DESIGN AND TECHNOLOGY

Paper 0979/12
Product Design

Key messages

Candidates who performed well demonstrated a good understanding of the question requirements and produced creative design work that was underpinned with sound technical understanding.
Candidates should be aware that the focus for **Question 1** is Resistant Materials, for **Question 2** Graphic Products and for **Question 3** Systems and Control.

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

Candidates should be encouraged to thoroughly read their chosen question to ensure that they avoid repeating points given in the question in their answers to **part (a)**.

Candidates should be advised that in **part (d)** they should evaluate their design proposals, not simply describe them.

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

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

General comments

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

Almost all candidates answered all the parts of their chosen question within the spaces provided and very few candidates used the additional space on the last page. If the additional space on the last page was used, it was almost always as a continuation of the response to **part (g)**.

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

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

Comments on specific questions

Question 1

(a) Most candidates were able to list four additional points about the function of a unit to display cakes that they considered to be important. Commonly seen answers indicated that the display unit would need to be made from a material that would be easy to wipe clean, prevent flies or insects getting to the cakes, display information such as the prices of the cakes, provide easy access to the cakes

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

(b) Most candidates used sketches and notes to good effect to show two methods that would allow parts of a display unit to be easily joined and dismantled. Commonly seen answers involved the use of magnets, screw fittings, push fit dowels and slots, Velcro or knock down fittings. A small number of candidates showed a joint, such as a dovetail joint, that was glued together and could not be easily joined or dismantled. The standard of written and visual communication for this question was often of an excellent standard.

(c) An impressive range of sketches with annotations was seen for this question. The most common solutions were racks or enclosed cases made from aluminium, brass or acrylic. Although some of the display units were square or rectangular in shape, other shapes such as cylinders or square based pyramids were seen. The strongest candidates added detailed annotations to their sketches that made it clear that they had fully considered how the cakes would be displayed and added or removed from the display unit. Most candidates designed a display unit that was freestanding, but a small number of candidates produced designs that would sit on a table. A very small number of candidates produced fewer than three ideas or three ideas that were very similar in form.

(d) The evaluations of ideas were generally very impressive, with most candidates able to clearly demonstrate a good understanding of the positive and negative features of their design proposals. Commonly seen answers referred to the how well the display unit would display the cakes, ease of use, stability, maintenance or safety. Some candidates found it difficult to express their thoughts clearly and concisely and may well have benefitted from using a more structured approach, such as bullet points. Almost all candidates chose one of their ideas, usually by giving the number of the idea, and justified their choice of idea for development. In the justification of the selection of their chosen idea candidates are required to do more than simply state that it is the best or it meets all the specification points.

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

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

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

Question 2

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

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

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

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

(e) A variety of methods were used to show the full solution to the design problem. These included freehand orthographic drawings, freehand exploded views, and isometric views. Many responses included a freehand three-dimensional (3D) sketch and a development (net), with supporting annotations. The highest scoring responses usually included details of the surface graphics for the package, such as a name, image or product information. This question specifically asks for construction details and important dimensions but, particularly in the weaker responses, these were often missing. Stronger candidates clearly showed the materials, dimensions and construction methods through their freehand sketches and notes. All candidates need to consider whether the information they provide would be sufficient for a skilled third-party to make the product.

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

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

Question 3

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

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

(c) An impressive range of sketches with annotations were seen for this question, although it was not always clear that the candidate fully understood the details of how the device would work. For example, some design proposals did not fully consider how the device would be adjusted to cut slices of different thickness. Some candidates saw the device as a single handheld item, but others viewed it as a 'jig' that could be used with an existing knife. It is important that all design ideas fully meet the design requirements if candidates are to access the full range of marks. A small number of candidates produced fewer than three ideas or ideas that were very similar.

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

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

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

(g) Most candidates used a combination of sketches and notes to outline a method of manufacturing one part of their design proposal. Commonly seen manufacturing methods included injection moulding, cutting out parts with a laser cutter or 3D printing. Most candidates used sketches and notes, usually in numbered stages, to show the method of manufacture. It is important that all candidates include the correct names of tools and equipment to be used in the method of manufacture if they are to access the full range of marks.

DESIGN AND TECHNOLOGY

Paper 0979/02
School Based Assessment

Key messages

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

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

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

General comments

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

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

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

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

Guidance for assessing coursework and other very useful support for 0979 can be found on the school support hub.

Comments on specific sections

Question 1

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

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

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

Question 2

Research into the Design Brief resulting in a Specification

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

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

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

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

Question 3

Generation and exploration of Design Ideas

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

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

Question 4

Development of Proposed Solution

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

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

Question 5

Planning for Production

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

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

Question 6

Product Realisation

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

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

Question 7

Testing and Evaluation

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

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

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

DESIGN AND TECHNOLOGY

Paper 0979/32
Resistant Materials

Key messages

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

General comments

Section A

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

Section B

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

Comments on specific questions

Section A

Question 1

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

Question 2

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

Question 3

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

Question 4

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

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

Question 5

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

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

Question 6

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

Question 7

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

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

Question 8

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

Question 9

(a) The majority of candidates named polystyrene correctly.

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

Question 10

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

Section B

Question 11

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

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

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

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

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

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

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

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

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

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

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

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

Question 12

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

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

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

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

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

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

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

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

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

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

Question 13

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

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

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

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

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

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

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

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

DESIGN AND TECHNOLOGY

Paper 0979/42
Systems and Control

Key messages

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

General comments

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

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

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

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

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

Comments on specific questions

Section A

Question 1

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

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

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

Question 2

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

Question 3

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

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

Question 4

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

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

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

Question 5

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

Question 6

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

Question 7

The fuse was the component symbol most frequently identified correctly.

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

Question 8

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

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

Question 9

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

Section B

Question 10

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

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

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

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

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

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

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

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

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

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

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

Question 11

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

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

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

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

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

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

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

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

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

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

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

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

Question 12

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

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

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

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

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

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

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

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

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

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

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

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

DESIGN AND TECHNOLOGY

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

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

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

Comments on specific questions

Section A

Question A1

Gym membership card

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

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

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

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

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

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

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

Question A2

Production of the gym membership card

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

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

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

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

Question A3

Membership card wallet

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

Question B4

Planometric views of the gym changing room.

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

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

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

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

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

Question B5

Gym weight

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

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

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

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