DESIGN AND TECHNOLOGY

Paper 0445/11
Product Design

Key messages

A wide range of responses were seen to the questions. Higher level responses demonstrated a good understanding of the design context, a high degree of creativity and excellent technical knowledge. Weaker responses often demonstrated only limited understanding of the design context.

All candidates should be encouraged to thoroughly read their chosen question to ensure that they fully understand the requirements.

In some responses the part questions appeared to be unconnected. For example, the materials named in part **(f)** and the manufacturing method described in part **(g)**, were not evident in the full solution proposed in part **(e)**. Candidates should be encouraged to view the paper as a holistic design exercise, rather than a series of individual questions.

General comments

Most candidates responded well to the given design situations and were able to select a question that fitted with the specialist option that they had studied.

Question 1 was the most popular question but not by a significant margin. **Question 3** was much more popular than usual.

Freehand sketching, creativity and knowledge of materials and processes were strengths for many candidates.

Some candidates were unable to clearly express their thoughts in the written parts of the paper and may have benefitted from adopting a more structured approach. For example, in part **(d)** some candidates may have benefitted from using 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 device for displaying twelve bottles of water that they considered to be important. Commonly seen responses referred to keeping the bottles stable, having the labels of the bottles visible, having the ability to be easily refilled, be easy to clean, be stable on different surfaces and being easy for the customer to access and take a bottle. Candidates should be advised against repeating points that are given in the question or giving generic points such as ‘easy to use’ or ‘safe’ that might apply to almost any product.

(b) Most candidates used sketches and notes to good effect to show two methods of holding multiple cylindrical objects. Commonly seen responses included tubes that the cylindrical items fitted into, circular holes cut through timber, long rectangular boxes for them to be stacked and vacuum formed trays with circular indentations. The methods were communicated well on the whole with good quality sketches and notes that clearly showed the intended method.

(c) Freehand sketches, with annotations and colour, were commonly seen methods used to show design ideas. Many excellent responses were seen, with the design ideas being both suitable and clearly communicated. In weaker responses the design ideas did not always fully meet the requirements of the question with features, such as the method of holding the bottles unclear or not considered at all. It is important that all design ideas fully meet the design requirements if candidates are to access the full range of marks. A significant number of candidates produced design ideas that were very similar to each other with only minor differences between them. Candidates are encouraged to try and produce a range of different ideas that show different ways of solving the problem.

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

(d) The evaluations of the ideas were generally sound, with candidates able to clearly demonstrate an understanding of the positive and negative features of their design proposals. Commonly seen responses focused on the main functions of the device, such as the access to the bottles, the stability, the amount of bottles that could be held or the suitability of the materials such as their strength or resistance to water.

It is important that candidates justify their evaluations, rather than making generic statements such as it will work well, if they are to access the full range of marks. Almost all candidates were able to choose one idea to develop further and give reasons for their choice.

(e) A variety of methods were used to show the full solution to the design problem. These included freehand orthographic drawings, exploded views, isometric views and materials lists. Commonly seen responses included rectangular boxes made from several pieces of wood or metal fastened together with circular holes to hold the tubes securely. Stronger responses provided drawings showing how only one bottle could be accessed at a time. Weaker responses often just redrew one of the designs from part **(c)** with no construction details or important dimensions included. Stronger responses showed dimensions sufficient details of construction methods for a skilled person to make the product.

All candidates should be advised against redrawing the design idea presented in part **(c)** and to focus on the construction details, dimensions and finishes.

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

(g) Most candidates were able to outline a method that could be used to manufacture one part of their design. Marking out, cutting and joining pieces of material using hand production techniques was the most seen method of manufacture. Some candidates used Computer Aided Design (CAD) and Computer Aided Manufacture (CAM) to produce part of their design or commercial processes, such as injection moulding or vacuum forming. The most successful responses used a combination of sketches and notes to outline the method of manufacture.

If candidates are to access the full range of marks, it is important that the method is appropriate for part of the solution proposed in **(e)** and the correct names of tools and equipment are used. Generic names of tools, such as a cutter, are not awarded marks.

Question 2

(a) Most candidates were able to list four additional points about the function of an adjustable height restriction sign for a theme park ride that they considered to be important. Commonly seen answers referred to the sign being easy to read by children, being stable, easily adjustable for different heights and rides and having colours/themes to suit the theme park.

Candidates should be advised against repeating points that are given in the question, for example the product will be lightweight, or giving generic points, such as it must be safe, that might apply to almost any product.

(b) Most candidates used sketches and notes to good effect to show two methods of temporarily fixing lightweight graphic materials. The most seen responses were push together slot and tab joints, metal fastenings such as paper clips and split pins, Velcro and magnets. Some candidates incorrectly showed permanent joining methods, such as the use of an adhesive. Many candidates showed methods relating to resistant materials such as wood joints and metal hinges which would not be suitable for lightweight graphic materials. The sketches and notes were almost always of a standard that allowed the joining method to be clearly communicated.

To score maximum marks, candidates must use both sketches and notes to show each method. A small number of candidates used only sketches and were awarded a maximum of one mark for each method.

(c) Some impressive sketches with annotations were seen for this question. The most seen responses involved the use of rigid graphic materials such as foamboard and corriflute slotted together to produce a freestanding sign that people walked through or stood against. In some responses it was unclear how the sign could be adjusted for different heights and different rides.

Some candidates showed designs made from resistant materials, such as wood or acrylic, rather than lightweight materials. 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 less than three ideas and were awarded pro rata marks.

(d) The evaluations of the ideas were generally impressive, with candidates able to clearly demonstrate an understanding of the positive and negative features of their design proposals. Candidates often focussed on the stability of the display, how easy it was to adjust or transport it between different rides or how long it might last in an outdoor environment.

It is important that candidates justify their evaluations, rather than making generic statements such as it is strong, if they are to access the full range of marks. Almost all candidates were able to choose one idea to develop further and give reasons for their choice.

(e) A variety of methods were used to show the full solution to the design problem. These included orthographic drawings, exploded views, isometric views and materials lists. Colour was frequently used to give clarity to the drawings. Construction details were often clearly shown through a three-dimensional sketch and a development (net) with labels identifying the materials and joining methods.

This question specifically asks for important dimensions but, particularly in weaker responses, these were often omitted.

(f) Most candidates were able to name two specific materials that would be used to make their design proposal and give reasons for their choices. Commonly seen materials were corrugated cardboard, Corriflute (corrugated plastic sheet), acrylic and medium density fibreboard (MDF), with the reasons referring to the properties of the material, such as provides a smooth surface, available in a range of colours or easy to wipe clean.

Candidates should be advised against giving generic names of materials, such as plastic, or generic reasons, such as easy to work with, as these are not awarded marks.

(g) Most candidates were able to identify and outline a method used to manufacture one part of their design proposal. Cutting out of thin sheet materials, either by hand or with the aid of CAD/CAM and joining with slotted joints or screw fasteners were commonly seen responses to this question. The most successful responses used a combination of sketches and notes to outline the method of manufacture. In a small number of responses candidates outlined manufacturing methods that were inappropriate for the material or solution proposed in **(e)**.

It is important that candidates include the correct names of the tools and equipment to be used in the method of manufacture if they are to access the full range of marks.

Question 3

(a) Most candidates that selected this question were able to list four additional points about the function of a device that would automatically count how many people had entered a theme park ride and stop people entering at a set number. Commonly seen answers related to the device having a visual indicator to show how many spaces were left on the ride, counting people accurately, safety and ease of operation, being easy to maintain and operate.

Candidates should be advised against repeating points that are given in the question, such as the device must stop at a set number or generic points that could apply to any product.

(b) Most candidates used sketches and notes to good effect to show two methods of automatically sensing movement such as pressure pads, motion sensing cameras, turnstiles, and light sensors.

To score maximum marks, candidates must use both sketches and notes to show each method. A small number of candidates produced only sketches and were awarded a maximum of one mark for each method.

(c) Imaginative sketches with annotations were seen in response to this question, with many candidates clearly showing devices that had the potential to automatically count people and show the number of people or places left. It was, however, sometimes unclear how the design idea would work as the sketches only included labels, such as 'camera counts the people' or 'this part shows how many spaces are left' rather than details of the actual system or mechanism.

It is important that all design proposals fully meet the design requirements if candidates are to access the full range of marks. A small number of candidates produced less than three ideas and were awarded pro rata marks.

(d) The evaluations of the ideas were generally well reasoned, with candidates able to clearly demonstrate an understanding of the positive and negative features of their design proposals. Points that focused on how accurately the device would count people, how easy it would be to operate or how it would prevent people entering once the number limit had been reached were commonly seen.

It is important that candidates explain their thoughts rather than making broad statements, such as it would not work well, if they are to access the full range of marks. Almost all candidates were able to choose one idea and give a reason for their choice.

(e) A variety of methods were used to show the full solution to the design problem. These included orthographic drawings, exploded views, isometric views and materials lists. Colour was frequently used to add clarity to the drawings. Most candidates included construction details for the individual parts of their design proposal but sometimes omitted to clearly show how these joined together to make the device.

This question specifically asks for important dimensions but, particularly in weaker responses, these were often missing.

(f) Most candidates were able to name two specific materials that would be used to make their design proposal and give reasons for their choices. Commonly seen materials were timber and manufactured boards, aluminium, and stainless steel with reasons for selection relating to the physical properties of the material such its durability or resistance to weather and corrosion.

Candidates should be advised against giving generic names of materials, such as metal, or generic reasons, such as easy to work with, as these are not awarded marks.

(g) Most candidates were able to identify and outline a method used to manufacture one part of their design. Commonly seen answers included the marking out, cutting and joining of pieces of material using hand production techniques. The use of vacuum forming, injection moulding, 3D printing and the use of a laser cutter were also shown by many candidates. The most successful candidates used a combination of sketches and notes to outline a 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 0445/12
Product Design

Key messages

A wide range of responses were seen to the questions. Higher level responses demonstrated a good understanding of the design context, a high degree of creativity and excellent technical knowledge. Weaker responses often demonstrated only limited understanding of the design context.

All candidates should be encouraged to thoroughly read their chosen question to ensure that they fully understand the requirements.

In some responses the part questions appeared to be unconnected. For example, the materials named in part **(f)** and the manufacturing method described in part **(g)**, were not evident in the full solution proposed in part **(e)**. Candidates should be encouraged to view the paper as a holistic design exercise, rather than a series of individual questions.

General comments

Most candidates responded well to the given design situations and were able to select a question that fitted with the specialist option that they had studied.

Question 1 and **Question 2** were the most popular questions. Very few candidates attempted **Question 3.**

Creativity, knowledge of the properties of materials and understanding of processes were particularly well demonstrated through freehand sketching with annotations.

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

Comments on specific questions

Question 1

(a) Most candidates were able to list four additional points about the function of a unit for moving twelve sets of tennis training equipment that they considered to be important. Commonly seen responses referred to the unit being stable, weatherproof, easy to manoeuvre or store, and preventing balls or bottles from rolling off. Candidates should be advised against repeating points that are given in the question or giving generic points such as ‘easy to use’ or ‘safe’ that might apply to almost any product.

(b) Most candidates used sketches and notes to good effect to show two methods of making an object moveable. Commonly seen responses included wheels, castors, handles, shoulder straps, skis, and rollers. The methods were communicated well on the whole with good quality sketches and notes that clearly showed the intended method.

(c) Freehand sketches, with annotations and colour, were commonly seen methods used to show design ideas. Many excellent responses were seen, with the design ideas being both suitable and clearly communicated. In weaker responses the design ideas did not always fully meet the requirements of the question with features, such as the method of holding the equipment in place unclear or not considered at all. It is important that all design ideas fully meet the design

requirements if candidates are to access the full range of marks. A significant number of candidates produced design ideas that were very similar to each other with only minor differences between them. Candidates are encouraged to try and produce a range of different ideas that show different ways of solving the problem.

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

(d) The evaluations of the ideas were generally sound, with candidates able to clearly demonstrate an understanding of the positive and negative features of their design proposals. Commonly seen responses focussed on the main functions of the device, such as the access to the equipment, the ease of moving and manoeuvring the unit, the protection of the equipment from the weather and the protection of the equipment from damage or theft.

It is important that candidates justify their evaluations, rather than making generic statements such as it will work well, if they are to access the full range of marks. Almost all candidates were able to choose one idea to develop further and give reasons for their choice.

(e) A variety of methods were used to show the full solution to the design problem. These included freehand orthographic drawings, exploded views, isometric views and materials lists. Commonly seen responses included rectangular chests or racks made from several pieces of wood or metal fastened together with separate compartments for the different types of equipment. Stronger responses provided drawings showing how the unit could be steered and secure the equipment inside. Weaker responses often just redrew one of the designs from part **(c)** with no construction details or important dimensions included. Stronger responses showed dimensions with sufficient details of construction methods for a skilled person to make the product.

All candidates should be advised against redrawing the design idea presented in part **(c)** and to focus on the construction details, dimensions and finishes.

(f) Most candidates were able to name two specific materials that would be used to make their design proposal and give reasons for their choices. Oak, pine, plywood and aluminium were commonly named materials, with reasons usually referring to the working properties, lightness or resistance to corrosion of the material. Candidates should be advised against giving generic names of materials such as wood, or generic reasons, such as easy to work with or readily available as these are not awarded marks.

(g) Most candidates were able to outline a method that could be used to manufacture one part of their design. Marking out, cutting and joining pieces of material using hand production techniques was the most seen method of manufacture. Some candidates used Computer Aided Design (CAD) and Computer Aided Manufacture (CAM) to produce part of their design or commercial processes, such as injection moulding or vacuum forming. The most successful responses used a combination of sketches and notes to outline the method of manufacture.

If candidates are to access the full range of marks, it is important that the method is appropriate for part of the solution proposed in **(e)** and the correct names of tools and equipment are used. Generic names of tools, such as a cutter, are not awarded marks.

Question 2

(a) Most candidates were able to list four additional points about the function of flat packed point of sale display unit for a volleyball that they considered to be important. Commonly seen answers referred to the unit being attractive and eye catching, stable and easily assembled and dismantled.

Candidates should be advised against repeating points that are given in the question, for example the product will be lightweight, or giving generic points, such as it must be safe, that might apply to almost any product. Candidates are encouraged to give responses of more than just one word if they are to gain the mark. For example, instead of just giving colourful, it is better to put brightly coloured to catch people's eye.

(b) Most candidates used sketches and notes to good effect to show two methods of displaying a spherical object so it can be clearly seen. The most seen responses were cups or semi spherical indentations to hold the ball in place. Glass cabinets and holders made from netting or mesh

material were also a popular method chosen. The sketches and notes were almost always of a standard that allowed the displaying method to be clearly communicated.

To score maximum marks, candidates must use both sketches and notes to show each method. A small number of candidates used only sketches and were awarded a maximum of one mark for each method.

(c) Some good sketches and annotations were seen for this question. The most seen responses involved the use of rigid graphic materials such as foamboard, corrugated card and corriflute slotted together to produce a freestanding display stand that held the volleyball off the floor and at eye level. In some responses it was unclear how the stand could be assembled from a flat pack form.

Some candidates showed designs made from resistant materials, such as wood or acrylic, rather than lightweight materials. 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 less than three ideas and were awarded pro rata marks.

(d) The evaluations of the ideas were generally impressive, with candidates able to clearly demonstrate an understanding of the positive and negative features of their design proposals. Candidates often focused on the stability of the display stand, how easy it was to see the volleyball or how eye catching it was.

It is important that candidates justify their evaluations, rather than making generic statements such as it is strong, if they are to access the full range of marks. Almost all candidates were able to choose one idea to develop further and give reasons for their choice.

(e) A variety of methods were used to show the full solution to the design problem. These included orthographic drawings, exploded views, isometric views and materials lists. Colour was frequently used to give clarity to the drawings. Construction details were often clearly shown through a three-dimensional sketch and a development (net) with labels identifying the materials and joining methods.

This question specifically asks for important dimensions but, particularly in weaker responses, these were often omitted.

(f) Most candidates were able to name two specific materials that would be used to make their design proposal and give reasons for their choices. Commonly seen materials were corrugated cardboard, Corriflute (corrugated plastic sheet), acrylic and medium density fibreboard (MDF), with the reasons referring to the properties of the material, such as provides a smooth surface, available in a range of colours or easy to wipe clean.

Candidates should be advised against giving generic names of materials, such as plastic, or generic reasons, such as easy to work with, as these are not awarded marks.

(g) Most candidates were able to identify and outline a method used to manufacture one part of their design proposal. Cutting out of thin sheet materials, either by hand or with the aid of CAD/CAM and joining with slotted joints or screw fasteners were commonly seen responses to this question. The most successful responses used a combination of sketches and notes to outline the method of manufacture. In a small number of responses candidates outlined manufacturing methods that were inappropriate for the material or solution proposed in **(e)**.

It is important that candidates include the correct names of the tools and equipment to be used in the method of manufacture if they are to access the full range of marks.

Question 3

(a) Most candidates that selected this question were able to list four additional points about the function of a device that would compress and insert a foam football into a plastic tube so that it takes up less space in a shop. Commonly seen answers related to the device being simple and safe to operate, easy to clean and maintain, and not causing damage to the ball.

Candidates should be advised against repeating points that are given in the question, such as the device must hold the ball or generic points that could apply to any product such as strong.

(b) Most candidates used sketches and notes to good effect to show two methods of closing the open end of a tube such as screw caps, stoppers or bungs,

To score maximum marks, candidates must use both sketches and notes to show each method. A small number of candidates produced only sketches and were awarded a maximum of one mark for each method.

(c) Imaginative sketches with annotations were seen in response to this question, with many candidates clearly showing devices that had the potential to compress a foam football into a tube. It was, however, sometimes unclear how the design idea would work as the sketches showed only limited details of the actual system or mechanisms and how they would operate to squash the ball or insert into the tube.

It is important that all design proposals fully meet the design requirements if candidates are to access the full range of marks. A small number of candidates produced less than three ideas and were awarded pro rata marks.

(d) The evaluations of the ideas were generally well reasoned, with candidates able to clearly demonstrate an understanding of the positive and negative features of their design proposals. Points that focused on the damage that might be caused to the ball, how much manual force would be needed to operate the device and how quickly the device would be to load and operate were commonly seen.

It is important that candidates explain their thoughts rather than making broad statements, such as it would not work well, if they are to access the full range of marks. Almost all candidates were able to choose one idea and give a reason for their choice.

(e) A variety of methods were used to show the full solution to the design problem. These included orthographic drawings, exploded views, isometric views and materials lists. Colour was frequently used to add clarity to the drawings. Most candidates included some construction details for the individual parts of their design proposal but sometimes omitted to clearly show how these joined together to make the device.

This question specifically asks for important dimensions but, particularly in weaker responses, these were often missing.

(f) Most candidates were able to name two specific materials that would be used to make their design proposal and give reasons for their choices. Commonly seen materials were stainless steel, aluminium and acrylic. Reasons for selection usually related to the physical properties of the material such its durability or high strength to weight ratio.

Candidates should be advised against giving generic names of materials, such as metal, or generic reasons, such as easy to work with, as these are not awarded marks.

(g) Most candidates were able to identify and outline a method used to manufacture one part of their design. Commonly seen answers included the marking out, cutting and joining of pieces of material using hand production techniques. The use of vacuum forming, injection moulding, 3D printing and the use of a laser cutter were also shown by many candidates. The most successful candidates used a combination of sketches and notes to outline a method of manufacture.

It is important that all candidates include the correct names of tools and equipment to be used in the method of manufacture if they are to access the full range of marks.

DESIGN AND TECHNOLOGY

Paper 0445/13
Product Design

Key messages

A wide range of responses were seen to the questions. Higher level responses demonstrated a good understanding of the design context, a high degree of creativity and excellent technical knowledge. Weaker responses often demonstrated only limited understanding of the design context.

All candidates should be encouraged to thoroughly read their chosen question to ensure that they fully understand the requirements.

In some responses the part questions appeared to be unconnected. For example, the materials named in part **(f)** and the manufacturing method described in part **(g)**, were not evident in the full solution proposed in part **(e)**. Candidates should be encouraged to view the paper as a holistic design exercise, rather than a series of individual questions.

General comments

Most candidates responded well to the given design situations and were able to select a question that fitted with the specialist option that they had studied.

Question 1 was more popular than **Question 2** and **Question 3**.

Creativity, knowledge of the properties of materials and understanding of processes were particularly well demonstrated through freehand sketching with annotations.

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

Comments on specific questions

Question 1

(a) Most candidates were able to list four additional points about the function of a drink bottle carrier that would attach to the frame of a pram or pushchair. Commonly seen responses referred to the unit being attached and removed from the push chair easily, being easy to access bottles, not damaging the water bottle or pram/push chair and holding it securely in place to prevent bottles falling out. Candidates should be advised against repeating points that are given in the question or giving generic points such as ‘easy to use’ or ‘safe’ that might apply to almost any product.

(b) Most candidates used sketches and notes to good effect to show two methods of temporarily attaching an item securely to a round tube. Commonly seen responses included cable ties, straps, jubilee clips, tube clamps, and moulded clamps tightened with a screw. The methods were communicated well on the whole with good quality sketches and notes that clearly showed the intended method.

(c) Freehand sketches, with annotations and colour, were commonly seen methods used to show design ideas. Many excellent responses were seen, with the design ideas being both suitable and clearly communicated. In weaker responses the design ideas did not always fully meet the requirements of the question with features, such as the method of holding the bottle in place

unclear or not considered at all. It is important that all design ideas fully meet the design requirements if candidates are to access the full range of marks. A significant number of candidates produced design ideas that were very similar to each other with only minor differences between them. Candidates are encouraged to try and produce a range of different ideas that show different ways of solving the problem.

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

(d) The evaluations of the ideas were generally sound, with candidates able to clearly demonstrate an understanding of the positive and negative features of their design proposals. Commonly seen responses focussed on the main functions of the device, such as the security of the fixing, the ease of attaching and detaching the holder, the weight or bulkiness of the holder and the ease of access to the bottle.

It is important that candidates justify their evaluations, rather than making generic statements such as it will work well, if they are to access the full range of marks. Almost all candidates were able to choose one idea to develop further and give reasons for their choice.

(e) A variety of methods were used to show the full solution to the design problem. These included freehand orthographic drawings, exploded views, isometric views and materials lists. Commonly seen responses included vacuum formed holders or plastic tubes to hold the bottle or containers made from several pieces of plastic, wood or metal fastened together to resemble a crate. Stronger responses provided drawings showing how the unit could be securely attached and detached from a round tube and how the parts would attach to each other. Weaker responses often just redrew one of the designs from part **(c)** with no construction details or important dimensions included. Stronger responses showed dimensions with sufficient details of construction methods for a skilled person to make the product.

All candidates should be advised against redrawing the design idea presented in part **(c)** and to focus on the construction details, dimensions and finishes.

(f) Most candidates were able to name two specific materials that would be used to make their design proposal and give reasons for their choices. Acrylic, aluminium and PVC were commonly named materials, with reasons usually referring to the working properties, lightness or resistance to corrosion of the material. Candidates should be advised against giving generic names of materials such as wood, or generic reasons, such as easy to work with or readily available as these are not awarded marks.

(g) Most candidates were able to outline a method that could be used to manufacture one part of their design. Marking out, cutting and joining pieces of material using hand production techniques was the most seen method of manufacture. Some candidates used Computer Aided Design (CAD) and Computer Aided Manufacture (CAM) to produce part of their design or commercial processes, such as injection moulding or vacuum forming. The most successful responses used a combination of sketches and notes to outline the method of manufacture.

If candidates are to access the full range of marks, it is important that the method is appropriate for part of the solution proposed in **(e)** and the correct names of tools and equipment are used. Generic names of tools, such as a cutter, are not awarded marks.

Question 2

(a) Most candidates were able to list four additional points about the function of bottle carrying device for holding six bottles, that can be folded flat for storage and allows the six bottles to be carried in one hand that they considered to be important. Commonly seen answers referred to the unit being comfortable to hold, preventing the bottles colliding and smashing, and being easily assembled from being flat.

Candidates should be advised against repeating points that are given in the question, for example the product will be lightweight, or giving generic points, such as it must be safe, that might apply to almost any product. Candidates are encouraged to give responses of more than just one word if they are to gain the mark. For example, instead of just giving adjustable, it is better to say adjustable to suit a range of different bottle shapes and sizes.

(b) Most candidates used sketches and notes to good effect to show two methods of temporarily fixing lightweight graphic materials without the use of adhesive. The most seen responses were push together slot and tab joints, metal fastenings such as paper clips and split pins, Velcro and magnets. Some candidates incorrectly showed permanent joining methods, including the use of an adhesive. Many candidates showed methods relating to resistant materials such as wood joints and metal hinges which would not be suitable for lightweight graphic materials. The sketches and notes were almost always of a standard that allowed the joining method to be clearly communicated.

To score maximum marks, candidates must use both sketches and notes to show each method. A small number of candidates used only sketches and were awarded a maximum of one mark for each method.

(c) Some good sketches and annotations were seen for this question. The most seen responses involved the use of rigid graphic materials such as foamboard, corrugated card and corriflute slotted together to produce a carrier for the six bottles. In some responses it was unclear how the stand could be folded flat.

Some candidates showed designs made from resistant materials, such as wood or acrylic, rather than lightweight materials. 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 less than three ideas and were awarded pro rata marks.

(d) The evaluations of the ideas were generally good, with candidates able to clearly demonstrate an understanding of the positive and negative features of their design proposals. Candidates often focussed on the comfort of the holder in someone's hand, how securely the six bottles were held in place or the weight of the holder.

It is important that candidates justify their evaluations, rather than making generic statements such as it is strong, if they are to access the full range of marks. Almost all candidates were able to choose one idea to develop further and give reasons for their choice.

(e) A variety of methods were used to show the full solution to the design problem. These included orthographic drawings, exploded views, isometric views and developments (nets). Colour was frequently used to give clarity to the drawings. Construction details were often clearly shown through a three-dimensional sketch and a development (net) with labels identifying the materials and joining methods.

This question specifically asks for important dimensions but, particularly in weaker responses, these were often omitted.

(f) Most candidates were able to name two specific materials that would be used to make their design proposal and give reasons for their choices. Commonly seen materials were corrugated cardboard, corriflute (corrugated plastic sheet), acrylic and thin sheet aluminium with the reasons referring to the properties of the material, such as the strength to weight ratio, ability to fold flat, or resistant to water spills.

Candidates should be advised against giving generic names of materials, such as plastic, or generic reasons, such as easy to work with, as these are not awarded marks.

(g) Most candidates were able to identify and outline a method used to manufacture one part of their design proposal. Cutting out of thin sheet materials, either by hand or with the aid of CAD/CAM and joining with slotted joints or adhesives were commonly seen responses to this question. The most successful responses used a combination of sketches and notes to outline the method of manufacture. In a small number of responses candidates outlined manufacturing methods that were inappropriate for the material or solution proposed in **(e)**.

It is important that candidates include the correct names of the tools and equipment to be used in the method of manufacture if they are to access the full range of marks.

Question 3

(a) Most candidates that selected this question were able to list four additional points about the function of a device that allows heavy multipacks of bottles to be moved around a shop. Commonly seen answers related to the bottles being held securely on the platform, the device being easy to manoeuvre around the shop, being compact and easy to store when not in use and being height adjustable for different sized shop assistants.

Candidates should be advised against repeating points that are given in the question, such as the device must lift the bottles or generic points that could apply to any product such as strong.

(b) Most candidates used sketches and notes to good effect to show two mechanical methods of lifting an object such as levers, rack and pinion and pully systems.

To score maximum marks, candidates must use both sketches and notes to show each method. A small number of candidates produced only sketches and were awarded a maximum of one mark for each method.

(c) Some imaginative sketches with annotations were seen in response to this question, with many candidates clearly showing devices that had the potential to lift and transport the multipacks of bottles around a shop. It was, however, sometimes unclear how the design idea would work as the sketches showed only limited details of the mechanism used to lift and lower the multipacks of bottles.

It is important that all design proposals fully meet the design requirements if candidates are to access the full range of marks. A small number of candidates produced less than three ideas and were awarded pro rata marks.

(d) The evaluations of the ideas were generally well reasoned, with candidates able to clearly demonstrate an understanding of the positive and negative features of their design proposals. Points that focused on the effort needed to move the device around the shop, the ease of lifting the and lowering the multipacks of bottles and ensuring the multipacks did not fall off the device whilst in use were commonly seen.

It is important that candidates explain their thoughts rather than making broad statements, such as it would not work well, if they are to access the full range of marks. Almost all candidates were able to choose one idea and give a reason for their choice.

(e) A variety of methods were used to show the full solution to the design problem. These included orthographic drawings, exploded views, isometric views and materials lists. Colour was frequently used to add clarity to the drawings. Most candidates included some construction details for the individual parts of their design proposal but sometimes omitted to clearly show how these joined together to make the device.

This question specifically asks for important dimensions but, particularly in weaker responses, these were often missing.

(f) Most candidates were able to name two specific materials that would be used to make their design proposal and give reasons for their choices. Commonly seen materials were stainless steel, aluminium, pine and plywood. Reasons for selection usually related to the physical properties of the material such its durability or high strength to weight ratio.

Candidates should be advised against giving generic names of materials, such as metal, or generic reasons, such as easy to work with, as these are not awarded marks.

(g) Most candidates were able to identify and outline a method used to manufacture one part of their design. Commonly seen answers included the marking out, cutting and joining of pieces of material using hand production techniques. The use of welding, vacuum forming, injection moulding, 3D printing and the use of a laser cutter were also shown by many candidates. The most successful candidates used a combination of sketches and notes to outline a method of manufacture.

It is important that all candidates include the correct names of tools and equipment to be used in the method of manufacture if they are to access the full range of marks.

DESIGN AND TECHNOLOGY

Paper 0445/02
School Based Assessment

Key messages

- When designing, ideas and proposals should be evaluated against the specification, so that reasoned decisions can be made about modifications to ideas or the rejection of particular proposals. A detailed specification is important as it features in most of the assessment criterion.
- Some candidates combine the plan for making with the photographic log of manufacture. They are separately assessed items. The plan must be produced prior to the commencement of manufacture.
- Wherever possible, candidates should test their product in the environment it is intended for and by a potential user or client. Candidates must include clear photographic evidence and comment on the testing of their product.

General comments

Much of the work seen in this assessment session was of a very high standard, highlighting the important key skills, knowledge and understanding developed in the study of Design and Technology.

External moderators made it very clear that it was a real pleasure to moderate the work submitted. Virtually all candidates selected appropriate projects that enabled sufficient scope to have full access to the assessment criteria.

Presentation of work is mostly of a very good standard, structured in a concise and logical manner that reflects the assessment criteria.

More candidates are correctly applying greater focus on objective research on the design brief and intended user/s in Assessment Criterion 2. They are analysing the information gained when researching to be useful when designing.

Moderators appreciated the teacher annotation of project work on the ICRC forms. It was very helpful to see how the Centre had awarded marks and in some cases inform the moderator of important and relevant information.

It is very pleasing to see that there are a growing number of entries from new Centres.

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

Comments on specific sections

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

This criterion is generally assessed accurately and consistently. Most candidates had evidence of a detailed investigation and full analysis of the design need. The majority of candidates identified the intended user/s or client/s and produced a design brief. Some work in this section was very brief and limited. Candidates would benefit from looking at the needs and expectations of the selected user group/client in more detail and consider the type of environment in which the designed product will be used to highlight key issues.

Research into the Design Brief resulting in a Specification

Marking on this criterion was mostly in line with accepted standards. There was an increase in the number of candidates who correctly applied more focus on the design brief and intended user/s. Detail of materials, tools, finishes and manufacturing processes research should only be presented if it is directly relevant to the candidates' own design and make task. A lot of this information could be of value in Assessment Criterion 4. Candidates should be encouraged to gather relevant information and data such as key features of existing products, ergonomic consideration, environmental factors, the size and shape of items to be used in or with the product being developed. Summarising the findings of research can be helpful.

Generation and exploration of Design Ideas

Some of the design work produced was of a very high standard. Candidates presented Innovative and creative design ideas and possibilities were explored and developed through an integration of annotated freehand sketching and CAD drawings.

Whilst most Centres assess this section generally accurately, a significant number of Centres are over generous in their assessment. In some instances, candidates produced a range of very similar concepts with limited annotation. They would benefit from producing a wider range of possibilities, including creative solutions, which are conceptually different design ideas. Candidates should not focus on one or two concepts but record any ideas however impractical they may appear at the time.

Some candidates had limited evidence of consideration of their specification during the design activity. Design proposals should be evaluated against the specification, so that informed, reasoned decisions can be made about modifications to ideas or the rejection of particular proposals.

Development of Proposed Solution

Many candidates fulfilled the range of criterion requirements in the development of their proposed solution.

There was clear evidence of the use of modelling and trialling to help make decisions about the form and functions of the product Decisions about materials, components required and construction methods to be used, including finishes were clearly shown.

It is important that candidates use appropriate drawing methods to assist in the clarification of the technical specification of their proposed product.

Most candidates correctly used appropriate evaluative comments and clear references to their specification in this section.

Planning for Production

Most candidates produce detailed, dimensioned working drawings, with an increasing number making very good use of CAD. The majority of production plans were of a very good standard, presented in the form of a logical sequence of stages of manufacture including details such as material lists, fittings and finishes.

Some candidates combine the plan for making with the photographic log of manufacture. They are separately assessed items. The plan for making criterion requires a working drawing/s which include full details for manufacture and evidence of production planning leading to a logical sequence of the stages of manufacture including material lists, fittings and finishes.

The plan must be produced prior to the commencement of manufacture.

Product Realisation

Some of the practical work produced in this assessment session was of an exceptionally high standard. The care, attention to detail and skills demonstrated by many candidates was outstanding.

Centres are generally very accurate and consistent in their assessment of the practical outcome. Feedback on marking in the Moderators Comments on School-based Assessment of Coursework Report gives an indication of whether marking is in line with accepted standards.

The marking of some Centres is consistently over generous in this criterion, which is indicated in the Moderator's Report with a clear explanation of why marks have been adjusted. Please ensure that you have access to the Centres Moderator's Report. The guidance material available on the Support Hub and in particular the Coursework Handbook is very useful to gauge standards.

To achieve the highest mark range, the product must be complete and finished to a very high standard. It must function well, meet the requirements of the specification, and be made with precision and accuracy.

Testing and Evaluation

Most candidates fully completed their product and many tested the product in the environment in which it was intended. It is important that the testing is clearly evidenced in the folder using information gained on the strengths and weaknesses of the product and presented using photographs with detailed comment.

In many cases, the client or proposed user contributed to the testing and evaluation which is to be encouraged wherever possible.

Most candidates evaluated the product against the against their specification. It is crucial that the original specification clearly summarises the key design criteria established in their research in order to produce a full evaluation.

DESIGN & TECHNOLOGY

Paper 0445/31
Resistant Materials

Key messages

- ***Section A*** questions require short, sometimes one-word, answers testing their knowledge and understanding of the syllabus content.

  Candidates need to read the questions **carefully** so that they are clear about what needs to be addressed. Mark allocations and the space provided for answers should also give candidates a clear indication of what is required.

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

- Many questions require candidates to provide sketches and notes.

  Candidates need to improve their drawing skills so that they can communicate their ideas clearly and their written skills so that additional notes are legible and relevant.

General comments

Section A

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

Section B

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

Comments on specific questions

Section A

Question 1

Many candidates stated that seasoning reduced the moisture content of timber.

For a second mark, candidates needed to state that the reduction in moisture content would minimise the risk of warping and shrinkage.

Question 2

(a) A minority of candidates named extrusion as the process used to manufacture plastic tube.

(b) Three possible processes; injection moulding, vacuum forming and press forming were accepted as processes that could be used to manufacture the plastic washing-up bowl.

More candidates achieved one mark for this question than for **part (a)**.

Question 3

(a) The cramps shown were 'sash' cramps. Very few candidates recognised the sash cramp.

(b) Many candidates understood that the scrap wood protected the edges of the hardwood strips and that it also provided more even pressure from the cramps.

Question 4

Many candidates gained one mark for naming tool **A** correctly; scriber, but only a small minority recognised the centre square for tool **B**.

Question 5

(a) Only a few responses had shown a simple former that could be used when bending the acrylic sheet to the shape of the letter rack.

(b) Most candidates provided an advantage of using a strip heater rather than an oven to heat the acrylic sheet. An oven would heat the whole sheet, making bending very difficult, whereas a strip heater would only heat the specific area that needed to be bent.

Question 6

Very few candidates could describe how 'polymorph' granules could be used to produce the handle. Polymorph is a 'smart' material with which candidates should be familiar.

Question 7

Many candidates completed the tee halving joint with varying degrees of accuracy.

Question 8

The position of a single hinge shown at **A** should have given candidates a clue as to the 'piano' hinge answer. Many candidates named a butt hinge incorrectly.

Question 9

A minority of candidates showed the correct positions for three additional pegs that would be used when bending the brass strip to shape.

Question 10

Most candidates identified comfortable armrests, wheels to move the chair about and adjustable height as design features of chair **A**.

Most candidates identified an ability to fold flat, lightweight construction and materials and easy to carry as design features of chair **B**.

Section B

Question 11

(a) A good guide for candidates when asked to provide 'specification points' was to start with the prefix:

'The drill rack must…..'

The most common points made included; 'must not interfere with the drill in use', 'must be secure on the pillar of the machine' and 'must allow for easy access to the drill bits'.

(b) (i) Many candidates showed at least three layers, (plies), for one mark, but only a minority showed the alternating grain direction on the layers, (plies).

(ii) Plywood was more suitable than the solid wood for the drill rack because it is more stable; i.e. it is unlikely to warp or shrink in use.

(c) (i) Only a minority of candidates named a suitable tool for cutting out the Ø80 hole. Hole saw and Forstner bit were the most common correct answers. Many candidates named saws that would not be practical.

(ii) Only a small number of candidates correctly named a suitable tool; mortise machine or router capable of cutting out the recess.

(iii) For three marks candidates needed to state that:

- the waste would be sawn off
- the sawn edges would be filed
- the edges glasspapered smooth.

One mark was awarded for naming the tools and equipment correctly.

Most candidates achieved marks for partially complete answers.

Some candidates produced good, clear sketches and accurate notes for maximum four marks.

(d) Only a minority of candidates described how the depth gauge on the pillar drill could be set to the depth of 12 mm. However, many candidates described an innovative method; how 'tape', wrapped around the drill bit, would indicate when the 12 mm depth was achieved.

(e) (i) Only a few candidates could name the tool used to tighten the scan fitting. The best answers included Allen key, hexagonal key and hexagonal head screwdriver.

(ii) Generally, only a minority of candidates seemed familiar with the common knock-down, (KD) scan fitting.

Holes needed to be drilled in the collar and the rack to accommodate the two 60 mm long screws.

Holes needed to be drilled so that the barrel nut could be inserted into either the top or edge of the rack.

The screws could then be tightened inside the barrel nut to clamp the drill rack to the pillar of the drilling machine.

(f) Most candidates achieved some of the six marks available for showing a practical container for storing the safety glasses. In design-type questions with a six-mark allocation it is vital that candidates address **ALL** the bullet points stated. These are designed to focus the candidates' attention and therefore gain access to all available marks.

Sketches and notes often failed to communicate ideas clearly. Candidates are advised to focus on improving their quality of sketches in order to access all the marks available.

Question 12

(a) Stronger responses stated that a veneer was a thin layer of solid wood and that it could be used to cover less attractive manufactured boards.

(b) Stronger responses showing how veneers could be laminated to make the shape of the stand of the xylophone included the following details:

1. gluing several veneers together
2. the use of male and female formers that would be used to produce the shape
3. some method of clamping the veneers inside the formers while the glue set.

Some candidates gave excellent details showing how a single former and the use of a vacuum bag could produce an accurate laminated stand.

(c) (i) Many candidates named an appropriate tool that could be used to mark line A; including scriber and felt tip marker pen.

(ii) Odd leg calipers would be used to mark out line **B**. Very few candidates named the odd leg calipers.

(iii) A minority of candidates understood that a centre punch could be used to make an indentation in the metal at point **C**.

(iv) The majority of candidates named a hacksaw or junior hacksaw correctly.

(v) The only acceptable files that could be used to make the edges flat were 'hand', 'flat' or 'half-round' files.

(d) (i) Many candidates named abrasives such as 'sandpaper', (glasspaper), which was inappropriate as it is an abrasive that is used on wood, not metal.

There were a few correct answers stating 'emery cloth' and wet and dry' paper.

(ii) Most candidates recognised the advantages of spray painting over brush painting, including; quicker, it gave a more even finish and that it did not leave any brush strokes.

(iii) There were many excellent responses showing safety precautions to be taken when spray painting. These included a well-ventilated area and the wearing of gloves and face masks.

(e) Very few candidates provided designs for a successful jig that could be used when cutting 25 mm lengths of dowel. Often, candidates did not appreciate that 25 mm is a very short length to be sawn.

Sketches and notes often failed to communicate ideas clearly. Candidates are advised to focus on improving their quality of sketches in order to access all the marks available.

(f) Very often candidates tended to 'over-complicate' their design ideas for the storage of the beater to go with the xylophone. There were some very good, simple solutions including the drilling of holes in either end of the stand underneath the bars for the beater to 'sit' inside. Some designs showed a widened stand with a 'routered' groove in which the beater could sit. Some candidates designed a dedicated box for the beater but did not always show how this would be fitted to the stand.

(g) Most candidates did decide correctly that beech was more sustainable than mild steel and gained one mark. The best answers supporting the choice of beech stated that trees could be replaced by replanting or that trees were a renewable source while there was a finite supply of steel.

Question 13

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

(b) (i) Many candidates named a scroll, Hegner or band saw as an appropriate saw that could be used to remove the waste acrylic. Some candidates named saws such as the jig saw that would not be appropriate.

(ii) A minority of candidates named a 'hand', 'flat' or 'half-round' file correctly.

(iii) The only appropriate abrasive paper for finishing the edges of the acrylic was silicon carbide paper, also referred to as 'wet and dry' paper. Very few candidates stated this correctly.

(iv) Only a minority of candidates recognised that position **C** was the correct position where the acrylic edges would be placed against the polishing mop. The direction of rotation shown in Fig. 13.3 should have assisted candidates in their selection.

(c) (i) Many candidates gave benefits of using CAD to design the headphone stand. The most common answers referred to ease and speed of editing, the capability to transfer data to a CNC machine or the overall accuracy and precision provided by CAD.

(ii) The majority of candidates gave benefits of using CAM, rather than hand tools, to cut out the headphone stand. The most common answers referred to speed, increased accuracy, less need to 'finish' edges and less waste of materials.

(d) A minority of candidates gained two marks for showing a male and a female former. Marks were awarded for references to heating the acrylic and clamping it in position.

(e) Many designs showed complex methods by which the headphone stand could be made more stable. The best responses concentrated on making the base wider and/or heavier. Many designs did not consider the aesthetic feature of the stand and added 'props' or 'supports' to the front of the stand that were neither practical nor attractive. Many candidates showed little consideration of acrylic with 'incompatible' materials and constructions.

Often, the lack of clarity in both sketches and notes meant that marks were difficult to award. Candidates are advised to focus on improving their quality of sketches in order to access all the marks available.

(f) Solutions to the storage of the headphone cable could have included the use of simple 'hooks' or a 'bracket' around which the cable could be wrapped. The position of the storage 'device' was important with some candidates fitting this to the back or base of the stand appropriately. However, some solutions showed the cable stored on the front of the stand that would interfere with the headphones.

(g) Many candidates were rewarded for providing some relevant statements why the manufacture and use of products made from plastic could be harmful to the environment. The most common answers referred to not all plastics being able to be recycled, plastic products taking a 'lifetime' to decompose, that the manufacture of plastics gave off harmful gases into the atmosphere, an increase in polluted oceans and of landfill sites.

DESIGN & TECHNOLOGY

Paper 0445/32
Resistant Materials

Key messages

- ***Section A*** questions require short, sometimes one-word, answers testing their knowledge and understanding of the syllabus content.
  Candidates need to read the questions carefully so that they are clear about what needs to be addressed. Mark allocations and the space provided for answers should also give candidates a clear indication of what is required.
- Candidates need to improve their knowledge and understanding of the practical processes and techniques required when 'working' with wood, metal and plastic. In order to achieve this, candidates must be able to 'match' tools and equipment to specific purposes.
- Many questions require candidates to provide sketches and notes.
  Candidates are advised to improve their drawing skills so that they can communicate their ideas clearly and their written skills so that additional notes are legible and relevant.

General comments

Section A

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

Section B

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

Comments on specific questions

Section A

Question 1

Only a minority of candidates could name all three tools correctly. There were many variations given for the names of each tool. 'Chisel' was accepted even though the correct name was 'cold chisel' and 'snips' rather than 'tinsnips'.

Question 2

Most candidates gained some marks for showing a tongue and groove joint. Drawing accuracy is vital in questions of this type.

Question 3

(a) Only a few responses correctly named the centre lathe as the machine on which the metal handle could be made.

(b) The term 'knurled' is a centre lathe process. Only a few candidates demonstrated knowledge of this part of the syllabus.

Question 4

(a) Only a few responses demonstrated understanding that the middle board needed to be inverted to counterbalance the movement in the hardwood.

(b) There were two reasons why three boards were joined together to make the tabletop rather than using one wide board:

1. wide boards were not generally available in hardwoods
2. three boards joined correctly created a stable tabletop to prevent warping.

Question 5

(a) Many candidates named HDPE, ABS or PP as suitable plastics from which to make the bucket.

(b) The majority of candidates gave an advantage for using a plastic rather than steel for the bucket. The most common correct answers included that it was lighter in weight or that it was resistant to corrosion.

Question 6

Only a very small minority of candidates demonstrated any knowledge or practical experience of how to plane 'end grain' in solid wood. There were two methods.

1. Clamp a 'sacrificial' board of similar thickness to that being planed at the end of the board to prevent the end grain from splitting.
2. Plane from one edge to the middle of the board -stop- then plane to the middle from the opposite edge.

Question 7

Only a few responses correctly explained the term 'work hardened'. Candidates are advised to revise key terms in the different material areas.

Question 8

Only a minority of candidates were able to show an exploded view of a stopped housing joint. This joint is a common and basic form of construction.

Question 9

Most candidates gave 'heat' as the correct answer.

Question 10

(a) The question was about why **children** might prefer to play with the plastic truck rather than the wooden truck. Some responses provided generic advantages of using plastic rather than wood; for example, 'easy to clean', instead of focusing on the specific application referred to in the question.

The best responses included 'lightweight', 'no splinters', 'more realistic' and 'more detailed'.

(b) The majority of candidates concentrated on information about how plastic was non-biodegradable. There was often little reference to wood being produced from trees that could be replanted, or that plastics, derived from a finite source, oil, would eventually run out.

(c) Most candidates recognised that the plastic truck would be manufactured by means of injection moulding.

Section B

Question 11

(a) Most candidates provided at least one property of acrylic making it suitable for the rack. The most common answers included 'variety of colours', 'inherent colour', self-finished', 'easy to work' and 'easy to bend when heated'.

(b) The most common items of research provided by most candidates referred to sizes and quantity of the marker pens, ease of access and the location of the rack.

(c) (i) Most responses attempted to describe how a 3D 'real life' model would help evaluate its success or that measurements could be checked 'first hand'.

(ii) Most responses recognised that a computer program offered many opportunities to edit, to test and trial a wide variety of features, or that the program data could be transferred to a CNC machine.

A high degree of accuracy was also possible.

(d) (i) Many responses gained at least one mark for naming tools that could be used to mark lines on the surface of the acrylic. The most common answers included a scriber or marker pen. Chinagraph pencil and odd leg calipers were excellent answers provided by only a minority of candidates.

(ii) With five marks available for this question, most candidates were able to access at least one of the five marks. The best responses provided accurate technical information such as the names of tools and processes as well as clear sketches.

Most candidates started correctly by drilling a hole in the acrylic through which the blade of an appropriate saw would be inserted. The saw would then be used to cut out most of the waste, followed using files to finish the edges.

(e) Only a small number of response were able to show a practical jig that would allow the holes to be drilled accurately.

(f) Most responses showed understanding that the acrylic sheet needed to be clamped securely. A sacrificial board would be placed underneath the acrylic. Additional information relating to drill speed, sacrificial material under the cramp to protect the surface of the acrylic was also rewarded.

(g) Many candidates demonstrated a good understanding of the method used to bend the acrylic to the shape of the rack. Relevant details included the method of heating the acrylic, a former or mould around which the acrylic could be bent and the method of retaining the acrylic while it cooled in position.

Question 12

(a) (i) Most candidates named a suitable hardwood. The most popular answers included oak and beech.

(ii) There was a variety of plastics that were suitable for the containers. Many candidates named one from ABS, HIPS, PP, PLA and acrylic.

(iii) Many candidates named steel and its variants, including mild steel and stainless steel, correctly.

There were some candidates who named non-ferrous metals such as aluminium incorrectly.

Candidates following a Resistant Materials course are advised to revise the difference between ferrous and non-ferrous metals.

(b) The majority of candidates showed a method of joining the two containers by means of magnets or 'velcro'. These methods would only achieve limited success. There were a minority of stronger responses showing some form of 'clip' that could be removed quickly and easily from the containers. Some solutions using screws or nuts and bolts were impractical since they would interfere with the salt and pepper shakers.

(c) (i) Many candidates named a scriber or marker pen correctly as the tool that could be used to mark out line A on the sheet of ferrous metal.

(ii) The only tool that could be used to mark out arc **B** on the sheet of ferrous metal was a pair of dividers. Compasses, named by many candidates, are not a metalworking marking out tool.

(iii) Many candidates named a centre punch correctly as the tool that would mark the centre for hole **C**.

(d) (i) The most suitable abrasives that could be used to prepare the metal to take a 'finish' were emery cloth, wet and dry, (silicon carbide), paper, steel or wire wool. Many candidates named 'sandpaper' that is only used on wood-based products.

(ii) Very few candidates were able to name the plastic used in the dip coating process: polythene.

(iii) The most common finish named by candidates was 'paint'. An alternative was to 'electroplate' the material. Chromium and galvanizing were also good answers provided by a minority of candidates.

(e) The best way of drilling a hole in the centre of the dowel was by inserting the dowel into a 3-jaw chuck on a woodturning or metal centre lathe. This method was identified by a very small minority of candidates. Limited reward was given for alternative methods because they would not achieve the level of accuracy provided by a centre lathe.

(f) Many responses included a 'butted' base against the edges of the 4mm thick acrylic, which is not what the question was asking. The question stated '**inside the tube'**. The best responses noted the dimensions 42 mm × 42 mm alongside the sketches, that referred to the inside measurements of the base.

(g) (i) Candidates demonstrated a reasonable understanding of the issues relating to the sustainability of metal and plastic.

Many candidates concentrated on the non-biodegradable property of ferrous metals while others explained that ferrous metals are produced from a non-renewable finite source and that the production of ferrous metals uses a lot of energy.

(ii) Plastic is made from a finite source. Many candidates explained that plastic is produced by processing oil, gas or coal and uses lots of energy and not all plastics can be recycled,

Question 13

(a) (i) The vast majority of candidates named a suitable hardwood for the end frame of the desk.

(ii) Many candidates gave reasons for using hardwood rather than softwood for the desk. The most common answers stated that hardwood was more durable or more attractive.

(iii) The vast majority of candidates named a suitable manufactured board for the desktop. The most common answers included plywood and MDF.

(iv) Many candidates named 'veneer' correctly.

(v) The best reason for applying a veneer to the desktop was to give an attractive appearance, to make it look like hardwood or that it would give the appearance of hardwood without the expense. Veneers do not offer 'protection'.

(b) (i) Many candidates named a marking gauge that would be used to draw the centre lines for the dowels.

(ii) Many candidates stated two dowels correctly.

(iii) Many candidates stated diameters of dowel that were impractical. Candidates needed to look carefully at the thickness of the rail and leg shown in Fig. 13.2. The thickness of 25 mm meant that the hole required to take the dowel could not exceed a maximum Ø12 mm. The minimum diameter of dowel should not be less than Ø6 otherwise it would be too weak.

(c) (i) Many candidates showed two cramps securing the end frame when glued.

For maximum four marks the cramps had to be shown below the centre of each rail and pieces of scrap wood shown between the cramp 'jaws' and the frame itself.

(ii) Sash cramps, 'F' cramps and quick (release) cramps were named correctly by many candidates

(iii) Many candidates achieved at least one mark for stating a check that would be carried out after gluing and clamping the frame. The most common answers referred to the removal of surplus glue and to check for tightness of the cramps. Some candidates referred to the frame being flat, not twisted or 'in winding'.

(d) Many candidates showed a practical method of 'guides' for the drawer to slide in out easily.

Many candidates showed a groove cut in either the side of the drawer or the support and a corresponding 'bead' applied to either the side of the drawer or the support. However, the question did require candidates to: 'Give details of all materials and constructions used'.

Many candidates denied themselves marks by not addressing this part of the question.

(e) There were many good designs showing the drawer divided into three areas partitioned.

Those designs achieving maximum marks addressed all parts of the question and provided:

- details of the constructions, showing how the partitions were joined inside the drawer
- important sizes that related accurately to the dimensions of the drawer
- appropriately named materials.

DESIGN & TECHNOLOGY

Paper 0445/33
Resistant Materials

Key messages

- ***Section A*** questions require short, sometimes one-word, answers testing their knowledge and understanding of the syllabus content.

  Candidates need to read the questions **carefully** so that they are clear about what needs to be addressed. Mark allocations and the space provided for answers should also give candidates a clear indication of what is required.

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- Many questions require candidates to provide sketches and notes.

  Candidates need to improve their drawing skills so that they can communicate their ideas clearly and their written skills so that additional notes are legible and relevant.

General comments

Section A

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Comments on specific questions

Section A

Question 1

Many candidates stated that seasoning reduced the moisture content of timber.

For a second mark, candidates needed to state that the reduction in moisture content would minimise the risk of warping and shrinkage.

Question 2

(a) A minority of candidates named extrusion as the process used to manufacture plastic tube.

(b) Three possible processes; injection moulding, vacuum forming and press forming were accepted as processes that could be used to manufacture the plastic washing-up bowl.

More candidates achieved one mark for this question than for **part (a)**.

Question 3

(a) The cramps shown were 'sash' cramps. Very few candidates recognised the sash cramp.

(b) Many candidates understood that the scrap wood protected the edges of the hardwood strips and that it also provided more even pressure from the cramps.

Question 4

Many candidates gained one mark for naming tool **A** correctly; scriber, but only a small minority recognised the centre square for tool **B**.

Question 5

(a) Only a few responses had shown a simple former that could be used when bending the acrylic sheet to the shape of the letter rack.

(b) Most candidates provided an advantage of using a strip heater rather than an oven to heat the acrylic sheet. An oven would heat the whole sheet, making bending very difficult, whereas a strip heater would only heat the specific area that needed to be bent.

Question 6

Very few candidates could describe how 'polymorph' granules could be used to produce the handle. Polymorph is a 'smart' material with which candidates should be familiar.

Question 7

Many candidates completed the tee halving joint with varying degrees of accuracy.

Question 8

The position of a single hinge shown at **A** should have given candidates a clue as to the 'piano' hinge answer. Many candidates named a butt hinge incorrectly.

Question 9

A minority of candidates showed the correct positions for three additional pegs that would be used when bending the brass strip to shape.

Question 10

Most candidates identified comfortable armrests, wheels to move the chair about and adjustable height as design features of chair **A**.

Most candidates identified an ability to fold flat, lightweight construction and materials and easy to carry as design features of chair **B**.

Section B

Question 11

(a) A good guide for candidates when asked to provide 'specification points' was to start with the prefix:

'The drill rack must…..'

The most common points made included; 'must not interfere with the drill in use', 'must be secure on the pillar of the machine' and 'must allow for easy access to the drill bits'.

(b) (i) Many candidates showed at least three layers, (plies), for one mark, but only a minority showed the alternating grain direction on the layers, (plies).

(ii) Plywood was more suitable than the solid wood for the drill rack because it is more stable; i.e. it is unlikely to warp or shrink in use.

(c) (i) Only a minority of candidates named a suitable tool for cutting out the Ø80 hole. Hole saw and Forstner bit were the most common correct answers. Many candidates named saws that would not be practical.

(ii) Only a small number of candidates correctly named a suitable tool; mortise machine or router capable of cutting out the recess.

(iii) For three marks candidates needed to state that:

- the waste would be sawn off
- the sawn edges would be filed
- the edges glasspapered smooth.

One mark was awarded for naming the tools and equipment correctly.

Most candidates achieved marks for partially complete answers.

Some candidates produced good, clear sketches and accurate notes for maximum four marks.

(d) Only a minority of candidates described how the depth gauge on the pillar drill could be set to the depth of 12 mm. However, many candidates described an innovative method; how 'tape', wrapped around the drill bit, would indicate when the 12 mm depth was achieved.

(e) (i) Only a few candidates could name the tool used to tighten the scan fitting. The best answers included Allen key, hexagonal key and hexagonal head screwdriver.

(ii) Generally, only a minority of candidates seemed familiar with the common knock-down, (KD) scan fitting.

Holes needed to be drilled in the collar and the rack to accommodate the two 60 mm long screws.

Holes needed to be drilled so that the barrel nut could be inserted into either the top or edge of the rack.

The screws could then be tightened inside the barrel nut to clamp the drill rack to the pillar of the drilling machine.

(f) Most candidates achieved some of the six marks available for showing a practical container for storing the safety glasses. In design-type questions with a six-mark allocation it is vital that candidates address **ALL** the bullet points stated. These are designed to focus the candidates' attention and therefore gain access to all available marks.

Sketches and notes often failed to communicate ideas clearly. Candidates are advised to focus on improving their quality of sketches in order to access all the marks available.

Question 12

(a) Stronger responses stated that a veneer was a thin layer of solid wood and that it could be used to cover less attractive manufactured boards.

(b) Stronger responses showing how veneers could be laminated to make the shape of the stand of the xylophone included the following details:

1. gluing several veneers together
2. the use of male and female formers that would be used to produce the shape
3. some method of clamping the veneers inside the formers while the glue set.

Some candidates gave excellent details showing how a single former and the use of a vacuum bag could produce an accurate laminated stand.

(c) (i) Many candidates named an appropriate tool that could be used to mark line A; including scriber and felt tip marker pen.

(ii) Odd leg calipers would be used to mark out line **B**. Very few candidates named the odd leg calipers.

(iii) A minority of candidates understood that a centre punch could be used to make an indentation in the metal at point **C**.

(iv) The majority of candidates named a hacksaw or junior hacksaw correctly.

(v) The only acceptable files that could be used to make the edges flat were 'hand', 'flat' or 'half-round' files.

(d) (i) Many candidates named abrasives such as 'sandpaper', (glasspaper), which was inappropriate as it is an abrasive that is used on wood, not metal.

There were a few correct answers stating 'emery cloth' and wet and dry' paper.

(ii) Most candidates recognised the advantages of spray painting over brush painting, including; quicker, it gave a more even finish and that it did not leave any brush strokes.

(iii) There were many excellent responses showing safety precautions to be taken when spray painting. These included a well-ventilated area and the wearing of gloves and face masks.

(e) Very few candidates provided designs for a successful jig that could be used when cutting 25 mm lengths of dowel. Often, candidates did not appreciate that 25 mm is a very short length to be sawn.

Sketches and notes often failed to communicate ideas clearly. Candidates are advised to focus on improving their quality of sketches in order to access all the marks available.

(f) Very often candidates tended to 'over-complicate' their design ideas for the storage of the beater to go with the xylophone. There were some very good, simple solutions including the drilling of holes in either end of the stand underneath the bars for the beater to 'sit' inside. Some designs showed a widened stand with a 'routered' groove in which the beater could sit. Some candidates designed a dedicated box for the beater but did not always show how this would be fitted to the stand.

(g) Most candidates did decide correctly that beech was more sustainable than mild steel and gained one mark. The best answers supporting the choice of beech stated that trees could be replaced by replanting or that trees were a renewable source while there was a finite supply of steel.

Question 13

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

(b) (i) Many candidates named a scroll, Hegner or band saw as an appropriate saw that could be used to remove the waste acrylic. Some candidates named saws such as the jig saw that would not be appropriate.

(ii) A minority of candidates named a 'hand', 'flat' or 'half-round' file correctly.

(iii) The only appropriate abrasive paper for finishing the edges of the acrylic was silicon carbide paper, also referred to as 'wet and dry' paper. Very few candidates stated this correctly.

(iv) Only a minority of candidates recognised that position **C** was the correct position where the acrylic edges would be placed against the polishing mop. The direction of rotation shown in Fig. 13.3 should have assisted candidates in their selection.

(c) (i) Many candidates gave benefits of using CAD to design the headphone stand. The most common answers referred to ease and speed of editing, the capability to transfer data to a CNC machine or the overall accuracy and precision provided by CAD.

(ii) The majority of candidates gave benefits of using CAM, rather than hand tools, to cut out the headphone stand. The most common answers referred to speed, increased accuracy, less need to 'finish' edges and less waste of materials.

(d) A minority of candidates gained two marks for showing a male and a female former. Marks were awarded for references to heating the acrylic and clamping it in position.

(e) Many designs showed complex methods by which the headphone stand could be made more stable. The best responses concentrated on making the base wider and/or heavier. Many designs did not consider the aesthetic feature of the stand and added 'props' or 'supports' to the front of the stand that were neither practical nor attractive. Many candidates showed little consideration of acrylic with 'incompatible' materials and constructions.

Often, the lack of clarity in both sketches and notes meant that marks were difficult to award. Candidates are advised to focus on improving their quality of sketches in order to access all the marks available.

(f) Solutions to the storage of the headphone cable could have included the use of simple 'hooks' or a 'bracket' around which the cable could be wrapped. The position of the storage 'device' was important with some candidates fitting this to the back or base of the stand appropriately. However, some solutions showed the cable stored on the front of the stand that would interfere with the headphones.

(g) Many candidates were rewarded for providing some relevant statements why the manufacture and use of products made from plastic could be harmful to the environment. The most common answers referred to not all plastics being able to be recycled, plastic products taking a 'lifetime' to decompose, that the manufacture of plastics gave off harmful gases into the atmosphere, an increase in polluted oceans and of landfill sites.

DESIGN & TECHNOLOGY

Paper 0445/41
Systems and Control

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

DESIGN & TECHNOLOGY

Paper 0445/42
Systems and Control

Key messages

- Questions requiring a 'State' or 'Give' answer will only require a short response.
  Any 'Describe' or 'Explain' questions will require more detail, and responses should be given in sentences rather than as short notes. As a guideline one mark is awarded for each valid point, up to the total for the question. Questions requiring sketches and notes should ideally be answered with both.
- Legible writing is vital. If the Examiner cannot read the response marks will not be awarded.
- Use of terms such as 'strong,' 'weak' or 'easy' should be avoided unless they are justified by adding additional information.
- Candidates should be advised to read all ***Section B*** questions carefully before deciding which one to answer. There were several cases where candidates had answered more than one question in ***Section B*** or had started to answer a question and abandoned it after a few parts.
- Candidates who run out of space in a response can either use space next to the question or the blank pages at the back of the question paper.
  When this is done an indication of where to find the response is advised.
- In questions that require either a single answer or a set number of answers it is important that candidates do not enter additional answers.
- Any spare time should be used by candidates to check that all the required questions have been attempted. Where there has been 'no response' it is a guaranteed 'no marks.'

General comments

In ***Section A*** the questions were accessible to most candidates, only a few had failed to answer all questions in the section. This reflected the preparation that centres had provided for the Key Content section of the syllabus.

In ***Section B*** the mechanism question proved to be the most popular with over half of all candidates attempting it. The electronics question was the least popular, but where it had been answered the marks for the question were generally high.

Candidates should be aware that questions in ***Section B*** may include topics from the Key Content or Common Content sections of the syllabus.

All of the ***Section B*** questions included parts that required calculation. In general, these were answered well, with the working being provided as well as the answer. In a few cases it was clear that the units being used in the calculation were not fully understood.

Where calculation answers result in either very large or very small numbers it is acceptable for candidates to use engineering notation.

Comments on specific questions

Section A

Question 1

This question was answered well by almost all candidates, with many gaining full marks.
The most frequent error was in mistaking **item C**, a castle for a frame structure.

Question 2

There were a few generic responses to this question, such as 'strong' that did not gain marks. What was required to gain the mark was 'strong in tension.' The properties required were those that made steel suitable for use in cables, a particular use that required the steel to be drawn out into a wire that could be incorporated into a cable, ductility was a correct answer frequently given. Weaker responses had given general properties of steel, many of which were not applicable to cables.

Question 3

The correct answer was 'Triangulation' and this was given by most candidates.

Question 4

Several responses had failed to answer the last part of the question. The phrase, 'when designing a car' in the question was often missed, resulting in answers about the general reduction of friction and the use of lubrication. Successful responses had mentioned aerodynamic or streamlined shaping of the car body, use of materials with a low coefficient of friction or reduction of areas in contact.

Question 5

Use of lubrication was correctly given in most cases; the second mark was given if the type of lubrication was specified.

Question 6

(a) This question was answered well by the full range of candidates. There were a few cases where slight variations for the type of motion had been used, e.g. 'circular' for rotary. Where it was understandable the mark was awarded.

(b) An example of oscillating motion was needed, the favourite being a clock pendulum. Other valid responses included a child's swing or a crank and slider mechanism. Most candidates gained the mark.

Question 7

(a) Almost all candidates were able to state the purpose of a switch in an electronic circuit. A few responses went into more detail than was needed to gain the mark.

(b) The majority of stronger responses recognised the reed switch. Weaker responses gave the answer as 'a switch' or a specific, incorrect type of switch.

(c) Any who had gained the mark for **part (b)** were able to describe correctly how the reed switch is operated. In most cases a mark could be given for use of a magnet. The precise functioning of the switch/how the magnet performs the switching was not so well known.

Question 8

There were three marks available for the conversion of values into volts. Confusion between 'milli' and 'mega' led to several errors. Stronger responses generally gained all three marks. Conversion of 2.1 kV to 2100 V produced very few errors. Most errors occurred with conversion of the last value, 20 mV, where mV was interpreted as MV or in a few cases as kV.

Section B

Question 9

(a) (i) Candidates generally showed some understanding of moments and were able to state what a moment is in terms of force being multiplied by distance. Most candidates had answered this part.

(ii) The unit of measurement for moments calculations was well known to some candidates. Errors from lower responses included omission of the metres from the unit or using m^2 after the 'N'.

(iii) This was a question that required careful reading of the stem. The value being looked for was the minimum force necessary **to open the door**. The basic calculation presented very little difficulty to the top 50 per cent of responses and in most cases the correct answer was arrived at.

This provided two of the marks; for the third mark it was the minimum force necessary to open the door, this would be any value greater than the answer to the calculation. This was a force > 4.41 N.

Many of the responses had stopped after the initial calculation. This would have given a value that would support equilibrium, rather than opening the door.

(b) Benefits and drawbacks from weaker responses were often restricted to generic terms, e.g. 'strong.' Those who commented on the visible features of each method gained the mark, e.g. with method **B** a benefit was that is a simple joint that could be produced on site without any specialist equipment. A drawback was that the two parts are not in line. With two of the beams the joint resulted in the beams being in line with each other. Responses that did not make use of the visible features of the joint were not rewarded. Valid benefits beyond those included in the mark scheme were accepted.

(c) (i) Points that referred to structural uses of lamination, such as 'layers of material joined using adhesive' were accepted. Any that referred to the use of decorative laminates were not accepted.

(ii) Any materials that could possibly be used in lamination were accepted; these ranged from wood used in laminated beams to polymer sheet used in laminated glass.

(d) (i) The joining method shown used rivets, which is a permanent method of joining metal parts. Higher scoring responses had generally recognised the methods used. A few responses had given the gusset plates as the method of joining. These were a strengthening/reinforcing feature rather than the joining method.

(ii) A higher proportion of candidates gained marks in this part compared to the previous part. A key feature of welding is the fact that it is faster and will incur lower labour costs than the use of rivets. Mention of welding being permanent did not gain a mark because riveting is also permanent.

(e) (i) Most candidates recognised that equilibrium refers to a state of balance where forces on each side of a structure are equal.

(ii) Many of the responses to supporting the flagpole in a vertical position used guy ropes/wires from the flagpole to the ground. For stability at least three would be required; a suitable method like this would gain the first mark. Each of the guy ropes would require anchoring to the ground, if this were either sketched or noted the second mark was given. For the third mark the method had to be functional, meaning that it would work in practice. Any who had drawn the fixing on the flagpole too low or the anchor points to close to the flagpole were not given the mark.

(f) The equation for strain was given in the question so candidates only had to substitute the values into the equation. Stronger responses demonstrated this without problem, carrying out either a conversion of 15 metres to millimetres or converting the change in length from millimetres to metres.

The resulting value could either have been given as 0.000133 or 1.33×10^{-4}.
The main errors encountered were in the conversion of 15 metres to millimetres.

Question 10

(a) (i) A high proportion of candidates answering this question identified the garden loppers as using a first order lever. The small number who did not gain the mark had used either second order, third order or had not given a response.

(ii) Marking the positions of the fulcrum, load and effort was accurately completed by most candidates. The small number of errors had resulted from placing the load between the fulcrum and effort.

(iii) Maintenance of a piece of mechanical equipment such as the garden loppers would be to counter the effects caused by the working conditions, e.g. contact with moisture, sap from branches and in some cases soil. After regular use, the blades could become blunt so sharpening blades would be

a maintenance task. Sap or moisture on the blades could potentially cause corrosion or loss of easy movement; this would be controlled by cleaning the blades and lubrication. The only method of adjustment is through the centre not holding the blades together. If that becomes loose a clean cut will not be possible.

In the mark scheme two marks can be gained from a full description of a single point. E.g. 'Adjustment of the centre nut' could be one mark, followed by 'to ensure that the blades are close enough to cut cleanly' or 'the cutting action is not too stiff' would be the second mark.

(iv) With this calculation the formula for mechanical advantage was not given. A high proportion of candidates arrived at the correct answer though. The only error that occurred in a small number of cases was in dividing 50 by 475.

(b) (i) This part required two answers: calculation of the movement caused by two turns of the handle and recognition of the direction of travel of the drill table.

The movement in the drill table for a single turn would move the table a distance equal to the pitch of the teeth on the rack, which was given as 2.5 mm. Moving the handle clockwise through 720º is two turns of the handle, which is equal to a movement of 2 × 2.5 mm. A few weaker responses had used the 720º to multiply by arriving at a very large figure for the movement. Candidates should be advised to carry out a rough calculation first to confirm what appears on their calculator, this would cut out a lot of mistakes. For the final mark, the direction of travel was required. Clockwise rotation of the handle means that the worm wheel is moving clockwise, this will cause the 30t pinion to move anticlockwise, lifting the table.

(ii) Reasons for choosing a rack and pinion gear required candidates to consider the properties of a worm and wheel, the one-way movement meaning that the heavy table cannot slip when it is being adjusted. A full turn of 360º will result in a movement of only 2.5 mm, so precision is possible when adjusting. There is a high mechanical advantage, so little effort goes into the movement. The rack itself can run the full length of the drill pillar allowing for a lot of movement. The teeth on the rack will have a high resistance to shear so will be able to support the weight of the table. A high proportion of stronger responses gave a successful explanation and gained the two marks.

(iii) Several responses showed a basic recognition of the plain bearing. Top responses were able to fully describe the bearing. In some cases, reasons for using particular materials were accurately given.

(iv) Reasons for choosing a plain bearing should include the fact that rotation will be very slow meaning that wear on the bearing surface will be insignificant. A common factor among responses was the low maintenance requirements. The bearing is also easily replaced if necessary.

(v) Prevention of wear in the rack and pinion gear system should include the use of lubrication. Oil will not be suitable as it would run off the surfaces. If grease were mentioned as a suitable lubricant, it would give the second mark for the part question.

(c) (i) Understanding of an idler gear in a gear train requires knowledge of what happens when two gears in a gear train rotate against each other. The direction of rotation as well as the output speed of the driven gear will change. Use of an idler between the driver and driven will allow same direction rotation without changing the relative speed of the driven gear. These points were the ones most frequently seen in responses. One factor that did not appear often was the ability of an idler to adjust or vary the distance between input and output shafts. Weaker responses generally gained at least one mark on this part.

(ii) Calculation of the output speed and the direction of rotation were not an issue to the candidates answering this question. The gear ratio proved no problem and in most cases the output direction was correctly noted, either with the word in the response space or with an anticlockwise arrow against the driven gear. A high proportion of responses gained all three marks.

Question 11

(a) (i) This question required candidates to know that an ammeter is connected in series. Of those answering this question the majority recognised this aspect and gained the first mark. The second mark was for getting the polarity correct. Again, the responses were mainly correct.

(ii) Knowing that a voltmeter is connected in parallel across the LED was the key gaining the marks. In a few cases the parallel connection was incorrectly made across R_1. As with the previous part the second mark was for correct polarity with the negative side of the voltmeter being connected to the LED cathode.

(b) (i) Stronger responses generally gained all three marks, a small number had made a mistake with the purpose of one of the items.

(ii) Reasons for using flux were not well known, with many responses not recognising that flux will prevent oxidation of both surfaces of both parts being soldered. The fact that flux will allow solder to flow better was seen rather more frequently. Those who stated that the flux will clean the joint were allowed the mark though it is only active fluxes that have a cleaning action, and in most cases they have to be washed off after soldering.

(iii) A wide variety of connection methods were seen and in most cases, sketching was good and the accompanying notes provided a clear description. In a few cases methods such as connection of surface mount components were used, they wee not accepted as surface mount connection requires soldering. The question clearly stated that soldered connections were not allowed.

(c) (i) Stronger responses generally recognised that capacitors **X** and **Y** were polarised. Following this they went on to explain the dangers of connecting polarised capacitors the wrong way round.

(ii) Most candidates did not answer this part well. Capacitor connection works in reverse to the way of resistor connection. With resistors in series the values are added, with capacitors in parallel the values are added. A small number of responses had correctly noted that in a timing circuit the delay would be increased.

(d) (i) Fig. 11.4 showed connections for a 555 astable circuit. This meant that the output would be a regular astable pulse. Any indication that the pulse would be regular was sufficient to gain the mark. A description of the astable output as being a continued on – off – on pulse would gain the mark for 'astable.'

(ii) For those who have carried out astable calculations this part provided no problem. The main point for candidates to note was that the 20 kΩ potentiometer was set to 12 kΩ, which was the figure that needed substituting for R_2 in the formula. A few candidates had entered the final value and not included the working. Whilst full marks are given for this if the answer is correct, it does mean that any marks for a part of the calculation being correct cannot be awarded.

(iii) There were four marks for this part requiring all connections necessary for a working circuit had to be added. The simplest, which most managed to get was the signal lamp connections from the relay normally open contact on one side and to ground on the other. With the transistor the base and emitter needed connecting. The diode had to be connecting with the anode to the 9V rail and cathode to the collector of Tr1. A common error was to miss off the connection 'blobs' where two or more connections joined.

DESIGN & TECHNOLOGY

Paper 0445/43
Systems and Control

Key messages

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

  If additional space is used the question and part number must appear clearly next to the response.

- Candidates should be reminded that failure to make a response will always result in no mark being awarded for that question. If an answer is offered there is a chance that it will gain a mark.

General comments

The majority of questions in ***Section A*** proved to be accessible to candidates and there were only a few questions with no response. There was clear evidence that all of the Key Content had been covered by centres when preparing their candidates. It should be noted that Key content and Common content from the syllabus may also appear in ***Section B*** questions.

In ***Section B*** the structures question was the most popular with 84 per cent of candidates answering this question. 16 per cent answered the mechanisms question and there were no responses to the electronics question.

All responses should appear in the space allocated. If there is not enough room the response can be continued on the blank pages at the end of the booklet. If additional space is used the question and part number must appear clearly next to the response.

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.

Comments on specific questions

Section A

Question 1

(a) Naming of two fossil fuels proved to be a straightforward lead into the paper for the majority of candidates. Only a small number had answered with incorrect fuels such as ethanol, carbon monoxide or carbon dioxide. Coal, natural gas and oil were the most popular responses.

(b) The provision of power at night from solar energy was a two-mark question with the first mark coming from a recognition that power from the sun can be stored. The required storage method was in a battery, though responses simply stating that power can be stored during the day gained a single mark for the question. The second mark was for stating that the battery discharges at night releasing electricity for use.

Question 2

The waterwheel structure shown in Fig. 2.1 was correctly identified by some candidates as a frame structure. Incorrect answers came in the form of other types of structure or in a few cases all types of structure.

Question 3

The use of triangulation in a structure was recognised by some candidates as being to provide stability or to form a rigid structure. Some candidates gave responses that stated that the strength of the structure had been increased but did not state how the strength was increased. Tension and static load were very well understood by a full range of candidates. Torsion was often the force that was poorly described or was missing an example.

Question 4

The question asked for descriptions of the three forces to include examples; in many weaker responses the examples were missing. Tension was very well understood by a full range of candidates. Torsion and static load were often the force that were poorly described or missing an example.

Question 5

Reasons for using spur gears focused mainly on the change in gear ratio and speed without any slipping. Stronger responses had mentioned the precise positioning possible. Those who had mentioned that spur gears fit into a small space gained a mark through benefit of the doubt as other transmission systems can fit into small spaces. The question discriminated well between different levels of candidate.

Question 6

Most candidates were able to mention use of an idler gear to gain the first mark. The second mark came from recognition that an odd number of gears will result in driver and driven shafts rotating in the same direction.

Question 7

The basic shape of a parallel linkage was seen in stronger responses, which were frequently awarded both marks for the question. The second mark was for showing the position of either fixed or moving pivots. Weaker responses had either not drawn any type of linkage or had not included any pivot points.

Question 8

Of the four electronic symbols shown the signal lamp and LDR were the most frequently correct. Weaker responses had often mistaken the capacitor symbol for a cell or battery and the diode symbol for an LED.

Question 9

The full range of candidates were able to place the resistance values in the correct order. The largest value, 3 MΩ and the smallest, 82R were the values most frequently misplaced. All candidates had attempted the question.

Section B

Question 10

(a) (i) A high proportion of candidates recognised that the steel rods in Fig. 10.1 were resisting tension.

(ii) Threaded sleeves are frequently used as an adjustment method for tensioning elements in a structure. The explanation given required an understanding of how increasing or reducing the length of the rod will affect the tension in the rod. That understanding provided one mark for those candidates who had included it. For the threaded sleeve to have a shortening effect it has to operate on both rods together. For that to happen a right-hand thread and a left-hand thread are needed. When the sleeve is rotated both rods will then be drawn in simultaneously. The strongest responses managed to provide a clear explanation of this.

(iii) The gusset plate was correctly identified in stronger responses, which went on to explain that the gusset plate will reduce movement between the two poles and prevent distortion. Any reference to the load being distributed was given credit.

(iv) This part was not answered well by many of the candidates. The links could provide a small amount of movement when the threaded sleeves are adjusted as they have pivot points at each end. A general fault was to say that the links were there simply to attach the adjusting rods to the steel poles.

(v) Clear knowledge of the properties of concrete was shown by most candidates. Most had given 'strength in compression' as the first reason for use in the foundation. 'Resistance to weather conditions' was an acceptable reason but candidates should pay attention to the weather conditions that will actually have an effect. The positioning of a foundation, largely below ground will reduce the effect of frost damage. A few responses mentioned the ease of pouring the concrete on site rather than having to transport a finished concrete casting to the site.

(b) (i) In almost all responses the wheelbarrow was recognised as a second order lever. In many cases candidates had done a small drawing to help them to identify the order of lever. Another approach was to write the letters L F E followed by F L E, then F E L to indicate each order of lever.

(ii) Most candidates had no problem in identifying the structural member as a strut, which will resist compression caused as the wheelbarrow is lifted. Weaker responses did not correctly identify this.

(iii) The drawings in Fig. 10.2 showed two methods of loading the wheelbarrow, in each the load is positioned differently. By moving the load to the front, it is closer to the fulcrum, which will increase the effect of the lever; by doing that the efficiency of the wheelbarrow is increased. Most responses showed understanding of this principle and gained at least one mark for the part.

(iv) When the wheelbarrow is in use it will either be stationary, or the handles will be lifted in order to push the wheelbarrow. When it is stationary the ground will provide an upward force to balance the load on the barrow, this amounts to equilibrium. When moving the users hand will supply the balancing force to provide equilibrium. This principle was understood by a high proportion of candidates but the weaker responses were at times poorly expressed.

(v) The setting out of the moments calculation was managed by most candidates. Calculation of the load was generally correct, arrived at by multiplying the number of bricks, the weight of a single brick and the conversion factor to Newtons. Candidates who had lost marks in the next stage had generally failed to add the two given dimensions together to give the distance from effort to fulcrum. With this question which has definite stages within the calculation it is important that candidates realise the merits of writing down of each stage. Intermediate marks can be awarded even where the final answer is incorrect.

(c) (i) Two advantages of nail plates over traditional joints were required, most candidates had gained a least one mark. Advantages most frequently seen related to low cost and increased speed of production.

(ii) Almost all candidates gained at least one mark for this part. Natural defects such as knots, splits or warping were accepted as well as the effects of termites or woodworm.

Question 11

(a) (i) View **B** in Fig. 11.1 shows the operating lever to a badge machine The requirement of the question was to state the order of lever used in the machine. Most candidates recognised it as first order.

(ii) There was one extra space on view **B** when it came to indicating positions of the load, effort and fulcrum. Marks were not awarded where two spaces were completed with the same letter. The fulcrum and load positions were invariably correct. A few candidates had marked the load as being at the pressure pad. That position was where the load was transferred to. The correct position for the load was at the point where the lever pressed onto the pressure pad pin.

(iii) Many candidates answered this question correctly. The lever moves with oscillating motion which is transferred to the reciprocating motion of the pin above the pressure pad.

(iv) The question was about the purpose of a particular spring in Fig. 11.1. In several responses the purpose was given as though it was a generic spring, totally separate to the mechanism. The spring shown is compressed as the lever operates, when pressure has been transferred to a badge the pressure pad needs to rise to allow the badge to be removed. A simple statement was needed e.g. 'To return the pressure pad to its original position when the lever is raised.'

(b) (i) The velocity ratio of the pulleys is obtained by counting the number of pulleys in the system, in this case 5. The calculation required the mechanical advantage to be multiplied by 0.88 to account for the loss in efficiency, this gave a figure of 4.4 as the actual mechanical advantage. The effort is obtained by dividing the load by 4.4 which calculates as 284.1 N. Any responses which only had the final answer gained all of the marks. Candidates should include all stages in the calculation so that part marks can be awarded if the final answer is incorrect.

(ii) Factors that cause loss of efficiency in a mechanism will always include friction. The mechanism should be analysed to identify where movement has occurred, which is also the point at which friction will play a part. Bearings reduce friction; the wrong type of bearing can decrease efficiency; increasing the number of pulleys can also increase the amount of friction involved. All mechanisms will lose efficiency through heating or generating sound. Many of the stronger responses gained both marks but weaker responses had frequently confused this part with the next part, where ways of increasing efficiency were asked for.

(iii) Methods of increasing efficiency include lubrication of any bearings; this was a frequent response along with the use of better-quality bearings such as ball or needle bearings. Only some candidates gained both marks for this part.

(c) (i) Maintenance tasks were required for the gravity fed oiler. General maintenance would include keeping the device clean, any oil residue would collect dust, so should be removed. After prolonged use of the machine the oil level will go down so adding extra oil is a regular task. Most candidates generally gained both marks on the question.

(ii) Only a few candidates gained the mark here. The most likely type to be chosen was a plain bearing, which could take a heavy load but must receive regular lubrication.

(iii) Bearings specifically to reduce maintenance will be of the 'sealed for life' type. A sealed ball bearing race will prevent the outer surfaces of the machine from getting oil on it. There were very few correct answers for this part.

(iv) This question required knowledge of the working characteristics of flat belts and pulleys. As with any pulley system unless the belt is ribbed it is likely to slip. Flat belts can also become detached from pulleys more easily than vee belts.

(v) Methods of tensioning flat belts can be split into, those that have fixed pulleys with a device to put pressure on the belt and those where one or both pulleys can be moved apart to apply tension. Either type could have been used in the response. Weaker responses failed to produce working methods in many cases.

Question 12

No candidates answered this question.

DESIGN AND TECHNOLOGY

Paper 0445/51
Graphic Products

Key messages

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

General comments

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

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

There are areas of the syllabus where some candidates performed well. The use of textural rendering to show materials such as wood and metal was demonstrated well. There were some areas where candidates did not generally perform well, and further improvements are needed. The drawing of orthographic views and sectional views are areas where many candidates did not perform well. Questions requiring knowledge of printing methods and adhesives were also not answered well by many candidates.

Comments on specific questions

Section A

Question A1

Sailing club logo

Candidates were asked to complete the drawing of the sailing club logo to a scale of 1 : 2.

(a) Candidates were required to complete the pentagonal outline of the logo by constructing a regular pentagon using the given side and centre lines. The best responses seen were where candidates scribed an arc with the same radius as the given side from one end of the given side through the vertical centre line and outwards. This gave candidates the centre point of the pentagon from which further arcs could be scribed which intersected with the first to plot the three other corners of the pentagon. Many candidates completed this correctly and achieved all four marks. Many candidates drew the pentagon to the wrong size and lost marks. Others showed no knowledge of how to construct a pentagon and drew irregular five-sided shapes gaining some of the marks.

(b) Candidates were required to complete the boat hull and mast. Most candidates completed this correctly and achieved all three marks. Many candidates drew the 45° angles section at the base of the mast incorrectly and lost a mark.

(c) Candidates were required to draw the cabin of the boat to the sizes shown. Most candidates drew the larger rectangle correctly and gained the mark. Fewer candidates drew the rectangular roof correctly. Some candidates drew it too 10 mm thick instead of 5 mm or projecting too far over the end of the larger rectangle.

(d) Candidates were required to complete the triangular shape of the rear sale by extending the given horizontal lines and vertical lines to the lengths shown. Most candidates did this correctly and achieved both marks on this question. Some candidates drew the triangle too small or too tall and lost marks.

(e) Candidates were required to complete the front sail by drawing an isosceles triangle to the sizes shown. Many candidates drew the long edge of the isosceles triangle to the correct angle and achieved one mark. Fewer candidates drew the line in the correct position resulting in the triangle being draw too big.

(f) Candidates were required to complete the curved waves by scribing arcs from the ends of the given curve and projecting horizontal lines to locate the centres and ends of the curves, then drawing in the curves to the correct radius. A large proportion of candidates drew the curves to the wrong radius and lost marks. Many candidates drew the curves freehand and did not achieve any marks on this question.

Question A2

Swimming badge sticker

(a) (i) This question required candidates to show knowledge of commercial printing techniques and name a suitable method of printing the sticker in quantities of 500. Many candidates stated a suitable method and achieved the mark. Some candidates stated methods such as screen printing or inkjet printing which would not be suitable and did not achieve the mark.

(ii) On this question candidates were required to show how the maximum number of stickers could be cut from the strip shown. Candidates were expected to tessellate the triangular shapes in order to achieve as many as possible within the strip. Many candidates did this correctly and achieved both marks. Many candidates drew a number of triangular shapes inside the rectangular space but did not maximise the area and lost marks.

Question A3

(a) This part of the question required candidates to show knowledge of adhesives and state a suitable type of adhesive for joining the card flag to the wooden dowel. Many candidates stated a suitable adhesive such as PVA glue and achieved the mark. Some candidates gave answers such as ‘white glue’ or ‘wood glue’ which were too vague and did not achieve a mark. A significant number of candidates did not respond to this question.

(b) This part of the question required candidates to show how the flag could be attached to the dowel securely whilst still being able to rotate freely around the dowel. Candidates were asked to sketch a suitable method in the space given. Many candidates simply copied the illustration and method given in part **(a)** of the question and only achieved one mark. Some candidates showed a method where the flag formed a loop that slid over the dowel allowing it to rotate freely but did not show how it would be prevented from sliding off. The best responses showed a clear method of allowing the flag to rotate and a stopper or end to the flag that stopped the flag sliding off.

Question B4

Orthographic view of the mooring cleat.

(a) Candidates were required to complete the orthographic views of the mooring cleat to a scale of 1 : 5 using the information given on the isometric view. Many candidates were able to complete the front view of the mooring cleat correctly and achieve the first six marks. Fewer candidates completed the side view correctly due to missing elements or not projecting the parts from the front view correctly. Many candidates did not attempt the plan view or just drew the outline of the base. Some candidates drew the plan view correctly but missed out hidden detail and lost marks. The best responses projected lines from the relevant parts on their completed front view to complete the side and plan views so that they matched up correctly.

(b) This question required candidates to have knowledge of textural rendering techniques and show skill in applying them to the image of the mooring cleat given. Candidates were expected to make the cleat look like stainless steel by applying pencil shading appropriately. Many candidates displayed some excellent rendering skills making the mooring cleat look cylindrical shaped and made from shiny metal and were awarded all four marks. Most candidates who attempted this question achieved two or three marks but lost marks for the overall quality of their shading.

(c) On this question candidates were required to complete the sectional view of the steel bolt and ground anchor from the information given in the exploded view. Many candidates did not respond to this question. Some candidates were able to draw the head of the bolt and washer correctly and gain some of the marks available. Fewer were able to add the shaft of the bolt and sides of the ground anchor correctly. Many candidates drew the bolt shaft or anchor sides too long or too short. Only a small proportion of candidates drew the sectional view correctly including adding hatching and achieved full marks.

Question B5

Isometric view of the toy boat.

(a) Candidates were required to complete the isometric view of the toy boat to a scale of 1 : 2 using the information given on the orthographic views. Many candidates were able to draw the right-hand side to the correct depth but most drew the side too long due to measuring from the given vertical edge of the curved back section rather than the actual end of the boat. Many candidates also drew the front profile of the boat to the incorrect sizes and lost further marks. Most candidates were able to draw the side face of the main boat cabin correctly, but many projected this to the wrong width losing marks but completing the remainder of the cabin to their own solution and gaining some of the marks available. Most candidates were able to complete the top and side of the back cabin but drew the chimney to the wrong length. The best responses used a 30° set square to draw the vertical and 30° angle lines to construct the shapes of the individual parts following the dimensions given and then project these correctly to construct the remainder of the boat hull and cabins.

(b) This question required candidates to have knowledge of textural rendering techniques and show skill in applying them to the image of the softwood block. Candidates were expected to make the block look like soft\wood by applying coloured pencil shading appropriately. Many candidates displayed some excellent rendering skills adding appropriate grain to the side and end grain to the top face. Most candidates who attempted this question achieved at least one mark but many lost marks for the overall quality of their shading.

(c) On this question candidates were required to describe how a stencil for applying the lettering to the side of the toy boat could be produced using CAD/CAM and used. Many candidates described the creation of the stencil on computer and uploading the design to a laser cutter and gained two of the marks. Fewer candidates described any stages after this such as setting up of the laser cutter and use of the stencil on the toy boat during spraying.

(d) This question required candidates to complete the full-size development (net) of the toy boat package to a scale of 1 : 3 using the given start point and information on the isometric view. Most candidates were able to complete the four main rectangular parts of the package that form the main square tube shape. Fewer candidates were also able to complete the closing flaps and end sections to match the ones given and in the correct positions on the development (net). Most candidates managed to accurately add the window cut-out in the correct position and to the correct size. Only a small proportion of candidates used the correct line convention to show the fold positions.

DESIGN AND TECHNOLOGY

Paper 0445/52
Graphic Products

Key messages

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

General comments

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

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

There are areas of the syllabus where some candidates performed well. Orthographic drawing questions were answered well by many candidates although hidden detail was an aspect of this drawing technique that very few candidates added correctly. There were some areas where candidates did not generally perform well, and further improvements are needed. The drawing of one-point perspective views and planometric views are areas where many candidates did not perform well. Questions requiring knowledge of CAD/CAM and thick and thin line drawing technique were also not answered well by many candidates.

Comments on specific questions

Section A

Question A1

Swimming badge

Candidates were asked to complete the full-size drawing of the swimming badge.

(a) Candidates were required to draw the Ø30 circle representing the head of the swimmer on the centre lines given. Most candidates completed this correctly and achieved the mark.

(b) Candidates were required to draw the complete the rectangular shape containing the word SWIMMING to the sizes given. Most candidates drew this to the correct height and width and achieved both marks.

(c) Candidates were required to complete the isosceles triangle by extending the given horizontal line and 45° lines to the vertical centre line and 'mirroring' this to complete the shape accurately. Most candidates did this correctly and achieved both marks on this question. Some candidates drew the triangle too small or with a point not on the centre line and only achieved one or none of the marks.

(d) Candidates were required to draw the hexagonal outline of the badge by constructing a regular hexagon using the given centre lines. The best responses seen were where candidates drew a circle with a 90 mm radius then scribed arcs beginning at the intersection of the horizontal centre line and circle to plot the 6 points of the hexagon correctly. Many candidates completed this correctly and achieved all three marks. Many candidates drew the hexagon to the wrong size and lost marks. Others showed no knowledge of how to construct a hexagon shape using a pair of compasses.

(e) Candidates were required to complete the arms and body of the swimmer by extending the given start lines at 30° and 60°. Most candidates drew the lines correctly and achieved all three marks. Some candidates drew the 60° lines at the wrong angle and lost marks.

(f) Candidates were required to complete the two curved waves by scribing arcs from the ends of the given curves to locate the centres of the curves, then drawing in the curves to the correct radius. A large proportion of candidates drew the curves to the wrong radius and lost marks. Many candidates drew the curves freehand and did not achieve any marks on this question.

Question A2

Swimming badge label

This question required candidates to show knowledge of lettering and to add missing text to the given label in a style and size consistent with the label given. The best responses projected horizontal lines across from the given label to show the height of the letters needed and then drew vertical lines inside the label the same width as the given numbers to construct a box of the correct size to draw the numbers into. Many candidates did this and achieved all three marks. Many candidates drew the numbers to the wrong size, thickness or in a style that did not look the same as the given example and lost marks. Some candidates drew numbers other than 25 and lost marks.

Question A3

(a) This question required candidates to show knowledge of CAD and CAM. Candidates were asked to explain how they would modify the given design of the swimming badge drawn on CAD so that it could be cut out and engraved on a laser cutter. Many candidates stated they would change the colour of some lines or make them dotted but did not explain how this related to them being cut or engraved. A large proportion of candidates did not answer this correctly and lost marks. A significant number of candidates did not respond to this question.

(b) This part of the question required candidates to complete the isometric view of the completed badge by adding the remaining sides and thickness of the hexagonal badge onto the given backboard to a scale of 2 : 1. Only a small proportion of candidates completed this correctly and achieved all five marks. Candidates were expected to project 30° lines across from the corners of the given sides and vertical lines down to locate the corners of the hexagon and construct the remainder of the outline before adding the thickness by projecting 30° lines 10 mm in length. Some candidates constructed one or two sides correctly but drew other sides too long or short. Most candidates were able to show the thickness correctly and achieve one mark. Many candidates achieved no marks or did not respond to this question.

Question B4

Orthographic view of the swim float.

(a) Candidates were required to complete the orthographic views of the swim float to a scale of 1:5 using the information given on the isometric view. Many candidates were able to complete the front view of the swim float and achieve the first nine marks. Very few candidates completed the side or plan view correctly due to missing elements of hidden detail. Most candidates were able to use the given start points to construct the right-hand side of the front view correctly and achieve the first 5 marks. Many candidates drew the top curve of the float to the incorrect radius or in the wrong position and lost marks. Most candidates were able to construct the outline of the side and plan views correctly by projecting lines horizontally and vertically from the front view. Fewer candidates were able to add further details such as the corners, hole and triangular cut-out onto these views and lost marks. The best responses projected lines from the relevant parts on their completed front view to complete the side and plan views so that they matched up correctly.

(b) (i) This question required candidates to show knowledge Styrofoam and name two properties of Styrofoam that made it suitable for the swim float. Many candidates named two appropriate properties and achieved both marks. Some candidates named incorrect properties or properties which were not relevant to its suitability for the swim float and lost marks.

(ii) This part of the question required candidates to show knowledge of adhesives and explain why PVA glue would not be suitable for use on the swim float. Many candidates explained that PVA is water based and so would come unstuck when used in water and achieved both marks. Many candidates simply stated the glue was not strong enough and did not achieve marks. Some candidates gave incorrect information such as stating that the glue would melt the Styrofoam and achieved no marks.

(c) On this question candidates were required to complete the estimated two-point perspective view of the storage rack using the given start points and vanishing point. Candidates were expected to project lines from the given corners on the storage rack to the vanishing point and use their knowledge of the technique to accurately position the missing vertical sections and complete them. Many candidates were able to draw the sides of the missing parts, but many drew them the same distance apart and thickness as the given ones rather than shortening them as they got closer to the vanishing point. Many candidates added three vertical sections instead of two and lost marks. Many candidates drew the sides of the missing sections in correctly but did not complete the remaining three sides of the rectangles and lost marks. Some candidates did not project lines to the vanishing point from the given front end and as a result drew the added sections too big

Question B5

Planometric view of the sign and stand.

(a) Candidates were required to complete the planometric view of the sign and stand to a scale of 1 : 5 using the information given on the orthographic views. Many candidates were able to draw the outer end profile of the stand base and achieve the first three marks, but many drew the angled parts incorrectly and lost marks. Most candidates were able to project 45° lines from their completed end profile to complete the base although many missed lines at the back edges and lost marks. Fewer candidates drew the outline of the sign correctly but gained some marks for drawing their own solution correctly. Only a small number of candidates achieved full marks on this question. The best responses used a 45° set square to draw the vertical and 45° angle lines to construct the shapes of the individual parts following the dimensions given.

(b) (i) This part of the question required candidates to show knowledge of thick and thin line technique. Many candidates achieved the first mark by drawing the outline of the stand in thick line. Fewer candidates drew the other elements of the stand in correctly and did not evidence a full understanding of the technique by applying it to the other elements of the stand. Many candidates lost marks because they did not show sufficient difference in the thickness of their lines to determine whether it was thick or thin. The best responses used a ruler for the straight lines and a thick pen to show the thick lines. Candidates are advised to only add thickness to the given lines on the image and leave thin lines untouched to ensure it is clear which lines are thick or thin if they do not have a pen or pencil of suitable thickness.

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(ii) This part of the question required the candidate to show knowledge of working with thin sheet plastics and name a suitable item of equipment that could be used for bending the acrylic sheet into shape. Many candidates gave correct answers such as strip heater, line bender or formers. Many candidates gave answers such as ‘vacuum former’ or ‘oven’ which although suitable for heating and shaping plastic would not be suitable for the stand shown.

(iii) On this part of the question candidates were required to state a suitable type of adhesive for joining the side pieces of the stand to the base. Many candidates gave hot glue or PVA glue which are not suitable for acrylic. Many candidates gave suitable solvent based adhesives such as Tensol cement or dichloromethane and achieved the mark.

(c) This question required candidates to complete the full-size development (net) of the alternative stand model using the given start point and information on the isometric view. Most candidates were able to complete the rectangular base section correctly. Most candidates were also able to complete the curved side faces and back face on the left-hand side. Fewer candidates managed to accurately mirror the left side over to the right-hand side and lost marks. Only a small proportion of candidates used the correct line convention to show the fold positions.

DESIGN AND TECHNOLOGY

Paper 0445/53
Graphic Products

Key messages

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

General comments

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

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

There are areas of the syllabus where some candidates performed well. The use of textural rendering to show materials such as wood and metal was demonstrated well. There were some areas where candidates did not generally perform well, and further improvements are needed. The drawing of orthographic views and sectional views are areas where many candidates did not perform well. Questions requiring knowledge of printing methods and adhesives were also not answered well by many candidates.

Comments on specific questions

Section A

Question A1

Sailing club logo

Candidates were asked to complete the drawing of the sailing club logo to a scale of 1 : 2.

(a) Candidates were required to complete the pentagonal outline of the logo by constructing a regular pentagon using the given side and centre lines. The best responses seen were where candidates scribed an arc with the same radius as the given side from one end of the given side through the vertical centre line and outwards. This gave candidates the centre point of the pentagon from which further arcs could be scribed which intersected with the first to plot the three other corners of the pentagon. Many candidates completed this correctly and achieved all four marks. Many candidates drew the pentagon to the wrong size and lost marks. Others showed no knowledge of how to construct a pentagon and drew irregular five-sided shapes gaining some of the marks.

(b) Candidates were required to complete the boat hull and mast. Most candidates completed this correctly and achieved all three marks. Many candidates drew the 45° angles section at the base of the mast incorrectly and lost a mark.

(c) Candidates were required to draw the cabin of the boat to the sizes shown. Most candidates drew the larger rectangle correctly and gained the mark. Fewer candidates drew the rectangular roof correctly. Some candidates drew it too 10 mm thick instead of 5 mm or projecting too far over the end of the larger rectangle.

(d) Candidates were required to complete the triangular shape of the rear sale by extending the given horizontal lines and vertical lines to the lengths shown. Most candidates did this correctly and achieved both marks on this question. Some candidates drew the triangle too small or too tall and lost marks.

(e) Candidates were required to complete the front sail by drawing an isosceles triangle to the sizes shown. Many candidates drew the long edge of the isosceles triangle to the correct angle and achieved one mark. Fewer candidates drew the line in the correct position resulting in the triangle being draw too big.

(f) Candidates were required to complete the curved waves by scribing arcs from the ends of the given curve and projecting horizontal lines to locate the centres and ends of the curves, then drawing in the curves to the correct radius. A large proportion of candidates drew the curves to the wrong radius and lost marks. Many candidates drew the curves freehand and did not achieve any marks on this question.

Question A2

Swimming badge sticker

(a) (i) This question required candidates to show knowledge of commercial printing techniques and name a suitable method of printing the sticker in quantities of 500. Many candidates stated a suitable method and achieved the mark. Some candidates stated methods such as screen printing or inkjet printing which would not be suitable and did not achieve the mark.

(ii) On this question candidates were required to show how the maximum number of stickers could be cut from the strip shown. Candidates were expected to tessellate the triangular shapes in order to achieve as many as possible within the strip. Many candidates did this correctly and achieved both marks. Many candidates drew a number of triangular shapes inside the rectangular space but did not maximise the area and lost marks.

Question A3

(a) This part of the question required candidates to show knowledge of adhesives and state a suitable type of adhesive for joining the card flag to the wooden dowel. Many candidates stated a suitable adhesive such as PVA glue and achieved the mark. Some candidates gave answers such as ‘white glue’ or ‘wood glue’ which were too vague and did not achieve a mark. A significant number of candidates did not respond to this question.

(b) This part of the question required candidates to show how the flag could be attached to the dowel securely whilst still being able to rotate freely around the dowel. Candidates were asked to sketch a suitable method in the space given. Many candidates simply copied the illustration and method given in part **(a)** of the question and only achieved one mark. Some candidates showed a method where the flag formed a loop that slid over the dowel allowing it to rotate freely but did not show how it would be prevented from sliding off. The best responses showed a clear method of allowing the flag to rotate and a stopper or end to the flag that stopped the flag sliding off.

Question B4

Orthographic view of the mooring cleat.

(a) Candidates were required to complete the orthographic views of the mooring cleat to a scale of 1 : 5 using the information given on the isometric view. Many candidates were able to complete the front view of the mooring cleat correctly and achieve the first six marks. Fewer candidates completed the side view correctly due to missing elements or not projecting the parts from the front view correctly. Many candidates did not attempt the plan view or just drew the outline of the base. Some candidates drew the plan view correctly but missed out hidden detail and lost marks. The best responses projected lines from the relevant parts on their completed front view to complete the side and plan views so that they matched up correctly.

(b) This question required candidates to have knowledge of textural rendering techniques and show skill in applying them to the image of the mooring cleat given. Candidates were expected to make the cleat look like stainless steel by applying pencil shading appropriately. Many candidates displayed some excellent rendering skills making the mooring cleat look cylindrical shaped and made from shiny metal and were awarded all four marks. Most candidates who attempted this question achieved two or three marks but lost marks for the overall quality of their shading.

(c) On this question candidates were required to complete the sectional view of the steel bolt and ground anchor from the information given in the exploded view. Many candidates did not respond to this question. Some candidates were able to draw the head of the bolt and washer correctly and gain some of the marks available. Fewer were able to add the shaft of the bolt and sides of the ground anchor correctly. Many candidates drew the bolt shaft or anchor sides too long or too short. Only a small proportion of candidates drew the sectional view correctly including adding hatching and achieved full marks.

Question B5

Isometric view of the toy boat.

(a) Candidates were required to complete the isometric view of the toy boat to a scale of 1 : 2 using the information given on the orthographic views. Many candidates were able to draw the right-hand side to the correct depth but most drew the side too long due to measuring from the given vertical edge of the curved back section rather than the actual end of the boat. Many candidates also drew the front profile of the boat to the incorrect sizes and lost further marks. Most candidates were able to draw the side face of the main boat cabin correctly, but many projected this to the wrong width losing marks but completing the remainder of the cabin to their own solution and gaining some of the marks available. Most candidates were able to complete the top and side of the back cabin but drew the chimney to the wrong length. The best responses used a 30° set square to draw the vertical and 30° angle lines to construct the shapes of the individual parts following the dimensions given and then project these correctly to construct the remainder of the boat hull and cabins.

(b) This question required candidates to have knowledge of textural rendering techniques and show skill in applying them to the image of the softwood block. Candidates were expected to make the block look like soft\wood by applying coloured pencil shading appropriately. Many candidates displayed some excellent rendering skills adding appropriate grain to the side and end grain to the top face. Most candidates who attempted this question achieved at least one mark but many lost marks for the overall quality of their shading.

(c) On this question candidates were required to describe how a stencil for applying the lettering to the side of the toy boat could be produced using CAD/CAM and used. Many candidates described the creation of the stencil on computer and uploading the design to a laser cutter and gained two of the marks. Fewer candidates described any stages after this such as setting up of the laser cutter and use of the stencil on the toy boat during spraying.

(d) This question required candidates to complete the full-size development (net) of the toy boat package to a scale of 1 : 3 using the given start point and information on the isometric view. Most candidates were able to complete the four main rectangular parts of the package that form the main square tube shape. Fewer candidates were also able to complete the closing flaps and end sections to match the ones given and in the correct positions on the development (net). Most candidates managed to accurately add the window cut-out in the correct position and to the correct size. Only a small proportion of candidates used the correct line convention to show the fold positions.