DESIGN AND TECHNOLOGY

Paper 0979/12
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 0979/02
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 0979/32
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 0979/42
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 AND TECHNOLOGY

Paper 0979/52
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.