DESIGN AND TECHNOLOGY

Paper 0445/05
Project

Key messages

- It is important that candidates be encouraged to plan their time effectively to ensure that they fully complete work that meets all aspects of the assessment criteria in the time allowed.
- Candidates should produce folders that make the best use of each page. For example, some candidates use overly large fonts, large headings and unnecessary embellishment. Candidates' folders should be detailed and concise.
- Many candidates use CAD to generate ideas. It is advisable for candidates to also use pencil or pen sketches so that they can explore their initial ideas quickly in order to produce a wider range of possible solutions. Candidates should be encouraged to explore innovative and creative possibilities at this stage.

General comments

Moderators greatly appreciate the work that centres do in preparing their students for this assessment unit and acknowledge the care and attention over the administrative tasks required to accurately complete documentation.

The majority of work submitted was generally well structured and covered the assessment criteria.

Some of the work submitted was of a very high quality, with many exceptionally well-made functional outcomes.

Most centres applied marks consistently and accurately and were in line with the standards set by the Awarding Body. There were a few instances however, where individual candidates within the sample submitted were awarded disproportionate marks resulting in an inaccurate rank order. Presenting the candidates in the correct rank order is vital.

When more than one teacher in a centre is making internal assessments, the centre must make arrangements for all candidates to be assessed to a common standard and that an accurate rank order is agreed.

Some folders are excessively large. It is not necessary for candidates to over-decorate their work or use large fonts to produce over-lengthy folders. Some candidates spend too much effort on unnecessary embellishment which carries no additional marks. A concise and detailed folder making the best use of each page is recommended.

An increasing number of centres submitted their work in a digital format. Work was detailed and well presented. Design ideas were scanned in and there was clear photographic evidence of manufacture, testing and evaluation. Any centres wishing to submit their work in a digital form should contact Cambridge International for details of the approved format.

Centres are encouraged to use the guidance given in this report and the focused information on the Moderators Comments on School Based Assessment of Coursework form when assessing the work of candidates.

Comments on specific tasks

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

Marks awarded in this section were generally accurate although a significant number tended to be lenient. A brief statement of what is to be designed will not access the middle or higher mark ranges.

To access the higher mark range, candidates must analyse the need in detail and consider the requirements of possible users.

The design opportunity and design brief were often communicated well. Candidates would benefit from looking at the needs and expectations of the selected user group in more detail.

Considering the type of environment in which the designed product will be used and highlighting key issues would be expected.

2. Research into the Design Brief resulting in a Specification

Most candidates produced focused and relevant research. A few candidates however, produced very large amounts of information, much of which was not related to the brief.

Whilst generic information about materials, tools, finishes and manufacturing processes is useful for knowledge and understanding, it should not be presented as part of the coursework unless it is relevant to the candidates' own design and product. Research needs to be more focused. Any information included should directly relate to the selected design challenge with personal findings and informed decisions. This section should include information such as the details and dimensions of items to be stored or fitted into the product.

Most candidates analyse existing products as part of their research but many do not draw out details that will help them when designing. Candidates should highlight the design strengths and weaknesses and use this information when generating a specification and when designing.

The best examples of research focused on the key relevant information which was necessary to support the candidates' design. Detailed and relevant specifications included high level personal observation and analysis.

Specifications were generally clear, detailed and justified; a significant number of candidates however, produced very brief and generic specifications that had little or no direct relevance to the product that they wished to design.

3. Generation and exploration of Design Ideas

There were many examples of exceptionally well-presented, innovative and creative design proposals.

Most centres assess this section accurately and in line with Cambridge International standards, but there are a significant number who assess too leniently. To access the higher mark range, a wide range of different, well-annotated possibilities is required.

A significant number of candidates did not consider the Design Specification during the design activity. The design proposals should be evaluated against the product specification, so that informed; reasoned decisions can be made about modifications to ideas or the rejection of particular proposals.

4. Development of Proposed Solution

This section was assessed too generously by a significant number of centres. Whilst many candidates had clear evidence of their developmental work, some candidates had little or no evidence in their folders yet were awarded marks in the middle and high marks range.

Modelling is usually executed in this section to help visualise the design proposal. Seeing the design in 3D helps to make sure items will fit, looks well-proportioned or products will be stable. An increasing number of candidates make excellent use of 2D and 3D modelling and computer aided images to develop their design proposal.

To obtain the higher marks, candidates need to focus on the decisions needed to be made about material choices, construction possibilities, finishes and purchased components. This is also done through experimentation and trialling with clear conclusions and decisions.

5. Planning for Production

Working drawings were mostly clear and of a good standard with many candidates producing high quality, detailed work. CAD is increasingly used to great effect in producing final drawings.

To achieve the highest mark ranges, drawings should include all the necessary details such as key dimensions, additional fixtures used e.g. hinges and screws, and finishes applied.

Many candidates produced detailed plans for production. Many produced a logical sequence of the stages of manufacture, including detailed cutting lists and approximate time allocations.

Candidates should be reminded to include details of specific tools, equipment, adhesives, and finishes. The planning section should include, where appropriate, a cutting list showing selected materials and quantity. Some candidates spend a great deal of time producing very detailed diagrams of each process and stage of manufacture, including fully detailed sketches of tools and equipment used which is unnecessary.

6. Product Realisation

The majority of centres are accurate and fair in awarding marks commensurate with the quality of work produced.

Centres are reminded that to achieve the higher mark range for Objective 6, the product should be completed to a high standard of outcome with precision and accuracy, meeting most or all of the requirements of the product specification.

Most candidates fully complete the manufacture of a practical outcome and there were many examples of exceptionally high quality manufactured products presented.

Candidates generally include a range of good quality photographs to show full details to highlight the complexity of their product. Many candidates produced a diary/photographic log of the key stages of manufacture of the product to emphasise key features and the quality of making, which is to be encouraged.

7. Testing and Evaluation

This section tended to be marked slightly leniently. Candidates often provided good evidence of the product in use in its intended environment and included third party comments. Many made reference to their specification but did not go on to suggest improvements or modifications. To access the higher mark ranges, the evaluation should include the identification of strengths and weaknesses and proposals for modifications. Modifications should ideally be in the form of sketches and notes. There should be clear photographic evidence of testing in this section.

DESIGN AND TECHNOLOGY

Paper 0445/11
Product Design

Key messages

- Descriptions of the three design ideas being proposed cannot be awarded marks as evaluation responses to part **(d)**. Candidates should be encouraged to provide justified evaluations on both positive and negative aspects of the proposed design ideas.
- Full solutions to the design problem, drawn in response to part **(e)**, should include construction details rather than manufacturing methods that might be used in the workshop/studio. Manufacturing methods are required as responses to part **(g)**.

General comments

Successful candidates followed the design process as set out on the A3 answer sheets showing that they could apply their design skills in an imaginative and creative way. Candidates tended to respond well when they focused their answers on the precise stage of the design process as set out on the A3 answer sheets. The three questions presented fairly open design situations, based on sporting activities in Schools whereby candidates could apply specific areas of knowledge and interest developed during the period of their study.

Question 1 was the most popular question, followed by **Question 2**, with a small number of candidates choosing **Question 3**.

Comments on specific questions

Question 1

Candidates appeared to understand fully the design requirements of a product for holding and transporting javelins and it was clearly one with which they were familiar in their normal day-to-day experiences. Suggested ideas showed evidence of original thinking with imaginative outcomes.

(a) Candidates were able to identify four functional points required of the product in addition to those outlined in the question. Successful responses to this introductory part of the question included: easy to access; lightweight; easy to store; minimal size to transport; stands by itself; javelin points protected; etc.

(b) Few candidates had difficulty showing two ways by which round section items could be secured and these included: in holes; slots; clips; elastic bands; hooks; etc.

(c) Responses to this part of the design questions have improved considerably over recent examinations and the majority of candidates were able to draw three different ideas. Successful candidates used the whole space provided to produce clear drawings using appropriate techniques so that design details were clear to the viewer. Marks were awarded for the quality of communication techniques, so drawings should be enhanced through the use of shading or colour and appropriate annotation added. Marks were also awarded for the suitability of ideas and successful candidates explained their thinking and added detail as they progressed.

(d) The majority of candidates evaluated effectively each of their design ideas in turn and then identified the chosen idea with reasons for choice stated. Centres had obviously taken note of previous reports as there were very few cases where candidates had produced a scoring table, marking or ticking each design idea against specification points. Candidates are required to

comment on particularly good and bad points on each of their design ideas before making their choice.

(e) There was evidence of good quality drawing in the presentation of the proposed design solution and constructional detail was provided either as part of the main presentation or through annotation or other surrounding smaller drawings. Candidates are free to choose their own drawing method so long as all constructional detail is clear to the viewer and significant dimensions are included. Candidates are not required to outline manufacturing methods here as this is required in the final part of the question.

(f) Many candidates were able to identify appropriate specific materials that could reasonably be used in the construction of the design outlined in the previous part of the question. Candidates must avoid the use of generic terms such as wood, metal and plastic as these cannot be marked positively.

(g) Successful candidates identified one part of their proposed solution and outlined a simple step by step approach to the production of this part, identifying tools at each stage. It is important that the process is specific to the chosen product and not general in nature. Full marks can be awarded only if this is the case.

Question 2

This question clearly appealed to those candidates following the Graphic Products option and most appreciated that a lightweight souvenir award would need to be produced through the use of semi resistant materials.

(a) Most candidates were able to suggest additional points to those identified in the question and successful responses included: attractive colour/shape; has impact; lightweight to carry; etc.

(b) The majority of candidates were able to identify two aspects of their School that might form the basis for such an award and appropriate suggestions included: includes School crest; model of a building; local landmark; local industry or community feature; School specialism; etc.

(c))
(d))
(e)) See **Question 1 (c) – (g)**
(f))

Question 3

Candidates who attempted this question had the opportunity to show their specialist interest in and knowledge of Systems and Control, as intended by the context of the design situation. Successful outcomes focused on the workshop experience of the candidates and resulted in manageable products.

(a) Additional points about the function of the scoreboard included: seen from wide angle; visible in dull/bright light; large numbers; above head height; specific display type; etc.

(b) Most candidates were able to identify two forms of number display including: electronic display; LED display; flashing lights; analogue display, flip over cards; etc.

(c) **)**
(d) **)**
(e) **)** See **Question 1(c) – (g)**
(f) **)**
(g))

DESIGN AND TECHNOLOGY

Paper 0445/12
Product Design

Key messages

- Descriptions of the three design ideas being proposed cannot be awarded marks as evaluation responses to part **(d)**. Candidates should be encouraged to provide justified evaluations on both positive and negative aspects of the proposed design ideas.
- Full solutions to the design problem, drawn in response to part **(e)**, should include construction details rather than manufacturing methods that might be used in the workshop/studio. Manufacturing methods are required as responses to part **(g)**.

General comments

Successful candidates followed the design process as set out on the A3 answer sheets showing that they could apply their design skills in an imaginative and creative way. Candidates tended to respond well when they focused their answers on the precise stage of the design process as set out on the A3 answer sheets. The three questions presented fairly open design situations based on garden greenhouses whereby candidates could apply specific areas of knowledge and interest developed during the period of their study.

Question 1 was, by far, the most popular question, with smaller numbers of candidates answering **Question 2** and **Question 3**.

Comments on specific questions

Question 1

Candidates appeared to understand fully the design requirements of a plant pot filling unit and it was clearly one with which they were familiar in their normal day-to-day experiences. Suggested ideas showed evidence of original thinking with imaginative outcomes.

(a) Candidates were able to identify four functional points required of the plant pot filling unit in addition to those outlined in the question. Successful responses to this introductory part of the question included: space for loose compost; storage for pots; hopper for compost; water resistant, tool storage; easy to clean; lightweight for moving/storage; etc.

(b) Few candidates had difficulty showing two types of folding feature and these included: hinged frames; sliding tubes; tubes located in fixed fittings; support struts; detachable legs/frames/tops; nuts/bolts; different types of hinge; etc.

(c) Responses to this part of the design questions have improved considerably over recent examinations and the majority of candidates were able to draw three different ideas. Successful candidates used the whole space provided to produce clear drawings using appropriate techniques so that design details were clear to the viewer. Marks were awarded for the quality of communication techniques so drawings should be enhanced through the use of shading or colour and appropriate annotation added. Marks were also awarded for the suitability of ideas and successful candidates explained their thinking and added detail as they progressed.

(d) The majority of candidates evaluated effectively each of their design ideas in turn and then identified the chosen idea with reasons for choice stated. Centres had obviously taken note of previous reports as there were very few cases where candidates had produced a scoring table, marking or ticking each design idea against specification points. Candidates are required to

comment on particularly good and bad points on each of their design ideas before making their choice.

(e) There was evidence of good quality drawing in the presentation of the proposed design solution and constructional detail was provided either as part of the main presentation or through annotation or other surrounding smaller drawings. Candidates are free to choose their own drawing method so long as all constructional detail is clear to the viewer and significant dimensions are included. Candidates are not required to outline manufacturing methods here as this is required in the final part of the question.

(f) Many candidates were able to identify appropriate specific materials that could reasonably be used in the construction of the design outlined in the previous part of the question. Candidates must avoid the use of generic terms such as wood, metal and plastic as these cannot be marked positively.

(g) Successful candidates identified one part of their proposed solution and outlined a simple step by step approach to the production of this part, identifying tools at each stage. It is important that the process is specific to the chosen product and not general in nature. Full marks can be awarded only if this is the case.

Question 2

This question clearly appealed to those candidates following the Graphic Products option and most appreciated that a greenhouse model of this type would need to be produced through the use of semi resistant materials.

(a) Most candidates were able to suggest four additional functional points to those identified in the question and successful responses included: visual impact; suitable colour; advertising aspect; use of net; printing method; folding issues; appropriate sizes; suitable constructions; etc.

(b) The majority of candidates were familiar with different types of 3D pop up system for this type of situation and appropriate suggestions included: elastic bands; lever systems; inflated balloon; pinned articulation; springs; etc.

(c))
(d))
(e)) See **Question 1 (c) – (g)**
(f))
(g))

Question 3

Candidates who attempted this question had the opportunity to show their specialist interest in and knowledge of Systems and Control, as intended by the context of the design situation. Successful outcomes focused on the experience of candidates and resulted in manageable products.

(a) Additional points about the function of the temperature controlled automatic closing greenhouse door included: temperature sensing methods; safety issues; different working environments; power sources; reliability when unattended; weight of door; etc.

(b) Most candidates were able to identify two mechanisms that would convert rotary to linear motion including: cam and follower; rack and pinion; crank and slider; screw thread and follower; pulley/cord and weight; etc.

(c))
(d))
(e)) See **Question 1 (c) – (g)**
(f))
(g))

DESIGN AND TECHNOLOGY

Paper 0445/13
Product Design

Key messages

- Descriptions of the three design ideas being proposed cannot be awarded marks as evaluation responses to part **(d)**. Candidates should be encouraged to provide justified evaluations on both positive and negative aspects of the proposed design ideas.
- Full solutions to the design problem, drawn in response to part **(e)**, should include construction details rather than manufacturing methods that might be used in the workshop/studio. Manufacturing methods are required as responses to part **(g)**.

General comments

Successful candidates followed the design process as set out on the A3 answer sheets showing that they could apply their design skills in an imaginative and creative way. Candidates tended to respond well when they focused their answers on the precise stage of the design process as set out on the A3 answer sheets. The three questions presented fairly open design situations based on cars whereby candidates could apply specific areas of knowledge and interest developed during the period of their study.

Question 1 was the most popular question, followed by **Question 2** with a fairly small number of candidates choosing **Question 3**.

Comments on specific questions

Question 1

Candidates appeared to understand fully the design requirements of holder for car cleaning items and it was clearly one with which they were familiar in their normal day-to-day experiences. Suggested ideas showed evidence of original thinking with imaginative outcomes.

(a) Candidates were able to identify four functional points required of the holder in addition to those outlined in the question. Successful responses to this introductory part of the question included: easy access to contents; lightweight; portable; stackable; stands by itself; waterproof; place to hang/dry leather; keeps bottles upright; etc.

(b) Few candidates had difficulty showing two ways of allowing water to drain from the holder and these included: holes in base; slots; cut away sides; grill; wire mesh; inclined base; etc.

(c) Responses to this part of the design questions have improved considerably over recent examinations and the majority of candidates were able to draw three different ideas. Successful candidates used the whole space provided to produce clear drawings using appropriate techniques so that design details were clear to the viewer. Marks were awarded for the quality of communication techniques so drawings should be enhanced through the use of shading or colour and appropriate annotation added. Marks were also awarded for the suitability of ideas and successful candidates explained their thinking and added detail as they progressed.

(d) The majority of candidates evaluated effectively each of their design ideas in turn and then identified the chosen idea with reasons for choice stated. Centres had obviously taken note of previous reports as there were very few cases where candidates had produced a scoring table, marking or ticking each design idea against specification points. Candidates are required to

comment on particularly good and bad points on each of their design ideas before making their choice.

(e) There was evidence of good quality drawing in the presentation of the proposed design solution and constructional detail was provided either as part of the main presentation or through annotation or other surrounding smaller drawings. Candidates are free to choose their own drawing method so long as all constructional detail is clear to the viewer and significant dimensions are included. Candidates are not required to outline manufacturing methods here as this is required in the final part of the question.

(f) Many candidates were able to identify appropriate specific materials that could reasonably be used in the construction of the design outlined in the previous part of the question. Candidates must avoid the use of generic terms such as wood, metal and plastic as these cannot be marked positively.

(g) Successful candidates identified one part of their proposed solution and outlined a simple step by step approach to the production of this part, identifying tools at each stage. It is important that the process is specific to the chosen product and not general in nature. Full marks can be awarded only if this is the case.

Question 2

This question clearly appealed to those candidates following the Graphic Products option and most appreciated that a lightweight holder for car brochures would need to be produced through the use of semi resistant materials.

(a) Most candidates were able to suggest four additional points to those identified in the question and successful responses included: attractive colour/shape; has visual impact; easy to transport; folds up; reflects car brand; easy to access brochures; etc.

(b) The majority of candidates were familiar with different methods of joining lightweight materials temporarily and appropriate suggestions included: tabs and slots; ‘velcro’; clips; split rings; tape; wire/plastic comb binders etc.

(c))
(d))
(e)) See **Question 1 (c) – (g)**
(f))
(g))

Question 3

Candidates who attempted this question had the opportunity to show their specialist interest in and knowledge of Systems and Control, as intended by the context of the design situation. Successful outcomes focused on the experience of candidates and resulted in manageable products.

(a) Additional points about the function of the torch holding device included: easy to fit torch; does not damage torch; adjustable angle/height; access to switch; stable in use; foldable; easy to store; etc.

(b) Most candidates were able to identify two mechanisms that could form part of adjustable devices including: bolt and wingnut; screw thread; slots; telescopic arm; flexible arm, cams; over centre devices; etc.

(c))
(d))
(e)) See **Question 1 (c) – (g)**
(f))
(g))

DESIGN AND TECHNOLOGY

Paper 0445/21
Graphic Products

Key Message

- The focus of this assessment is Graphic Products. Future candidates would benefit from practical activities based on the questions contained in this paper.

General comments

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

The standard of work was comparable to that of the previous year.

There are areas of the syllabus however, in which further improvements are needed. Candidates must be able to render two-dimensional drawings to make them appear three-dimensional. Practical experience of using cardboard to make pop-up cards and foam board to construct concept models are also areas that need to be improved.

Comments on specific questions

Question A1

Designs for a Birthday Card

(a) **Part (a)** required candidates to complete the scale 1:2 drawing of the design for the front and back of a given birthday card by completing the 296×210 outline, drawing in the centre fold to the correct convention, and rendering the balloons to make them appear three-dimensional. Most candidates completed the outline and the fold line but this line was not always to the correct convention. The rendering of the balloon did not always show a curved surface.

(b) A sketch and notes were required to show how a stencil could be used to apply a number 5 to the bottom right hand corner of the card. This could be by using a spray paint or a felt tip pen. To improve their knowledge, practical activities giving candidates experience of the use of stencils would be beneficial.

Question A2

(a) A strip of card to the size given in the question was required to be added to the part folded card to enable a pop-up mechanism to work. This system appears on many greetings cards. Very few candidates attached the strip of card pre-folded and in the correct position to make the mechanism work.

(b) There are many ways of joining the strip of card to the birthday card. The main methods currently used include: 'Sellotape', Double sided tape, 'Pritt stick', and PVA glue.

Question A3

Packaging for 25 Birthday Cards

Most candidates attempted all parts of this compulsory question.

(a) The question asked candidates to complete the end and front first angle orthographic views of an assembled package that would hold 25 birthday cards. Most candidates completed the end view. The Front view required a top right diagonal and the two lower diagonals to be added. A circular seal needed to be drawn to match the existing one given in the top half of the box.

(b) Candidates were asked to draw a pie chart to show the relative sales figures for the balloons, horses and pirate versions of the birthday card designs. The data given added up to 1800 and by simple calculation this gave sectors of 160°, 80° and 120°.

Candidates needed to improve their knowledge for this question as not all candidates drew the required pie chart, with many omitting the labels that would enhance the appearance of the chart.

Question B4

Model of a bridge in foam board

This question was also derived from a real 'Graphic Product'.

A classroom exercise to make the model bridge in foam board would be most beneficial to future candidates' understanding of this commonly used application.

This question was attempted by a smaller number of the candidates. Overall, candidates gained a wide range of marks for their answers.

(a) Candidates were required to complete the plan view drawn in third angle projection, by adding a horizontal line to show the thickness of the front edge.

Hidden detail of the rectangular slots in the bridge sides also needed to be added.

The side view required a semi-ellipse 100×40 to be added along with the two side base lines. The remaining rectangular slot needed to be drawn in the correct position.

(b) (i) This part of the question required candidates to draw the sectional view of foam-board. Responses showed that very few candidates had knowledge of this modelling material.

(ii) Experience of cutting out foam board was needed by candidates to respond to this question correctly. Additions to the list could contain: Craft Knife, Scalpel, Stanley knife, steel rule, safety rule.

(c) Candidates needed experience of using foam board for similar graphic models to correctly answer this part of the question. Because of the edge thickness, re-enforcing underneath the visible surface is one solution to the bridge parts coming loose. Another common practice is the insertion of long dress-making pins to the joint effectively giving the joint a dowel type re-enforcing.

Question B5

Desk Tidy

This question was derived from an actual 'Product' used in an office.

A classroom exercise to make the packaging in cardboard, 'perspex' and in foam board, would be most beneficial to future candidates' understanding of the relevant folding and jointing of three materials that are in common use for constructing this type of Graphic Product

This question was attempted by a large number of the candidates. Overall, candidates gained a wide range of marks for their answers.

(a) In **Model 1** candidates were asked to sketch a solution to make the desk tidy box from one piece of folded 3 mm plastic sheet. Several developments exist with all requiring folds in the correct place. Most candidates sketched a workable development (net) but the fold lines were not always to the correct convention. Candidates needed to improve their knowledge for this question as the question also asked for the material to be shown graphically and this was omitted in many candidate solutions.

Model 2 required candidates to sketch the construction of the same desk tidy from 10 mm wood. The thickness of the wood required an adjustment to the sizes of the sides so that an outer cube of 100 mm would be formed. At least one of the pieces of wood needed to be shown with surface and end grain to attain full marks.

(b) Candidates were required to give two reasons why plastic material is suitable for Model 1. Acceptable answers included: can be heated and bent, material available in a range of colours, can be easily wiped clean.

(c) Candidates were required to draw a 1:2 isometric view of Model 2 that had been modified. Many candidates drew the outer of the box correctly to size. The inner of the box needed to show the wall thickness of 10 mm and where the truncating cut passed at an angle through the front right hand part, the width of the material in the drawing would appear thicker. The internal corner had to be correctly positioned and the internal base in a position that allowed for the thickness

DESIGN AND TECHNOLOGY

Paper 0445/22
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.

General comments

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

The standard of work was comparable to that of the previous year.

There are areas of the syllabus however, in which further improvements are needed. Candidates must be able to use effectively the correct convention for fold lines and apply thick and thin lines technique to enhance a pictorial view. Candidates would benefit from the practical experience of using foam board and Styrofoam as modelling materials.

Comments on specific questions

Question A1

Folded Leaflet

(a) (i) Candidates were required to complete the outline of a 296×210 sheet of A4 paper to a scale of 1:2.

(ii) Two fold lines were to be added so that the leaflet would fold to give 6 faces

(iii) Thick and thin line technique was to be added to the given drawing of the table. The principle for this application is that thick lines only appear where one side of the edge is visible.

(b) Candidates were required to use a sketch and notes to show how the drawing of the table could be embossed. The sketch needed to show the table raised or indented and some explanation that it had been pushed up or down by a press.

Question A2

Self-adhesive label

(a) An understanding of the use of a self-adhesive label was required by this question. Candidates were asked to complete a full size isometric drawing of the given self-adhesive label and add the text box and circle. Most candidates drew the text box to the correct size. The circle needed to be illustrated by an elliptical shape. This ellipse was not always drawn to the correct orientation.

(b) The question asked for completion of a list for the decisions to be made when selecting the text. The answers could include: font, bold, italic, typeface style, colour.

Question A3

Some candidates did not attempt all parts of this compulsory question.

(a) The question asked candidates to complete the unfinished development of a card closure for a polythene bag. Many candidates completed the outline but did not include the Euroslot. Some candidates drew the Euroslot in the top half of the closure but did not 'invert' it in the lower half or draw it the same distance from the fold line. The fold line had to be to the correct convention to gain full marks.

(b) Data from sales of three different sizes was given in a numerical format. Candidates were asked to represent the data in a three-dimensional format. Most candidates drew a bar chart but not all bar charts were drawn three-dimensionally. A scale representing sales was required vertically and the bars plotted to this scale and labelled correctly for their relevant size.

Question B4

Novelty sweet package

This question was derived from an actual 'Graphic Product' used in a shop.

This question was attempted by a large number of candidates. Overall, candidates gained a wide range of marks for their answers.

(a) An incomplete third angle orthographic projection of a sweet package was to be completed by:

(i) Adding the second ear;

(ii) Completing the glue tab and the tail;

(iii) Completing the end view.

Most candidates attempted all parts of the question with a range of solutions.

(b) Candidates were asked to sketch a design for a one-piece development (net) of the novelty sweet packaging. Marks were awarded for five connecting surfaces with two ears and a tail box, two triangular shaped surfaces added to the base or front and sufficient glue tabs to hold the development (net) together. The correct convention for a fold line was also required.

(c) (i) The question asked the candidate to complete the three incomplete words to spell **S**hape **M**emory **A**lloy

(ii) Reasons why SMA is a suitable material for the spectacles include: easy to bend, safe material, will return to its original shape.

Question B5

Model of an office building

This question was also derived from a real 'Product'. Candidates would benefit from making models from foam board and Styrofoam.

This question was attempted by a smaller number of candidates. Overall, candidates gained a wide range of marks for their answers.

(a) This question required candidates to render one pictorial drawing as two layers of foam board glued together The foam board needed to show that each board had a top and bottom thin surface of card or plastic and an inner core of foam.

A second pictorial drawing needed to show Styrofoam with a layer of wood glued together. The foam needed to have the correct convention applied and the wood needed to have grain on the top surface and end.

(b) (i) This part of the question required candidates to give two reasons why Styrofoam is a suitable material for modelling the blocks. Correct answers included that it is available in large block sizes and is easy to cut and shape.

(ii) Suitable adhesives for joining Styrofoam are PVA and double-sided tape.

(c) Candidates were required to complete an isometric of a model of a five storey office block where each floor is rotated by 90° on its central axis. Marks were awarded for each floor being the correct orientation and the correct size and shape.

(d) To add realism to the office block model, candidates were asked to show sketches and notes of a method of adding windows to the surface of the Styrofoam model. Acceptable answers included self-adhesive labels, drawing with felt tip pen and cutting out rectangles with a scalpel/Stanley knife.

DESIGN AND TECHNOLOGY

Paper 0445/23
Graphic Products

Key message

- The focus of this assessment is Graphic Products. Future candidates would benefit from practical activities based on the questions contained in this paper.

General comments

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

The standard of work was comparable to that of the previous year.

There are areas of the syllabus however, in which further improvements are needed. Candidates must be able to use effectively the correct convention for fold lines and apply hatching to a sectional view. Candidates would benefit from the practical experience of using corrugated cardboard and Drawing in Planometric projection.

Comments on specific questions

Question A1

Folded Map

(a) Candidates were required to complete the design for the front of a map by:

(i) Completing the outline of the given sheet of paper.

(ii) Drawing the fold lines to the correct position and convention.

(iii) Constructing a regular hexagon of 20 side around a letter M.

(b) Candidates were required to use a sketch and notes to show what is meant by ‘die cutting’. Successful responses showed the shape being cut with a single or double cutter to provide a clear hole.

Question A2

Schematic route map

(a) An understanding of the schematic style of representation of a route was needed to fully answer this question. From the given pictorial map, locations were labelled in the correct order and position with adjoining arrows for the route to be taken. Three extra locations and four arrows needed to be evident.

(b) The question asked for two ways of making the schematic drawing clearer. Suitable answers included: Colour coding, pictograms, number sequence, distance, time and scale.

Question A3

Some candidates did not attempt all parts of this compulsory question.

(a) The question asked candidates to complete the unfinished development (net) of a card envelope. Many candidates completed an outline by copying the given flap twice but did not make the fourth fold flap larger than the other three. The larger fold flap and the opposite flap needed to be folded inwards in feint drawing to determine the size and position of the cut slots.

(b) Data from sales of maps over a three year period was given in a numerical format. Candidates were asked to represent the data in a line graph. Most candidates drew a line graph but not all were drawn correctly to a scale that the candidate had drawn vertically. Labels correctly positioned gain full marks.

Question B4

Child's play house

This question was derived from an actual 'Graphic Product' sold in a toy shop.

This question was attempted by a large number of candidates. Overall, candidates gained a wide range of marks for their answers.

(a) An incomplete first angle orthographic projection of a play house was to be completed by:

(i) Adding to the front view the missing lines to the right and the horizontal lines.

(ii) Adding to the end view with a roof and the elliptical chimney hole.

(iii) Adding to the plan with the two roof triangles being equal.

Most candidates attempted all parts of the question with a range of solutions.

(b) Candidates were asked to draw the relevant projection symbol in box A.
For first angle projection, two concentric circles were to be drawn on the right and a truncated cone to sizes matching the circles drawn on the left. The smallest part of the cone must have been drawn on the extreme left to be correct.

(c) (i) The question asked the candidate to draw a sectional view of corrugated cardboard. Corrugated cardboard consists of a solid top and solid bottom layer with a corrugated (sine wave shape) internal wave of bent card.

(ii) The equipment needed to cut out a window in the wall of the play house includes: Craft knife, Stanley knife, scalpel, Safety rule, steel rule, metal straight edge.

(iii) Strengthening the lower part of the cut-out for the window can be achieved by attaching pieces of the corrugated card to the internal lower sill of the window with the corrugations 90° to the direction of that of the body of the play house. A suitable adhesive would be PVA or contact adhesive. A variety of drawings and notes explained this well.

Question B5

Pencil sharpener

This question was attempted by a smaller number of candidates. Overall, candidates gained a wide range of marks for their answers.

(a) This question required candidates to complete a one point perspective drawing of the pencil sharpener case. Initially the square front face and the centrally located circle had to be drawn. The edges of the square face were to be shown going to VP1. The back edges and the join lines had to be represented by lines parallel to the given front square.

(b) This part of the question required candidates to complete the sectional view of the pencil sharpener case. Effectively, candidates needed to draw a mirror of what had been given and then add the conventional section lines. Candidates who used lines in different directions for different parts gained full marks.

(c) A knowledge of 'Polymorph' used as a modelling medium was needed to be experienced to answer this part of the question. Two important properties of 'Polymorph' were asked for and they are: Can be easily moulded when warmed with hot water. Can be re-cycled and used many times.

(d) Candidates need to improve on their knowledge of orthographic drawings as they are not easily understood by all. Planometric drawings are now commonly used to show people what a product looks like. This question asked the candidate to draw the pencil sharpener case in planometric projection. The correct solution showed three vertical lines coming down from the given square and a hidden detail vertical line to the back edge. Parallel lines showed the bottom of the prism (hidden detail to the back) and internally a cone drawn from the given circle on the top face to a smaller circle on the bottom face drawn in hidden detail completed the view.

DESIGN AND TECHNOLOGY

Paper 0445/31
Resistant Materials

Key messages

- Candidates need to read the questions carefully and be clear about what the question is asking **before** attempting an answer.
- Candidates need to improve their knowledge and understanding of a range of wood-based materials, metals and plastics, their properties and uses.
- Candidates need to improve their communication 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 provide appropriate detail.

General comments

Section A

Candidates need to develop their knowledge and understanding in order to improve their responses when answering all questions in this section.

Section B

This section always has a number of questions with large mark allocations requiring a combination of clear and accurate sketches supported by detailed written notes. Careful reading of the questions is needed before answering. Those questions requiring candidates to provide design solutions not only demand clear sketches but additional notes providing **all** constructional details and named materials.

Comments on specific questions

Section A

Question 1

Most candidates were able to describe 3 safety considerations in the design of the scooter: the most common being adjustable handlebar height, robust materials, no sharp points, a foot operated brake and a stable footrest. Some candidates did not answer the question correctly by listing 3 specification points.

Question 2

Many candidates recognised that the bevel-edge chisel was used with wood although most could not describe a **specific** use. Most candidates did not know what a cold chisel was used for.

Question 3

Most candidates were able to show the basic shape of a tenon saw. The marks were awarded for showing the ‘back’ of the saw and a second mark for the correct shape of blade.

Question 4

The majority of candidates had no knowledge of SMA- **S**hape **M**emory **A**lloy which is a smart material.

Question 5

Candidates needed to improve their knowledge for this question. The majority of candidates were unable to identify the correct tool for each of the processes described. All the tools are used with basic metalworking techniques.

Question 6

(a) Many candidates named polyethelene (polythene) correctly but there were also many candidates who were unaware of the symbol and number corresponding to a specific plastic material.

(b) The majority of candidates described a problem for the environment of using products made from plastic. The most common related to plastic being non-biodegradable, some plastics could not be recycled and some plastics gave off toxic fumes when burnt.

Question 7

Many candidates gained 2 out of 3 marks for showing a housing joint but only a very small minority drew what the question required; a **stopped** housing joint. Candidates are reminded to read questions carefully.

Question 8

Only a minority of candidates could explain the term 'non-ferrous alloy' in full. Some candidates knew that a non-ferrous metal was a metal that did not contain iron but did not understand the term 'alloy'. Some candidates knew what an alloy was but did not understand the term 'non-ferrous'.

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Many candidates described a benefit of using a hot melt glue gun; the most common being that it was a quick process. Drawbacks included that the glue did not produce a particularly strong joint and that there was danger of burns when handling the hot gun.

Question 10

Candidates needed to improve their knowledge for this question as very few candidates named **both** fastening devices and the method of tightening them. The hexagonal nut and wing nut are basic fastenings that candidates should be familiar with.

Section B

Question 11

(a) Many candidates named a thermoplastic; acrylic being the most common. Many candidates named steel as a ferrous metal but gained no marks as the question required a **specific** name such as mild steel or stainless steel. Only a few candidates could provide an appropriate thickness for their named materials. Candidates are reminded that when working with resistant materials they should know the standard/stock sizes available.

(b) (i) Candidates needed to improve their knowledge and understanding for this question. Although most candidates named a chinagraph pencil or marker pen correctly, some candidates could not name an appropriate way of marking a line on the surface of a thermoplastic.

(ii) The majority of candidates could not name a scriber as the correct tool used to mark a line on the surface of ferrous metal.

(c) (i) Many candidates gained marks for this question with many achieving maximum marks for showing how the thermoplastic would be softened by means of a strip heater or line bender, the use of a former to achieve the desired bend and a method of retention while it cooled.

(ii) Although many candidates did achieve 1 or 2 marks for showing how the bookends could be bent to shape when made from ferrous metal, generally candidates were less sure of the techniques involved. Good answers included the use of a mallet or a hammer with scrap wood to prevent

damage to the surface of the metal. Many candidates showed the use of a former or vice jaws to enable the metal to be bent to the correct shape.

(d) (i) Candidates were given the choice to describe 3 main stages involved in joining the storage strips to the bookends when made from **either** thermoplastic **or** ferrous metal. Candidates needed to develop their knowledge and understanding for this question. Thermoplastic strips would be joined using acrylic (Tensol) cement with which candidates should be familiar. The strips would be joined by brazing or the use of epoxy resin.

(ii) There were some good methods showing how the storage strips could be joined to the bookends without the use of a permanent method described in part **(i)**. The best methods involved the use of slots into which the strips could be inserted. Many candidates described how the strips could be screwed to the bookends without realising that the thermoplastic would be too thin for this to be practical. Many candidates simply 'glued' the strips to the bookends even though the question stated

'without the use of a permanent method'.

(e) (i) Candidates needed to state that self-finishing meant that the thermoplastic would receive no applied finish (1 mark) and that it would be cleaned and 'buffed' to a high quality (1 mark).

Only a minority of candidates demonstrated any knowledge of self-finishing.

(ii) Candidates needed to develop their knowledge of dip coating with plastic. Most candidates stated that the metal would be dipped into melted plastic. The basic technique involves the metal being heated and dipped into plastic. Centres are reminded that dip coating is one of the techniques candidates should have experience of in the '*Finishes'* section of the syllabus.

(f) Most candidates were able to provide one benefit to a manufacturer of producing the bookends without the storage strips. The most common answers related to less materials being used, lower labour costs, quicker manufacture and easier storage.

Question 12

(a) (i) Candidates needed to develop their knowledge for this question as many could not name a hardwood for the sign. Candidates are expected to be familiar with a range of hardwoods and softwoods, their properties and uses when following a Resistant Materials course.

(ii) Most candidates named at least one appropriate tool to remove each of the areas labelled **A, B** and **C**. Most answers involved the use of a variety of saws including a Hegner or equivalent, a coping saw and a tenon saw.

(iii) This question tested candidates' knowledge of the preparation that would be carried out **before** applying a finish. The best answers, (in a minority) included the use of different grades of glasspaper (commonly referred to as 'sandpaper') and the removal of dust. Most candidates could not describe these processes.

(iv) This question was concerned with the actual application of a suitable finish and how a high quality could be achieved. The best answers referred to careful application of a varnish using a brush, making sure that brushstrokes were in the same direction and taking care not to apply the varnish too liberally.

(b) Many candidates did not read the question carefully and fixed the sign to the wall using screws that were visible on the front of the sign. The best answers, (in a minority) showed the use of brackets or some type of hooks that were fixed to the wall and over which the sign could be attached. Many candidates simply nailed or glued the sign to the wall.

(c) Many candidates did attempt to show a freestanding support. Because there were 8 marks available for this question the bullet points were there to help focus the candidates' attention to the important design considerations: a stable base, a method of joining the sign to the support, two important sizes and the names of the materials and construction methods. Many candidates achieved some marks but failed to address all the bullet points. There were some potentially practical designs that lacked the necessary details to achieve maximum marks.

(d) Candidates needed to improve their knowledge for this question and also ensure that they read the question carefully. This question stated: '*Describe how CAD could be used to design the words...'* yet most answers described how a computer could be linked to a CNC machine and the data transferred to enable the words to be cut out. The question required details about the use of named CAD software that enabled different fonts, size and spacing to be carried out. In addition, candidates could have described how CAD allows for effective on-screen modelling and evaluation before manufacture.

Question 13

(a) Candidates needed to develop their knowledge for this question. The majority of candidates could not identify the hardwood from the list of four materials given.

Candidates are expected to be familiar with a range of hardwoods, softwoods and manufactured boards when following a Resistant Materials course.

(b) The recognised method of joining boards edge to edge requires that the edges are **planed** flat and square then glued together and held with sash cramps. The **addition** of a tongue and groove, dowel or biscuit is acceptable. Candidates needed to develop their knowledge for this question. Most candidates did not know how to join the boards other than use an adhesive with many using files and/or glasspaper too carry out some preparation to the edges

(c) Many candidates did not read the question carefully and did not refer to Fig. 12 showing clearly the rail and its size, 50 mm wide $\times$ 20 mm thick. This would have helped candidates to identify a construction that could have been used to join the rail to the end; for example, a mortise and tenon or dowel joint. Candidates needed to develop their knowledge for this question as many described how a butt joint, (sometimes nailed or screwed), could be used. This was not rewarded.

(d) Most candidates gained marks for providing details showing how the waste wood could be removed from the end of the stool. Many candidates achieved 3 marks for showing a combination of various stages: holding the wood securely in a vice, removing the waste wood by means of a coping or Hegner saw, use of a chisel and mallet and use of files and glasspaper to make smooth.

(e) (i) The bit shown was a saw tooth bit. Because of its similarity, a forstner bit was also accepted. Candidates needed to improve their knowledge for this question as few candidates could name the bit shown correctly.

(ii) This question showed that candidates need to develop their understanding as this is a process of which all candidates should have first-hand practical experience. When drilling through wood it is essential to position a sacrificial piece underneath the wood to be drilled and to secure it using G cramps.

(f) Very few candidates described how the application of a named non-slip material and adhesive to the surface of the stool would prevent a person from slipping.

(g) (i) Polypropylene was the suitable plastic for the stool, but very few candidates gave this answer. As with other resistant materials, candidates are expected to have knowledge of a range of thermoplastics and thermosetting plastics, their properties and uses.

(ii) Many candidates did not recognise that the stool would be manufactured by means of injection moulding. Vacuum forming was a common, incorrect answer.

(iii) Very few candidates gave a detailed explanation worthy of maximum 3 marks. The main reasons why the wooden stool would be more expensive to manufacture in large quantities are that it used more materials, more constructional processes which increase the time of production which, in turn, resulted in higher costs.

DESIGN AND TECHNOLOGY

Paper 0445/32
Resistant Materials

Key messages

- Candidates need to read the questions carefully and be clear about what the question is asking **before** attempting an answer. Many candidates gave one-word answers to questions requiring more detailed responses. The number of lines for the answer and the space provided give an indication of the depth of answer required.
- Candidates need to improve their communication 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 provide appropriate detail.
- In order to achieve good marks for ***Section A***, candidates need to develop a wide knowledge and understanding of materials, tools and processes used when working with wood, metal and plastic.

General comments

Section A

Candidates need to develop their knowledge and understanding in order to improve their responses when answering all questions in this section.

Section B

This section always has a number of questions with large mark allocations requiring a combination of clear and accurate sketches supported by detailed written notes. Careful reading of the questions is needed before answering. Those questions requiring candidates to provide design solutions not only demand clear sketches but additional notes providing **all** constructional details and named materials.

Comments on specific questions

Section A

Question 1

Most candidates were able to draw the construction of blockboard. Some drawings did not show the top and bottom plies (or layers) clearly.

Question 2

(a) Many candidates could not name the metal (cast iron) from which the vice was made. Mild steel, which was inappropriate, was named by many candidates.

(b) Many candidates were not familiar with basic properties of materials and could not give a property of beech that made it suitable for wooden vice jaws. In order to be awarded a mark, candidates needed to state more detail in their response than just the term ‘strong’. The best answers stated that beech was hard, close-grained, it would not split or that it was shock absorbent.

Question 3

Most candidates chose ‘temperature’ correctly for the smart material.

Question 4

(a) The majority of candidates named correctly injection moulding or blow moulding as the processes used to manufacture the watering can.

(b) The majority of candidates understood that mild steel corrodes (rusts) but the explanation required more information (for 2 marks) such as mild steel is a ferrous metal or that it contained iron that resulted in corrosion.

(c) (i) Most candidates named **A** as the cheaper of the two watering cans to mass produce.

(ii) Many candidates stated incorrectly that plastic was a cheaper material for the watering can. The best correct reasons included that the plastic watering can involved fewer processes (fabrication), it could be manufactured quicker (decreasing labour costs and increasing profit) and that it used less materials.

Question 5

Many candidates gained at least 1 mark for correctly extending the arms of the outside calipers. However, there were many drawings that did not show accurately the ends of the calipers used to measure outside diameters of round material.

Question 6

Candidates needed to improve their knowledge for this question. This question tested the candidates' knowledge and understanding of health and safety procedures of two specific workshop processes. Many candidates gave responses, with limited detail, referring to the use of goggles without considering the actual processes.

Acrylic cement (Tensol) can cause skin irritation and requires the use of gloves or barrier cream. Acrylic cement is also dangerous to health if the fumes are breathed in and can be flammable in confined spaces. The use of a face mask and/or a well ventilated area are essential. Only a minority of candidates were able to describe these dangers and preventative measures.

Answers relating to pouring molten aluminium were also varied. The main danger concerned the extreme heat of the molten metal and the use of leather protective equipment such as apron, gauntlets and closed shoes. Many candidates had little or no knowledge of this process.

Question 7

Only a minority of candidates could provide the correct information for **all 3** items of information on the box of screws.

A referred to the gauge of the screw thread. 'Diameter' was marked as correct.
B referred to the length of the screw. 'Height' was marked as correct.
C referred to the type of head of the screw. 'Countersink' was marked as correct but many answers that referred to the 'type' of screw were unclear.

Question 8

Most candidates provided an accurate drawing of a tongue and groove joint.

Question 9

(a) The majority of candidates understood the purpose of seasoning.

While many answers described how seasoning was essential to reduce moisture content, many candidates also referred to seasoning being important to reduce the possibility of the wood shrinking, warping or splitting later.

(b) Many candidates named 'kiln' or 'artificial' seasoning correctly.

Question 10

The vast majority of candidates named nylon correctly but were less sure of the plastic used to make saucepan handles and dark electrical fittings.

Section B

Question 11

(a) The best answers referred to the size of the back of the car where the picnic table would be folded flat, what the table would need to hold, where it was going and the anthropometric considerations of the users. In addition, there were excellent answers stating the need to research suitable materials for outdoor use and appropriate finishes. Some candidates did not gain any marks for presenting their answers as a list of 'specification' points.

(b) (i) Most candidates named mild steel or aluminium for the metal legs and rails. Stainless steel was not considered appropriate.

(ii) Most candidates named welding, brazing or soldering for the heat processes used to join the legs and rails.

(c) Many candidates recognised that covering the manufactured board table top with a plastic laminate would enhance its appearance, protect the surface from spillages and enable it to be cleaned more easily. Many candidates gave incomplete answers such 'protect' and 'stop it getting damaged' without further qualification and did not receive any marks.

(d) (i) Before answering all parts of **Question (d)** candidates were given an instruction:

*Include details of materials, fittings and constructions when answering parts **(i)**, **(ii)** and **(iii)**.*

Only a small minority of candidates achieved maximum marks for this question. Most answers used some type of hinge, often a butt or back flap to enable frame **A** to fold against the underside of the table top. Many candidates were awarded 2 marks for showing the method but did not address the other requirements of the question. For example, if candidates had stated that the hinge was made from mild steel or brass and that it could be screwed to the underside of the table top using 12 mm long countersunk head screws then maximum marks would have been awarded.

(ii) There were some good methods used to hold the frames against the underside of the table top when it was carried. These included the use of spring clips and simple locking devices. Some methods which achieved only partial reward were often too complicated to be entirely practical; for example, the use of a hasp and staple or bolt that required some form of locking/unlocking.

As with part **(i)** many candidates did not address the initial instruction relating to details of materials etc.

(iii) Candidates needed to develop their understanding for this question. To lock the end frames so they could not fold inwards required the use of some type of 'brace'. There were many such devices drawn for the award of 1 mark. Unfortunately, most braces lacked details showing how they would be attached to the end frames or the table top. Often the brace was shown with some kind of pivot but without any additional descriptive notes further marks could not be awarded. Many devices interfered with the folding of the frames.

(e) Many candidates gained at least 1 mark for describing a telescopic principle with a smaller square tube able to slide up and down inside the original leg. Many candidates did add some form of pin or rod that could be inserted to pre-drilled holes in the leg and inner tube to fix the height. However, very often details of the pin such as its material and size etc. were not provided.

Question 12

(a) (i) Most candidates showed a clear understanding of a sliding bevel and how it would be used to mark out the shape of the bird feeder.

(ii) Most candidates named an appropriate saw to cut out the shape. The most commonly named saws included a tenon, jig and coping saws.

(iii) Many candidates named an appropriate type of plane; smoothing or jack, which could be used to make the edges flat and smooth.

(b) (i) Many candidates were unable to name a specific type of nail that could be used to join the ends to the base. The most common appropriate nails included panel pins, round wire and oval nails.

(ii) The most commonly correct answers for adhesives that could be used outdoors included PVA, Cascamite and synthetic resin. Epoxy resin would not be suitable for this application and contact adhesive would be inappropriate. Those candidates who named an appropriate adhesive generally stated an accurate 'time to set'.

(c) Many candidates named a butt hinge or a piano hinge correctly. A back flap hinge could not be fitted to the 15 mm thick top rail. The accuracy of sketches showing the named hinge was variable. Many candidates did not achieve maximum 3 marks for this part of the question.

(d) (i) There were some excellent clear sketches showing the acrylic sheet secured in a vice, use of a coping saw to remove the waste and the use of files and/or wet and dry (silicon carbide) paper to make the edges flat and smooth. Some candidates needed to improve their knowledge and understanding for this question as answers that showed a chisel and mallet being used on acrylic were not awarded any credit.

(ii) The best way to fit the acrylic window inside the bird feeder was to cut out a groove or to add beads.

The most common method was to cut a groove. There were 4 marks available and an instruction: '*Include all constructional details'* which meant that candidates needed to describe the size/depth of the groove, how it could be cut out and the tools and equipment required.

(e) Candidates needed to improve their knowledge and understanding for this question. The vast majority of solutions provided involved the use of welded pieces joined to the aluminium rod or some type of 'hook' shape to prevent the rod from sliding off. Unfortunately, most of these solutions would have prevented the rod from being inserted into the bird feeder in the first instance.

(f) Most candidates focused on the weather, theft and vandalism as the main problems faced by designers when designing products for outdoor use. There were some good answers: for example, when concerned about the weather some candidates suggested the use of a waterproof paint or varnish. When concerned about theft answers focused on ways by which products could be made more securely fixed.

Question 13

(a) The majority of candidates gave advantages of MDF over solid wood; the most common correct answers relating to its stability, it was easier to work, availability and lower cost.

(b) (i) The majority of candidates understood that using a template meant greater speed and accuracy rather than marking the shape by hand.

(ii) Most candidates named correctly a coping saw or jig saw to cut out the curved shape.

(iii) Many candidates named a half round or round (rat tail) file to finish the curve. Some candidates needed to improve their knowledge for this question. A specific name of the file was required, not just 'file'. Some candidates named a rasp. A rasp is a cutting tool that would not make the cut surface smooth. Some candidates named sandpaper (glasspaper) which is not a 'tool'.

(c) (i) Most candidates achieved at least 1 mark for this question. Only a minority of candidates were able to show the marked positions for the dowel with the dimensions. Some candidates drew the positions on the wrong end even though end **A** was labelled clearly in the question.

(ii) Most candidates selected the appropriate diameter of dowel to be used: Ø6 or Ø9.

(iii) Many candidates understood that the chamfer on the end of the dowel would help guide the dowel into the hole. Very few candidates understood the purpose of the grooves. The grooves would allow space for the glue when inserted. Without the grooves much of the glue would be forced out on entry.

(iv) There were some excellent drilling jigs provided by candidates. Generally candidates are becoming more familiar with the principle of jigs to increase speed and accuracy of manufacture. The simplest jig was a template placed on top of the end to be drilled.

More effective jigs showed a template with location against at least one or two surfaces.

There were some candidates who needed to improve their knowledge for this question as they demonstrated limited understanding of the term 'jig'.

(v) Most candidates who provided a practical jig went on to give varied explanations of how it would be used.

(d) Many candidates gained some marks for providing details showing how the keyhole slot could be cut out. The best methods involved the use of Ø5 and Ø10 drills followed by use of a piercing saw and a warding file. Some candidates named an abrafile and a Hegner saw with a metal cutting blade. Unfortunately some methods used saws including the coping saw which is used to cut wood, not metal.

(e) Many candidates gained 1 mark for stating that paint enhanced the appearance of the shelf unit more than a clear varnish. The main point of the question was that MDF is unattractive and a clear finish would look unsightly. Some candidates stated that a choice of coloured paint could 'match' the existing surroundings.

(f) There were many good answers to this question. Most related to the convenience of collecting the self-assembly product and taking it home. Others stated that consumers achieved a sense of self-satisfaction on assembling the product. One good reason for their popularity was that self-assembly products are generally cheaper than ready-assembled products.

DESIGN AND TECHNOLOGY

Paper 0445/33
Resistant Materials

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(a) Many candidates named a thermoplastic; acrylic being the most common. Many candidates named steel as a ferrous metal but gained no marks as the question required a **specific** name such as mild steel or stainless steel. Only a few candidates could provide an appropriate thickness for their named materials. Candidates are reminded that when working with resistant materials they should know the standard/stock sizes available.

(b) (i) Candidates needed to improve their knowledge and understanding for this question. Although most candidates named a chinagraph pencil or marker pen correctly, some candidates could not name an appropriate way of marking a line on the surface of a thermoplastic.

(ii) The majority of candidates could not name a scriber as the correct tool used to mark a line on the surface of ferrous metal.

(c) (i) Many candidates gained marks for this question with many achieving maximum marks for showing how the thermoplastic would be softened by means of a strip heater or line bender, the use of a former to achieve the desired bend and a method of retention while it cooled.

(ii) Although many candidates did achieve 1 or 2 marks for showing how the bookends could be bent to shape when made from ferrous metal, generally candidates were less sure of the techniques involved. Good answers included the use of a mallet or a hammer with scrap wood to prevent damage to the surface of the metal. Many candidates showed the use of a former or vice jaws to enable the metal to be bent to the correct shape.

(d) (i) Candidates were given the choice to describe 3 main stages involved in joining the storage strips to the bookends when made from **either** thermoplastic **or** ferrous metal. Candidates needed to develop their knowledge and understanding for this question. Thermoplastic strips would be joined using acrylic (Tensol) cement with which candidates should be familiar. The strips would be joined by brazing or the use of epoxy resin.

(ii) There were some good methods showing how the storage strips could be joined to the bookends without the use of a permanent method described in part **(i)**. The best methods involved the use of slots into which the strips could be inserted. Many candidates described how the strips could be screwed to the bookends without realising that the thermoplastic would be too thin for this to be practical. Many candidates simply 'glued' the strips to the bookends even though the question stated

'without the use of a permanent method'.

(e) (i) Candidates needed to state that self-finishing meant that the thermoplastic would receive no applied finish (1 mark) and that it would be cleaned and 'buffed' to a high quality (1 mark).

Only a minority of candidates demonstrated any knowledge of self-finishing.

(ii) Candidates needed to develop their knowledge of dip coating with plastic. Most candidates stated that the metal would be dipped into melted plastic. The basic technique involves the metal being heated and dipped into plastic. Centres are reminded that dip coating is one of the techniques candidates should have experience of in the '*Finishes'* section of the syllabus.

(f) Most candidates were able to provide one benefit to a manufacturer of producing the bookends without the storage strips. The most common answers related to less materials being used, lower labour costs, quicker manufacture and easier storage.

Question 12

(a) (i) Candidates needed to develop their knowledge for this question as many could not name a hardwood for the sign. Candidates are expected to be familiar with a range of hardwoods and softwoods, their properties and uses when following a Resistant Materials course.

(ii) Most candidates named at least one appropriate tool to remove each of the areas labelled **A, B** and **C**. Most answers involved the use of a variety of saws including a Hegner or equivalent, a coping saw and a tenon saw.

(iii) Candidates needed to develop their knowledge for this question. This question tested candidates' knowledge of the preparation that would be carried out **before** applying a finish. The best answers, (in a minority) included the use of different grades of glasspaper (commonly referred to as 'sandpaper') and the removal of dust. Most candidates could not describe these processes.

(iv) This question was concerned with the actual application of a suitable finish and how a high quality could be achieved. The best answers referred to careful application of a varnish using a brush, making sure that brushstrokes were in the same direction and taking care not to apply the varnish too liberally.

(b) Many candidates did not read the question carefully and fixed the sign to the wall using screws that were visible on the front of the sign. The best answers, (in a minority) showed the use of brackets or some type of hooks that were fixed to the wall and over which the sign could be attached. Many candidates simply nailed or glued the sign to the wall.

(c) Many candidates did attempt to show a freestanding support. Because there were 8 marks available for this question the bullet points were there to help focus the candidates' attention to the important design considerations: a stable base, a method of joining the sign to the support, two important sizes and the names of the materials and construction methods. Many candidates achieved some marks but failed to address all the bullet points. There were some potentially practical designs that lacked the necessary details to achieve maximum marks.

(d) Candidates needed to improve their knowledge for this question and also ensure that they read the question carefully. This question stated: '*Describe how CAD could be used to design the words...'* yet most answers described how a computer could be linked to a CNC machine and the data transferred to enable the words to be cut out. The question required details about the use of named CAD software that enabled different fonts, size and spacing to be carried out. In addition, candidates could have described how CAD allows for effective on-screen modelling and evaluation before manufacture.

Question 13

(a) Candidates needed to develop their knowledge for this question. The majority of candidates could not identify the hardwood from the list of four materials given.

Candidates are expected to be familiar with a range of hardwoods, softwoods and manufactured boards when following a Resistant Materials course.

(b) The recognised method of joining boards edge to edge requires that the edges are **planed** flat and square then glued together and held with sash cramps. The **addition** of a tongue and groove, dowel or biscuit is acceptable. Candidates needed to develop their knowledge for this question. Most candidates did not know how to join the boards other than use an adhesive with many using files and/or glasspaper too carry out some preparation to the edges

(c) Many candidates did not read the question carefully and did not refer to Fig. 12 showing clearly the rail and its size, 50 mm wide $\times$ 20 mm thick. This would have helped candidates to identify a construction that could have been used to join the rail to the end; for example, a mortise and tenon or dowel joint. Candidates needed to develop their knowledge for this question as many described how a butt joint, (sometimes nailed or screwed), could be used. This was not rewarded.

(d) Most candidates gained marks for providing details showing how the waste wood could be removed from the end of the stool. Many candidates achieved 3 marks for showing a combination of various stages: holding the wood securely in a vice, removing the waste wood by means of a coping or Hegner saw, use of a chisel and mallet and use of files and glasspaper to make smooth.

(e) (i) The bit shown was a saw tooth bit. Because of its similarity, a forstner bit was also accepted. Candidates needed to improve their knowledge for this question as few candidates could name the bit shown correctly.

(ii) This question showed that candidates need to develop their understanding as this is a process of which all candidates should have first-hand practical experience. When drilling through wood it is essential to position a sacrificial piece underneath the wood to be drilled and to secure it using G cramps.

(f) Very few candidates described how the application of a named non-slip material and adhesive to the surface of the stool would prevent a person from slipping.

(g) (i) Polypropylene was the suitable plastic for the stool, but very few candidates gave this answer. As with other resistant materials, candidates are expected to have knowledge of a range of thermoplastics and thermosetting plastics, their properties and uses.

(ii) Many candidates did not recognise that the stool would be manufactured by means of injection moulding. Vacuum forming was a common, incorrect answer.

(iii) Very few candidates gave a detailed explanation worthy of maximum 3 marks. The main reasons why the wooden stool would be more expensive to manufacture in large quantities are that it used more materials, more constructional processes which increase the time of production which, in turn, resulted in higher costs.

DESIGN AND TECHNOLOGY

Paper 0445/41
Systems and Control

Key messages

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- All responses should be in the space given for that response.

General comments

There were very few difficulties apparent in the accessibility of ***Section A*** to the candidates. Knowledge of the three areas of the syllabus was good and candidates had in most cases provided clear answers. The question that proved most difficulty for candidates was **1(b)** which required the number of connections on a DPDT switch to be identified. Candidates should be advised that in this type of question they should look at the information that is given in the question, in this case, the configuration of the switch. A double throw switch will have three contacts; from this it should follow that two switches will have six contacts.

In the questions requiring structure types to be named and drawn, careful reading of the question should have identified that in both cases natural structures were required. There is a strong case here for candidates to underline or highlight the key words in the question before formulating a response. Sketching, where it was used to support a response, was in most cases very good.

The Structures based question in ***Section B*** remained the most popular, followed by the Mechanisms; rather fewer candidates chose the Electronics question.

Comments on specific questions

Section A

Question 1

(a) The majority of candidates gained marks on this question. The toggle switch was recognised in most cases and the switch symbol was correctly identified as ‘push to break’. Candidates needed to improve their knowledge of the contact arrangement.

(b) Candidates needed to improve their knowledge for this question as very few correct responses were seen, with either 3 or 4 contacts being chosen rather than 6.

Question 2

In most cases the LED was correctly connected to the +6V rail and the resistor to the 0V rail. The ammeter was then either connected in parallel or in some cases it was not connected at all. Of those who had used a series connection there were a number who had then connected the LED and resistor legs together.

Question 3

The advantages of a transistor switch were widely appreciated, a number of responses noted that the output would not require debouncing and that the switching speed could be a lot faster than a mechanical switch.

Question 4

(a) Candidates needed to improve their knowledge for this question as there were very few fully correct answers given. Recognition of the oscillating movement was correctly identified by many candidates for the output part of the motion but the input was frequently described as reciprocating.

(b) The lever was generally identified correctly as 2nd order.

(c) The majority of candidates scored at least one mark in this question. The fact that motion was transferred to the moveable bar by the gear attached to a common shaft was recognised but the gear being rotated by the holes in the lever was in many cases not commented on.

Question 5

In most cases candidates knew the correct sequence of fulcrum followed by effort then load. The standard of drawing was mainly good with recognisable examples being used. A few candidates had drawn an example and then gone on to do a drawing of a generic third class lever, rather than labelling the example.

Question 6

Apart from the few who had drawn man-made frame structures this question was well answered with clear drawings.

Question 7

A similar comment could be made with this question, where a few chose to draw man-made shell structures or mass structures.

Question 8

The use of ties, braces or gussets was well known to candidates. In some cases more than one method was used to increase the strength of the joint. The mark available for indication of the fixing method was only gained by higher achieving candidates.

Question 9

The concept of equilibrium being a state of balance or clockwise moments being equal to anti clockwise moments was widely recognised. Those who went on to state the structure would be stable with no movement gained both of the available marks.

Section B

Question 10

(a) The majority of candidates who chose this question gained marks for identifying the strut and tie. Candidates needed to improve their knowledge for this question because knowledge of the forces being resisted was less well known. The bending force acting on part **C** was the least known part of the question.

(b) (i) The three areas of the stress/strain graph were frequently mixed up, the term ‘elastic deformation’ being the most frequent to be correctly explained.

(ii) ‘Elastic limit’ was in many responses confused with the deformation caused in the previous part. The candidates who had gained marks for the previous part were more likely to provide a clear explanation for this part of the question.

(iii) Candidates needed to improve their knowledge for this question because 'Plastic deformation' was the least well known of the terms and was frequently mistaken for a reference to the way that polymers behave when under strain. More able candidates gained a mark for knowing that it referred to permanent deformation, gaining the second mark for knowing that no fracturing occurs within the plastic deformation stage was uncommon.

(c) (i) A number of different answers were given for the minimum number of cables needed with a few candidates correctly stating that three was the number required.

(ii) There were a number of methods for tensioning the cable shown, the most successful showing mechanisms such as a ratchet and pawl. Candidates needed to improve their knowledge for this question as details were in many cases not clear and information on how the tension could be adjusted was not stated.

(iii) The force acting on the pivot was in many cases identified as tension or torsion, rather than shear.

(iv) The value for the counterweight was correctly calculated by the more able candidates, who gained all four marks. The remainder of candidates gained a mark in many cases for the correct formula and substitution into it.

(d) The difference between static and dynamic loading on a bridge was well known and in most cases suitable examples were given.

(e) The use of a honeycomb structure was familiar to many candidates with the most common reason being given referring to the light weight of the structure.

Question 11

(a) In this question the safety device for mains electricity was generally identified as a residual current device. The natural gas and compressed air safety devices were frequently mixed up.

(b) (i) The majority of candidates gained both marks for this part; those who lost a mark had generally missed the reduced speed of the driven pulley.

(ii) In most cases the direction of rotation of the gears was correctly given.

(iii) Candidates needed to improve their knowledge for this part of the question. General features of a belt drive were often given rather than making a direct comparison to a geared drive. Those who did gain marks often referred to the lack of lubrication needed or the fact that belt drives are much quieter.

(iv) It was frequently recognised that drive systems will lose efficiency through friction and that the generation of heat and sound will both contribute to a drop in efficiency.

(c) (i) The bevel gear was correctly identified in most cases.

(ii) The main reason given for using a bevel gear was that it will change the direction of drive. Very few responses noted that it is suited to a large difference in the number of teeth in the driver and driven gears.

(iii) The velocity ratio was accepted in a number of formats, the majority of candidates gained a mark for this aspect. There were a significant number who had reversed the order of the figures so did not gain the second mark.

(iv) This calculation was well answered with most candidates gaining both marks.

(v) Knowledge of bearing types was evident in most cases with the majority of responses referring to expected working life of the bearing being reduced.

(vi) Whilst many responses noted the reduction in friction resulting from the use of a ball bearing very few referred to the reduced thrust caused by the bearing.

(d) The most able candidates correctly calculated the advantage given by each of the two levers involved and were then able to give the total advantage. In a few cases one of the earlier calculations was incorrect.

Question 12

(a) (i) In most cases the voltmeter was correctly connected in parallel with the lamp.

(ii) The current flow in the circuit was calculated accurately by the majority of candidates who had answered this question.

(iii) Those who had a correct answer to the previous part had generally gained marks for calculating the power of the lamp.

(b) (i) The purpose of tinning the pads on a PCB was not widely known.
It was realised that it made soldering easier, but not why it made it easier.

(ii) A common response to the placing of the IC holder was to 'place it correctly', with no indication that the pin 1 end of the holder should be correctly aligned or that the holder should be checked for bent pins not entering the hole. Most candidates gained the mark for soldering each pin.

(iii) The general concept of melting the solder and then re-soldering once the resistor was in position was widely appreciated. Very few responses offered a clear method of applying pressure to the resistor to move it down to the correct position. None of the sketches seen showed the board in an inverted position, which would be the easiest way to melt the solder.

(c) (i) The method of combining 2 input gates to give a 3 input gate was not widely known. A common error was to join the two outputs together or to use a common connection to both gates.

(ii) Those who had successfully joined the two gates had generally labelled the three inputs correctly.

(d) (i) This question was well answered with the majority of responses gaining all four marks.

(ii) Candidates needed to improve their knowledge for this question. The position for the transistor was generally correct but the symbols used were often inaccurate and very few candidates had used a current limiting resistor before the base connection. Various configurations for the connections were seen and any that were functional gained marks. In a few cases candidates had gone further than required by the question and had added a relay circuit to drive the LED. This method also gained marks.

(iii) The advantages of PIC systems were well appreciated in most cases with responses focusing on the ability to re-program quickly when developing the circuit. Changes to the sequence of the lights would also be possible.

DESIGN AND TECHNOLOGY

Paper 0445/42
Systems and Control

Key messages

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- Candidates should be reminded that only one question should be attempted in ***Section B***. It is important to read through all ***Section B*** questions before deciding which one to attempt.
- All responses should be in the space given for that response.

General comments

There were very few difficulties apparent in the accessibility of ***Section A*** to the candidates. Knowledge of the three areas of the syllabus was good and candidates had in most cases provided clear answers. The question that proved most difficulty for candidates was **1(b)** which required the number of connections on a DPDT switch to be identified. Candidates should be advised that in this type of question they should look at the information that is given in the question, in this case, the configuration of the switch. A double throw switch will have three contacts; from this it should follow that two switches will have six contacts.

In the questions requiring structure types to be named and drawn, careful reading of the question should have identified that in both cases natural structures were required. There is a strong case here for candidates to underline or highlight the key words in the question before formulating a response. Sketching, where it was used to support a response, was in most cases very good.

The Structures based question in ***Section B*** remained the most popular, followed by the Mechanisms; rather fewer candidates chose the Electronics question.

Comments on specific questions

Section A

Question 1

(a) The majority of candidates gained marks on this question. The toggle switch was recognised in most cases and the switch symbol was correctly identified as 'push to break'. Candidates needed to improve their knowledge of the contact arrangement.

(b) Candidates needed to improve their knowledge for this question as very few correct responses were seen, with either 3 or 4 contacts being chosen rather than 6.

Question 2

In most cases the LED was correctly connected to the +6V rail and the resistor to the 0V rail. The ammeter was then either connected in parallel or in some cases it was not connected at all. Of those who had used a series connection there were a number who had then connected the LED and resistor legs together.

Question 3

The advantages of a transistor switch were widely appreciated, a number of responses noted that the output would not require debouncing and that the switching speed could be a lot faster than a mechanical switch.

Question 4

(a) Candidates needed to improve their knowledge for this question as there were very few fully correct answers given. Recognition of the oscillating movement was correctly identified by many candidates for the output part of the motion but the input was frequently described as reciprocating.

(b) The lever was generally identified correctly as 2nd order.

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In most cases candidates knew the correct sequence of fulcrum followed by effort then load. The standard of drawing was mainly good with recognisable examples being used. A few candidates had drawn an example and then gone on to do a drawing of a generic third class lever, rather than labelling the example.

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A similar comment could be made with this question, where a few chose to draw man-made shell structures or mass structures.

Question 8

The use of ties, braces or gussets was well known to candidates. In some cases more than one method was used to increase the strength of the joint. The mark available for indication of the fixing method was only gained by higher achieving candidates.

Question 9

The concept of equilibrium being a state of balance or clockwise moments being equal to anti clockwise moments was widely recognised. Those who went on to state the structure would be stable with no movement gained both of the available marks.

Section B

Question 10

(a) The majority of candidates who chose this question gained marks for identifying the strut and tie. Candidates needed to improve their knowledge for this question because knowledge of the forces being resisted was less well known. The bending force acting on part **C** was the least known part of the question.

(b) (i) The three areas of the stress/strain graph were frequently mixed up, the term ‘elastic deformation’ being the most frequent to be correctly explained.

(ii) ‘Elastic limit’ was in many responses confused with the deformation caused in the previous part. The candidates who had gained marks for the previous part were more likely to provide a clear explanation for this part of the question.

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(e) The use of a honeycomb structure was familiar to many candidates with the most common reason being given referring to the light weight of the structure.

Question 11

(a) In this question the safety device for mains electricity was generally identified as a residual current device. The natural gas and compressed air safety devices were frequently mixed up.

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(ii) In most cases the direction of rotation of the gears was correctly given.

(iii) Candidates needed to improve their knowledge for this part of the question. General features of a belt drive were often given rather than making a direct comparison to a geared drive. Those who did gain marks often referred to the lack of lubrication needed or the fact that belt drives are much quieter.

(iv) It was frequently recognised that drive systems will lose efficiency through friction and that the generation of heat and sound will both contribute to a drop in efficiency.

(c) (i) The bevel gear was correctly identified in most cases.

(ii) The main reason given for using a bevel gear was that it will change the direction of drive. Very few responses noted that it is suited to a large difference in the number of teeth in the driver and driven gears.

(iii) The velocity ratio was accepted in a number of formats, the majority of candidates gained a mark for this aspect. There were a significant number who had reversed the order of the figures so did not gain the second mark.

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(iii) The advantages of PIC systems were well appreciated in most cases with responses focusing on the ability to re-program quickly when developing the circuit. Changes to the sequence of the lights would also be possible.

DESIGN AND TECHNOLOGY

Paper 0445/43
Systems and Control

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Comments on specific questions

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Question 9

The concept of equilibrium being a state of balance or clockwise moments being equal to anti clockwise moments was widely recognised. Those who went on to state the structure would be stable with no movement gained both of the available marks.

Section B

Question 10

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(a) In this question the safety device for mains electricity was generally identified as a residual current device. The natural gas and compressed air safety devices were frequently mixed up.

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(iv) It was frequently recognised that drive systems will lose efficiency through friction and that the generation of heat and sound will both contribute to a drop in efficiency.

(c) (i) The bevel gear was correctly identified in most cases.

(ii) The main reason given for using a bevel gear was that it will change the direction of drive. Very few responses noted that it is suited to a large difference in the number of teeth in the driver and driven gears.

(iii) The velocity ratio was accepted in a number of formats, the majority of candidates gained a mark for this aspect. There were a significant number who had reversed the order of the figures so did not gain the second mark.

(iv) This calculation was well answered with most candidates gaining both marks.

(v) Knowledge of bearing types was evident in most cases with the majority of responses referring to expected working life of the bearing being reduced.

(vi) Whilst many responses noted the reduction in friction resulting from the use of a ball bearing very few referred to the reduced thrust caused by the bearing.

(d) The most able candidates correctly calculated the advantage given by each of the two levers involved and were then able to give the total advantage. In a few cases one of the earlier calculations was incorrect.

Question 12

(a) (i) In most cases the voltmeter was correctly connected in parallel with the lamp.

(ii) The current flow in the circuit was calculated accurately by the majority of candidates who had answered this question.

(iii) Those who had a correct answer to the previous part had generally gained marks for calculating the power of the lamp.

(b) (i) The purpose of tinning the pads on a PCB was not widely known.
It was realised that it made soldering easier, but not why it made it easier.

(ii) A common response to the placing of the IC holder was to 'place it correctly', with no indication that the pin 1 end of the holder should be correctly aligned or that the holder should be checked for bent pins not entering the hole. Most candidates gained the mark for soldering each pin.

(iii) The general concept of melting the solder and then re-soldering once the resistor was in position was widely appreciated. Very few responses offered a clear method of applying pressure to the resistor to move it down to the correct position. None of the sketches seen showed the board in an inverted position, which would be the easiest way to melt the solder.

(c) (i) The method of combining 2 input gates to give a 3 input gate was not widely known. A common error was to join the two outputs together or to use a common connection to both gates.

(ii) Those who had successfully joined the two gates had generally labelled the three inputs correctly.

(d) (i) This question was well answered with the majority of responses gaining all four marks.

(ii) Candidates needed to improve their knowledge for this question. The position for the transistor was generally correct but the symbols used were often inaccurate and very few candidates had used a current limiting resistor before the base connection. Various configurations for the connections were seen and any that were functional gained marks. In a few cases candidates had gone further than required by the question and had added a relay circuit to drive the LED. This method also gained marks.

(iii) The advantages of PIC systems were well appreciated in most cases with responses focusing on the ability to re-program quickly when developing the circuit. Changes to the sequence of the lights would also be possible.