. Very few candidates showed end grain added appropriately to one end of the block. A significant number of candidates did not respond to this question.

(b) (i) Candidates were required to name an item of CAM equipment that could be used to create lettering and cut out a shape in 5 mm acrylic. Many candidates gave correct answers to this with laser cutter being the most common response.

(ii) Candidates were required to state one way the lettering on the acrylic name plate could be altered on screen. There was a wide range of acceptable answers for this question and many candidates achieved the mark.

Question B4

Games piece container

This question was derived from an actual ‘Graphic Product’ made as a concept model.

(a) Candidates were required to complete the planometric view of the container to a scale of 1:2. Most candidates were able to draw the lower section of the container to the correct size, but many had drawn it to an incorrect height. Fewer candidates were able to draw the outline of the rectangular indented section to the correct size or depth. Only a handful of candidates also added the base of the circular indent on the top section correctly. There were very few candidates that achieved full marks on this question.

(b) (i) Candidates were asked to complete the table to show one tool or item of equipment for each stage of the making process that would be used to create the container in **part (a)**. Most candidates were

able to name an appropriate item for the cutting and smoothing of the blocks, but fewer were able to name a suitable adhesive to join the layers of Styrofoam together. Solvent based glues and hot glue were common incorrect answers.

(ii) This part of the question asked the candidate to state a property of Styrofoam that made it suitable for the container. A range of responses were received for this question and many candidates achieved the mark.

(c) (i) Candidates were asked to complete the full-size sectional view of the alternative container design. Most candidates had drawn the wall and base to the correct thickness, but the container was drawn to the wrong overall height and/or width. Many candidates had drawn the divider in the wrong position. Very few candidates added any hatching to the sectional view.

(ii) Candidates were asked to sketch a modification to the container that allowed the divider to be easily removed and replaced. This question was generally not well answered. A variety of solutions were received including slots, pegs and dowels that held the divider in place and could be taken out when removal of the divider was required. Many candidates had drawn very basic 2D sketches but could improve on the clarity and communication of their design. The best responses showed clear 3D sketches of a suitable system with appropriate annotation.

Question B5

Game board figure

(a) Candidates were required to complete the isometric view of the game board figure to a scale of 2:1. Many candidates were able to draw the front part of the body and the top of the legs but did not draw the feet projecting forwards. Many candidates showed the appropriate thickness to the body, arms and legs of the figure but had drawn the shoulders incorrectly. Many candidates had drawn the base correctly to their own solution. The candidates who correctly read the orthographic views and worked methodically from the given start point achieved the best results.

(b) (i) This part of the question required candidates to draw the development (net) of the board game box to a scale of 1:10. Many candidates were able to complete the lid of the box and the base correctly but missed the back side adjoining the lid or had drawn it incorrectly inside the base. Some candidates added the missing sides but needed to show glue flaps/tabs in the correct positions or to an appropriate size. Very few candidates used the correct fold line convention which could be seen on the given start point. Centres are advised to ensure candidates are aware of the different line conventions used for showing things such as hidden detail, centre lines and fold lines.

(ii) Candidates were asked to name a suitable method of cutting out the developments (nets) in quantities of 5000. Laser cutter was a common incorrect answer. However, many candidates did name a suitable mass production method such as die cutting and achieved the mark.

(c) (i) Candidates were required to complete the sequence for making a prototype of the board games box by drawing a suitable sketch to show the stages given in the table. Candidates were expected to follow the 3D convention of the existing stages to show all four stages of the process. Many candidates had drawn some very clear 3D sketches showing suitable materials and equipment being used and achieved all four marks. The quality of sketching was good overall.

(d) This question required candidates to state the meaning of the symbol shown. Most candidates correctly identified the meaning of the symbol and achieved the mark.

DESIGN AND TECHNOLOGY

Paper 0445/52
Graphic Products 52

Key messages

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

General comments

Candidates were required to complete all questions in ***Section A*** (***A1, A2*** and ***A3***) and then go on to answer either **Question B4** or **B5** from ***Section B***. An equal number of candidates chose to answer **Question B4** and **B5**. However, a small number of candidates answered all questions and are advised to read the rubric carefully.

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

There are areas of the syllabus where some candidates did not generally perform well and further improvements are needed. The drawing of basic geometric shapes, such as hexagons and octagons, and exploded isometric views are areas where many candidates need improvement. The correct use of line conventions and textural representation techniques are also areas where many candidates would benefit from further improvement. Practical skills used in graphics such as the use of v-cutting and the application of self-adhesive vinyl techniques were other areas where candidate knowledge was not widely evident.

Comments on specific questions

Section A

Question A1

school Bus image

Candidates were asked to complete the full size drawing of the school bus to the dimensions given by constructing and combining basic geometric shapes.

(a) (i) Candidates were required to draw a rectangular bumper to the sizes given and in the correct position. Most candidates had drawn the bumper correctly by constructing a rectangle 140 mm wide ×
10 mm high on the centre line. Some had drawn the bumper too long.

(ii) Candidates were required to draw the vertical sides, horizontal roof and sloping sides of the bus outline to the sizes given. Most candidates had drawn the outline correctly. Some candidates had drawn the vertical sides to the correct length but in the wrong position.

(iii) Candidates were required to draw the windscreen outline and the eyes to the sizes given. Many candidates had drawn both parts correctly. Some candidates had drawn the eyes to the wrong radius or in wrong position. The best responses used a compass set to the correct radius and on the given centre lines. Candidates who did not use a compass resulted in irregular curves and arcs which did not achieve the marks.

(iv) Candidates were required to draw the half octagon to the sizes given. Many candidates had drawn a shape with the correct number of sides but not a regular half octagon. Some candidates had drawn a regular half octagon but not to the sizes given.

(v) Candidates were required to draw the two isosceles triangles for the mirrors on the bus. Most candidates achieved both marks on this question.

(b) (i) Candidates were required to draw the bus stop sign by constructing a regular hexagon to the correct size and in the correct position on the given centre line. Many candidates had drawn six sided shapes but many of the hexagons were irregular in shape and did not achieve the mark.

(ii) Candidates were required to draw the two sides of the bus stop sign post by adding two vertical lines each side of the given centre line. Most candidates completed this correctly and achieved the mark.

Question A2

Bus timetable

This question asked the candidate to complete the full-size development (net) of the bus timetable.

(a) Candidates were given a corner of the timetable front page from which to project the top and side edges of the pages. Most candidates had drawn all three pages of the development (net) correctly. Some candidates had drawn the width correctly but to an incorrect height. A significant number of candidates had drawn the timetable folded into three parts similar to the given drawing in the question. Very few candidates used the correct fold line conventions which was needed for the fourth mark. Centres are advised to ensure candidates are aware of the different line conventions used for showing things such as hidden detail, centre lines and fold lines.

(b) (i) Candidates were asked to name a suitable method of printing the timetables in quantities of 5000. Many candidates correctly named an appropriate method. Lithography and flexography were the most common correct answers.

(iii) Candidates were required to name a suitable method of cutting out the developments (nets) of the timetables. Many candidates correctly named an appropriate method and achieved the mark. Laser cutter was the most common incorrect answer given by many candidates.

Question A3

Candidates were required to add the missing stops on the diagram of the bus journey by calculating the appropriate distance and drawing the position using the 1:20 scale. Many candidates had drawn all three stops correctly and achieved all the marks. Some candidates had drawn stop 2 correctly but had drawn stops 3 and 4 too close or far away from stop 2.

Question B4

Timetable holder

This question was derived from an actual ‘Graphic Product’ made as a concept model.

(a) Candidates were required to complete the exploded isometric view of the timetable holder by using the information given in the orthographic views and the given start point. Candidates were expected to project lines at 30º from the existing side piece and back board to construct the missing side piece in the correct position. Most candidates were able to project lines from the existing side piece to draw the profile correctly and add the correct thickness but many had drawn the side in the wrong position.

Candidates needed to compete the base of the timetable holder to the correct length, width and depth. Many candidates had drawn the width and depth correctly but had drawn the length too short or too long.

Candidates were then expected to draw the front piece of the timetable holder in the correct position and to the correct size. Many candidates had drawn the length and thickness correctly but

to the incorrect height. Many candidates had drawn the front piece in the wrong position. Very few candidates achieved full marks on this question. Centres are advised to ensure candidates are aware of the correct methods of drawing exploded views in particular the positioning of items using the centre lines.

(b) Candidates were asked to render the drawing of the timetable side piece to look like clear acrylic. Candidates were expected to use correct colours and graphical shading techniques to create a realistic representation of clear material. Many candidates added some appropriate rendering but very few candidates produced a high-quality textural representation of clear acrylic.

(c) This question required candidates to name a suitable thin sheet plastic that could be used to vacuum form the timetable holder design shown. Many candidates named a suitable sheet plastic such as acrylic, polystyrene or PVC.

(d) (i) Candidates were asked to complete the table to show the stages of the vacuum forming process by adding sketches to stage. Candidates were expected to show a sheet of plastic in place, the clamps holding it in position and the plastic being heated. Most candidates had drawn the sheet plastic correctly in place and clamped down but needed to draw a heater or any kind of heat being applied to the plastic.

(ii) Candidates were asked to describe the process shown in stage 3 of the table. Candidates were expected to describe the raising of the bed, the turning on of the vacuum and the plastic being sucked around the mould. Many candidates described two of the processes but very few gave all three and achieved full marks.

(e) (i) Candidates were asked to complete the table to show a suitable tool or item of equipment for the processes of trimming and smoothing of the vacuum formed plastic. Most candidates were able to name a suitable tool or item of equipment for smoothing the edges but very few were able to name a suitable tool for trimming off the excess plastic. Stanley knives/craft knives etc. were the most common incorrect answer.

(ii) Candidates were asked to sketch a modification to the vacuum formed timetable holder to make it more stable and prevent it from falling over. Candidates were expected to add some sort of support to the timetable holder. Many candidates re-designed the complete timetable holder rather than modifying the existing holder or modified the timetable holder from **part (a)** instead of the vacuum formed holder form **parts (c)** and **(d)**. Candidates are advised to read the question carefully.

Question B5

Model Bus stop

(a) Candidates were required to complete the orthographic views of the bus stop model to a scale of 1:2. Most candidates were able to complete the side view by adding the window to the correct size and in the correct position, and had drawn the outline and front wall of the bus top onto the front view correctly with the wall thickness. A significant number of candidates had drawn the seat too big but in the correct position. Most candidates had drawn the roof correctly by projecting lines from the plan and side view, but many missed the bus stop sign on the front view. Many candidates did not complete the plan view. Some candidates had drawn the central vertical line to show the roof ridge, but many missed the bus stop sign on the left of the plan. The candidates who correctly read the given isometric view and worked methodically from the given part complete orthographic views achieved the best results.

(b) (i) This part of the question required candidates to show how the model of the bus stop could be made by folding a single piece of foamboard at 90º angles. Candidates were expected to show the use of angled v-cuts through the top layer of card and foam middle layer to allow the foamboard to be folded into the required 90º angles. Many candidate responses showed angled v-cuts but cutting all the way through the 3 layers of foamboard. Many candidates showed methods that would not work such as scoring and folding of the foamboard in the same way as would be used for paper or card. Centres are advised to ensure candidates are aware of the different techniques used for the cutting and folding of different graphic materials.

(ii) Candidates were asked to name a suitable adhesive to join the Styrofoam roof to the foamboard walls. Many candidates gave correct answers such as PVA glue. Many candidates named solvent-based glues such as superglue or hot glue which would melt the Styrofoam and not be suitable.

(c) Candidates were required to complete the isometric view of the Styrofoam base to a scale of 1:2 using the information given on the orthographic views. Many candidates were able to draw the vertical front and side faces but very few constructed the sloping edges correctly.

(d) (i) This question required candidates to describe how self-adhesive lettering produced on a vinyl cutter would be applied to the base. Candidates were expected to describe the 'weeding' of the unwanted parts from the vinyl. Candidates needed to describe the application of transfer tape to the front of the lettering to allow removal of the lettering from the vinyl backing sheet, followed by the application and removal of the transfer tape. Candidates need to describe the weeding or transferral parts of the process in sufficient detail to achieve all the marks.

(ii) This part of the question required candidates to state a method of accurately applying the 'Bus Shelter' text to the base without the use of CAD/CAM. Many candidates gave answers which involved the use of CAD/CAM such as self-adhesive vinyl stickers and laser cutting which did not achieve the marks. Candidates who responded with techniques such as the use of markers, stencils and spray paints achieved the marks.

DESIGN AND TECHNOLOGY

Paper 0445/53
Graphic Products 53

Key messages

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

General comments

Candidates were required to complete all questions in ***Section A*** (***A1***, ***A2*** and ***A3***) and then go on to answer either **Question B4** or **B5** from ***Section B***. An equal number of candidates chose to answer **Question B4** and **B5**. However, a small number of candidates answered all questions and are advised to read the rubric carefully.

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

There are areas of the syllabus where some candidates need further improvements. The construction and drawing of ellipses and drawing of basic geometric shapes such as hexagons and octagons are areas where many candidates did not perform well. The methods and techniques for drawing in one and two-point perspective are also areas where many candidates would benefit from further improvement. The process of vacuum forming and non-permanent joining methods such as slots, arrow-tabs and flaps were other areas where candidate knowledge was not widely evident.

Comments on specific questions

Section A

Question A1

Key image

Candidates were asked to complete the drawing of the key to a scale of 4:1 to the dimensions given by constructing and combining basic geometric shapes.

(a) (i) Candidates were required to draw the circular head of the key and the rectangular shaft with a triangular end to the sizes given and in the correct position. Most candidates had drawn the circular head correctly by constructing an arc with 48 mm radius on the centre lines given. Some candidates had drawn the circle to the correct radius but in the wrong position. Most candidates constructed the rectangular shaft correctly, but some had drawn the triangular end too long.

(ii) Candidates were required to construct the regular half octagon to the sizes given and in the correct position. Many candidates had drawn a half octagon but not regular in size and shape. Some candidates had drawn the half octagon correctly but at an incorrect distance from the end.

(iii) Candidates were required to draw the rectangular cut-out in the correct position and to the sizes given. Many candidates had drawn the rectangle to the correct size. Some candidates had drawn the rectangle in the wrong position.

(b) (i) Candidates were required to draw the elliptical shape of the key head and the rectangular shaft. Candidates were expected to construct a regular ellipse with a major and minor axis to the sizes given by using an appropriate method. The concentric circle method was the most popular method

used. Many candidates had drawn some form of ellipse with the correct major and minor axis' but were unable to plot points correctly. Many candidates had drawn the ellipse rotated at 90º. Very few candidates plotted sufficient points to enable them to draw a neat uniform ellipse. Centres are advised to ensure candidates are aware of a suitable method to construct ellipses. Some candidates appeared to have used a trammel to construct the ellipse but had not included the trammel with the paper. Centres are advised to ensure the trammel is attached to the paper if candidates use this method.

(ii) Candidates were required to construct the rectangle and hexagon to the sizes given. Most candidates had drawn the rectangle correctly, but many needed to construct the regular hexagon to the sizes given. Centres are advised to ensure candidates are aware of the methods used to construct simple geometric shapes such as hexagons, pentagons and octagons.

Question A2

Keyring fob

This question asked the candidate to complete the isometric view of the assembled keyring fob to a scale of 1:2.

(i) Candidates were given a corner of the middle piece from which to project the bottom and side edges and construct the rest of the shape from. Most candidates had drawn the front face of the middle piece to the correct height, width and thickness. Some candidates had drawn the height and width correctly but needed to add thickness to achieve all the marks.

(ii) Candidates were required to construct the back piece of the keyring fob. Many candidates did this correctly and achieved the full four marks. Some candidates had drawn the horizontal top surface to the incorrect height or width but added the sloping edges correctly to their own solution and added the thickness. A significant number of candidates did not attempt this question.

Question A3

Keyring fob design

For this question, candidates were required to draw a design for a keyring fob that would be used for a car key. Candidates were expected to draw a simple shape representing a car that could be cut from acrylic. Many candidates had drawn a side or front view of a car or part of a car. Some candidates had drawn detailed pictures with too much detail. Many candidates had drawn pictures of keys and did not achieve a mark. Candidates are advised to read the question carefully.

Question B4

Key Rack

(a) Candidates were required to complete the exploded isometric view of the key rack to a scale of 1:2 by using the information given in the orthographic views and the given start point. Candidates were expected to project lines vertically and at 30º from the existing edges and hook to construct the missing hook and back section of the key rack. Most candidates were able to project lines from the existing hook to draw the profile correctly, but many had drawn the hook to the incorrect thickness and in the incorrect position.

Candidates were then expected to complete the backboard of the key ring rack to the correct sizes using the two holes to locate the position. Many candidates had drawn the overall size of the backboard correctly but had drawn the horizontal top edges or vertical sides to the wrong sizes. Many candidates added the correct 8 mm thickness to the backboard, but few candidates had drawn the backboard in the correct position.

Centres are advised to ensure candidates are aware of the correct methods of drawing exploded views in particular the positioning of items using the centre lines.

(b) (i) Candidates were asked to describe how CAD/CAM could be used to produce a suitable stencil for the KEYS lettering. Many candidates described the use of a computer program to draw the letters and the use of an item of CAM equipment to cut out the letters in card. However very few

candidates were able to describe how the letters are formatted or transferred from the computer to the CAM equipment.

(ii) Candidates were asked to describe one advantage of using a stencil compared to painting on the 'KEYS' lettering by hand. Many candidates named one advantage but needed a more adequate description of the advantage given. An example of this is where candidates gave 'quicker' but needed to describe why the use of the stencil made it quicker.

(c) Candidates were asked to complete the estimated one-point perspective of the alternative backboard by projecting horizontal lines from the given side face and lines from the given front face to the vanishing point. Many candidates had drawn the backboard correctly and gained all five marks. Some candidates had drawn the lower section extended too far past the top section. Many candidates had drawn the front face of the top section too small. Centres are advised to ensure candidates are aware of the techniques used to create one-point and two-point perspective drawings.

(d) Candidates were asked to draw and label a pie chart to display the information given in the table. Many candidates had drawn the pie chart showing all three sections correctly and gained full marks. Some candidates were able to show the work section correctly but had drawn the house and car sections at the wrong angles. A significant number of candidates had drawn bar charts instead of pie charts and did not achieve the marks. Candidates are advised to read the question carefully.

Question B5

Padlock

(a) Candidates were required to complete the orthographic views of the padlock to a scale of 1:2. Most candidates were able to complete the rectangular outline and two vertical inner edge lines of the front views to show the main body of the padlock. Fewer candidates had drawn the curved locking bar above the main body correctly. Many candidates missed out the circle around the keyhole. Most candidates completed the side view of the padlock correctly and gained both marks. Very few candidates projected vertical lines from the front view and side views or used a 45º angle above the side view to allow the projection of lines across horizontally to construct the outer edges of the plan view.

The candidates who correctly read the given isometric view and worked methodically from the given part complete orthographic views achieved the best results.

(b) (i) This part of the question required candidates to show a design for a locking lid added to the end of the padlock box. Candidates were expected to show the use of appropriate folds and locking tabs to achieve a suitable solution. Many candidates had drawn a lid with suitable flaps but did not show any type of locking method. Some candidates added a separate plastic or cardboard cap to the end of the package but missed out details of how it would be attached or locked. Centres are advised to ensure candidates are aware of the different types of locking tabs and folds used in the construction of graphic products such as packages.

(c) Candidates were required to complete the full-size sectional view through the vacuum formed padlock package. Many candidates had drawn the two sections to the correct height and width but had drawn them the wrong way around or missed out the vertical centre dividing line.

(d) (i) This question required candidates to show knowledge of thick and thin line technique by applying it correctly to the drawing of the mould. Many candidates completed this correctly and gained all three marks. Some candidates added thick lines to the outer edge of the drawing but were unable to correctly add the relevant thickness to the other parts of the mould.

(ii) This part of the question required candidates to describe how the mould could be modified to make removal of the vacuum formed plastic sheet easier. Very few candidates achieved high marks on this question. Many candidates gave incorrect answers which described making the mould from a soft, easily compressible material that could be easily removed or drilling holes in the mould to create air vents. Candidates who responded with techniques such as adding draft angle to the sides, rounding off the sharp corners or the use of a release agent achieved the marks. Centres are advised to ensure candidates are aware of the vacuum forming and blow moulding process.