DESIGN AND TECHNOLOGY

Paper 0445/11
Product Design

Key Messages

- Candidates should be encouraged to provide justified evaluations on both positive and negative aspects of proposed design ideas, in response to part **(d)**.
- Full solutions to the design problem, drawn in response to part **(e)**, should focus on construction details of the product rather than aspects of the design already covered in part **(c)** or manufacturing methods to be covered in part **(g)**.

General comments

Successful candidates followed the design process as set out on the revised A3 answer sheets showing that they could apply their design skills in an imaginative and creative way. The revised answer sheets provided slightly more structure to responses in some part questions and this appeared to help many candidates. The three questions presented fairly open design situations, based on pets and other animals, whereby candidates could apply specific areas of knowledge and interest developed during the period of their study.

Candidates tended to score well when they focused their answers on the precise stage of the design process as set out on the A3 answer sheets.

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

Comments on specific questions

Question 1

Candidates appeared to understand fully the requirements of the design need for the transportation of small pets and it was clearly one with which they were familiar in their normal day-to-day experiences. Suggested outcomes were normally based on some form of hand held carrier and there was evidence of original thinking with imaginative outcomes.

(a) Candidates were able to identify functional points required of the unit in addition to those outlined in the question. Successful responses to this introductory part of the question included: comfortable for pet; lightweight/easy to carry/transport; pet cannot get hurt from sharp edges; keeps pet protected; food/water does not spill; easy access to pet; easy access to food/water; secure/pet cannot escape; etc.

(b) Few candidates had difficulty showing two ways of putting the pet into or taking it out of the unit and these included: hinged door on side; hinged flap on top; sliding door/flap; top clips off/on base; roller screen; etc.

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

(d) The majority of candidates evaluated effectively each of their design ideas in turn and then identified the chosen idea with reasons for choice given. Centres had obviously taken note of previous reports as there were few cases where candidates had produced a table marking each design idea against specification points. This approach is not appropriate as candidates are required to comment on particular good and bad points about 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. Marks are awarded for the appropriateness of the process.

Question 2

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

(a) Most candidates were able to suggest additional points to those outlined in the question and successful responses included: attractive colour/shape; realistic animal shapes; appeals to young children; parts easy to handle; no small parts; easy instructions/rules; hygienic/easy to keep clean; etc.

(b) The majority of candidates were familiar with ways by which items could be matched in the game and appropriate suggestions included: fitting similar shapes; sliding shapes through slots; colours; size; rewards; sound feedback; linking lines; stickers; etc.

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

Question 3

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

(a) Additional points about the function of the indicating system included: weather/water resistant; minimal power use; easy to set up; clear indicator; does not frighten pet; does not damage door; etc.

(b) Most candidates were able to identify two display methods including: coloured lights/discs; flaps on signs; sliding signs; ‘flags’; semaphore arms; sounds; etc.

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

DESIGN AND TECHNOLOGY

Paper 0445/12
Product Design

Key Messages

- Candidates should be encouraged to provide justified evaluations on both positive and negative aspects of proposed design ideas, in response to part **(d)**.
- Full solutions to the design problem, drawn in response to part **(e)**, should focus on construction details of the product rather than aspects of the design already covered in part **(c)** or manufacturing methods to be covered in part **(g)**.

General comments

Successful candidates followed the design process as set out on the revised A3 answer sheets showing that they could apply their design skills in an imaginative and creative way. The revised answer sheets provided slightly more structure to responses in some part questions and this appeared to help many candidates. The three questions presented fairly open design situations, based on gardening, whereby candidates could apply specific areas of knowledge and interest developed during the period of their study.

Candidates tended to score well when they focused their answers on the precise stage of the design process as set out on the A3 answer sheets.

The three optional questions were each answered by similar numbers of candidates.

Comments on specific questions

Question 1

Candidates appeared to understand fully the requirements of the design needs for the kneeling aid and it was clearly one with which they were familiar in their normal day-to-day experiences. Suggested outcomes were normally based on some form of shallow carcase or frame and there was evidence of original thinking with imaginative outcomes.

(a) Candidates were able to identify functional points required of the kneeling aid in addition to those outlined in the question. Successful responses to this introductory part of the question included: lightweight/easy to carry/move; water resistant; help return to standing position; would not damage plants; easy to store; comfortable for knees; include hand hold/grip; etc.

(b) Few candidates had difficulty showing two additional features and these included: trowel/ implement holder; seed packet holder; drinks holder; etc.

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

(d) The majority of candidates evaluated effectively each of their design ideas in turn and then identified the chosen idea with reasons for choice given. Centres had obviously taken note of previous reports as there were few cases where candidates had produced a table marking each design idea against specification points. This approach is not appropriate as candidates are required to comment on particular good and bad points about 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. Marks are awarded for the appropriateness of the process.

Question 2

This question clearly appealed to those candidates following the Graphic Products option and most appreciated that a point of sale display stand of the type to be designed could be produced through the use of semi resistant materials.

(a) Most candidates were able to suggest additional points to those outlined in the question and successful responses included: attractive colour/shape/layout; simple wording; stable in use; flat pack for distribution; pictures of flowers; etc.

(b) The majority of candidates were familiar with ways by which the point of sale display stand could be made waterproof and appropriate suggestions included: any form of roof/shelter; examples of waterproof materials/finishes; waterproof constructions; for whole stand or individual packets; etc.

(c)

(d) See **Question 1 (c) – (g)**

(e)

(f)

(g)

Question 3

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

(a) Additional points about the function of the hose pipe storage system included: water resistant; does not damage hose; adjustable for different pipe lengths/diameters; freestanding/fixed to wall; method of winding/pulling in; etc.

(b) Most candidates were able to identify two methods by which the hosepipe could be joined and separated quickly including: quick release and holding methods; snail cam; sprung lever; screw thread based; over centre cam; etc.

(c)

(d) See **Question 1 (c) – (g)**

(e)

(f)

(g)

DESIGN AND TECHNOLOGY

Paper 0445/13

Product Design

Key Messages

- Candidates should be encouraged to provide justified evaluations on both positive and negative aspects of proposed design ideas, in response to part **(d)**.
- Full solutions to the design problem, drawn in response to part **(e)**, should focus on construction details of the product rather than aspects of the design already covered in part **(c)** or manufacturing methods to be covered in part **(g)**.

General comments

Successful candidates followed the design process as set out on the revised A3 answer sheets showing that they could apply their design skills in an imaginative and creative way. The revised answer sheets provided slightly more structure to responses in some part questions and this appeared to help many candidates. The three questions presented fairly open design situations, based on sporting activities, whereby candidates could apply specific areas of knowledge and interest developed during the period of their study.

Candidates tended to score well when they focused their answers on the precise stage of the design process as set out on the A3 answer sheets.

Question 1 was, by far, the most popular question, with a smaller number of candidates choosing **Question 2** and few choosing **Question 3**.

Comments on specific questions

Question 1

Candidates appeared to understand fully the requirements of the design needs of the storage unit for table tennis bats and balls and it was clearly one with which they were familiar in their normal day-to-day experiences. Suggested outcomes were normally based on some form of carcase unit and there was evidence of original thinking with imaginative outcomes.

(a) Candidates were able to identify functional points required of the unit in addition to those outlined in the question. Successful responses to this introductory part of the question included: easy access to bats and balls; lightweight/easy to carry; balls cannot get squashed; surface of bats protected; comfortable to carry; hold additional items; etc.

(b) Few candidates had difficulty showing two ways of holding table tennis balls in the unit and these included: in recess; in holes; clips; slots; tube; pockets; etc.

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

(d) The majority of candidates evaluated effectively each of their design ideas in turn and then identified the chosen idea with reasons for choice given. Centres had obviously taken note of previous reports as there were few cases where candidates had produced a table marking each design idea against specification points. This approach is not appropriate as candidates are required to comment on particular good and bad points about 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. Marks are awarded for the appropriateness of the process.

Question 2

This question clearly appealed to those candidates following the Graphic Products option and most appreciated that a display of the type to be designed could be produced through the use of semi resistant materials.

(a) Most candidates were able to suggest additional points to those outlined in the question and successful responses included: attractive colour/shape/layout; simple wording; popular sport; low energy consumption; weather proof if outside; easy to move around; etc.

(b) The majority of candidates were familiar with ways by which movement could be achieved on a display of this type and appropriate suggestions included: sliders; hinged portion; any form of rotation; cams; springs; cranks; etc.

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

Question 3

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

(a) Additional points about the function of the golf putting device included: weather/water resistant; minimal power use; does not hurt golfer when returned; quiet in use; does not damage ball; adjustable for distance; etc.

(b) Most candidates were able to identify two ways by which a ball could be sent back to the golfer including: fired by spring/elastic/arm; through tube; chute; belt/chain; spiral; etc.

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

DESIGN AND TECHNOLOGY

Paper 0445/21
Graphic Products

Key Message

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

General Comments

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

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

There are areas of the syllabus however, in which further improvements are needed. Candidates must be able to draw a planometric view from given information of a simple circular shape. Drawing a sectional view of two separate parts and the understanding of 'perforation' are also areas that need to be improved.

Comments on specific questions

Question A1

Hotel Model

(a) A pictorial image of part **A** was required to have the thick and thin line technique applied. A thick line is only applied to a side where one side producing the edge can be seen. Where two sides can be seen producing the edge this line is left 'thin'.

(b) Part **B** was required to be drawn by removing a 30 x 40 rectangle from the isometric given. Some candidates added a 30 x 40 rectangle above the given, leaving the bottom part oversize.

Part **C** was required to have the slope drawn 30 down and 40 across the top.

Question A2

Front View

Many candidates drew part **A** extending beyond the vertical side of part **C**. By referring to the pictorial image, part **B** sits alongside part **C** and behind part **A**. A horizontal line across the width of part **C** needs to be drawn to show the edge of the slope 30 mm from the top.

Plan

Part **A** needed to be drawn 10 thick across the front of part **C** and protruding 10 mm to the right of C to cloak part **B**. Part **B** was to be drawn 10 thick and 60 deep so that the back aligned with the back of part **C**. A horizontal line 20 mm from the back should be evident to show the edge of the slope.

Question A3

Card model of a House

Most candidates attempted all parts of this compulsory question.

(a) The question asked candidates to complete an isometric view of the house. Many candidates drew the vertical line on the left and the two lines at 30° showing the ridge and the lower edge of the roof. Not all candidates managed to draw a line parallel to the line given on the gable end to show the correct far left end of the roof.

(b) Candidates were asked to name two ways of adding colour to the card model.

Correct responses included:
- Crayons
- Felt tip pens
- Brush paint
- Spray paint

(c) Candidates were asked to use a sketch and notes to show what is meant by 'perforation'.

A sectional view of a piece of card would show a series of elliptical slots and circular holes that penetrate the thickness of the card leaving a very small amount of card in-between each slot/hole. This enables the card to be torn along the given line of 'perforation'.

(d) The candidates needed to state one reason why the development of the model was considered to be uneconomical. Whilst many said 'lots of waste' very few candidates completed the question to give a method of how this problem could be overcome.

Other suitable reasons included: uses virgin card, shape does not tessellate.

Question B4

Package for Chocolates

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

A classroom exercise to make the box and the closure of the packaging would be most beneficial to future candidates' understanding of this Graphic Product.

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

(a) Candidates were asked to drawn a full size planometric view of the closure for the box. Responses in both 45/45 and 60/30 were accepted. High scoring answers started with a circle Ø50 on the centre lines given. A top band 25 wide was then added. Sides 30 deep were then drawn to each end and a base 25 wide completed the closure.

(b) Candidates were required to complete a 'roll-out' development of the card box. From the pictorial view given and the start boxes, candidates should be able to complete the development. Many drew the square base below the given side, with an additional half top drawn two side away from the given top. Glue tabs were added by all candidates but not always in the correct place. Whilst the correct convention for a fold line was given, not all candidates repeated the correct convention.

(c) (i) The printing method required was Lithography or digital printing.

(ii) Acceptable answers for the specific plastic used to vacuum form the trays were: ABS, HIPS, PET, Polystyrene, Polypropylene, PVC.

(iii) Sketches and notes were required to explain the vacuum forming process.

Sketches had to show:
1. The concept of a former.

2. Flat sheet being heated.
3. Suction (vacuum) forcing the softened sheet onto the former shape.

Notes had to accompany the sketches and explain fully what was happening.

Question B5

Customer research Stand

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

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

(a) Many candidates managed to add shading to the tube. High scoring candidates managed to add graduated shading to enhance the round/shiny image of the tube.

(b) The sectional view required a break line adding to the top of the break in the name board. A horizontal line was to be drawn across the top of the tube, and the right hand inner wall of the tube added. Section lines could then be drawn at the same angle on the walls of the tube and at a different angle on the name board. The centre of the tube should have been left empty.

(c) An ellipse to the size given was required to be drawn. Many different constructions were accepted providing that the major axis was 100 mm and the minor axis was 70 mm. Where candidates had used a trammel, marks for construction were awarded if the trammel was drawn on the paper or attached.

(d) (i) Many candidates managed to draw a pie chart with angles of 160° 80° and 120°. Colour was required to enhance the drawing with clear labels for each washing powder.

(ii) Advantages of using ICT for customer research included: Data can be entered directly into a database and manipulated / printed in different forms. ICT can reach a wider audience and can save time/money sorting data.

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*** and ***A3***) and then go on to answer *either* **B4** *or* **B5** from ***section B***. An equal number of candidates chose to answer **Question B4** and **B5**. A small number of candidates did not follow the rubric instruction and omitted **Question A3** or answered all the questions.

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

There are areas of the syllabus however, in which further improvements are needed. Candidates must be able to draw a solid object to size in two point perspective projection. The rendering of shapes to represent a given material is also an area that needs to be improved.

Comments on specific questions

Question A1

Model Torch

(a) Candidates were required to draw a full size isometric view of part **A** of the model torch. Successful candidates drew a block 60 square and 20 high. A 30 square was then drawn centrally placed 15 above this block. Tapers were added to join up the 30 square with the 60 square. A circle Ø20 could then be drawn centrally on the 30 square surface. The circle needed to be constructed as it would appear as an ellipse in this isometric view.

(b) The pictorial sketch of the body of the torch was to be completed by adding the front curve and the straight side of the slide switch.

Question A2

1. A suitable material from which the model could be made was asked to be stated. Suitable answers included: *Styrofoam, balsa wood, MDF*.

2. Suitable reasons for choice of material should have been: *Easy to shape, accepts a paint finish.*

Question A3

Card packaging for model torch

Unfortunately, some candidates did not attempt this entire compulsory question.

(a) The question asked candidates to complete the two given orthographic views. **The front view** required the top line and the right hand vertical to be added. The glue flap also needed to be completed so that it appeared symmetrical. **The plan** required the top line and the right hand line to

be completed to form a square. A circle of relative size should also be visible on the plan in hidden detail.

(b) Candidates were asked to sketch the development (net) of the packaging. Many candidates responded by drawing a strip similar in width to what had been given in part **(a)** and dividing this into four parts with a glue flap at one end. Some candidates did not make two of the parts square and some candidates placed the hole incorrectly. High scoring solutions showed a back and front upright consistent in size with the drawing in part **(a)** and a hole in the square part that would appear in the lower part when folded and assembled. Fold lines were not always drawn according to convention.

(c) The packaging was considered to be environmentally friendly because:

- It used re-cycled / unbleached card so less trees need to be cut down;
- The development (net) does not have sides so less card needs to be used;
- Vegetable inks could have been used as they are less toxic to the environment.

Question B4

Desk Calendar

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

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

(a) A two point perspective view of the base of the desk calendar was to be drawn (the wooden blocks were to be removed).

Many candidates managed to connect the front vertical line to VP1 and VP2. Most candidates completed the front by drawing the two uprights to touch the diminishing line to VP2.

Lines to VP1 to form the inner edge and the back proved to be difficult for some candidates. Some candidates managed to show the 'floor' of the base.

(b) Candidates were asked to render the block to show that it was made from wood. Most candidates showed grain on the top whilst few candidates 'connected' this grain pattern to the end and side correctly. Brown / yellow was used correctly to show tone.

(c) The question required candidates to explain the three listed processes. A good response would be as follows:

Design
A computer program such as 'word' would be needed. The font type, outline and size would need to be selected. The letters would need to be typed in and adjusted to the correct size.

Manufacture
Self- adhesive Vinyl would need to be loaded into a CAM machine such as a plotter. The design would then be sent from the computer to the plotter where the knife cuts the shape.

Application
Transfer film would be needed to lift the design from the vinyl sheet. Weeding would have to take place before the design is smoothed onto the wooden block. The transfer film could then be peeled off.

Question B5

Shampoo bottle

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

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

(a) (i) An ellipse was required to be drawn on the given centre lines to represent the plan view of the shampoo bottle. The ellipse was to be drawn 60 x 40 in the correct orientation. Correct responses showed construction and a minimum of six plots. A smooth connecting curve completed the drawing.

(ii) The letters N and E needed to be added in the same style and size as the given letters.

(b) This question required candidates to complete a table to show three pieces of information that would be included on the shampoo bottle. Box 1 required the words *High* and *Density.*

Box two and three required a drawing and an explanation from one of the following:

- A bar code so the product can be scanned at the p.o.s;
- The contents so the consumer can check what is in the bottle;
- The Manufacturers Name so you remember the product and buy again;
- The Volume / weight so you can compare contents and value for money.

Other answers could refer to expiry date health or safety.

(c) Candidates were required to draw a bar chart showing the results of the questionnaire. Marks were awarded for three bars drawn on a suitable vertical scale. Labels were required on both the X and Y axis. Appropriate colour and labels correctly applied to the bars of the chart to enhance the communication.

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***. An equal number of candidates chose to answer **Question B4** and **B5**. A small number of candidates did not follow the rubric instruction and omitted **Question A3** or answered all the questions.

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

There are areas of the syllabus however, in which further improvements are needed. Candidates must be able to draw a solid object to size in two point perspective projection. The rendering of shapes to represent a given material is also an area that needs to be improved.

Comments on specific questions

Question A1

Model Torch

(a) Candidates were required to draw a full size isometric view of part **A** of the model torch. Successful candidates drew a block 60 square and 20 high. A 30 square was then drawn centrally placed 15 above this block. Tapers were added to join up the 30 square with the 60 square. A circle Ø20 could then be drawn centrally on the 30 square surface. The circle needed to be constructed as it would appear as an ellipse in this isometric view.

(b) The pictorial sketch of the body of the torch was to be completed by adding the front curve and the straight side of the slide switch.

Question A2

1. A suitable material from which the model could be made was asked to be stated. Suitable answers included: *Styrofoam, balsa wood, MDF*.

2. Suitable reasons for choice of material should have been: *Easy to shape, accepts a paint finish.*

Question A3

Card packaging for model torch

Unfortunately, some candidates did not attempt this entire compulsory question.

(a) The question asked candidates to complete the two given orthographic views. **The front view** required the top line and the right hand vertical to be added. The glue flap also needed to be completed so that it appeared symmetrical. **The plan** required the top line and the right hand line to

be completed to form a square. A circle of relative size should also be visible on the plan in hidden detail.

(b) Candidates were asked to sketch the development (net) of the packaging. Many candidates responded by drawing a strip similar in width to what had been given in part **(a)** and dividing this into four parts with a glue flap at one end. Some candidates did not make two of the parts square and some candidates placed the hole incorrectly. High scoring solutions showed a back and front upright consistent in size with the drawing in part **(a)** and a hole in the square part that would appear in the lower part when folded and assembled. Fold lines were not always drawn according to convention.

(c) The packaging was considered to be environmentally friendly because:

- It used re-cycled / unbleached card so less trees need to be cut down;
- The development (net) does not have sides so less card needs to be used;
- Vegetable inks could have been used as they are less toxic to the environment.

Question B4

Desk Calendar

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

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

(a) A two point perspective view of the base of the desk calendar was to be drawn (the wooden blocks were to be removed).

Many candidates managed to connect the front vertical line to VP1 and VP2. Most candidates completed the front by drawing the two uprights to touch the diminishing line to VP2.

Lines to VP1 to form the inner edge and the back proved to be difficult for some candidates. Some candidates managed to show the 'floor' of the base.

(b) Candidates were asked to render the block to show that it was made from wood. Most candidates showed grain on the top whilst few candidates 'connected' this grain pattern to the end and side correctly. Brown / yellow was used correctly to show tone.

(c) The question required candidates to explain the three listed processes. A good response would be as follows:

Design
A computer program such as 'word' would be needed. The font type, outline and size would need to be selected. The letters would need to be typed in and adjusted to the correct size.

Manufacture
Self- adhesive Vinyl would need to be loaded into a CAM machine such as a plotter. The design would then be sent from the computer to the plotter where the knife cuts the shape.

Application
Transfer film would be needed to lift the design from the vinyl sheet. Weeding would have to take place before the design is smoothed onto the wooden block. The transfer film could then be peeled off.

Question B5

Shampoo bottle

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

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

(a) (i) An ellipse was required to be drawn on the given centre lines to represent the plan view of the shampoo bottle. The ellipse was to be drawn 60 x 40 in the correct orientation. Correct responses showed construction and a minimum of six plots. A smooth connecting curve completed the drawing.

(ii) The letters N and E needed to be added in the same style and size as the given letters.

(b) This question required candidates to complete a table to show three pieces of information that would be included on the shampoo bottle. Box 1 required the words *High* and *Density.*

Box two and three required a drawing and an explanation from one of the following:

- A bar code so the product can be scanned at the p.o.s;
- The contents so the consumer can check what is in the bottle;
- The Manufacturers Name so you remember the product and buy again;
- The Volume / weight so you can compare contents and value for money.

Other answers could refer to expiry date health or safety.

(c) Candidates were required to draw a bar chart showing the results of the questionnaire. Marks were awarded for three bars drawn on a suitable vertical scale. Labels were required on both the X and Y axis. Appropriate colour and labels correctly applied to the bars of the chart to enhance the communication.

DESIGN AND TECHNOLOGY

Paper 0445/31
Resistant Materials

Key messages

- Candidates need to read the questions carefully and be clear about what the question is asking **before** attempting an answer.
- Candidates need to improve their communication skills. They must try to provide clearly drawn sketches when attempting questions that begin with the statement: *Use sketches and notes to....* In addition, notes should enhance and make clearer what they have drawn and not simply state the obvious.
- In order to achieve good marks for ***Section A*** candidates need to develop a wide knowledge and understanding of materials, tools and processes used when working with wood, metal and plastic. There were many occasions where candidates described techniques used with wood or plastics incorrectly for metal.

General comments

Section A

Many candidates lacked the all-round knowledge and understanding required to answer all questions in this section and performed less well than on ***Section B***.

Section B

This section always has a number of questions with large mark allocations requiring a combination of clear and accurate sketches supported by detailed written notes. Careful reading of the questions is needed before answering. In some cases, candidates provided information not asked for in the question and which could not be given any credit. For example, in **Question11 (c)(i)**, when the question asked candidates to " *show how the handhold could be cut out...."* **no marks** were allocated for providing details of marking out.

Comments on specific questions

Section A

Question 1

Most candidates named the jig saw correctly but fewer named the Scroll or Hegner saw.

Question 2

Many candidates provided names that were 'close to' but not precisely the technical terms for the types of screw slots: Posidriv or Phillips for slot **A** and straight or flat slot for **B**.

Question 3

(a) and (b) Many candidates correctly recognised that epoxy resin was used as an adhesive but only a minority of candidates knew that polyester resin was used with glass fibre.

Question 4

(a) and (b) Only a minority of candidates recognised the riveting process in **(a)** while most candidates named an alternative method of joining metal permanently. The most common correct answers being welding, brazing and soldering.

Question 5

Very few candidates could name all three Centre lathe parts.

Question 6

It was disappointing that most candidates could not complete an accurate drawing of a tee hinge. Many candidates gained one mark for a drawing that showed the one long flap part of the hinge.

Question 7

Carbon fibre reinforced plastic (CFRP) is a modern composite material. The majority of candidates did not understand the properties of CFRP. The best correct answers referred to the lightness of weight, high tensile strength and flexibility.

Question 8

Many candidates recognised the claw hammer with fewer naming the Warrington/cross-pein hammer. Most candidates provided correct specific uses for both hammers: the removal of nails for the claw hammer and the nailing of pins and nails for the Warrington/cross-pein hammer.

Question 9

The majority of candidates named only one or two of the three parts of the injection moulding machine.

Question 10

Very few candidates gained the maximum three marks for providing details of a drilling jig used to drill the holes accurately. Some candidates showed a metal plate that would fit on the end of the piece of wood and gained one mark. For a further two marks the metal plate needed to be located on the end of the wood across its width and length to provide a positive location so that the jig would not move.

Section B

Question 11

This was the most popular choice of questions in ***Section B***.

(a) (i) For a maximum five marks the development had to show the correct bending and cutting lines. Many candidates used broken lines and solid lines to differentiate but failed to state which was which. A simple 'key' stating cut lines and bend lines would have sufficed. The vast majority of candidates did not show the slightly shortened length and width of the tray sides; (see **Question (a)(iii)**).

(ii) Most candidates recognised that a scriber would scratch the surface of the acrylic permanently while the mark made by a marker pen could be erased.

(iii) Only a minority of candidates understood why there was a gap at the corner of the tray. This enabled the tray sides to be bent more cleanly, it improved the appearance and it also meant that the tray could be cleaned more easily.

(b) Many candidates were awarded at least one or two marks for describing stages in finishing the cut edges of the acrylic handholds. It is important that candidates are clear about those techniques that are specific to acrylic. The best answers included details of draw filing, the use of a scraper and silicon carbide paper to make it smooth. The use of a polishing mop and an appropriate compound would be used to polish the edges. Glasspaper, often referred to as 'sandpaper', is not appropriate when working with acrylic. Silicon carbide or 'wet and dry paper' is the standard abrasive.

(c) (i) Many candidates were awarded at least one or two marks for describing how the handhold could be cut out and the edges made smooth. The best answers included the use of a drill to drill a small hole into which the blade of a coping saw or Hegner saw could be inserted, the waste cut out and then filed to achieve the shape. The use of a laser cutter to produce the shape is excellent but maximum marks can only be awarded where candidates provide full practical details of the actual process. Simply stating 'laser cutter' only gained one mark.

(ii) The vast majority of candidates understood that the designer would need to consider ergonomics when designing the handholds because of the comfort to the user and the appropriate sizes.

(d) For three marks candidates needed to show how the acrylic would be heated, the use of a former around which the acrylic could be formed and the method of retention while the acrylic cooled. Most candidates achieved marks for the first two points but many failed to describe the last stage.

(e) The majority of candidates gained marks for designing some sort of handhold that could be attached to the tray. The bullet points in the question related directly to the marks allocated: i.e. up to two marks for each of the points addressed. There was a wide variety of materials named for the handhold. There were some excellent solutions displaying good communication skills in terms of sketches and expansive notes. Many candidates used acrylic while others opted for wood or metal. The choice of wood or metal often lead to difficulties when describing how the handhold would be made and how it would be fixed to the tray.

Some joining methods that involved the use of nuts and bolts, while practical, were very crude and ugly. Candidates are encouraged to be mindful of aesthetic considerations when providing constructional details when developing products.

Question 12

This was the second most popular choice of questions in ***Section B***.

(a) The vast majority of candidates named a correct manufactured board for the table top, the most popular answers being MDF and plywood.

(b) Many candidates understood that veneer could become damaged easily, that it could crack or peel off.

(c) The majority of candidates gained marks for this question. There were many excellent answers showing some form of 'lipping' joined either onto the edges of the table top or onto the surface of the table top with gaps left at the corners to assist cleaning. Two marks were available for providing a practical solution. The remaining marks were awarded for answers to each of the bullet points. Often, candidates did not address all three bullet points and therefore denied themselves the opportunity of being awarded maximum marks.

(d) There were many good answers showing some sort of metal plate attached to the underside of the table top. Other excellent solutions involved the use of additional steel tubes. It was important that the method of attaching the 'plate' or tubes to the underside of the table top was made clear. Many candidates used screws but some methods were not practical.

(e) Some candidates simply stated a method of joining the steel tube by brazing or welding. The important part of this question was how the existing joint at **A** could be **strengthened**. There were some excellent solutions showing the joint with triangular braces in two directions or the addition of 90° corner brackets. Many candidates did not address the final part of the question by providing adequate details of materials, sizes and constructions used.

(f) The majority of candidates provided practical solutions to making adjustable heights for the table top. The majority showed two different size tubes able to move up and down as required with some form of 'pin' to lock the tubes together at the appropriate height. Often the only details missing were those involving the locking device. Important sizes such as the diameter of drilled holes, the distances between locking positions and the length and material for the pin were the type of details that candidates needed to supply if they were to gain maximum marks.

(g) Many candidates gained one mark for referring to the user. For example, anthropometric data included dimensions such as reach and height of the person in a seated position. Many candidates referred to the height of the bed but made no reference to the person sitting in the bed.

Question 13

This was the least popular choice of questions in ***Section B***.

(a) Many candidates did not provide specification points for the coffee table. Instead, there were many descriptions of what needed to be considered but not a list of requirements that a designer would set down and try to meet. To answer this question candidates should have started with the statement; 'The coffee table must....' The following specification points were appropriate.

The coffee table must;

- have an appropriate size of surface on which drinks and snacks could be placed;
- have a surface that must withstand accidental spillages;
- have provision for newspapers and magazines;
- include a minimal number of constructions;
- must be an appropriate height for people sitting in low chairs.

(b) Unfortunately many candidates who attempted this question had little or no understanding of the lamination process. This process involves the use of male and female formers and layers of veneer glued and clamped together appropriately.

(c) (i) The most popular correctly named marking out tools included a marking knife, marking gauge and try square. Some candidates named a scriber which would be used to mark on metal, not wood.

(ii) The most appropriate saws used to cut out the slot were the Scroll/Hegner, band and jig saw. Coping and tenon saws would not be practical due to the length of the slot and the frame and 'back' of these saws would prevent a full cut from being made.

(d) Many candidates achieved at least one or two marks for this question but few gained maximum marks. The purpose of the cork block around which glasspaper would be wrapped to provide even pressure was not understood. Most candidates did understand the purpose of the damp cloth and the glasspaper.

(e) (i) Generally, answers to this question were very good. Many candidates recognised that the application of a finish would provide an improved appearance or that it would protect the surface from spillages.

(ii) The majority of candidates suggested a varnish finish and some appropriate types of oil.

(iii) Many candidates provided sensible precautions, (not safety precautions), to achieve a high quality finish. The best answers referred to an even coat, brushing in one direction and to avoid drips.

(f) Only a minority of candidates could provide advantages of the laminated table over the traditional legs and rails construction. A stronger overall form due to the minimum number of joints was the best answer. Some candidates correctly stated that it would be quicker to manufacture but could not say why. The reason is that once the formers have been constructed the process is quicker than the fabrication of legs and rails to the table top.

(g) (i) and (ii) In the context of D&T the use of computers is of great importance and relevance. It is essential that candidates, where possible, have first-hand experience of utilising this facility to perform a variety of tasks.

Many candidates explained how computers could be used to look for existing solutions on the Internet. This was the most common correct answer. Computers could also be used to produce research data from questionnaires in the form of charts and diagrams.

Many candidates explained how software could be used to produce 3D on-screen models of design ideas. Computers could also be used to send drawings electronically to clients.

DESIGN AND TECHNOLOGY

Paper 0445/32
Resistant Materials

Key messages

- Candidates need to read the questions carefully and be clear about what the question is asking **before** attempting an answer.
- Candidates need to improve their communication skills. They must try to provide clearly drawn sketches when attempting questions that begin with the statement: *Use sketches and notes to....* In addition, notes should enhance and make clearer what they have drawn and not simply state the obvious.
- In order to achieve good marks for ***Section A***, candidates need to develop a wide knowledge and understanding of materials, tools and processes used when working with wood, metal and plastic.

  There were many occasions where candidates described techniques used with wood or plastics incorrectly for metal.

General comments

Section A

Many candidates lacked the all-round knowledge and understanding required to answer all questions in this section and performed less well than on ***Section B***.

Section B

This section always has a number of questions with large mark allocations requiring a combination of clear and accurate sketches supported by detailed written notes. Careful reading of the questions is needed before answering. In some cases, candidates provided information not asked for in the question, which could not be given any credit. For example, in **Question 9**, when the question asked candidates to " *describe three main stages in removing the waste....*" **no marks** are allocated for providing details of marking out.

Comments on specific questions

Section A

Question 1

This question was badly answered. The best way for candidates to answer this question was to imagine they were asking someone to supply them with a quantity of nuts and bolts. The person would need to know the following information:

the material from which they were made, the diameter of the nut or bolt, the length, the type of head and the quantity required.

Question 2

The majority of candidates gained at least one mark for completing the frame of the coping saw. For full marks the second retaining pin needed to be included in the drawing.

Question 3

(a) and (b) The majority of candidates answered this question correctly by naming the sash cramp, (F cramp was accepted), and stating that the purpose of the scrap wood was to protect the frame from being damaged.

Question 4

Only a small minority of candidates were able to identify the two smart materials, polymorph and nitinol, from the list of materials given. Candidates must be familiar with a range of smart and modern materials, their properties and uses.

Question 5

Many candidates achieved at least one mark for this question. Most candidates gave a specific use for the brace; to drill holes, but could not name the actual tool. Many candidates confused the type of caliper shown and failed to describe a specific use. Outside calipers are used to measure the external or outside diameter of round bar or tube.

Question 6

(a) and (b) The vast majority of candidates did not understand the main advantage of using veneers to make furniture. Veneers are thin layers of solid wood that can be used to cover cheaper, but more stable, manufactured boards to give the appearance of solid wood.

Many candidates did provide a disadvantage of using veneers to make furniture. The most common answer was that veneers were not as durable as solid wood and that they could become damaged easily.

Question 7

Most candidates were unable to provide a technically correct method of strengthening the corner joint shown. The best answers showed some sort of triangular brace across the corner, the addition of blocks to support both the upright and horizontal pieces, dowel and K-D fittings. Many candidates nailed or screwed the the joint. Nailing and screwing into end grain is bad practice as it tends to split the wood fibres. Answers using at least two nails or screws were awarded one mark only.

Question 8

(a) and (b) The majority of candidates could not name the sand casting or die-casting process that would be used to produce the aluminium alloy handle. The most common correctly named finish for the handle was paint. Polishing and buffing were accepted as self-finishing processes.

Question 9

Many candidates achieved marks for this question. Stages involving marking out were not required and no reward was given for answers including such details. There were numerous stages in the process of removing the waste wood, including:

drilling a hole, inserting a blade of a coping or Scroll/Hegner saw, chain drilling, filing and glasspapering. Some candidates confused techniques used with metal and named wet and dry (silicon carbide) paper rather than glasspaper.

Question 10

(a) Very few candidates could name the laminating or steam bending processes that would be used to produce the legs of chair A.

(b) The best answers named a mortise and tenon or dowel joints to join the legs and rails of chair B. There were many joints named that were impractical and inappropriate.

(c) Most candidates understood that the laminated or steam bent chair would be stronger and more stable. Some candidates correctly explained that fewer constructions in chair A contributed to its overall strength.

Section B

Question 11

This was the most popular choice of questions in ***Section B***.

(a) (i) Many candidates described advantages of flat-pack furniture for the consumer. The most common answers referred to it being readily available for collection, ease of transportation home, cheaper because of self-assembly and the satisfaction of constructing it themselves.

(ii) Most candidates described advantages to the manufacturer. The most common answers referred to the lower costs of manufacture since no assembly was required, this in turn created more sales and greater profit. Less storage space required was also an excellent advantage for the manufacturer.

(b) This question was answered badly. It was disappointing that the majority of candidates did not produce a sketch of a recognised knock-down, (K-D) fitting used to join the top and end of the desk together. Some credit was given for the use of dowel and screws. There is a wide range of K-D fittings including modest blocks, scan fittings and screw and barrel fittings that could have gained maximum marks.

(c) Most candidates gained marks for this question. The best answers showed pre-manufactured metal fittings made up of two parts. One part screwed to the edge of the shelf and the other to the inside of the desk with rollers or wheels providing the sliding movement. Those methods involving the use of grooves, cut into the surface or by applied beads also gained maximum marks. Simple housings were less practical and gained fewer marks. Many candidates showed potentially good methods but were denied maximum marks mainly due to unclear sketches that were often too small, or to a lack of detail such as the method of joining the parts to the desk or important sizes.

(d) (i) Most candidates gave advantages of spray painting over brush application. The best answers referred to speed and the even application.

(ii) There were many excellent safety precautions described. The most common correct answers described the use of a face mask, eye protection and a well-ventilated area. Wearing gloves was considered irrelevant.

(e) This question gave candidates the opportunity to evaluate the computer desk against three specific criteria: safety, appearance and costs. Although most candidates did achieve some marks for the question, generally candidates could have provided more detailed comments.

(i) Most correct answers concentrated on the lack of sharp edges or that the front edge of the keyboard was sharp. The stability of the desk was rarely mentioned.

(ii) Some candidates described the clean, simple form of the desk with adequate space for the keyboard and additional equipment. Some answers referred to the likelihood that the desk would be painted in an attractive colour.

(iii) This part of the question was very badly answered with many candidates providing an actual cost for the desk. The best answers related to the economic use of materials, manufactured board, and self-assembly.

(f) Most answers did not provide sufficient detailed explanations to gain more than one mark.

Sustainability is an important feature to be considered when designing and making products. Many products are designed to last a specific period of time. The question required candidates to study the computer desk and explain why it could be considered to have a limited lifetime. Manufactured boards are not necessarily weaker than solid wood but some K-D fittings could, over time, with use, make the desk weaker. Other factors such as fashion can influence the lifetime of a product.

Technological developments including those of laptops and tablets could mean a lower demand for computer desks.

Question 12

This was the second most popular choice of questions in ***Section B***.

(a) Many candidates provided only one reason why mild steel was suitable for the barbecue body. The most common reasons were its resistance to heat and its durability.

(b) The majority of candidates stated that an applied finish would enhance the appearance of the mild steel or that it would help to resist corrosion.

(c) Marks were awarded for sketches showing how the mild steel sheet would be held securely while it was cut, the tool used to cut the sheet and the correct name of the tool. Many candidates showed the sheet secured to a bench by means of a G cramp. The methods of cutting were not always practical. A hacksaw would only be partially successful. The best answer, rarely seen, was to use tin snips, (not always named correctly).

(d) There were many partially correct answers with candidates supplying some, if not all of the following details. To bend the sheet some sort of former was needed around which the flaps could be shaped, a method of holding the sheet securely and the method of force, using a hammer and scrap wood or a mallet.

(e) The vast majority of candidates showed the ends joined to the sides of the barbecue body permanently by means of welding, brazing or pop-riveting.

(f) With eight marks allocated to this question it was essential that candidates read what was required and addressed all the bullet points in order to access **all** the available marks.

Many candidates produced design solutions that were practical and gained some reward.

Most solutions involved some form of platform or frame that would support the barbecue body above the ground at a height of 500mm.

Often, candidates worked with the same materials given in the question; mild steel. Important sizes were often missing or the 500mm dimension, given in the question, was repeated and gained no reward. Temporary methods of joining the support to the barbecue body often involved the use of screws and nuts and bolts that were very effective. Many solutions simply required the barbecue body to rest safely on the support without any additional fittings and fixings. This method was considered acceptable as long as the barbecue body was safely positioned on a broad enough support.

(g) There were some very good racks designed to hold the three barbecue tools. The most common design involved the use of hooks joined to a ‘plate’ that would, in turn, be fixed to the barbecue body.

Many candidates scored up to three marks for providing a potentially successful design solution.

However, many candidates did not answer the last part of the question requiring details of materials and constructions used. Many solutions involved the use of inappropriate materials; for example, the use of wood and plastic to make containers that would be joined to the body of the barbecue. In addition, many of those solutions involving the use of hooks often did not name the material or give any indication of the length or diameter of the material used to make them.

Question 13

This was the least popular choice of questions in ***Section B***.

(a) (i) The vast majority of candidates correctly named an appropriate plastic for the palette; the most common answers being acrylic and polystyrene.

(ii) Many candidates incorrectly stated that an advantage of using MDF for the former rather than solid wood was that it was cheaper. Cost was not relevant. MDF is more stable, it has no grain markings that could become visible on a vacuum formed plastic product and MDF was easier to cut and shape with less risk of splitting.

(iii) Very few candidates answered this question correctly. The considerations to be taken into account when making a former included: a draft angle, rounded edges/corners, adequate air holes and an appropriate depth.

(b) Many candidates demonstrated a very good knowledge of the vacuum forming process and provided good quality sketches and clear additional notes.

(c) (i) Many candidates correctly named injection moulding as an appropriate process to produce the plastic paint pots.

(ii) Most candidates showed the manufactured board top clamped to a flat surface with scrap wood underneath the work piece to provide support and protection.

(iii) Many candidates showed the manufactured board top nailed or screwed **and** glued to the softwood sides of the holder.

(d) There were many good design modifications that were potentially successful. Some candidates showed how the paintbrushes could be stored within the existing holder by means of grooves and drilled holes. Other modifications involved additional 'containers' being constructed and joined to the outside of the holder. As in previous design-type questions, the additional information about materials, constructions and sizes was often incomplete or missing altogether.

DESIGN AND TECHNOLOGY

Paper 0445/33
Resistant Materials

Key messages

- Candidates need to read the questions carefully and be clear about what the question is asking **before** attempting an answer.
- Candidates need to improve their communication skills. They must try to provide clearly drawn sketches when attempting questions that begin with the statement: *Use sketches and notes to....* In addition, notes should enhance and make clearer what they have drawn and not simply state the obvious.
- In order to achieve good marks for ***Section A***, candidates need to develop a wide knowledge and understanding of materials, tools and processes used when working with wood, metal and plastic.

General comments

Section A

Many candidates lacked the all-round knowledge and understanding required to answer all questions in this section and performed less well than on ***Section B***.

Section B

This section always has a number of questions with large mark allocations requiring a combination of clear and accurate sketches supported by detailed written notes. Careful reading of the questions is needed before answering. In some cases, candidates provided information not asked for in the question, which could not be given any credit. For example, in **Question 12(g)(i)**, when the question asked candidates to " *show how the waste could be removed....*" **no marks** are allocated for providing details of marking out.

Comments on specific questions

Section A

Question 1

(a) The majority of candidates indicated the correct length of the countersunk screw with fewer able to indicate the length of the round head screw.

(b) Only a minority of candidates could explain what was meant by the term 'gauge'.

Question 2

(a) The majority of candidates named a suitable plastic for the light unit with acrylic the most common correct answer.

(b) The majority of candidates gave two properties of the plastic that made it suitable for the light unit with the most common correct answers referring to its ability to be shaped, weather resistant and transparent or inherent coloured in appearance.

Question 3

The vast majority of candidates completed an accurate drawing of a G cramp.

Question 4

Only a minority of candidates were able to describe how the shape could be produced using a plane followed by glasspaper. This method was the most practical and effective. Those candidates who described the use of files and rasps did also gain two marks. There were some excellent answers that described the use of a router for one mark, and then provided a sketch of the correct shape router cutter for the second mark.

Question 5

(a) Most candidates named the vacuum forming process correctly.

(b) Only a minority of candidates were able to provide the correct reason for the ribs in the design of the food packaging: to provide strength and rigidity. Many candidates incorrectly thought its purpose was to keep food fresh or to provide grip for the user.

Question 6

(a) The majority of candidates named sand casting correctly as the metalworking process.

(b) Only a minority of candidates named aluminium correctly, although brass is also used widely.

Question 7

(a) Very few candidates could name polystyrene. Expanded polystyrene is one of the most popular plastics used for modelling and it was disappointing that candidates were not aware of this.

(b) The main advantages of using polymorph for the handle are that it can be moulded quickly using only hot water and that it can be moulded to the exact shape of the hand. In addition, there is little or no finishing required. Candidates need to be aware of smart and modern materials.

Question 8

Apart from an extremely small minority of candidates no one was able to complete the drawing of the vice jaws. There is a 'vee' cut out of each jaw that provides grip to round section material.

Question 9

Many candidates achieved at least one mark for showing the correct position of at least one peg.

Question 10

Many candidates achieved some marks for naming correctly the blow torch, fire bricks or solder.

Section B

Question 11

This was the most popular choice of question in ***Section B***.

(a) The majority of candidates named two marking out tools; the most common being a marker pen, steel rule and try square. A scriber would not be suitable as it would leave a permanent mark on the acrylic.

(b) Most candidates understood the dangers when drilling acrylic. The most common correct precautions related to drill speed and clamping the work piece securely with scrap wood underneath.

(c) For three marks candidates needed to describe how the acrylic would be heated using a strip heater or line bender, the use of a former, (usually a block of wood), and a method of retention

while the acrylic cooled. This would be achieved by simply holding the acrylic in place or by using cramps. The use of an oven to heat the acrylic was not appropriate as a clearly defined, sharp bend was required.

(d) Some candidates showed a good understanding of the extrusion process by describing how the granules are fed into the hopper, a screw then moves them along the chamber where they are softened using heat, then forced through a die. Many candidates gained marks for partially accurate descriptions. The best answers also used correct technical terminology.

(e) Generally the results for showing an additional partition were poor. There were a minority of very good answers that showed a strip of acrylic joined to the base of the rack with acrylic cement, accompanied by some important sizes, for example, the height of the partition and the thickness of acrylic used. Often sketches lacked clarity and written notes were insufficient.

(f) There were some very good sketches and notes describing how the hooks would be made. The best answers showed the acrylic rod secured in a vice while being cut with a hacksaw. The ends would be filed and cemented permanently into the holes. Credit was also given for those answers that showed the acrylic being cut by a coping saw, tenon saw or machine saw such as a Scroll or Hegner saw. Wet and dry, (silicon carbide) paper could be used to smooth the ends. No alternative, such as epoxy resin, was acceptable for joining the rod to the rack permanently.

Candidates are reminded that the bullet points stated in the question are there to help them focus on the important information to be included in their answers.

(g) The majority of candidates did not address this question correctly. The question stated that:

*'Holes must **not** be visible when viewed from the front.'*

Many candidates still drilled holes behind the front of the rack which would still be visible and which would not allow a screwdriver to fit inside the rack to enable it to be screwed to a wall. There were some excellent answers that showed the use of brackets that would be attached to the back of the rack which then would be slotted down screws in the wall.

Question 12

This was the second most popular choice of question in ***Section B***.

(a) Many candidates were unable to give two characteristics of hardwoods used to make high quality furniture. The best characteristics relate to figure, grain, colour and stability. Strength was too vague to gain one mark.

(b) Only a minority of candidates were able to give one reason why the hardwood used for the coffee table should be seasoned. The best answers stated that seasoning was necessary to prevent shrinkage, warping and splitting, which created a more stable material.

(c) (i) The majority of candidates gave a reason for applying a lipping to the edges of the table top made from manufactured board. The most common reasons were to hide the edge, make it more attractive and prevent it from splitting.

(ii) Very few candidates described a type of lipping that could be applied. A variety of types were available, including solid wood that could be glued and/or pinned to the edges, or veneer that could be glued on or ironed-on.

(d) The type of joint that could be used to join the rail and leg of a coffee table is standard 'stool' construction that candidates should know. There were many good answers, the most common being a mortise and tenon and dowel joints.

(e) (i) The majority of candidates named either a smoothing plane or Jack plane to remove the waste wood.

(ii) Most candidates showed the leg held in a woodworkers vice and angled so that the planing could be carried out horizontally.

(f) Most candidates did not understand how to secure the table top to the rails. Many answers showed screws and dowels drilled through the table top into the rails. This would look unattractive. The best methods, shown by some candidates, was to screw or dowel from underneath the rail into the top or to use brackets or K-D fittings that would be hidden. Some candidates provided an excellent method; that of pocket screwing.

(g) (i) Many candidates gained marks for showing how the waste could be removed to allow the 6mm thick glass to be inserted. There were three main stages in this process: drill a hole through which the blade of a jig saw or Scroll/Hegner saw could be inserted, followed by cutting out and making smooth using a variety of files. Some candidates included details of how the rectangular shape would be marked out. Since this was not required no marks were awarded for this information.

(ii) There were some very good methods of supporting the glass inside the table top. Applied beads were very popular. Some candidates showed the wood removed to produce a rebate that would support the top. Some candidates described how a router could be used successfully. Many candidates did not achieve maximum marks because they did not address the final part of the question which was to provide details of constructions and sizes. These could have included the sectional size of the beads or the width and depth of the rebate as well as how the beads would be made.

(h) The majority of candidates did not achieve the maximum two marks. The coffee table could be considered environmentally friendly because it was made from wood that could be replaced and that it used materials that were recyclable or recycled. It is important that candidates consider carefully the implications of environmental factors in their design work.

Question 13

This was the least popular choice of question in ***Section B***.

Only several candidates attempted this question, reflecting the rarity of metalworking practice taking place in Centres. It is essential that candidates have a sound working knowledge of working with a range of resistant materials, including metal.

(a) (i) The candidates named two marking out tools correctly.

(ii) To cut out the slot a hole would be drilled through the metal into which an abra file saw or Hegner saw with a metal cutting blade could be inserted. The slot could be cut out and the edges made smooth by filing.

(b) (i) A suitable applied finish was paint or dip-coated plastic.

(ii) Self-finishing metal involves the use of wet and dry, (silicon carbide) paper of at least two differing grades and the use of a polishing mop and appropriate compound.

(c) To bend the sheet metal it would need to be clamped securely, either in a vice, or onto a bench.

A former around which the metal could be shaped was needed and the method of force, either a mallet or a hammer and scrap wood. The correct use of technical vocabulary is very important.

(d) The modification to the DVD rack in order to connect an identical rack were practical but tended to be crude involving the use of nuts and bolts. Good designs could have incorporated the use of ‘clips’ and ‘slides’ that would have been less intrusive.

(e) The most appropriate methods of preventing the sharp edges of the rack scratching a polished surface was by adding a ‘softer’ material such as wood or by folding over the edges.

(f) The main reason why the DVD rack could be considered to be a product with a limited lifetime was not due to the choice of materials or the methods of construction but to technological developments: DVDs will become less popular as more advanced methods of listening to music become available.

DESIGN AND TECHNOLOGY

Paper 0445/41
Systems and Control

Key messages

- Candidates must ensure that the rubric is followed and only one question in ***Section B*** is answered.
- Candidates should be reminded that clear writing and annotated sketches that make full use of the available space are recommended.
- It is important that responses are limited to the allocated response area as far as possible; however, any parts of a response that does not fit the space should be added to additional sheets attached to the booklet.
- Those candidates who had chosen to answer the electronics question had generally made use of the given formula for their response. It is important that the correct units are then applied to the final answer.
- The number of candidates failing to give any sort of response to parts of a question was fewer than in previous sessions. Candidates should be encouraged to offer a response that could potentially gain a mark rather than leaving a blank space.

General comments

All of the questions on the paper proved accessible to the majority of candidates and most had followed the instructions on question choice; only a small number had attempted to answer more than one question in ***Section B***.

Communication and presentation in general were clear, in both written and graphic responses. This was most apparent in question 5 of ***Section A*** where fitting and soldering an LED had to be described; some excellent sketches were seen in response to this question.

As with recent sessions the mechanisms and structures questions in ***Section B*** proved to be the most popular with candidates.

When answering calculation questions candidates should be advised to look carefully at the units used in the question and ensure that any necessary conversions are carried out. It is also important that working is shown for calculations so that partial marks can be awarded for the correct aspects of the response. When calculators are being used this can be difficult and in a number of cases it was not possible to award any marks because only an incorrect answer with no working was given.

Comments on specific questions

Section A

Question 1

(a) The majority of candidates knew that adding reinforcement to concrete increases the strength, but in order to gain the mark, reference to tensile strength or resistance to bending had to be made.

(b) The resistance to corrosion of plastic based reinforcement was generally recognised though few candidates used the fact that the reinforcement can be added during the mixing stage of the concrete. Only a minority of candidates gained the mark for this question.

Question 2

(a) Shear force being the cause of the cracking was noted by most candidates.

(b) Reference to movement in the ground was a common response with many giving a reason, such as earthquake, for the movement occurring.

Question 3

This question was well answered with clear drawings in most cases and accurate use of force arrows to indicate the resistance to compression of a strut and the resistance to tension of a tie.

Question 4

(a) Very few candidates failed to tackle this question and the majority correctly gave heat and sound as the types of energy produced from unwanted friction.

(b) As with the previous part there was clear understanding of where friction is needed in a mechanism and the examples, such as cycle brakes, gained marks.

Question 5

(a) This question was only answered correctly by the higher achieving candidates. The features that should have led to the crank mechanism being identified were the handle being offset from the centre axis of the rotating section and the use of spur gears in the final drive.

(b) A high proportion of candidates identified the 40t and 8t gears correctly from the given list and the majority of these had put the two gears in the correct order of driver gear 40t, driven gear 8t needed for an increase in speed.

Question 6

Nearly all candidates scored at least one mark for naming the electronic symbols. In most cases the variable resistor and the LDR were correctly named; the thermistor seemed to be the one that was not so well known.

Question 7

The majority of those who had noted that the capacitor was electrolytic stated that it should be fitted the correct way round in a circuit. Somewhat fewer had given a method of identifying the polarity of the legs such as the shorter cathode leg or the stripe on the casing, with either '-' or '+' markings.

Question 8

(a) (i) The majority of candidates attempted the question with a much smaller proportion gaining the mark for applying the voltage drop in the calculation. A common error was to miss the unit from the figure given in the answer, which should have been 0.35W. Those who had mistakenly used either 9V or 2V in the calculation with a correct answer for those figures were rewarded with one mark.

(ii) Candidates who had completed the calculation correctly generally gained a mark for identifying the 0.4W power rating of the resistor. For those who had calculated incorrectly, and given a power rating to match their result, a mark for error carried forward was allowed.

(b) More than half of the candidates gained a mark for giving the correct result of using a resistor with too low a power rating; the resistor would be destroyed. Any form of destruction of the resistor was allowed as was damage to the LED.

Section B

Question 9

(a) (i) The advantages of using aluminium rather than wood for ladder construction were generally well known, the majority of candidates correctly identified the advantage of lighter weight and higher achieving candidates gained a second mark for resistance to corrosion / insect attack. Very few noted that manufacture would be easier to control or rungs can be extruded with grip on them.

(ii) The forces of compression on the top face and tension on the lower face of the rung were well known and a high proportion of candidates gained both marks.

(iii) The calculation of reactions where the rung joined the ladder sides was very well done by those who knew the correct method. Full marks were awarded to those with a correct result of 506.76N for R2 and 243.24N for R1, whether or not the working was shown. Candidates should be made aware that while a correct solution with no working gains full marks an incorrect one will gain no marks; whereas if the working is shown it is possible to gain the intermediate marks.

(iv) A number of incorrect solutions showed a strain gauge being used for the measurement of deflection, when a dial gauge, centrally placed, was the only suitable solution. Other errors included using methods that could not be relied on to produce precise, accurate results, such as a ruler.

(v) Very few answers showed understanding of a factor of safety or how it can be applied to a structure. Recognition that a safe working load will be less than the maximum design load was only shown in a few cases. Very few candidates recognised that user weight, weight of items being carried, or slipping on the ground, would have an effect.

(vi) There were some very good answers for this question that demonstrated an understanding of how equipment is used and why separate printed instructions would not be adequate. A single point clearly described was awarded both marks; for example stating that a notice printed or attached to the ladder with maximum safe weight stated and safe angles of leaning shown, would be worth two marks.

(b) (i) This question was well answered with candidates showing clear understanding of the advantages, such as mechanical strength and reduced reliance on adhesives offered by a mortise and tenon joint.

(ii) Good use was made of gusset plates and either screws or dowels inserted across the joint to prevent removal. Drawings were generally clear and well annotated.

(iii) There was confusion in many cases between temporary and permanent methods of joining timber. Those who did gain the marks generally gave screws or bolts with very few mentioning G cramps or sash cramps.

(c) A high proportion of candidates scored one or two marks out of the available four on this question. The longer spans allowed by lamination was a common feature with a few noting that laminated beams can be more aesthetically pleasing than a steel girder. Candidates should note that where an explanation is called for it is not enough to just list the factors involved, the benefits offered should form part of the response.

Question 10

(a) (i) A high proportion of candidates recognised at least two of the drive systems shown in the illustration; very few had failed to gain any marks at all.

(ii) This question was not answered well. Of the three drive systems shown, the vee belt between the intermediate shaft and the blade axle, was the only one that allowed any slipping. That factor should have given an indication of the reason for choice, with the result of slight slipping being less or no damage to any components beyond that point in the drive system.

(b) The calculation of speed of the blade axle was answered well with a high proportion of candidates gaining all three marks for giving 320 rpm and the answer. As with the other calculations in the paper it is to the candidates' advantage to show all of the working that leads to their answer.

(c) (i) The majority of candidates correctly identified the mower handle as being a first order lever.

(ii) Most of the responses gained all of the available three marks with a minority mixing up the positions of load and effort while identifying the roller as the fulcrum.

(d) Conversion of motion was understood in more than half of the responses; there were very few single marks, the majority identifying input and output motion as rotary to linear.

(e) (i) Explanations of the benefits of using a worm gear were in some cases confused. The large reduction in speed was the most regularly identified benefit but very few showed understanding of the one way nature of the motion and the fact that the spur gear cannot turn the worm wheel, in this case ensuring that the lift cannot drop back.

(ii) This part was generally well answered with widespread recognition that the load is spread and safety is increased when more cables are used.

(iii) In many cases the knowledge of hydraulics was not good with frequent confusion between pneumatic and hydraulic features.

(f) The roller and flat followers were in most cases drawn correctly. Very few candidates had noted that the third example already had the follower drawn and the requirement was to amplify the movement from the cam by extending the follower and having an off centre pivot point.

Question 11

(a) A high proportion of candidates answering this question gained full marks for distinguishing between the conductors crossing and conductors joined symbols and for knowing the symbol for a voltmeter.

(b) (i) This part of the question was well answered with most of the calculations being accurately completed to give an output of 2.11V.

(ii) In about half of the responses the 1MΩ variable resistor was correctly identified as having the most suitable value. With the candidates who had got it wrong there was no particular preference shown for any one of the incorrect answers.

(iii) The question required both two input OR gates to be combined into a three input gate. This was correctly carried out in half of the responses by taking the output from one gate and feeding it into an input of the second gate.

(c) (i) In a high proportion of responses pins 4 and 7 were correctly identified as the 0V and supply connections and were added to the diagram.

(ii) The results of the given input conditions on the comparator were generally not known. The acceptable answers allowed for some tolerance but needed to be close to 0V and to the power supply voltage respectively.

(iii) There was more than one correct solution to the routing of the tracks in this question. Those candidates who had carried out this task in a practical way could generally produce a workable solution. Thickness of the track or neatness was not judged, only the placing of the track.

(iv) As with the previous part those who had used a PCB layout in practical work showed understanding that the reason for reversal of the symbols was to allow them to read correctly on the copper layer.

(d) (i) This question focused on the understanding of how a relay works and the connections needed for it to operate. There were a number of fully correct answers seen, showing the common relay connector attached to the supply voltage, the normally open connection to the pump motor and the other motor connection to 0V.

(ii) In the majority of cases a diode symbol was drawn on the circuit but very few had correctly placed it in reverse bias with the negative end of the diode connected to the positive rail.

(iii) The identification of the negative end or cathode was shown clearly as a stripe in about half of the responses seen.

(e) The majority of candidates correctly identified at least one key benefit of using a programmable IC. The most common benefit given related to the precision / accuracy of the time delay. None had recognised that it is easier to interface with other inputs and outputs or that the effective size of the circuit board can be reduced.

DESIGN AND TECHNOLOGY

Paper 0445/42
Systems and Control

Key messages

- Candidates must ensure that the rubric is followed and only one question in ***Section B*** is answered.
- Candidates should be reminded that clear writing and annotated sketches that make full use of the available space are recommended.
- It is important that responses are limited to the allocated response area as far as possible; however, any parts of a response that does not fit the space should be added to additional sheets attached to the booklet.
- Those candidates who had chosen to answer the electronics question had generally made use of the given formula for their response. It is important that the correct units are then applied to the final answer.
- The number of candidates failing to give any sort of response to parts of a question was fewer than in previous sessions. Candidates should be encouraged to offer a response that could potentially gain a mark rather than leaving a blank space.

General comments

All of the questions on the paper proved accessible to the majority of candidates and most had followed the instructions on question choice; only a small number had attempted to answer more than one question in ***Section B***.

Communication and presentation in general were clear, in both written and graphic responses. This was most apparent in question 5 of ***Section A*** where fitting and soldering an LED had to be described; some excellent sketches were seen in response to this question.

As with recent sessions the mechanisms and structures questions in ***Section B*** proved to be the most popular with candidates.

When answering calculation questions candidates should be advised to look carefully at the units used in the question and ensure that any necessary conversions are carried out. It is also important that working is shown for calculations so that partial marks can be awarded for the correct aspects of the response. When calculators are being used this can be difficult and in a number of cases it was not possible to award any marks because only an incorrect answer with no working was given.

Comments on specific questions

Section A

Question 1

(a) The majority of candidates knew that adding reinforcement to concrete increases the strength, but in order to gain the mark, reference to tensile strength or resistance to bending had to be made.

(b) The resistance to corrosion of plastic based reinforcement was generally recognised though few candidates used the fact that the reinforcement can be added during the mixing stage of the concrete. Only a minority of candidates gained the mark for this question.

Question 2

(a) Shear force being the cause of the cracking was noted by most candidates.

(b) Reference to movement in the ground was a common response with many giving a reason, such as earthquake, for the movement occurring.

Question 3

This question was well answered with clear drawings in most cases and accurate use of force arrows to indicate the resistance to compression of a strut and the resistance to tension of a tie.

Question 4

(a) Very few candidates failed to tackle this question and the majority correctly gave heat and sound as the types of energy produced from unwanted friction.

(b) As with the previous part there was clear understanding of where friction is needed in a mechanism and the examples, such as cycle brakes, gained marks.

Question 5

(a) This question was only answered correctly by the higher achieving candidates. The features that should have led to the crank mechanism being identified were the handle being offset from the centre axis of the rotating section and the use of spur gears in the final drive.

(b) A high proportion of candidates identified the 40t and 8t gears correctly from the given list and the majority of these had put the two gears in the correct order of driver gear 40t, driven gear 8t needed for an increase in speed.

Question 6

Nearly all candidates scored at least one mark for naming the electronic symbols. In most cases the variable resistor and the LDR were correctly named; the thermistor seemed to be the one that was not so well known.

Question 7

The majority of those who had noted that the capacitor was electrolytic stated that it should be fitted the correct way round in a circuit. Somewhat fewer had given a method of identifying the polarity of the legs such as the shorter cathode leg or the stripe on the casing, with either '-' or '+' markings.

Question 8

(a) (i) The majority of candidates attempted the question with a much smaller proportion gaining the mark for applying the voltage drop in the calculation. A common error was to miss the unit from the figure given in the answer, which should have been 0.35W. Those who had mistakenly used either 9V or 2V in the calculation with a correct answer for those figures were rewarded with one mark.

(ii) Candidates who had completed the calculation correctly generally gained a mark for identifying the 0.4W power rating of the resistor. For those who had calculated incorrectly, and given a power rating to match their result, a mark for error carried forward was allowed.

(b) More than half of the candidates gained a mark for giving the correct result of using a resistor with too low a power rating; the resistor would be destroyed. Any form of destruction of the resistor was allowed as was damage to the LED.

Section B

Question 9

(a) (i) The advantages of using aluminium rather than wood for ladder construction were generally well known, the majority of candidates correctly identified the advantage of lighter weight and higher achieving candidates gained a second mark for resistance to corrosion / insect attack. Very few noted that manufacture would be easier to control or rungs can be extruded with grip on them.

(ii) The forces of compression on the top face and tension on the lower face of the rung were well known and a high proportion of candidates gained both marks.

(iii) The calculation of reactions where the rung joined the ladder sides was very well done by those who knew the correct method. Full marks were awarded to those with a correct result of 506.76N for R2 and 243.24N for R1, whether or not the working was shown. Candidates should be made aware that while a correct solution with no working gains full marks an incorrect one will gain no marks; whereas if the working is shown it is possible to gain the intermediate marks.

(iv) A number of incorrect solutions showed a strain gauge being used for the measurement of deflection, when a dial gauge, centrally placed, was the only suitable solution. Other errors included using methods that could not be relied on to produce precise, accurate results, such as a ruler.

(v) Very few answers showed understanding of a factor of safety or how it can be applied to a structure. Recognition that a safe working load will be less than the maximum design load was only shown in a few cases. Very few candidates recognised that user weight, weight of items being carried, or slipping on the ground, would have an effect.

(vi) There were some very good answers for this question that demonstrated an understanding of how equipment is used and why separate printed instructions would not be adequate. A single point clearly described was awarded both marks; for example stating that a notice printed or attached to the ladder with maximum safe weight stated and safe angles of leaning shown, would be worth two marks.

(b) (i) This question was well answered with candidates showing clear understanding of the advantages, such as mechanical strength and reduced reliance on adhesives offered by a mortise and tenon joint.

(ii) Good use was made of gusset plates and either screws or dowels inserted across the joint to prevent removal. Drawings were generally clear and well annotated.

(iii) There was confusion in many cases between temporary and permanent methods of joining timber. Those who did gain the marks generally gave screws or bolts with very few mentioning G cramps or sash cramps.

(c) A high proportion of candidates scored one or two marks out of the available four on this question. The longer spans allowed by lamination was a common feature with a few noting that laminated beams can be more aesthetically pleasing than a steel girder. Candidates should note that where an explanation is called for it is not enough to just list the factors involved, the benefits offered should form part of the response.

Question 10

(a) (i) A high proportion of candidates recognised at least two of the drive systems shown in the illustration; very few had failed to gain any marks at all.

(ii) This question was not answered well. Of the three drive systems shown, the vee belt between the intermediate shaft and the blade axle, was the only one that allowed any slipping. That factor should have given an indication of the reason for choice, with the result of slight slipping being less or no damage to any components beyond that point in the drive system.

(b) The calculation of speed of the blade axle was answered well with a high proportion of candidates gaining all three marks for giving 320 rpm and the answer. As with the other calculations in the paper it is to the candidates' advantage to show all of the working that leads to their answer.

(c) (i) The majority of candidates correctly identified the mower handle as being a first order lever.

(ii) Most of the responses gained all of the available three marks with a minority mixing up the positions of load and effort while identifying the roller as the fulcrum.

(d) Conversion of motion was understood in more than half of the responses; there were very few single marks, the majority identifying input and output motion as rotary to linear.

(e) (i) Explanations of the benefits of using a worm gear were in some cases confused. The large reduction in speed was the most regularly identified benefit but very few showed understanding of the one way nature of the motion and the fact that the spur gear cannot turn the worm wheel, in this case ensuring that the lift cannot drop back.

(ii) This part was generally well answered with widespread recognition that the load is spread and safety is increased when more cables are used.

(iii) In many cases the knowledge of hydraulics was not good with frequent confusion between pneumatic and hydraulic features.

(f) The roller and flat followers were in most cases drawn correctly. Very few candidates had noted that the third example already had the follower drawn and the requirement was to amplify the movement from the cam by extending the follower and having an off centre pivot point.

Question 11

(a) A high proportion of candidates answering this question gained full marks for distinguishing between the conductors crossing and conductors joined symbols and for knowing the symbol for a voltmeter.

(b) (i) This part of the question was well answered with most of the calculations being accurately completed to give an output of 2.11V.

(ii) In about half of the responses the 1MΩ variable resistor was correctly identified as having the most suitable value. With the candidates who had got it wrong there was no particular preference shown for any one of the incorrect answers.

(iii) The question required both two input OR gates to be combined into a three input gate. This was correctly carried out in half of the responses by taking the output from one gate and feeding it into an input of the second gate.

(c) (i) In a high proportion of responses pins 4 and 7 were correctly identified as the 0V and supply connections and were added to the diagram.

(ii) The results of the given input conditions on the comparator were generally not known. The acceptable answers allowed for some tolerance but needed to be close to 0V and to the power supply voltage respectively.

(iii) There was more than one correct solution to the routing of the tracks in this question. Those candidates who had carried out this task in a practical way could generally produce a workable solution. Thickness of the track or neatness was not judged, only the placing of the track.

(iv) As with the previous part those who had used a PCB layout in practical work showed understanding that the reason for reversal of the symbols was to allow them to read correctly on the copper layer.

(d) (i) This question focused on the understanding of how a relay works and the connections needed for it to operate. There were a number of fully correct answers seen, showing the common relay connector attached to the supply voltage, the normally open connection to the pump motor and the other motor connection to 0V.

(ii) In the majority of cases a diode symbol was drawn on the circuit but very few had correctly placed it in reverse bias with the negative end of the diode connected to the positive rail.

(iii) The identification of the negative end or cathode was shown clearly as a stripe in about half of the responses seen.

(e) The majority of candidates correctly identified at least one key benefit of using a programmable IC. The most common benefit given related to the precision / accuracy of the time delay. None had recognised that it is easier to interface with other inputs and outputs or that the effective size of the circuit board can be reduced.

DESIGN AND TECHNOLOGY

Paper 0445/43
Systems and Control

Key messages

- Candidates must ensure that the rubric is followed and only one question in ***Section B*** is answered.
- Candidates should be reminded that clear writing and annotated sketches that make full use of the available space are recommended.
- It is important that responses are limited to the allocated response area as far as possible; however, any parts of a response that does not fit the space should be added to additional sheets attached to the booklet.
- Those candidates who had chosen to answer the electronics question had generally made use of the given formula for their response. It is important that the correct units are then applied to the final answer.
- The number of candidates failing to give any sort of response to parts of a question was fewer than in previous sessions. Candidates should be encouraged to offer a response that could potentially gain a mark rather than leaving a blank space.

General comments

All of the questions on the paper proved accessible to the majority of candidates and most had followed the instructions on question choice; only a small number had attempted to answer more than one question in ***Section B***.

Communication and presentation in general were clear, in both written and graphic responses. This was most apparent in question 5 of ***Section A*** where fitting and soldering an LED had to be described; some excellent sketches were seen in response to this question.

As with recent sessions the mechanisms and structures questions in ***Section B*** proved to be the most popular with candidates.

When answering calculation questions candidates should be advised to look carefully at the units used in the question and ensure that any necessary conversions are carried out. It is also important that working is shown for calculations so that partial marks can be awarded for the correct aspects of the response. When calculators are being used this can be difficult and in a number of cases it was not possible to award any marks because only an incorrect answer with no working was given.

Comments on specific questions

Section A

Question 1

(a) The majority of candidates knew that adding reinforcement to concrete increases the strength, but in order to gain the mark, reference to tensile strength or resistance to bending had to be made.

(b) The resistance to corrosion of plastic based reinforcement was generally recognised though few candidates used the fact that the reinforcement can be added during the mixing stage of the concrete. Only a minority of candidates gained the mark for this question.

Question 2

(a) Shear force being the cause of the cracking was noted by most candidates.

(b) Reference to movement in the ground was a common response with many giving a reason, such as earthquake, for the movement occurring.

Question 3

This question was well answered with clear drawings in most cases and accurate use of force arrows to indicate the resistance to compression of a strut and the resistance to tension of a tie.

Question 4

(a) Very few candidates failed to tackle this question and the majority correctly gave heat and sound as the types of energy produced from unwanted friction.

(b) As with the previous part there was clear understanding of where friction is needed in a mechanism and the examples, such as cycle brakes, gained marks.

Question 5

(a) This question was only answered correctly by the higher achieving candidates. The features that should have led to the crank mechanism being identified were the handle being offset from the centre axis of the rotating section and the use of spur gears in the final drive.

(b) A high proportion of candidates identified the 40t and 8t gears correctly from the given list and the majority of these had put the two gears in the correct order of driver gear 40t, driven gear 8t needed for an increase in speed.

Question 6

Nearly all candidates scored at least one mark for naming the electronic symbols. In most cases the variable resistor and the LDR were correctly named; the thermistor seemed to be the one that was not so well known.

Question 7

The majority of those who had noted that the capacitor was electrolytic stated that it should be fitted the correct way round in a circuit. Somewhat fewer had given a method of identifying the polarity of the legs such as the shorter cathode leg or the stripe on the casing, with either '-' or '+' markings.

Question 8

(a) (i) The majority of candidates attempted the question with a much smaller proportion gaining the mark for applying the voltage drop in the calculation. A common error was to miss the unit from the figure given in the answer, which should have been 0.35W. Those who had mistakenly used either 9V or 2V in the calculation with a correct answer for those figures were rewarded with one mark.

(ii) Candidates who had completed the calculation correctly generally gained a mark for identifying the 0.4W power rating of the resistor. For those who had calculated incorrectly, and given a power rating to match their result, a mark for error carried forward was allowed.

(b) More than half of the candidates gained a mark for giving the correct result of using a resistor with too low a power rating; the resistor would be destroyed. Any form of destruction of the resistor was allowed as was damage to the LED.

Section B

Question 9

(a) (i) The advantages of using aluminium rather than wood for ladder construction were generally well known, the majority of candidates correctly identified the advantage of lighter weight and higher achieving candidates gained a second mark for resistance to corrosion / insect attack. Very few noted that manufacture would be easier to control or rungs can be extruded with grip on them.

(ii) The forces of compression on the top face and tension on the lower face of the rung were well known and a high proportion of candidates gained both marks.

(iii) The calculation of reactions where the rung joined the ladder sides was very well done by those who knew the correct method. Full marks were awarded to those with a correct result of 506.76N for R2 and 243.24N for R1, whether or not the working was shown. Candidates should be made aware that while a correct solution with no working gains full marks an incorrect one will gain no marks; whereas if the working is shown it is possible to gain the intermediate marks.

(iv) A number of incorrect solutions showed a strain gauge being used for the measurement of deflection, when a dial gauge, centrally placed, was the only suitable solution. Other errors included using methods that could not be relied on to produce precise, accurate results, such as a ruler.

(v) Very few answers showed understanding of a factor of safety or how it can be applied to a structure. Recognition that a safe working load will be less than the maximum design load was only shown in a few cases. Very few candidates recognised that user weight, weight of items being carried, or slipping on the ground, would have an effect.

(vi) There were some very good answers for this question that demonstrated an understanding of how equipment is used and why separate printed instructions would not be adequate. A single point clearly described was awarded both marks; for example stating that a notice printed or attached to the ladder with maximum safe weight stated and safe angles of leaning shown, would be worth two marks.

(b) (i) This question was well answered with candidates showing clear understanding of the advantages, such as mechanical strength and reduced reliance on adhesives offered by a mortise and tenon joint.

(ii) Good use was made of gusset plates and either screws or dowels inserted across the joint to prevent removal. Drawings were generally clear and well annotated.

(iii) There was confusion in many cases between temporary and permanent methods of joining timber. Those who did gain the marks generally gave screws or bolts with very few mentioning G cramps or sash cramps.

(c) A high proportion of candidates scored one or two marks out of the available four on this question. The longer spans allowed by lamination was a common feature with a few noting that laminated beams can be more aesthetically pleasing than a steel girder. Candidates should note that where an explanation is called for it is not enough to just list the factors involved, the benefits offered should form part of the response.

Question 10

(a) (i) A high proportion of candidates recognised at least two of the drive systems shown in the illustration; very few had failed to gain any marks at all.

(ii) This question was not answered well. Of the three drive systems shown, the vee belt between the intermediate shaft and the blade axle, was the only one that allowed any slipping. That factor should have given an indication of the reason for choice, with the result of slight slipping being less or no damage to any components beyond that point in the drive system.

(b) The calculation of speed of the blade axle was answered well with a high proportion of candidates gaining all three marks for giving 320 rpm and the answer. As with the other calculations in the paper it is to the candidates' advantage to show all of the working that leads to their answer.

(c) (i) The majority of candidates correctly identified the mower handle as being a first order lever.

(ii) Most of the responses gained all of the available three marks with a minority mixing up the positions of load and effort while identifying the roller as the fulcrum.

(d) Conversion of motion was understood in more than half of the responses; there were very few single marks, the majority identifying input and output motion as rotary to linear.

(e) (i) Explanations of the benefits of using a worm gear were in some cases confused. The large reduction in speed was the most regularly identified benefit but very few showed understanding of the one way nature of the motion and the fact that the spur gear cannot turn the worm wheel, in this case ensuring that the lift cannot drop back.

(ii) This part was generally well answered with widespread recognition that the load is spread and safety is increased when more cables are used.

(iii) In many cases the knowledge of hydraulics was not good with frequent confusion between pneumatic and hydraulic features.

(f) The roller and flat followers were in most cases drawn correctly. Very few candidates had noted that the third example already had the follower drawn and the requirement was to amplify the movement from the cam by extending the follower and having an off centre pivot point.

Question 11

(a) A high proportion of candidates answering this question gained full marks for distinguishing between the conductors crossing and conductors joined symbols and for knowing the symbol for a voltmeter.

(b) (i) This part of the question was well answered with most of the calculations being accurately completed to give an output of 2.11V.

(ii) In about half of the responses the 1MΩ variable resistor was correctly identified as having the most suitable value. With the candidates who had got it wrong there was no particular preference shown for any one of the incorrect answers.

(iii) The question required both two input OR gates to be combined into a three input gate. This was correctly carried out in half of the responses by taking the output from one gate and feeding it into an input of the second gate.

(c) (i) In a high proportion of responses pins 4 and 7 were correctly identified as the 0V and supply connections and were added to the diagram.

(ii) The results of the given input conditions on the comparator were generally not known. The acceptable answers allowed for some tolerance but needed to be close to 0V and to the power supply voltage respectively.

(iii) There was more than one correct solution to the routing of the tracks in this question. Those candidates who had carried out this task in a practical way could generally produce a workable solution. Thickness of the track or neatness was not judged, only the placing of the track.

(iv) As with the previous part those who had used a PCB layout in practical work showed understanding that the reason for reversal of the symbols was to allow them to read correctly on the copper layer.

(d) (i) This question focused on the understanding of how a relay works and the connections needed for it to operate. There were a number of fully correct answers seen, showing the common relay connector attached to the supply voltage, the normally open connection to the pump motor and the other motor connection to 0V.

(ii) In the majority of cases a diode symbol was drawn on the circuit but very few had correctly placed it in reverse bias with the negative end of the diode connected to the positive rail.

(iii) The identification of the negative end or cathode was shown clearly as a stripe in about half of the responses seen.

(e) The majority of candidates correctly identified at least one key benefit of using a programmable IC. The most common benefit given related to the precision / accuracy of the time delay. None had recognised that it is easier to interface with other inputs and outputs or that the effective size of the circuit board can be reduced.

DESIGN AND TECHNOLOGY

Paper 0445/05

Project

General Comments

The 2015 November moderation session ran very smoothly. The work that Centres do in preparing their students for moderation and the care and attention over the administrative tasks required to accurately complete documentation is greatly appreciated.

The vast majority of work submitted was well structured and covered the assessment criteria. Some of the work submitted was very innovative with many candidates producing well manufactured, high quality, functional outcomes.

The majority of candidates manage their time effectively to ensure that a functional product is completed, leaving sufficient time for appropriate testing and evaluation. Some of the work produced is outstanding and Centres and candidates are to be congratulated on the effort and care that goes into their projects.

A growing number of Centres include individual candidate assessment sheets with supporting comment. These are very helpful for moderators to see how and where marks were awarded.

Centres are reminded that if after internal moderation a different total mark is inserted on the Coursework Assessment Summary Form, it is helpful to moderators if it is made clear on the form where any changes in marks to particular assessment criterion have been made.

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

To access the highest mark range for Testing and Evaluation, candidates should have photographic evidence of the product in use.

The majority of Centres apply marks consistently and accurately and in line with the standards set by the Awarding Body. Centres are encouraged to use the guidance given in this report and the specific information in the Moderators Comments on School Based Assessment of Coursework form when assessing the work of candidates.

Comments on Specific Questions

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

Candidates generally complete this section very well. Most candidates explained the need fully, using photographs where appropriate, and described the needs of the user group before producing a clear and detailed design brief. A number of Centres were lenient in awarding marks in this section; a brief statement is not enough to access the middle or higher mark ranges. To access the higher mark range, candidates must analyse the need in detail and consider the requirements of possible users.

2. Research into the Design Brief resulting in a Specification

Work continues to improve in this section. The majority of candidates produced focused and relevant research. Some candidates however, produce very large amounts of information, much of which is not related to the brief. Research needs to be more focused on the situation chosen and specifications should state the main functions and qualities of the product.

Many candidates analyse existing products as part of their research, they should highlight the particular design strengths and weaknesses and use this information when generating a specification and when designing.

This section should include information such as the details and dimensions of items to be stored or fitted into the product.

More candidates produced detailed and justified briefs and most candidates focused on the specific details of the requirements for their product.

3. Generation and exploration of Design Ideas

Although most Centres assess this section accurately and in line with Cambridge standards, a significant number are too lenient. A wide range of different, well-annotated possibilities is required to access the higher mark range. Ideas should be evaluated on their suitability for further development making reference to the specification.

Much of the work sampled had well-presented, innovative and creative design proposals.

4. Development of Proposed Solution

This section requires candidates to show their decision making regarding development of their initial concepts/ideas, materials and construction methods, through trialling and testing where appropriate, and modelling. Most candidates had clear evidence of developmental work.

Some Centres are generous with their assessment. Candidates must show their design decision – making; giving reasons for selecting materials and the manufacturing process to access the higher mark ranges. An increasing number of candidates make very good use of 2D and 3D modelling and computer aided images to develop their design proposal.

5. Planning for Production

Working drawings continue to be of a good standard with many candidates producing high quality work. To achieve the highest mark ranges, drawings should include all details necessary, such as: key dimensions, additional fixtures used e.g. hinges and screws, and finishes applied. The best drawings should enable a third party to have all the information required to manufacture the product.

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

6. Product Realisation

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

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

Candidates generally include good quality photographs to show full details of their product. Many gave photographic evidence of key stages of manufacture of the product to emphasize particular features and the quality of making which is to be encouraged.

7. Testing and Evaluation

Centres tend to be lenient when assessing this section. To access the higher mark range, candidates should, where possible, test the product in its intended environment and produce detailed evaluations of successes and possible weaknesses.

Photographic evidence ought to be included in this section.

A tick list against the specification is not appropriate. In many cases the specification is not detailed and restricts comments on the performance and appearance of the product. Candidates should use sketches and notes to recommend modifications and possible improvements based on their evaluation.

A number of candidates included third party evaluations from clients or potential users of the product which is to be encouraged.