DESIGN AND TECHNOLOGY

Paper 0445/11
Product Design

Key messages

- Candidates should respond to **part (a)** with additional functional points that are specific to the particular question and design problem being solved. Generic points such as: should be strong, durable, safe or aesthetic cannot be awarded marks. If these areas are being covered then the response should be qualified in terms of the particular design problem.
- Candidates should remember that simple drawings are often better than many words when describing manufacturing methods suggested in response 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. The three questions presented fairly open design situations based on aspects of travel, 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 fewer answering **Question 3**.

Centres are reminded that there is no requirement to include question papers when returning completed A3 answer sheets to Cambridge at the end of the examination.

Comments on specific questions

Question 1

Candidates appeared to understand fully the design requirements of a storage system for wet umbrellas on a bus and it was obviously something 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 storage system in addition to those outlined in the question. Successful responses to this introductory part of the question included: does not obstruct passengers; easy access; collects water; water drains away; waterproof materials; clearly labelled.

(b) Few candidates had difficulty showing two places on a bus where a storage system of this type could be located including: recess on outside; on folding doors; behind driver's seat; under windscreen; on end of seats.

(c) Responses to this part of the design questions have improved considerably over recent examinations and many 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 using 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 weaker 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 point of sale package of this type would need to be produced using semi resistant materials.

(a) Most candidates were able to suggest four additional functional points to those identified in the question and successful responses included: lightweight for transportation; easy to carry; point of sale appeal; non-toxic materials; waterproof; recyclable.

(b) Candidates were familiar with different methods of creating handles on packaging and appropriate suggestions included: cut out slots; card folded to form ledge; paper ‘rope’; string/cord; moulded plastic.

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

Question 3

A small number of candidates attempted this question but those who did 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 wheelchair holding system included: must fit all chair types; reachable from chair; no dangerous protrusions when not in use; easy to operate; automatic ‘clip–in’; does not damage chair.

(b) Candidates were able to show two securing mechanisms including: sliding bolt; course screw; over centre clamp; servo; pneumatic piston; spring clips.

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

DESIGN AND TECHNOLOGY

Paper 0445/12
Product Design

Key messages

- Candidates should respond to **part (a)** with additional functional points that are specific to the particular question and design problem being solved. Generic points such as: should be strong, durable, safe or aesthetic cannot be awarded marks. If these areas are being covered then the response should be qualified in terms of the particular design problem.
- Candidates should remember that simple drawings are often better than many words when describing manufacturing methods suggested in response 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. The three questions presented fairly open design situations based on watches, 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 very few answering **Question 3**.

Centres are reminded that there is no requirement to include question papers when returning completed A3 answer sheets to Cambridge at the end of the examination.

Comments on specific questions

Question 1

Candidates appeared to understand fully the design requirements of a storage and display unit for wrist watches. A display unit of this type was clearly something 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 storage and display unit in addition to those outlined in the question. Successful responses to this introductory part of the question included: ease of access; security aspects; easy to carry; appropriate materials for display; holding methods for each watch; format of display.

(b) Few candidates had difficulty showing two protection methods and these focused either on the protection of individual watches or making the display unit secure including: close fitting profile location; soft materials; secure individual holding methods; dome shaped covers; different types of sliding or hinged lid; locking methods; alarms.

(c) Responses to this part of the design questions have improved considerably over recent examinations and many 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 using 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 weaker 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 countertop display of this type would need to be produced using 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; appropriate sizes; suitable constructions; water resistance.

(b) The majority of candidates were familiar with different methods of making card water resistant and appropriate suggestions included: lamination with plastic sheet; water resistant film cover; wax dipping; painting; hydrophobic spray.

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

Question 3

Very few candidates attempted this question but those who did 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 device for providing movement to power a watch included: easy to operate; appropriate to size of watch; quiet or silent in use; source of movement – battery, motor, solar, clockwork; style in keeping with watch.

(b) Candidates were able to identify two methods of creating movement including: rack and pinion; crank and slider; pendulum; stepper motor; electronics to control polarity.

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

DESIGN AND TECHNOLOGY

Paper 0445/13
Product Design

Key messages

- Candidates should respond to part **(a)** with additional functional points that are specific to the particular question and design problem being solved. Generic points such as: should be strong, durable, safe or aesthetic cannot be awarded marks. If these areas are being covered then the response should be qualified in terms of the particular design problem.
- Candidates should remember that simple drawings are often better than many words when describing manufacturing methods suggested in response 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. The three questions presented fairly open design situations based on aspects of toy trains, 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 very few answering **Question 3**.

Centres are reminded that there is no requirement to include question papers when returning completed A3 answer sheets to Cambridge at the end of the examination.

Comments on specific questions

Question 1

Candidates appeared to understand fully the design requirements of a pull-along toy train and it was something 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 pull-along toy train in addition to those outlined in the question. Successful responses to this introductory part of the question included: non-toxic materials; safe shape; pulling string; low friction; realistic appearance; bright colours; appeal to young children.

(b) Few candidates had difficulty showing two methods of linking parts allowing for easy detachment including: hook and eye; fixed pins and chain; hooks and chain; slotting mechanisms; magnets; dowels; ‘Velcro’.

(c) Responses to this part of the design questions have improved considerably over recent examinations and many 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 using 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 weaker 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 an architectural model of this type would need to be produced using semi resistant materials. Some candidates focused too much on the full-size building or structure at the expense of the architectural model asked for in the question.

(a) Most candidates were able to suggest four additional functional points to those identified in the question and successful responses included: lightweight for transportation; stable in use; attracts attention; realistic appearance; include surrounding area; transparent windows.

(b) Many candidates were familiar with different methods of representing building materials on a model and appropriate suggestions included: paper lay-on; lines/grooves cut into surface; plastic sheet added; stencil painting; ‘built up’ blocks and bricks; balsa strips.

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

Question 3

A small number of candidates attempted this question but those who did 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 lifting road barrier system included: safe power source; hidden mechanism; operated as train approaches; firm fixing to track or board; barriers linked together.

(b) Candidates were able to identify two methods of reducing the output speed of a motor including: belt and pulley; chain and sprocket; worm and wheel; gear system; electronic control.

(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** & **A3**) and then go on to answer *either* **B4** *or* **B5** from ***Section B***. A small number of candidates did not follow the instructions and omitted **Question A3** or answered all questions.

There are areas of the syllabus in which further improvements are needed. Candidates must be able to project views in third angle projection and be able to draw curves to touch other curves and straight lines. Both are areas that need to be improved. Practical experience of using vacuum forming to produce food trays would be a valuable activity.

Comments on specific questions

Question A1

Sandwich shop logo

Candidates were given detail drawings of a logo for a sandwich shop. On the given centre lines candidates were required to draw full size:

(a) the regular hexagonal shaped border;

(b) the upper and lower parts of the bread bun;

(c) the centre fillings (burger and cheese);

(d) the missing letters of SANDWICH.

Most candidates completed the drawing of the logo. Some candidates had difficulty in drawing the upper part of the bun where an R96 curve touched an angle line that was sitting on a vertical line at the two ends of a 140 horizontal.

Drawing in the missing letter C was not achieved as well as the letter N by many candidates.

Question A2

A sandwich package

A fully dimensioned development (net) of a sandwich package was given to candidates.

(a) Candidates were required to assemble the package and to draw it in isometric projection in the space provided. A corner had been started as guidance. Candidates needed to draw the base and upright both 120 mm. The sloping side could then be drawn joining the ends of the top and the lower front corner.

(b) A diamond shaped label needed to be drawn on the sloping face. Two solutions were accepted: one central to the face or one central to the given lettering. Either solution had to be a regular diamond 100×50.

(c) The closure flap needed to be drawn parallel to the sloping face and on the side passing through the given elliptical sticker.

Question A3

Alternative secure closure

(a) This required candidates to use sketches and notes to show a method of keeping the lid closed without the use of a sticker. Many successful systems were illustrated with full explanatory notes. Slots and arrow tabs were the most successful solutions.

Question B4

A vacuum formed sandwich package

This question was derived from a real 'Graphic Product'. A classroom exercise to make the sandwich package using vacuum forming, would be most beneficial to future candidates' understanding of this commonly used application.

(a) Candidates were required to complete the half scale orthographic views of the mould used for vacuum forming the package. The starting lines for each view and the given symbol showed that the views were in third angle projection.

The plan required the outline of two rectangles to be completed and R12 and R6 corners added appropriately.

The side view required a symmetrical left-hand side to be drawn to the same length as the plan. Where the two sloping sides meet, a R12 curve needed to be shown joining the two slopes.

Finally, the end view could be drawn by projecting the height of the side view and the depth of the plan.

(b) This part of the question required a full-size sectional view on the cut line **A-A.** Features that were required were: two trays, depth of trays 40, symmetrical trays with draft both sides, trays 50 wide at the top with a gap of 10mm.

(c) (i) Suitable plastics for vacuum forming are Polystyrene or HIPS.

(ii) The purpose of the draft angle is to allow the easy removal from the mould after forming. It is the same principle as removing a sandcastle from the bucket full of damp sand on the beach.

(d) The parts to be labelled were heater, former and bed.

Question B5

Display Stand

This question was derived from an actual 'Product' used by shops

Views of a display stand for sandwiches were shown in three orthographic views.

(a) Candidates were required to complete a two-point perspective view to a scale of 1:5. Marks were awarded for the correct side view with lines aligning with VP1. The treads of the steps and the

risers needed to be projected to the right to VP2 and the far-right edge of the steps needed to be drawn with vertical risers and the treads going back to VP1.

(b) This part of the question asked candidates to state one advantage and one disadvantage of flat packing the stand before despatch to the customer.

The advantages are: makes a smaller parcel and is cheaper to post, less likely to get damaged in transit, can be folded and stored until the next use.

The disadvantages are: requires recipient to spend time on assembly, may be difficult to assemble, could be incorrectly assembled, parts may be misaligned/lost

(c) A table showing the sales of sandwiches in one week was given. Candidates were required to complete a pie chart using the given data. Two of the angles could be drawn using a standard set square (45° and 30°) but others need the use of a protractor. The quantities needed to be drawn in the correct sector and the filling type in the circular band.

DESIGN AND TECHNOLOGY

Paper 0445/22
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** & **A3**) and then go on to answer *either* **B4** *or* **B5** from ***Section B***. A small number of candidates did not follow the instructions and omitted **Question A3** or answered all questions.

There are areas of the syllabus in which further improvements are needed. Candidates must be able to project views in third angle projection and be able to draw curves to touch other curves and straight lines. Both are areas that need to be improved. Practical experience of using vacuum forming to produce food trays would be a valuable activity.

Comments on specific questions

Question A1

Sandwich shop logo

Candidates were given detail drawings of a logo for a sandwich shop. On the given centre lines candidates were required to draw full size:

(a) the regular hexagonal shaped border;

(b) the upper and lower parts of the bread bun;

(c) the centre fillings (burger and cheese);

(d) the missing letters of SANDWICH.

Most candidates completed the drawing of the logo. Some candidates had difficulty in drawing the upper part of the bun where an R96 curve touched an angle line that was sitting on a vertical line at the two ends of a 140 horizontal.

Drawing in the missing letter C was not achieved as well as the letter N by many candidates.

Question A2

A sandwich package

A fully dimensioned development (net) of a sandwich package was given to candidates.

(a) Candidates were required to assemble the package and to draw it in isometric projection in the space provided. A corner had been started as guidance. Candidates needed to draw the base and upright both 120 mm. The sloping side could then be drawn joining the ends of the top and the lower front corner.

(b) A diamond shaped label needed to be drawn on the sloping face. Two solutions were accepted: one central to the face or one central to the given lettering. Either solution had to be a regular diamond 100×50.

(c) The closure flap needed to be drawn parallel to the sloping face and on the side passing through the given elliptical sticker.

Question A3

Alternative secure closure

(a) This required candidates to use sketches and notes to show a method of keeping the lid closed without the use of a sticker. Many successful systems were illustrated with full explanatory notes. Slots and arrow tabs were the most successful solutions.

Question B4

A vacuum formed sandwich package

This question was derived from a real 'Graphic Product'. A classroom exercise to make the sandwich package using vacuum forming, would be most beneficial to future candidates' understanding of this commonly used application.

(a) Candidates were required to complete the half scale orthographic views of the mould used for vacuum forming the package. The starting lines for each view and the given symbol showed that the views were in third angle projection.

The plan required the outline of two rectangles to be completed and R12 and R6 corners added appropriately.

The side view required a symmetrical left-hand side to be drawn to the same length as the plan. Where the two sloping sides meet, a R12 curve needed to be shown joining the two slopes.

Finally, the end view could be drawn by projecting the height of the side view and the depth of the plan.

(b) This part of the question required a full-size sectional view on the cut line **A-A.** Features that were required were: two trays, depth of trays 40, symmetrical trays with draft both sides, trays 50 wide at the top with a gap of 10mm.

(c) (i) Suitable plastics for vacuum forming are Polystyrene or HIPS.

(ii) The purpose of the draft angle is to allow the easy removal from the mould after forming. It is the same principle as removing a sandcastle from the bucket full of damp sand on the beach.

(d) The parts to be labelled were heater, former and bed.

Question B5

Display Stand

This question was derived from an actual 'Product' used by shops

Views of a display stand for sandwiches were shown in three orthographic views.

(a) Candidates were required to complete a two-point perspective view to a scale of 1:5. Marks were awarded for the correct side view with lines aligning with VP1. The treads of the steps and the

risers needed to be projected to the right to VP2 and the far-right edge of the steps needed to be drawn with vertical risers and the treads going back to VP1.

(b) This part of the question asked candidates to state one advantage and one disadvantage of flat packing the stand before despatch to the customer.

The advantages are: makes a smaller parcel and is cheaper to post, less likely to get damaged in transit, can be folded and stored until the next use.

The disadvantages are: requires recipient to spend time on assembly, may be difficult to assemble, could be incorrectly assembled, parts may be misaligned/lost

(c) A table showing the sales of sandwiches in one week was given. Candidates were required to complete a pie chart using the given data. Two of the angles could be drawn using a standard set square (45° and 30°) but others need the use of a protractor. The quantities needed to be drawn in the correct sector and the filling type in the circular band.

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 small number of candidates did not follow the instruction and answered all the questions.

There are areas of the syllabus in which further improvements are needed. Candidates need to be able to project views in orthographic and draw shapes in planometric projection. In addition, candidates must be able to effectively use the correct convention for fold lines.

Comments on specific questions

Question A1

Package for a pocket radio

Candidates were required to complete the development (net) for the outer sleeve of a package by drawing:

(a) the outer shape of the development (net) to the given sizes;

(b) the required glue flap to an appropriate size;

(c) the rectangular hole for the clear plastic window.

A glue flap of approximately 10 wide needed to be drawn on the base edge and a window 70 × 45 drawn in the correct orientation on the upper face.

Question A2

(a) (i) A suitable adhesive for fixing the sleeve together was PVA.

(ii) A suitable adhesive for fixing the plastic window in place was contact adhesive/glue gun/double sided tape or UHU type adhesive

(b) The most suitable material for the clear plastic window is acetate, clear polythene, cellophane or LDPE.

Question A3

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

The question asked candidates to complete the orthographic views.

(a) (i) Most candidates completed the missing hidden detail on the side view. Correct responses showed a large rectangular hole 70 × 20 in the correct position in hidden detail and a circular hole 30 × 10 in the correct position in hidden detail.

(ii) The front view was completed by projecting lines from the plan view to give an outline of 100 × 30. Projection lines from the plan and the side view also positioned the holes to be drawn in hidden detail on the front view.

A large rectangular hole 70 × 20 was needed for the radio, a circular hole 30 × 10 in the correct position was needed for the ancillaries and holes 30 × 15 were needed for the circular batteries. Hidden detail lines were needed to depict all of these shapes

(b) (i) The front view of the sleeve was drawn. Candidates were asked to state the scale used. The correct answer was 2:1

(ii) Candidates were asked to complete the missing letters. Letter 'C' and letter 'A' were attempted by all candidates with letter 'A' scoring full marks in most cases.

Question B4

Point of sale display stand

This question was derived from an actual display stand used in a shop. Two orthographic views of the display stand were given with full dimensions.

(a) Candidates were required to complete the half scale isometric view of the display stand given the position of the front edge and the lettering.

(b) The outline of a wooden former used to assist the bending of the acrylic was drawn. Candidates were asked to render the wooden block to look like softwood.

(c) A drawing of the left-hand half of another point of sale display stand was given. This display stand was of the folded card type and needed to be assembled by folding and gluing using the tabs shown. Candidates were asked to draw a one-point perspective drawing of the fully assembled stand. All top edges needed to be projected to the V.P. The right-hand end needed completing with lines parallel to the left-hand end and an appropriate distance from the left-hand end.

Question B5

Torch

(a) This question required candidates to complete a planometric drawing of the torch shown in three dimensioned orthographic views. The front square needed to be added 50 × 50 with the lens 50 × 10. The outer shape needed completing with the addition of the back of the handle, the sloping bottom edge and the handle hole. The inside of the handle at the back corner was not always added by candidates.

(b) The outline of a circular battery was given. Candidates were asked to render the battery to make it look three-dimensional. Some variation of shading from left to right on the body and the terminal was required. This effect showed dark at both edges with light in the middle of the body.

(c) The exploded view showed the component parts of the battery holder for the torch. Several component parts needed to be added to the sectional drawing that had been started.

DESIGN AND TECHNOLOGY

Paper 0445/31
Resistant Materials

Key messages

- Candidates need to read the questions carefully before starting their answer. Candidates should try to focus on the key elements of each question. The mark allocation given to each question and the space provided to answer the question provides candidates with a clear indication of what is required.
- Candidates need to improve their knowledge and understanding of the practical processes required to 'work' the resistant materials, wood, metal and plastic. Currently many candidates name tools or describe processes that are totally unsuitable for specific materials.
- Candidates should carefully note the requirements of the question. They must try to provide clearly drawn sketches when attempting questions that begin with the statement: *Use sketches and notes to....* In addition, notes should enhance and make clearer what they have drawn and not simply state the obvious.

General comments

Section A

Many candidates lacked the all-round knowledge and understanding required to answer 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. Many candidates did not understand how to address the questions effectively.

Comments on specific questions

Section A

Question 1

The majority of candidates achieved at least one mark for naming an appropriate manufacturing process.

Question 2

The majority of candidates described achieved at least one mark for naming an appropriate marking out tool that could be used to mark out the block of metal. There were some excellent answers naming oddleg calipers or scriber, a centre or dot punch and dividers used to mark out a line, centre and arc respectively.

Question 3

There were some very good reasons why consumers may prefer to buy the wall-mounted kitchen roll holder. The most common reasons included; easier access to the kitchen roll, that it would free up space on the counter or work surface and that it would be more stable.

Question 4

(a) Many candidates stated correctly that timber contained moisture that needed to be removed but did not always go on to state why. There were some excellent answers that included the need to minimise the chances of subsequent warping, cupping and shrinkage.

(b) Many candidates provided acceptable variations of natural and open air seasoning as the alternative method to kiln seasoning.

Question 5

Most candidates gained at least one mark for showing the acrylic sheet clamped to the drilling machine table. Many candidates went on to gain further credit.

Question 6

Some candidates did not read the question carefully and simply described what was shown in the figure. Many candidates recognised that the use of scrap wood held at both ends would allow the plane to travel across the entire end without splitting the end grain.

Question 7

Most candidates appeared to be familiar with the terms sustainable and biodegradable recognising oak and pine respectively.

Question 8

Many candidates did not read the information written to the figure showing the computer desk carefully and provided sketches and notes relating to a desk made from wood-based materials. The information stated clearly 'mild steel tube 20 × 20 × 2'. However, there were some excellent answers including the use of an additional strut, the material name and the method of joining. There were also some excellent triangular plates welded or screwed to the frame of the computer desk.

Question 9

(a) Most candidates could not name the centre lathe operation of knurling with many innovative, but incorrect answers.

(b) Most candidates recognised the purpose of knurling even if they could not name the method in **(a)**.

Question 10

Almost all candidates chose the laminated table in answer to this question. There were many excellent reasons given including fewer constructions meaning quicker manufacture and therefore lower labour costs. Those candidates who chose the fabricated table often commented on the use of fewer materials, no dependence on the use of an expensive mould and that the constructions could be produced quickly by machine.

Section B

Question 11

(a) The majority of candidates were unable to give at least one benefit of using marine plywood for the planter. The best reasons included it being water resistant, tough, hardwearing and environmentally friendly.

(b) Many candidates recognised that dip-coating would provide a corrosion resistant finish that would be attractive. Other benefits included the ease and speed of application.

(c) There were two specific joints that candidates should have focused on: the method of joining the sides together and the method of joining the base to the sides. Many candidates only addressed one of these using a combination of nails, screws, dowels and an adhesive. Knock-down (KD) fittings were also appropriate.

(d) The question stated that the stand was to be self-assembled from eight separate pieces of mild steel tube. The majority of candidates did not read the question carefully and provided sketches and notes describing methods of joining such as welding that could not be considered to be self-assembly. However, there were some excellent designs that used a larger diameter tube to cover and join the smaller diameter tubes at **X**, sometimes secured with a screw. Some candidates used one-piece plastic fittings that would be simply fitted over the tube at **Y**. The use of pre-manufactured fittings such as those described is to be encouraged in questions relating to customers involved with self-assembly.

(e) Most of the methods used to fix the planter to the stand were fairly crude involving the use of screws and nuts and bolts. The method of fixing had to allow for removal of the planter from the stand and some of the methods shown would have taken considerable time to achieve. Some solutions did not fix the planter to the stand but only provided grooves or recesses onto which the planter would locate. There were some excellent designs that used small brackets or clips that could be released quickly to separate the planter from the stand. Poor quality sketches with vague written information did not help candidates to achieve marks.

(f) To determine the length, width and depth of the box used to contain the parts of the planter and its stand, candidates needed to look carefully at each of the parts and consider the most effective way of stacking these inside the box. The majority of candidates who achieved any marks managed to work out a suitable length for the box. The majority of candidates could not provide an appropriate width or depth.

(g) The majority of candidates concentrated on whether or not the materials were biodegradable or not. The focus should have been on whether or not manufactured boards could be recycled or re-used or that some boards are made from recycled materials. Products made from mild steel can be disassembled, melted down and re-used.

Question 12

(a) The best reasons for using plywood for the toy helicopter were that it has uniform strength in all directions and that it works and machines well and it does not split easily. Some varieties of plywood are not cheap.

(b) Most candidates were able to name at least one or two appropriate tools or items of equipment that could be used to produce the sides of the helicopter.

(c) Very few candidates achieved full marks for this question. Many candidates recognised that a contact adhesive, by definition, sets much more quickly than PVA but could not provide a second advantage. Many answers simply stated that it was stronger. The real advantage of a contact adhesive is that the joint does not require clamping.

(d) Most candidates were unsure as to the purpose of the saw cut in the end of the dowel or the chamfer. The saw cut allowed space for the adhesive while the chamfer gave the dowel a more easy entry into the drilled hole.

(e) Many candidates did not read the question carefully and produced sketches and notes describing how the foot could be made from wood-based material and not the 5 mm thick acrylic sheet stated clearly in the question. Candidates were provided with three bullet points to address. Marks were therefore allocated for each response. Many candidates did not address some of these bullet points and denied themselves marks. It was not sufficient to state ‘mark the acrylic out’ without actually naming an appropriate marking out tool. Similarly, when cutting out the shape ‘saw’ is too vague, whereas coping saw or scroll saw would have gained marks.

(f) There were a minority of really good, practical designs showing how the rotor blade could be fitted to the dowel that was glued into the roof of the helicopter. Most candidates copied the outline shape given in the question. Many of the stated sizes and named materials were appropriate. However, for many candidates that is as far as their answers could be credited with marks. Many candidates drilled a 6 mm diameter hole in the rotor blade which would not rotate freely since the diameter of the dowel was also 6 mm diameter. There were some good designs that showed a 6.5 mm or 7 mm diameter hole providing clearance to allow for free rotation and the use of washers and a cap or stopper to retain the position of the rotor blade.

(g) The most common correct ways by which the designer made the toy helicopter child friendly included the safety features of rounded edges and no sharp or small items that a child could swallow. An appropriate size to fit in a hand and the movement of the rotor blade were also good answers.

(h) Many candidates recognised that plywood could be considered environmentally friendly because some boards could be recycled or that they use recycled materials so this would mean that fewer trees would need to be cut down.

Question 13

(a) Most candidates named an appropriate permanent construction. The most common was a mortise and tenon joint and some dowel joints. Housings and halvings were not appropriate. Candidates were given half a page of space in which to sketch their constructions, but many sketches were too small to show details clearly enough.

(b) (i) Most candidates clearly showed the positions for two cramps holding the side rails and rungs together.

(ii) Most candidates named the sash cramp correctly. F cramps were also acceptable, but G cramps would not be practical.

(iii) Most candidates named a suitable adhesive and PVA was the most common answer with some naming cascamite correctly.

(iv) Most candidates were unable to provide two basic checks that should be carried up when clamping a frame such as the ladder sides and rungs. Candidates could have described checking for 90° squareness between the sides and the rungs, checking for flat (not in 'winding') and checking to ensure all excess adhesive was removed.

(c) (i) The most commonly named plastic to vacuum form was acrylic and a few named polystyrene. There were some inappropriate thermoplastics named as well as some thermosets.

(ii) Many candidates showed a draft angle on one or two of the sides to achieve one mark, but most did not show the rounded edges necessary to ensure successful forming.

(iii) It was clear that some candidates had first-hand experience of the vacuum forming process and produced informative and clearly presented sketches and notes. Most candidates were able to access some of the marks available even if the process they described was not completely correct.

(d) The majority of candidates gained at least one mark for showing a basic design idea of how a plant pot could be attached to a rung while allowing for quick removal. The most common methods included some sort of hook, usually made from plastic or metal, attached to the plant pot. The method of attachment was often crude when using a combination of screws or nuts and bolts.

(e) Many candidates gained at least one mark for showing a piece of rubber attached the bottom of the feet to provide more grip. Some candidates added extra pieces of wood to increase the area of the feet. However, this would not be practical since the angle at which the ladder would be positioned against the wall will always be different.

DESIGN AND TECHNOLOGY

Paper 0445/32
Resistant Materials

Key messages

- Candidates need to read the questions carefully before starting their answer. Candidates should try to focus on the key elements of each question. The mark allocation given to each question and the space provided to answer the question provides candidates with a clear indication of what is required.
- Candidates need to improve their knowledge and understanding of the practical processes required to 'work' the resistant materials, wood, metal and plastic. Currently many candidates name tools or describe processes that are totally unsuitable for specific materials.
- Candidates should carefully note the requirements of the question. They must try to provide clearly drawn sketches when attempting questions that begin with the statement: *Use sketches and notes to....* In addition, notes should enhance and make clearer what they have drawn and not simply state the obvious.

General comments

Section A

Many candidates lacked the all-round knowledge and understanding required to answer 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. Many candidates did not understand how to address the questions effectively.

Comments on specific questions

Section A

Question 1

The majority of candidates achieved at least one mark for naming an appropriate manufacturing process.

Question 2

The majority of candidates described achieved at least one mark for naming an appropriate marking out tool that could be used to mark out the block of metal. There were some excellent answers naming oddleg calipers or scriber, a centre or dot punch and dividers used to mark out a line, centre and arc respectively.

Question 3

There were some very good reasons why consumers may prefer to buy the wall-mounted kitchen roll holder. The most common reasons included; easier access to the kitchen roll, that it would free up space on the counter or work surface and that it would be more stable.

Question 4

(a) Many candidates stated correctly that timber contained moisture that needed to be removed but did not always go on to state why. There were some excellent answers that included the need to minimise the chances of subsequent warping, cupping and shrinkage.

(b) Many candidates provided acceptable variations of natural and open air seasoning as the alternative method to kiln seasoning.

Question 5

Most candidates gained at least one mark for showing the acrylic sheet clamped to the drilling machine table. Many candidates went on to gain further credit.

Question 6

Some candidates did not read the question carefully and simply described what was shown in the figure. Many candidates recognised that the use of scrap wood held at both ends would allow the plane to travel across the entire end without splitting the end grain.

Question 7

Most candidates appeared to be familiar with the terms sustainable and biodegradable recognising oak and pine respectively.

Question 8

Many candidates did not read the information written to the figure showing the computer desk carefully and provided sketches and notes relating to a desk made from wood-based materials. The information stated clearly 'mild steel tube 20 × 20 × 2'. However, there were some excellent answers including the use of an additional strut, the material name and the method of joining. There were also some excellent triangular plates welded or screwed to the frame of the computer desk.

Question 9

(a) Most candidates could not name the centre lathe operation of knurling with many innovative, but incorrect answers.

(b) Most candidates recognised the purpose of knurling even if they could not name the method in **(a)**.

Question 10

Almost all candidates chose the laminated table in answer to this question. There were many excellent reasons given including fewer constructions meaning quicker manufacture and therefore lower labour costs. Those candidates who chose the fabricated table often commented on the use of fewer materials, no dependence on the use of an expensive mould and that the constructions could be produced quickly by machine.

Section B

Question 11

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(g) The most common correct ways by which the designer made the toy helicopter child friendly included the safety features of rounded edges and no sharp or small items that a child could swallow. An appropriate size to fit in a hand and the movement of the rotor blade were also good answers.

(h) Many candidates recognised that plywood could be considered environmentally friendly because some boards could be recycled or that they use recycled materials so this would mean that fewer trees would need to be cut down.

Question 13

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(e) Many candidates gained at least one mark for showing a piece of rubber attached the bottom of the feet to provide more grip. Some candidates added extra pieces of wood to increase the area of the feet. However, this would not be practical since the angle at which the ladder would be positioned against the wall will always be different.

DESIGN AND TECHNOLOGY

Paper 0445/33
Resistant Materials

Key messages

- Candidates need to read the questions carefully before starting their answer. Candidates should try to focus on the key elements of each question. The mark allocation given to each question and the space provided to answer the question provides candidates with a clear indication of what is required.
- Candidates need to improve their knowledge and understanding of the practical processes required to work the resistant materials, wood, metal and plastic. Currently many candidates name tools or describe processes that are totally unsuitable for specific materials.
- Candidates should carefully note the requirements of the question. They must try to provide clearly drawn sketches when attempting questions that begin with the statement: *Use sketches and notes to....* In addition, notes should enhance and make clearer what they have drawn and not simply state the obvious.

General comments

Section A

Many candidates lacked the all-round knowledge and understanding required to answer 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. Many candidates did not understand how to address the questions effectively.

Comments on specific questions

Section A

Question 1

Many candidates gave vague properties of the plastics used to make the cycle helmet. The most common correct answers referred to properties including lightweight, impact resistant and weather resistant.

Question 2

Many candidates did not read this question carefully and provided the names of materials rather than the names of suitable manufacturing processes. Some candidates achieved all three marks by naming a woodturning lathe, die-casting and injection moulding.

Question 3

A few candidates drew dovetail nailing onto the two pieces of wood shown being glued together. It was essential that the nails were shown at a dovetail angle.

Question 4

Many candidates achieved at least partial credit for naming a thermosett for the saucepan handle and a ferrous alloy for the saucepan. Reasons for the choice were often correct, but there were many candidates who could not distinguish between thermosetts and thermoplastics or between ferrous and non-ferrous metals.

Question 5

The majority of candidates recognised at least one of the pre-drilled holes and many recognised all three.

Question 6

Most candidates did not understand the effects of incorrect seasoning of solid wood. Only an extremely small minority of candidates showed the board cupping with the board becoming narrower across its top surface. Shrinkage and movement are important to consider when designing and making products using solid wood.

Question 7

(a) Many candidates understood that galvanising involved the application of a coat of metal and even stated that the reason was to prevent corrosion without stating the important word, zinc.

(b) Most candidates gave a correct reason for galvanising the body of the wheelbarrow. Those candidates who gave the correct reason in **(a)** were credited in **(b)**.

Question 8

Most answers fell into three categories: those which showed exactly how anthropometric data could be used in the design of the go-kart, those which showed some understanding without relating it directly to the go-kart and those which showed candidates knew nothing at all about anthropometrics. The strongest answers referred to measurements of specific parts of the body relating to a specific part of the go-kart; for example, the width of a person's back to fit inside the seat of the go-kart.

Question 9

(a) There were few correct answers to this question. The vast majority of candidates demonstrated a lack of knowledge about between-centres woodturning. There are two methods of woodturning: between-centres and faceplate turning. Centres should ensure candidates have knowledge of these.

(b) Many candidates showed some initiative when giving a reason for removing the corners of a length of wood that would be turned using the between-centres method. Many realised that the removal of the sharp corners would make it easier to make the wood round or that it could prevent the wood from splitting when turned.

Question 10

(a) & (b) Most candidates demonstrated a lack of knowledge about screw cutting in metal. These are basic practical processes that candidates should have experienced or have knowledge of. Cutting a thread on the inside of a hole in metal using a tap and tap wrench and cutting a thread on a round rod using a circular split die held in a die stock are two such processes.

(c) The threaded rod was difficult to tighten by hand because of a lack of leverage. The best method of modifying the rod was to add a tommy bar for which candidates achieved two marks. The addition of some sort of handle to the rod gained one mark.

Section B

Question 11

(a) There were some very good drawings showing different layers (plies) with alternating grain direction. Some candidates made the point that plywood always has an odd number of layers. Many candidates did not make their drawings clear enough to show the constructional details and some provided drawings relating to the whole desk tidy rather than the construction of plywood.

(b) The drawings of a cross-halving joint varied from excellent 3D exploded views to simplistic 2D drawings and some constructions that were not cross-halving joints at all.

(c) (i) The strongest candidates named the hole saw correctly.

(ii) To cut out the Ø90 disc did not require the use of a hole saw. The disc could be produced by cutting the round shape by means of a variety of hand and machine saws then finishing the shape using a sanding disc or files and glasspaper.

(d) Many candidates recognised that the template would need to be made from a material that would preserve the shape necessary for accurate shapes to be drawn over and over again.

(e) Most candidates gained some marks for giving advantages of CAD. The most common correct answers included on-screen modelling, the ability to edit quickly and the facility to transfer data to connected CAM hardware.

(f) Very few candidates provided clear, practical details showing how the desk tidy could rotate. The strongest answers recognised that an additional base was needed, a pivot that would allow the desk tidy to rotate and details about the materials used and the methods of construction.

(g) (i) The key part of this question was why it would be necessary to use different grades of glasspaper to prepare the surfaces for spray paint. Candidates should understand that any abrasive paper scratches the surface. A coarse grade should be followed by a medium grade and finally by a fine grade. Therefore, the scratches are made progressively finer.

(ii) There were many excellent safety precautions provided when using spray paint. The best referred to a well-ventilated area and the use of a face mask, eye protection and gloves to protect the skin.

(h) Quality control checks can be carried out at any stage during the manufacture of a product. However, the question emphasised the word ‘during’ the manufacture of a batch of desk tidies. There were some good answers including an overall visual check, specific checks of measurements, sizes and fit, and surface finish. Many candidates described checks that would be part of a final evaluation of the product rather than those that would be carried out during manufacture.

Question 12

(a) There were many good specification points listed and the most frequently seen included stability of the rack, making sure the toothbrushes did not touch each other and that it should be easy to clean.

(b) (i) Many candidates recognised that a scriber would produce a permanent mark or would scratch the acrylic whereas the mark made by a marker pen could be erased.

(ii) Many candidates gained marks for showing the acrylic clamped to a bench using a G cramp and supported with scrap wood underneath to prevent splitting and damage to the bench.

(c) The majority of candidates did not focus on the main point of the question: that acrylic is a thermoplastic. Many simply stated why acrylic was a good choice of material from which to make the toothbrush holder. There were some excellent answers that described how thermoplastics such as acrylic could be formed using heat and re-formed if necessary.

(d) (i) Only a minority of candidates named draw filing as the method used to finish the edges of the acrylic.

(ii) Very few candidates understood the reason for using different grades of wet and dry, (silicon carbide) paper. Abrasive papers scratch the surface and it is only by starting with a medium/coarse grade and working through the grades to the finest grade that the scratches become lighter and virtually invisible so that they can be buffed and polished finally to a high-quality finish.

(e) (i) Few candidates could provide a design for a drilling jig. Jig design is an important aspect of batch production, whether related to cutting to length, drilling multiple holes or constructional detail. Many candidates showed variations of a drill with numerous twist drills attached which is impractical. There were a few excellent jig designs. The first stage was to show a plate with four holes that could be simply placed on top of the acrylic for one mark. A second mark was awarded if the plate was located against a side of the acrylic and a third mark if it was located against two or more sides or edges of the acrylic.

(ii) Only a minority of candidates achieved the maximum three marks for this question. There were some excellent sketches showing the acrylic heated using a strip heater or line bender, the use of a former and a method of retaining the shape while the acrylic cooled down.

(f) Most candidates were awarded marks for showing a modification to the toothbrush holder in order to accommodate the tube of toothpaste. Many candidates simply added an extra box and achieved partial marks. The best designs extended the holder and incorporated the space for the tube of toothpaste.

(g) (i) Most candidates were able to provide one benefit of using stainless steel in a bathroom. The more relevant benefits include its resistance to corrosion in humid conditions, its attractive appearance and that it could be easily cleaned.

(ii) Only a minority of candidates achieved full marks for this question. The stainless steel toothbrush holder would be expensive to manufacture due to the number of components that would need to be machined and assembled and the time it would take to complete them.

Question 13

(a) Very few candidates gave advantages of using a manufactured board rather than a solid wood for the cycle rack. There were some common misconceptions. Manufactured boards are not necessarily cheaper, and they are not all easy to work. The most valid advantages included their uniform strength and stability and the widths of boards available.

(b) The majority of candidates gained one or two marks for cutting out the shape and making the edges smooth. Only a minority achieved maximum marks. The strongest answers described how a hole could be drilled to produce the curved shape, followed by use of a scroll saw (or equivalent) and the use of files and glasspaper to make the shape smooth.

(c) (i) Most candidates were able to draw the positions of the dowels and show appropriate spacing.

(ii) Many candidates could not design a drilling jig. There were many variations of a machine drill with multiple chucks using multiple drills to drill the holes.

(d) Candidates should be encouraged to provide alternative properties of mild steel other than the vague ‘durable’. Properties such as hardwearing, tough and an ability to be bent to shape gained marks.

(e) This question did not ask candidates for benefits of CAD but about the purpose of making computer-generated models of the cycle rack. There were some good answers including a visual check of key components, their sizes and function and the subsequent editing that could be carried out.

(f) The majority of candidates were able to identify both the bench shears and tinsnips as tools that could be used to cut out the development (net).

(g) (i) Many candidates named a permanent method of joining the flaps using a heat process with the most common being welding and soldering.

(ii) Few candidates named an appropriate method of joining the flaps permanently without the use of a heat process. The strongest answers stated the use of rivets or epoxy resin adhesive. Many candidates stated that screws could be used. The use of screws alone does not produce a permanent joint.

(h) (i) Most candidates correctly chose the round head screw but for the wrong reason. Only a few candidates recognised that drilling a countersunk hole in 2 mm thick mild steel sheet was impractical as the material is too thin. The round head screw would provide excellent pressure on the surface of the mild steel sheet.

(ii) Few candidates were able to provide two precautions for this question. This question was not concerned with items of PPE. It was concerned with precautions such as clamping the sheet metal securely, providing sacrificial material under the sheet, removing the chuck key and setting the correct drill speed.

(i) The cycle rack made from manufactured board would be the more expensive to manufacture in quantity due to the material being more expensive than mild steel sheet and the number of processes involved resulting in higher labour costs.

DESIGN AND TECHNOLOGY

Paper 0445/41
Systems and Control

Key messages

- Candidates should be reminded that they are required to answer every question in ***Section A*** but only one question in ***Section B***. There were several instances where all three ***Section B*** questions had been attempted.
- All responses should appear in the space allocated for that response. If there is not enough room, the response can be continued on additional sheets attached to the booklet. If additional sheets are used the question and part number must appear clearly next to the response.
- In questions that require either a single answer or a set number of answers it is important that candidates do not enter additional answers. Any errors can be corrected by crossing through the incorrect responses.
- If a question requires sketches and notes, both should be used in the response.
- Explanation should be given in sentences rather than as short notes.
- In calculation questions, units should be applied to the answer wherever it is appropriate. Any working should be shown as it is possible to gain marks from this even if the final answer is incorrect.

General comments

The questions in ***Section A*** proved accessible to the majority of candidates with only a few offering no response for individual questions. The majority of responses were clear with stronger candidates providing good evidence that the syllabus content had been well covered. Knowledge of the use of different forms of model making within designing and making was good. However, weaker candidates often gave one-word answers, when what was needed was justification for what they had put. For example, in **Question 1(b)** benefits of computer modelling were given as 'quick' or 'easy', neither of which gained credit. Responses such as 'quick to produce and edit', or 'allows pre-drawn parts to be used to cut down the time spent' gained credit as they defined the aspect that could be carried out quickly.

Candidates should read each question carefully before making a choice and starting their response.

Where sketches were required, they were generally clear and good use had been made of the available space. Annotation was generally accurate and informative.

Comments on specific questions

Section A

Question 1

(a) Some candidates were unclear about the size of a physical model. A number of candidates had assumed that it was a scaled down version of the intended design, but with very small artefacts the model could be scaled up to show more detail. Nearly all candidates gave at least one valid benefit of using a physical model. Stronger candidates noted that different materials could be handled as part of the modelling process.

(b) Many of the benefits of computer-generated models indicated first-hand experience of this technique. Justification was required for any responses that referred to the speed of the process. Ease of storage when compared to a physical model was a valid benefit given in many cases.

(c) A number of alternative uses for computers in manufacturing were given. 3D printing was a common response, along with internet research.

Question 2

In many cases knowledge of equilibrium was incomplete. Responses showed some recognition that opposing forces are equal but very few candidates mentioned that a structure in equilibrium would be balanced and would not be moving. Stronger candidates went on to describe the relationship between clockwise and anticlockwise moments.

Question 3

The response required for the meaning of 'moment' in a structure was simply, force $\times$ distance. The question was answered correctly by the majority of candidates.

Question 4

(a) (i) The cable link was recognised as a second order of lever by most candidates.

(ii) The force acting in the cable was usually correctly given as tension, but a few weaker candidates gave alternative answers.

(iii) This part proved more challenging than the previous two. The purpose of the counterbalance was to ensure that the lever arm returns to its resting position when the tension in the cable is released. The weight of the counterbalance causes the arm to rotate clockwise.

(b) This was well answered with a range of valid reasons given for the use of electronic signalling. Many of the responses used the lack of maintenance required as there is no movement involved.

Question 5

(a) Many candidates gained credit for recognising the rotary motion but slightly fewer gave the output motion as reciprocating.

(b) Either a cam and follower or a crank and slider would produce the same conversion of motion as an eccentric and stronger candidates gained the mark for this.

Question 6

(a) The risks from soldering were understood in most cases, with burns and fumes being the most commonly given. In a few cases, lead transferred to the hands was correctly noted as a hazard.

(b) The precautions taken against one of the identified risks were generally correct. The final part of the question asked how the risk was reduced by the given precaution. Weaker candidates did not attempt this part. The precautions given were sometimes impractical, but credit was given where the precaution would have reduced or prevented the risk.

Question 7

The question asked for the name of an instrument used to measure electrical resistance. The range of responses indicated that weaker candidates knew the name of a test instrument, but the instrument they chose was frequently unable to measure resistance. Those who used a multimeter were credited but to be fully accurate the response should have stated that the multimeter was on a resistance setting.

Question 8

(a) Understanding of tolerance in a resistor was clear from the stronger candidates but not from the other candidates. The response should have mentioned both the stated value of the resistor and

the actual value. The strongest responses noted that a precise value would not be possible and that some fluctuation from the stated value is necessary.

(b) Reference to the coloured bands on the resistor was required in the response, but in many cases, candidates went beyond this and stated precisely which band represented the tolerance.

Section B

Question 9

(a) (i) Many responses correctly identified the scaffolding as a frame structure.

(ii) The safety features visible on the scaffolding were generally identified correctly with the wrapping around the poles at street level being the most commonly used example. The mesh fencing on the upper levels was also frequently noted as the second feature required.

(iii) In most responses, the reason for triangulation was correctly stated as providing rigidity to the scaffolding.

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(v) Marks for this part were allocated for functional method, clear illustration and showing a method of fixing the scaffold pole to the method used to spread the load. The first two parts were very well answered but the method of fixing the scaffold pole was frequently omitted. In a few examples a permanent fixing such as welding was given. In most cases candidates drew an addition that was larger in surface area than the pole but there was nothing to stop the pole from sliding straight through it, negating the larger surface area.

(b) (i) The forces acting on the concrete barrier were identified correctly by stronger candidates.

(ii) Most candidates knew the reasons for using stainless steel

(iii) There were very few correct answers to this part with candidates generally unaware of how a strain gauge would be attached to the wall. There were a few who mentioned glue but almost none were specific about the type of adhesive that would be suitable. Very few responses mentioned the alignment arrows that assist in placing the strain gauge accurately.

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(ii) The first part of the response needed to mention accurate alignment or how the tubes should be held in position but this was seldom seen. The actual technique used was more frequently identified as welding or brazing. Very few responses went for a bolt and nut concealed in the tubing as the method.

(iii) Knowledge of gusset plates as a reinforcement method was generally good. Sketches of the plate in position showed clear understanding of their use.

(iv) In most cases the calculation was clearly laid out in stages that could be followed. Those candidates who did not show the working from their response gained full marks if the final answer was correct, but no partial credit could be given for an incorrect answer with no evidence of working.

(v) Only the strongest candidates gained marks on this part by explaining the part played by the change in perpendicular distance from the load to the fulcrum.

Question 10

(a) (i) The majority of candidates answering the mechanisms question gained credit for recognising the worm gear.

(ii) At least one reason for using a worm gear was given and in most cases this was the large reduction given by the worm gear. Very few responses mentioned the fact that it can only be turned in one direction.

(iii) Function of the idler gear was not well known. It was judged to affect speed in some cases, rather than transferring the drive or reversing direction of rotation.

(iv) There were few correct responses to the gear ratio calculation. Candidates should be advised to always include all of their working for a question of this type.

(v) The self-lubricating nature of nylon was known by stronger candidates. The fact that a nylon gear can be injection moulded for speed and subsequent saving in cost was rarely mentioned.

(b) No candidates made use of a jockey wheel when showing how a chain could be tensioned. Having adjustment on the spacing between the two gears was the chosen method for most candidates. Weaker candidates did not provide a slot to allow movement of one of the gears.

(c) (i) Candidates needed to give a general safety precaution for each of the given power sources. A number of responses listed personal protection equipment rather than protective features applied to the power source.

(ii) Problems with the storage of electricity were not well known. Those who based their responses on battery usage gained credit. Problems of over production of renewable electricity in solar and wind farms were largely ignored.

(iii) Methods of combining electronics and pneumatics were not well understood. The use of solenoid valves and reed switches for positional information was only used by the stronger candidates.

(d) In many responses candidates realised that a gravity system could lead to loss of oil. The extra labour involved in keeping the oil reservoir filled was not widely recognised.

Question 11

(a) (i) Almost all candidates answering the question had clear knowledge of how to prepare a soldering iron for use. All of the possible correct responses were seen, but the most common was ‘cleaning the tip of the iron on a damp sponge before use’.

(ii) Removal of an incorrectly soldered component was clearly described in many of the responses, and most candidates showed evidence of having used a desoldering tool. There were a number of candidates who gained both marks but, in most cases, the final stage of pulling the wire from the board was omitted. Stronger candidates gained both marks with a full description of a single point.

(iii) Calculation of the value of protective resistor was generally well carried out in terms of the use of Ohm’s law. Use of the voltage drop across each segment was only seen in stronger responses.

(iv) Those candidates who carried out the calculation correctly generally chose the correct resistor value. Any candidates who did not get the calculation correct were given credit if they had chosen a suitable resistor to match their calculated value.

(v) The logic levels for segments that would be switched on were generally given correctly. The level for those that would be switched off were usually correct for the number segment. However, often the decimal point did not have a logic value applied to it. Very few responses gave the correct value for the common cathode.

(vi) A number of the strongest candidates correctly noted that use of a single resistor for all segments would result in varying brightness.

(b) (i) The majority of candidates knew that a magnet is needed to operate a reed switch.

(ii) This part was well answered with clear understanding of logic symbols and of the associated truth table.

(iii) The majority of responses showed the correct general shape of a NAND gate but in a few cases the inputs were missing.

(c) (i) Completing the circuit connections required knowledge of a bipolar transistor circuit and also of the coil connections for a relay. There were more responses getting the mark for connecting the protective resistor than for the relay connections. A common fault was to connect to the relay outputs rather than to the coil.

(ii) The use of a diode to prevent damage to the transistor was widely known, but back EMF as the cause of the damage was not so well known.

(iii) Understanding of switch connections was not fully understood. Very few candidates noted that a double throw switch will have three connections. The double pole aspect was understood by more candidates.

DESIGN AND TECHNOLOGY

Paper 0445/42
Systems and Control

Key messages

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- All responses should appear in the space allocated for that response. If there is not enough room, the response can be continued on additional sheets attached to the booklet. If additional sheets are used the question and part number must appear clearly next to the response.
- In questions that require either a single answer or a set number of answers it is important that candidates do not enter additional answers. Any errors can be corrected by crossing through the incorrect responses.
- If a question requires sketches and notes, both should be used in the response.
- Explanation should be given in sentences rather than as short notes.
- In calculation questions, units should be applied to the answer wherever it is appropriate. Any working should be shown as it is possible to gain marks from this even if the final answer is incorrect.

General comments

The questions in ***Section A*** proved accessible to the majority of candidates with only a few offering no response for individual questions. The majority of responses were clear with stronger candidates providing good evidence that the syllabus content had been well covered. Knowledge of the use of different forms of model making within designing and making was good. However, weaker candidates often gave one-word answers, when what was needed was justification for what they had put. For example, in **Question 1(b)** benefits of computer modelling were given as 'quick' or 'easy', neither of which gained credit. Responses such as 'quick to produce and edit', or 'allows pre-drawn parts to be used to cut down the time spent' gained credit as they defined the aspect that could be carried out quickly.

Candidates should read each question carefully before making a choice and starting their response.

Where sketches were required, they were generally clear and good use had been made of the available space. Annotation was generally accurate and informative.

Comments on specific questions

Section A

Question 1

(a) Some candidates were unclear about the size of a physical model. A number of candidates had assumed that it was a scaled down version of the intended design, but with very small artefacts the model could be scaled up to show more detail. Nearly all candidates gave at least one valid benefit of using a physical model. Stronger candidates noted that different materials could be handled as part of the modelling process.

(b) Many of the benefits of computer-generated models indicated first-hand experience of this technique. Justification was required for any responses that referred to the speed of the process. Ease of storage when compared to a physical model was a valid benefit given in many cases.

(c) A number of alternative uses for computers in manufacturing were given. 3D printing was a common response, along with internet research.

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In many cases knowledge of equilibrium was incomplete. Responses showed some recognition that opposing forces are equal but very few candidates mentioned that a structure in equilibrium would be balanced and would not be moving. Stronger candidates went on to describe the relationship between clockwise and anticlockwise moments.

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The response required for the meaning of 'moment' in a structure was simply, force $\times$ distance. The question was answered correctly by the majority of candidates.

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(a) (i) The cable link was recognised as a second order of lever by most candidates.

(ii) The force acting in the cable was usually correctly given as tension, but a few weaker candidates gave alternative answers.

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(b) This was well answered with a range of valid reasons given for the use of electronic signalling. Many of the responses used the lack of maintenance required as there is no movement involved.

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(a) Many candidates gained credit for recognising the rotary motion but slightly fewer gave the output motion as reciprocating.

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(a) The risks from soldering were understood in most cases, with burns and fumes being the most commonly given. In a few cases, lead transferred to the hands was correctly noted as a hazard.

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The question asked for the name of an instrument used to measure electrical resistance. The range of responses indicated that weaker candidates knew the name of a test instrument, but the instrument they chose was frequently unable to measure resistance. Those who used a multimeter were credited but to be fully accurate the response should have stated that the multimeter was on a resistance setting.

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Section B

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DESIGN AND TECHNOLOGY

Paper 0445/43
Systems and Control

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DESIGN AND TECHNOLOGY

Paper 0445/05
Project

Key messages

- Apply greater focus on quality rather than quantity. Use a reasonable size font and avoid unnecessary embellishment.
- Ensure that there is sufficient clear photographic evidence to show the key features and quality of the product.
- Ensure that there is evidence of the product being tested to access the higher mark ranges for testing and evaluation.

General comments

Some of the work submitted this assessment session was of a very high standard. A number of projects were innovative and practical outcomes were of a very good standard.

In many cases, work submitted for moderation was well presented with all appropriate paperwork present. However, there was a slight increase in the number of transcription errors in the transfer of marks to the MS1. Centres are reminded to take care over this to avoid the risk of errors.

Candidates prepared their work in a concise and logical manner that reflected the assessment criteria. It is important that folders have a logical flow through the process of introducing the design challenge, researching, designing, developing, planning, making and evaluating.

Centres are reminded that practical outcomes and three-dimensional prototype models should not be forwarded with the sample for moderation.

Many candidates did not make best use of the A3 sheets. Fonts were often too large, leading to unnecessarily large folders. Work needs to be structured, focused and presented clearly.

Marks were applied consistently and accurately by many centres. It is important that a correct order of merit is achieved through careful assessment and moderation. A number of candidates were given far too generous mark allocations and placed above other candidates in the centre, with no evidence to support the high marks awarded for assessment criteria and their position in the rank order.

If marks are changed during internal moderation, please indicate in the Assessment Criterion where adjustment has occurred.

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

https://schoolsupporthub.cambridgeinternational.org

Comments on specific sections

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

Although some candidates produced appropriate detail of the analysis of need and the requirements of the user and achieved the higher mark range, many produced a brief statement of design intention with some reference to the user. Many candidates made limited or no reference to the design or user/s needs and were incorrectly awarded marks in the middle and higher mark range. The design opportunity and design brief tended to be communicated well but candidates should look at the needs and expectations of the selected user group in more detail.

2. Research into the Design Brief resulting in a Specification

Some centres were slightly lenient in assessing this section. Research needs to be more focused on the situation chosen and specifications should state the main functions and qualities of the product. Many candidates did not access specific research directly related to their brief. For example, candidates designing storage units should research information about the range, number and sizes of items to be stored.

The analysis of existing products was generally well carried out with candidates identifying key features that would help when designing. Some candidates used existing products as their only source of information in this section. This alone cannot access full marks. It is important where appropriate, to research other areas such as specific ergonomic or anthropometric requirements Sometimes information/data was collected by candidates, but limited conclusions were drawn to be of relevance when designing. This was particularly evident with some questionnaires. Candidates should be encouraged to include more personal observation and analysis when researching.

Summarising the findings of research can be beneficial. This type of analysis of the research section would lead to an informed and thorough design specification.

Specifications were generally clear and justified but many tended to be too brief and generic. By explaining the design criteria in more detail, candidates show a greater understanding and can access a higher level of attainment.

3. Generation and exploration of Design Ideas

Some of the design work presented was outstanding; exceptionally well-presented, innovative and creative. Many candidates presented a good integration of models with sketched ideas and design possibilities and showing a natural progression of design thinking and development.

Whilst most centres assessed this section accurately, a significant number were far too generous in their assessment. The support hub has examples of assessed coursework that would help when gauging the marks to be awarded.

To access the higher mark range, a wide range of different, well-annotated possibilities is required. Ideas should be evaluated on their suitability for further development and refer to the specification.

Many candidates produced a small range of different design ideas. They would have benefitted from exploring and evaluating each idea in more detail, including material possibilities, aesthetic considerations and experimentation with proportions etc. before going onto the next concept. This would enable them to access the highest mark range.

Candidates must make it clear why ideas had been selected for further development. Many candidates produced very limited evaluations of ideas and made little or no reference to the specification.

4. Development of Proposed Solution

This section was assessed too generously by a significant number of centres.

Whilst some candidates showed clear evidence of reasoned decision making about the form, materials and construction of the final solution; many making excellent use of simple models to check proportions and basic functions, many had very limited or no evidence of the development of ideas in their folders. Candidates should explain why specific materials, possible joining methods and finishes have been selected for their final solution

Many candidates made very good use of three – dimensional modelling and CAD modelling to help to visualise the size, shape and proportions of the design proposal.

5. Planning for Production

This section was assessed accurately by most centres. Most candidates produced detailed, dimensioned working drawings with CAD being increasingly used to very good effect in the generation of working drawings. Some candidates used 3-D representational CAD drawings which did not include dimensional detail.

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

Most candidates produced a logical sequence of the stages of manufacture, including detailed cutting lists in their comprehensive plan for production. A small number were very basic and lacked sufficient information required to manufacture the product.

6. Product Realisation

Centres are accurate and fair in awarding marks commensurate with the quality of work produced for this section.

Almost all candidates fully completed the manufacture of a practical outcome and there were many very high-quality manufactured products presented.

Most candidates used photographic evidence during the key stages of manufacture of the product to emphasise particular features and the quality of making.

Centres are reminded that marks allocated to making should reflect the overall complexity of the product, the level of skill demonstrated by the candidate, and the quality of the making of the final product.

7. Testing and Evaluation

A significant number of centres tended to be too lenient in this section.

Some candidates do not test the product for its intended use and make very limited comment about the quality of manufacture or the products performance against the specification. Candidates should use photographic evidence to show the product in use.

Tick lists alone are not appropriate when evaluating the final outcome.

Most candidates identified strengths and weaknesses of the product, but not all go on to use sketches and notes to suggest proposals for further improvement or further development.

Many candidates had clients/users identified who were able to test and evaluate the final product which is to be encouraged.