DESIGN AND TECHNOLOGY

Paper 0979/12
Product Design 12

Key messages

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

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

Candidates should avoid repeating points given in the question in their answers to **part (a)**.

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

Candidates should be encouraged to view the paper as a holistic design exercise. A small number of candidates built their design proposals around largely pre-prepared answers for **parts (a)**, **(f)** and **(g)**. For example, in **part (g)** almost all the candidates from some centres described vacuum forming or steam bending timber to produce a curved shape.

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

General comments

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

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

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

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

Comments on specific questions

Question 1

(a) Most candidates were able to list four additional points about the function of a display unit for model cars that they considered to be important. Commonly seen answers referred to how easy it would be to view the cars, ensuring the cars did not roll off the display unit, using materials that could easily be cleaned, the aesthetics of the display unit or the structural stability of the materials. A few candidates considered a method of illuminating the cars when on display in the unit important. Candidates should be advised against repeating points that are given in the question or giving generic points, such as cheap, that might apply to almost any product.

(b) Most candidates used sketches and notes to good effect to show two methods of joining modular display units together. Commonly seen answers involved the use of dowels, Velcro, woodscrews, dovetail shaped fittings, hooks, and push fittings. Most candidates interpreted the question as a temporary joining method but permanent joining methods, for example the use of an adhesive, were also awarded marks. The standard of written and visual communication for this question was often of an excellent standard.

(c) An impressive range of sketches with annotations was seen for this question. The most common solutions were made from acrylic, glass, pine, aluminium, brass, or stainless steel. The strongest candidates added detailed annotations to their sketches that made it clear that they had fully considered how the cars would sit on the display unit and how the display units would fasten together. Most candidates designed a display unit for six cars that would join with identical display units. Some candidates interpreted the question as a display unit for one, two or three cars that would join with identical display units. Both approaches were considered acceptable as they met the design requirements for the question. A small number of candidates produced fewer than three ideas or three ideas that were very similar.

(d) The evaluations of ideas were generally very impressive, with most candidates able to clearly demonstrate a good understanding of the positive and negative features of their design proposals. Commonly seen answers referred to the how easy it would be to join the display units together, stability when units were joined together, the effectiveness of the method used to prevent the cars rolling off the display unit, the cost of the materials used to make the display unit or the aesthetics of the display unit. Some candidates may have benefited from adopting a more structured approach to express their ideas more clearly, such as the use of bullet points. Almost all candidates chose one of their ideas, usually by giving the number of the idea, and justified their choice of idea for development.

(e) A variety of methods were used to show the full solution to the design problem. These methods included freehand orthographic drawings, exploded views, isometric views, and material lists. Colour, and enlarged drawings of details, were commonly used to add clarity to drawings. This question specifically asked for construction details and important dimensions. Weaker responses could be improved by including these. The most successful candidates clearly indicated the materials, joining methods, dimensions, and finishes in their freehand sketches and notes. All candidates need to consider whether the information they provide would be sufficient for a skilled third-party to make the product.

(f) Most candidates were able to name two specific materials that would be used in the construction of their design proposal and gave reasons for their choices. Commonly named materials included stainless steel, aluminium, pine, and acrylic. The reasons for the choice of material often referred to the aesthetic qualities, working properties or structural strength of the material. Candidates should be advised against giving generic names of materials, such as plastic, as these responses are not awarded marks.

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

Question 2

(a) Most candidates were able to list four additional points about the function of the package for three replica ancient coins that they considered to be important. Commonly seen answers referred to the properties of the materials to be used to make the package, the size or shape of the package, the method of displaying the coins or the cost of producing and transporting the package. Candidates should be advised against repeating points that are given in the question, for example the package must hold three coins, or giving generic points that might apply to almost any product.

(b) Most candidate used sketches and notes to good effect to show two methods of protecting products during transportation. Many candidates showed the use of corrugated cardboard, Corriflute (corrugated sheet plastic), foamboard, expanded polystyrene, bubble wrap, vacuum formed trays or sponge as the method of protecting a product during transportation. The standard of written and visual communication for this question was almost always sufficient to communicate the method, and often of an excellent standard.

(c) An impressive range of sketches with annotations were seen for this question, with colour used to good effect to show the materials and surface graphics. Many candidates chose to use lightweight materials, such as corrugated card or polypropylene sheet, for their package but a few used resistant materials, such as acrylic or pine. Almost all the design ideas clearly showed how the three coins would be protected during transportation but in some designs the display aspect was either omitted or unclear. It is important that all design ideas fully meet the design requirements if candidates are to access the full range of marks. A small number of candidates produced fewer than three ideas or three ideas that were very similar.

(d) The evaluations of ideas were generally very impressive with candidates able to clearly demonstrate an understanding of the positive and negative aspects of their design proposals. Commonly seen answers focused on how difficult it would be to manufacture the package, the cost of transporting the package, how long it would last as a display or whether it could be recycled after use. To access the full range of marks, candidates should aim justify their evaluations more and avoid using general statements, such as that it would work well. Almost all candidates chose one of their ideas, usually by giving the number of the idea, and justified their choice of idea for development.

(e) A variety of methods were used to show the full solution to the design problem. These included freehand orthographic drawings, freehand exploded views, and isometric views. Many responses included a freehand three-dimensional (3D) sketch and a development (net), with supporting annotations. This question specifically asked for construction details and important dimensions. Weaker responses could be improved by including these. Stronger candidates clearly showed the materials, dimensions and construction methods through their freehand sketches and notes. All candidates need to consider whether the information they provide would be sufficient for a skilled third-party to make the product.

(f) Most candidates were able to name two specific materials that would be used in the construction of their design proposal and gave reasons for their choices. Expanded polystyrene, corrugated cardboard and Corriflute (corrugated sheet plastic) were commonly named materials. The main reasons for choosing these materials were often linked to the method of manufacture, such as joining with an adhesive or double-sided tape, the range of colours available, structural strength of the material or how easy it would be to recycle the material after use. Candidates should be advised against giving the generic names of materials, such as plastic, or generic reasons for choosing the material.

(g) Most candidates used a combination of sketches and notes to outline a method of manufacturing one part of their design proposal. Many candidates described how the development (net) for the package would be cut out by hand, using a craft knife, safety rule and cutting mat, and then folded and glued together. Some candidates explained how computer numerically controlled (CNC) machines, such as a laser cutter, could be used to cut out the parts of their design proposal. It is important that all candidates include the correct names of tools and equipment to be used in the method of manufacture if they are to access the full range of marks.

Question 3

(a) Very few candidates chose to answer this question. Candidates that did answer this question were usually able to list four additional points about the function of a container for storing and sorting marbles that they considered to be important. Commonly seen answers related to how the marbles would be put in and taken out of the container, how the device might be carried, the durability of the materials or the performance of the sorting mechanism. Candidates should be advised against repeating points that are given in the question, for example the container must include a method of sorting the marbles by size, or giving generic points that might apply to almost any product.

(b) Most candidates used sketches and notes effectively to show two methods of sorting objects by size. Many candidates showed a sheet of material with different size holes, tapered tubes, or a series of different size doors. Some more ingenious methods focused on the idea that the larger marbles would be heavier and therefore used the weight as a means of sorting marbles by size. Some candidates showed methods of storing different size marbles, for example containers with small, medium and large written on them, rather than a method of sorting objects by size. The standard of written and visual communication for this question was almost always sufficient to communicate the method, and often of an excellent standard.

(c) An impressive range of sketches with annotations were seen for this question, although it was not always clear that the candidate fully understood how the device would work. For example, some design proposals needed to better consider how the marbles would be put in and taken out of the container. The container, in some respects, appeared to be an enclosed game. It is important that all design ideas fully meet the design requirements if candidates are to access the full range of marks. A small number of candidates produced fewer than three ideas or ideas that were very similar.

(d) The evaluations of ideas were generally very good, with candidates able to clearly demonstrate an understanding of the positive and negative aspects of their design proposals. Many responses focused on the durability of the materials, how easy it would be to manufacture the container, how convenient it would be to carry the container or the performance of the sorting mechanism. It is important that candidates justify their evaluations rather than making broad statements, such as that it is the best design idea, if they are to access the full range of marks. Almost all candidates chose one of their ideas, usually by giving the number of the idea, and justified their choice of idea for development.

(e) A variety of methods were used to show the full solution to the design problem. These included freehand orthographic drawings, freehand exploded views, freehand isometric views, and materials lists. Most candidates made extremely good use of the space provided to answer the question, with one main drawing in the centre of the page and notes and drawings of details, such as the joints for the container, around it. This question specifically asked for construction details and important dimensions. Weaker responses could be improved by including these. Stronger candidates included details of materials, construction, finishes and dimensions in their sketches and notes. All candidates need to consider whether the information they present would be sufficient for a skilled third-party to make the product.

(f) Most candidates were able to name two specific materials that would be used in their design proposal and gave reasons for their choices. The most common materials named were acrylic and pine, with the reasons relating to the aesthetic qualities or working properties of the material. Candidates should be advised against giving generic names of materials such as wood, or generic reasons such as that it is easy to work with, as these are not awarded marks.

(g) Most candidates used a combination of sketches and notes to outline a method of manufacturing one part of their design proposal. Commonly seen manufacturing methods included the use of heat processes to shape acrylic or cutting out parts with hand tools or a laser cutter. Most candidates used sketches and notes, usually with numbered stages, to show the method of manufacture. It is important that all candidates include the correct names of tools and equipment to be used in the method of manufacture if they are to access the full range of marks.

DESIGN AND TECHNOLOGY

Paper 0979/02
School Based Assessment

Key messages

- Most candidates describe a design need and generate a design brief. To access the higher mark range, they need to consider both the design need and the needs of the user in more detail. Many candidates identify a client who can provide useful information and feedback throughout the project. This is to be encouraged wherever possible.

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

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

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

General comments

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

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

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

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

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

https://schoolsupporthub.cambridgeinternational.org

Comments on specific sections

Question 1

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

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

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

Question 2

Research into the Design Brief resulting in a Specification

As well as researching the particular features of existing products and gathering information and data such as ergonomic or environmental factors, candidates are also expected to collect information directly relating to the user and the user's needs for the product. This is often done through the use of interviews, surveys, letters, e-mails, and internet research.

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

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

Question 3

Generation and exploration of Design Ideas

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

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

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

Question 4

Development of Proposed Solution

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

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

Question 5

Planning for Production

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

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

Question 6

Product Realisation

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

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

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

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

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

Question 7

Testing and Evaluation

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

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

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

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

DESIGN AND TECHNOLOGY

Paper 0979/32
Resistant Materials 32

Key messages

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

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

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

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

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

General comments

Section A

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

Section B

This section always has questions with large mark allocations that require a combination of clear and accurate sketches supported by detailed written notes. It is essential that candidates attempt all parts of the question to access the full mark range.

Comments on specific questions

Section A

Question 1

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

Question 2

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

Question 3

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

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

Question 4

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

Very few candidates showed the completed plug.

Question 5

The majority of candidates identified aluminium as the pure metal.

Question 6

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

Question 7

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

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

Question 8

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

Question 9

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

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

Question 10

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

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

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

Section B

Question 11

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

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

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

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

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

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

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

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

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

In addition, sketches needed to be large and clear.

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

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

Question 12

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

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

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

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

The use of various saws was not considered appropriate.

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

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

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

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

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

Candidates are advised to read the questions carefully.

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

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

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

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

Question 13

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

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

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

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

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

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

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

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

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

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

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

DESIGN & TECHNOLOGY

Paper 0979/42
Systems and Controls

Key messages

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

General comments

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

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

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

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

It is important that candidates read each question carefully, noting any important features that appear in bold type. This applies especially to the questions where the number of responses required is written in bold type.

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

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

Comments on specific questions

Section A

Question 1

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

Question 2

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

Question 3

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

Question 4

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

Question 5

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

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

Question 6

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

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

Question 7

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

Question 8

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

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

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

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

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

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

Question 9

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

Section B

Question 10

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

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

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

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

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

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

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

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

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

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

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

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

Question 11

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

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

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

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

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

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

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

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

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

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

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

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

Question 12

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

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

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

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

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

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

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

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

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

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

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

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

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

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

DESIGN AND TECHNOLOGY

Paper 0979/52
Graphic Products 52

Key messages

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

General comments

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

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

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

Comments on specific questions

Section A

Question A1

school Bus image

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

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

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

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

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

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

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

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

Question A2

Bus timetable

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

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

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

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

Question A3

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

Question B4

Timetable holder

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

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

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

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

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

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

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

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

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

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

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

Question B5

Model Bus stop

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

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

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

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

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

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