

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 include construction details rather than manufacturing methods that might be used in the workshop/studio.

General comments

Successful responses 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 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 the requirements of a small general store, 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 storage and display of DVD cases in the general store and it was clearly one with which they were familiar in their normal day-to-day experiences. Suggested outcomes normally displayed one DVD case well and there was evidence of original thinking with imaginative outcomes.

- (a) Candidates were able to identify functional points required of the storage and display unit in addition to those outlined in the question. Successful responses to this introductory part of the question included: appropriate height/position; DVDs easy to access/remove; easy to move unit around; keep dust off DVDs; easy to see display; DVDs do not fall out; has impact; etc.
- (b) Few candidates had difficulty showing two places where the unit could be positioned in the general store and these included: on existing shelves; on checkout/pay counter; near entrance; on a wall; near the window; 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 answers used the whole space provided to produce clear drawings using appropriate techniques so that design details were clear to the viewer. Marks are 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 answers evaluated effectively each of the 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 promotional card of this type would need to be produced through the use of semi resistant materials.

- (a) Most candidates were able to suggest additional points to those identified in the question and successful responses included: attractive colour/shape; has impact; invites people to read; includes images of some products sold; will go through letter boxes easily; will not tear/damage; etc.
- (b) The majority of candidates were familiar with graphic features that could be used and appropriate suggestions included: pop-up; slider; opening window/flap; raised products; photo of shop; specific font type/colour/form; 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 reaching device included: adjustable length; takes different shapes and sizes; lightweight; comfortable to hold; easy to store; simple to operate; etc.
- (b) Most candidates were able to identify two examples of appropriate reaching/gripping/lifting methods including: screw cramps; jaws; levers; flexible rubber clips; spring clips; ledges; 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 include construction details rather than manufacturing methods that might be used in the workshop/studio.

General comments

Successful responses 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 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 the requirements of a small general store, 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 storage and display of DVD cases in the general store and it was clearly one with which they were familiar in their normal day-to-day experiences. Suggested outcomes normally displayed one DVD case well and there was evidence of original thinking with imaginative outcomes.

- (a) Candidates were able to identify functional points required of the storage and display unit in addition to those outlined in the question. Successful responses to this introductory part of the question included: appropriate height/position; DVDs easy to access/remove; easy to move unit around; keep dust off DVDs; easy to see display; DVDs do not fall out; has impact; etc.
- (b) Few candidates had difficulty showing two places where the unit could be positioned in the general store and these included: on existing shelves; on checkout/pay counter; near entrance; on a wall; near the window; 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 answers used the whole space provided to produce clear drawings using appropriate techniques so that design details were clear to the viewer. Marks are 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 answers evaluated effectively each of the 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 promotional card of this type would need to be produced through the use of semi resistant materials.

- (a) Most candidates were able to suggest additional points to those identified in the question and successful responses included: attractive colour/shape; has impact; invites people to read; includes images of some products sold; will go through letter boxes easily; will not tear/damage; etc.
- (b) The majority of candidates were familiar with graphic features that could be used and appropriate suggestions included: pop-up; slider; opening window/flap; raised products; photo of shop; specific font type/colour/form; 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 reaching device included: adjustable length; takes different shapes and sizes; lightweight; comfortable to hold; easy to store; simple to operate; etc.
- (b) Most candidates were able to identify two examples of appropriate reaching/gripping/lifting methods including: screw cramps; jaws; levers; flexible rubber clips; spring clips; ledges; 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 include construction details rather than manufacturing methods that might be used in the workshop/studio.

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 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 the requirements of food preparation and presentation 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 the most popular question, followed by **Question 2** with only a very small number of candidates choosing **Question 3**.

Comments on specific questions

Question 1

Candidates appeared to understand fully the design requirements of the mobile unit for food. It was clearly one with which they were familiar in their normal day-to-day experiences. Suggested solutions often included other functions to those stated and there was evidence of original thinking with imaginative outcomes.

- (a)** Candidates were able to identify functional points required of the mobile unit in addition to those outlined in the question. Successful responses to this introductory part of the question included: easy to move around; easy to access dishes; dishes do not fall out; protects food; hygienic; can be easily cleaned; stain proof; additional items held/use; fits in with décor/room; etc.
- (b)** Few candidates had difficulty showing two methods of preventing slippage and these included: additional rails; stand up edges; friction surface; recessed spaces; holes; 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 answers used the whole space provided to produce clear drawings using appropriate techniques so that design details were clear to the viewer. Marks are 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 carrier of this type would need to be produced through the use of semi resistant materials.

- (a) Most candidates were able to suggest additional points to those identified in the question and successful responses included: attractive colour/shape; has impact; lightweight/easy to carry; easy access to items; items held separately; addition of eating platform/section; recyclable materials; will not tear/damage; etc.
- (b) The majority of candidates were familiar with different forms of handle that could be used and appropriate suggestions included: string/rope/tape; cardboard strip; cut out slots; extra layers; specific shaping to carrier form; 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 page turning device included: simple to operate; adjustable to height of person/surface; takes different sizes and shapes of book; east to store; 'kitchen proof'; etc.
- (b) Most candidates were able to identify two methods of protection including: integral splatter guard; freestanding guard; guard fixed to wall/cupboard; sliding/hinging cover; 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 cylindrical shape. The construction of a regular hexagon and the bisection of angles are also areas that need to be improved.

Comments on specific questions

Question A1

Coffee Mug

- A pictorial image of a coffee mug was given. Many candidates added to the side view a top line, the left hand side line and the two lines representing the square base. Most candidates added the outer edge of the handle in line with that given in the plan. The inner line was to be added by candidates replicating the thickness from the part of the handle that had been given.
- One dimension was required to be added to the plan view. Complete answers included limit lines, dimension lines with arrows and the correct numerical value in millimetres (mm) of the actual size and not to the scale.
- A first angle projection symbol was required comprising of two concentric circles and a truncated cone drawn to the left of the circles and in the correct orientation.

Question A2

- A partially completed section view of the mug was given. The information showed the handle as a rectangle with 45° section lines. This should have led the candidate to hatching the space between the two circles at 45° and completing the outer arc where it joins the handle. The remaining part of the handle is solid as it is viewed from above and not cut by the section.
- A design printed on the mug using a thermochromic ink, adds interest because the design changes colour as the hot drink warms up the ceramic mug. As the mug cools, the design returns to its original state

Question A3

Take away coffee cup, sleeve and lid

Unfortunately, not all candidates attempted this compulsory question losing the 11 marks available.

- (a) The question asked candidates to draw a scale 1:2 planometric view of the cup to the given sizes. Some candidates drew a solution that was in isometric projection. Marks were awarded for two correct sized circles 80 apart on the given centre lines with sloping sides connecting them.
- (b) Candidates were asked to describe three of the main steps in the vacuum forming process used to make the coffee cup lid. Many candidates responded incorrectly and described 'blow moulding' or 'injection moulding'.

Correct responses included:

- constructing a mould or former that has draft on its edges
 - positioning the former
 - clamping the plastic sheet in the former
 - heating the plastic sheet until it is soft / pliable
 - raising the mould
 - applying the vacuum
 - removing / cooling the plastic / trimming the shape.
- (a) (i) A sectional view of corrugated card would show a wavy line with an optional top or bottom layer but not both.
- (ii) The corrugated card is used for the sleeve because it has an 'air space' that acts as an insulator. The heat from the coffee cup is not transferred to the fingers of the person holding the cup.

Question B4

Cafe Loyalty Card

This question was derived from an actual 'Graphic Product' used by a Cafe.

A classroom exercise to make the loyalty card, 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) (i) Many candidates drew a Hexagon. Full marks were awarded to candidates who drew a regular hexagon 60 side.
- (ii) Most candidates drew three lines from opposite corners to divide the hexagon into six equal triangles.
- (iii) Candidates were required to determine the centre of each triangle by dividing two of the angles of one equilateral triangle and then transfer this centre to the five remaining triangles. A $\text{Ø}20$ circle was to be drawn in the centre of each triangle
- (iv) A flow chart was required to show customers what they have to do to get a free drink. Process boxes similar to the one given had to contain:
- collect sticker
 - attach sticker
 - repeat five more times (could be a decision box with Y/N loop)
 - collect free drink.

An 'end' box was to be included with a similar shape to the 'start' box.
All boxes in the flow chart were required to be the same width.

- (v) Candidates were told that 10 000 loyalty cards are to be produced by lithography
- (i) 'Die cutting' or 'Stamping' would be the preferred commercial process used to cut out the loyalty cards
- (ii) ICT could be used in the design and manufacture of the loyalty cards for:
 - reserach
 - copying and pasting images
 - design using CAD
 - plotter cutting using CAM.

Question B5

Package for biscuits

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) (i) Many candidates managed to draw an ellipse on the given centre lines. Candidates scored marks for the correct Major and Minor axis, clear construction and an outline that was correct. Some candidates used a 'trammel' and where this was attached or drawn on the exam paper, marks were awarded accordingly.
- (ii) Most candidates added five more surfaces to the given drawing. Where candidates drew each additional surface correctly to size and position full marks were awarded. Some candidates misread the pictorial view and failed to add the sides to the base. The two sides needed to be in the correct orientation and have two glue tabs each to be consistent with the pictorial image.

All fold lines were to be drawn in the correct convention and similar to the two already given in the incomplete development.

- (b) There were many solutions to this question. The key points were that the fold in flap needed to be kept in place without the use of glue. The most common response from candidates was an arrow and slot system.
- (c) A triangle with three arrows 'chasing' clockwise is the acceptable international symbol for 'Recycling'

The second label gives the date that the edible product is best eaten before.

The last label is used on products where the weight is 'estimated'. This label is usually found on pre-packed products.

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 planometric view from given information of a simple cylindrical shape. The construction of a regular hexagon and the bisection of angles are also areas that need to be improved.

Comments on specific questions

Question A1

Coffee Mug

- A pictorial image of a coffee mug was given. Many candidates added to the side view a top line, the left hand side line and the two lines representing the square base. Most candidates added the outer edge of the handle in line with that given in the plan. The inner line was to be added by candidates replicating the thickness from the part of the handle that had been given.
- One dimension was required to be added to the plan view. Complete answers included limit lines, dimension lines with arrows and the correct numerical value in millimetres (mm) of the actual size and not to the scale.
- A first angle projection symbol was required comprising of two concentric circles and a truncated cone drawn to the left of the circles and in the correct orientation.

Question A2

- A partially completed section view of the mug was given. The information showed the handle as a rectangle with 45° section lines. This should have led the candidate to hatching the space between the two circles at 45° and completing the outer arc where it joins the handle. The remaining part of the handle is solid as it is viewed from above and not cut by the section.
- A design printed on the mug using a thermochromic ink, adds interest because the design changes colour as the hot drink warms up the ceramic mug. As the mug cools, the design returns to its original state

Question A3

Take away coffee cup, sleeve and lid

Unfortunately, not all candidates attempted this compulsory question losing the 11 marks available.

- (a) The question asked candidates to draw a scale 1:2 planometric view of the cup to the given sizes. Some candidates drew a solution that was in isometric projection. Marks were awarded for two correct sized circles 80 apart on the given centre lines with sloping sides connecting them.
- (b) Candidates were asked to describe three of the main steps in the vacuum forming process used to make the coffee cup lid. Many candidates responded incorrectly and described 'blow moulding' or 'injection moulding'.

Correct responses included:

- constructing a mould or former that has draft on its edges
 - positioning the former
 - clamping the plastic sheet in the former
 - heating the plastic sheet until it is soft / pliable
 - raising the mould
 - applying the vacuum
 - removing / cooling the plastic / trimming the shape.
- (a) (i) A sectional view of corrugated card would show a wavy line with an optional top or bottom layer but not both.
- (ii) The corrugated card is used for the sleeve because it has an 'air space' that acts as an insulator. The heat from the coffee cup is not transferred to the fingers of the person holding the cup.

Question B4

Cafe Loyalty Card

This question was derived from an actual 'Graphic Product' used by a Cafe.

A classroom exercise to make the loyalty card, 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) (i) Many candidates drew a Hexagon. Full marks were awarded to candidates who drew a regular hexagon 60 side.
- (ii) Most candidates drew three lines from opposite corners to divide the hexagon into six equal triangles.
- (iii) Candidates were required to determine the centre of each triangle by dividing two of the angles of one equilateral triangle and then transfer this centre to the five remaining triangles. A Ø20 circle was to be drawn in the centre of each triangle
- (iv) A flow chart was required to show customers what they have to do to get a free drink. Process boxes similar to the one given had to contain:
- collect sticker
 - attach sticker
 - repeat five more times (could be a decision box with Y/N loop)
 - collect free drink.

An 'end' box was to be included with a similar shape to the 'start' box.
All boxes in the flow chart were required to be the same width.

- (v) Candidates were told that 10 000 loyalty cards are to be produced by lithography
- (i) 'Die cutting' or 'Stamping' would be the preferred commercial process used to cut out the loyalty cards
- (ii) ICT could be used in the design and manufacture of the loyalty cards for:
 - reserach
 - copying and pasting images
 - design using CAD
 - plotter cutting using CAM.

Question B5

Package for biscuits

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) (i) Many candidates managed to draw an ellipse on the given centre lines. Candidates scored marks for the correct Major and Minor axis, clear construction and an outline that was correct. Some candidates used a 'trammel' and where this was attached or drawn on the exam paper, marks were awarded accordingly.
- (ii) Most candidates added five more surfaces to the given drawing. Where candidates drew each additional surface correctly to size and position full marks were awarded. Some candidates misread the pictorial view and failed to add the sides to the base. The two sides needed to be in the correct orientation and have two glue tabs each to be consistent with the pictorial image.

All fold lines were to be drawn in the correct convention and similar to the two already given in the incomplete development.

- (b) There were many solutions to this question. The key points were that the fold in flap needed to be kept in place without the use of glue. The most common response from candidates was an arrow and slot system.
- (c) A triangle with three arrows 'chasing' clockwise is the acceptable international symbol for 'Recycling'

The second label gives the date that the edible product is best eaten before.

The last label is used on products where the weight is 'estimated'. This label is usually found on pre-packed products.

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 enlarge a figure to a given scale using a graphical method. The construction of a regular hexagon and an equilateral triangle on a given centre are also areas that need to be improved.

Comments on specific questions

Question A1

Toy figure

- A pictorial image of several parts of a toy figure was given. Two incomplete orthographic views were also given. Many candidates added the circle representing the head and a rectangle representing the left arm to the plan view.
- Most candidates added the dowel to the right arm in hidden detail. Many candidates omitted the single dowel connecting the body to the legs. A small number of candidates did not use hidden detail for the dowels.
- A third angle projection symbol was required comprising of two concentric circles and a truncated cone drawn to the right of the circles and in the correct orientation

Question A2

- A given pictorial view of the head of the toy figure was given. Candidates were asked to make the head look spherical. Successful outcomes used shading in decreasing arcs and/or balloon high/low light rendering.
- This question required candidates to show how a stencil is used to add a name to the toy. The question required a drawing of a piece of card with cut-outs (stencil) and a pen or marker in use to mark through the cut-out letters. Simple notes or clear labels were accepted.

Question A3

Blister package

Unfortunately, not all candidates attempted this compulsory question.

- (a) The question asked candidates to complete an exploded sectional view of the blister package. Correct responses showed a dome drawn to the right of the centre flat line. A top and a left hand side line to the rectangular cone part linking up with the right hand side already given by drawing by a curve.
- Finally, a flat was required to be evident to the right of the dome and to the left of the rectangular cone.
- (b) Candidates were asked to describe three main features of the former required to vacuum form the blister pack. Many candidates responded incorrectly and described the *process* of 'vacuum forming' or 'blow moulding'

Correct responses included:

- constructing a former that has draft on its edges
 - a smooth finish to the former
 - strength of the former to withstand suction
 - correct shape of former
 - quality materials used for the former
 - a former capable of withstanding the heat of vacuum forming
- (c) (i) A triangle formed by three arrows chasing in a clockwise manner is the acceptable international symbol for recycling.
- (ii) Acceptable answers for why the card should be recycled included:
- better for the environment
 - fewer trees chopped down to make wood pulp
 - less landfill if card is used again
 - better image for the company

Question B4

Shape sorter

This question was derived from an actual 'Product' used by children.

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

- (a) An incomplete top for the sorter was given to a scale of 1:2.
- (i) Many candidates drew a circle. Full marks were awarded to candidates who drew a circle $\varnothing 30$ in a similar PCD to the given square.
- (ii) Most candidates drew an equilateral triangle of 30 side on the given centreline, in the correct orientation and in a similar PCD to the given square.
- (iii) Many candidates drew a hexagon on the given centre line. Full marks were awarded to responses that showed a regular hexagon 20 side in the correct orientation and on a similar PCD to the given square
- (b) A pie chart was required to show customers the sales in 2014 of the four different coloured shape sorters. Correct responses showed a circle within the given centre lines divided up into four sectors. Yellow 90° , Red 45° , Green 75° and Blue 150° . Colour or shading enhanced the chart with labels to each sector giving the correct quantities.

- (c) Candidates were told that a modified top to the sorter is to be produced by using CAD.
- (i) CAD is an abbreviation for Computer Aided Design.
- (ii) a line drawing of an elliptical shape could be captured from the Internet to use in a CAD drawing package by:
- highlight or right click on image
 - menu - copy image
 - cursor to new page / program
 - menu-paste/click to position.

Question B5

Puzzle

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) Many candidates labelled the 'foamboard' correctly to show card/paper on the upper surface and expanded polystyrene or polystyrene foam in the middle.
- (ii) The pieces of equipment that would be used to cut the foamboard are:
- a cutting mat
 - a safety / steel rule
 - a craft knife / Stanley knife / scalpel.
- (iii) Foamboard is considered a suitable material for the puzzle because:
- It is easy to cut so shapes can be made easily
 - It has a smooth surface and pictures can be printed onto it
 - It is rigid so pieces slot together easily
 - It has thickness so it is easy to pick up.
- (b) This question required candidates to construct an enlargement to scale of one piece of the puzzle. Correct solutions showed one side/corner of the 'cross' drawn three times larger and to the right of the given shape. Lines were then projected back from both ends of the new side through the existing drawing to determine a Vanishing Point (VP). This point could then be used to project the remaining corners of the puzzle shape to the new enlarged drawing. Other graphical methods using a vanishing point were accepted.
- (c) Candidates were required to draw a 1:2 scale isometric view of the base of the puzzle on the given start point **A**. Many candidates drew the outline to the correct size and 10 deep. The top surface needed to show a rim width of 5 mm. The inner side of the base needed to be drawn 7.5 deep. This scale drawing requirement provided a variety of responses. A correct scale drawing of the inner part of the base was produced by only a minority of candidates.

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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 did not display 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 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(c)(i)**, when the question asked candidates to “*show how the slot could be cut out....*” no marks are allocated for providing details of *marking* out.

Comments on specific questions

Section A

Question 1

Most candidates named at least one of the tools correctly.

Question 2

Many candidates gave benefits of using a saw with replaceable blades. The most common answers described how it would be cheaper to replace the blade rather than the whole saw, the different blades could be used to cut different materials and that broken or blunt blades could be replaced.

Question 3

Many candidates correctly recognised the composite materials Kevlar and glass reinforced plastic.

Question 4

- (a) Many candidates provided an accurate method of joining the mild steel rod to a base. The most common methods were welding, brazing and epoxy resin.
- (b) Methods of joining the acrylic rod to a base were less accurate. Epoxy resin has only limited strength and there were numerous incorrect variations on the correct answers of acrylic/plastic cement and Tensol.

Question 5

- (a) Many candidates named the dowel joint correctly but only a minority named the (corner) bridle.

Question 6

- (b) The majority of candidates recognised that the bridle joint, B, had greater gluing area than the dowel joint.
- (a) It was disappointing that most candidates could not name the die and the tap, reflecting a lack of practical metalworking techniques and processes.
- (b) and (c) While most candidates could not name the tool used to cut external and internal threads there were many answers that demonstrated a 'vague' knowledge and understanding of the purpose of both tools; typified by reference to "*cutting the swirls*" or "*cutting the grooves*" in the metal. However, these vague references were not sufficient to gain marks.

Question 7

There were many variations in the quality and accuracy of the completed tee halving joint. Those drawings that were completed correctly without the use of a ruler or straight edge were rewarded at the same level as those who did use them.

Question 8

Very few candidates understood that the reason for the splits was due to drying out and the subsequent shrinkage. Many answers referred to additional moisture or humidity. The best answers described the splits being caused by poor seasoning, excessive drying out and only a small minority of answers stated that the hardwood top had been fixed to the frame of the table without any allowance for movement.

Question 9

The majority of candidates described at least one way in which the design of the palm sander included ergonomics. The most common correct answers referred to the shape of the handle and the ability to grip it, the smooth rounded corners/shape of the sander and some excellent references to the dust bag to collect sawdust that would otherwise be breathed in.

Question 10

- (a) Many candidates named high density polyethylene. A mark was awarded for polythene on its own.
- (b) There were various answers to what was meant by the arrowed lines around the number 2. The best answers stated that it could be recycled. Those answers that stated that it could be recycled twice were rewarded with the 'twice' being ignored. Some candidates failed to achieve a mark because they carelessly stated that polyethylene was or had been recycled.

Section B

Question 11

This was the least popular question attempted by candidates.

- (a) There were many good answers rewarded for showing at least 4 stages in producing the one-off strip. Marking out was an important feature of this process. The quality of sketches was not always

as clear as it should have been and some candidates did not provide any sketches at all. A maximum of 3 marks was awarded to those answers that comprised solely written notes.

- (b) There were many different drilling jigs of varying success. The best answers used some form of 'plate' that fitted over the strip to be drilled or a 'baseboard' onto which the strip could sit, ready to be drilled. Positive location was important as was some form of 'stop' so that strips could be positioned for drilling quickly. The question asked candidates to name materials used to make the jig but many ignored this and failed to achieve the mark available.
- (c) (i) Most candidates recognised that the application of a finish would enhance the appearance of the strips or protect them.
(ii) Candidates were less sure of the disadvantages of applying a finish. The best answers referred to the paint chipping, the possible harm to children of putting the blocks in their mouths and several excellent answers that pointed out that applying paint could actually 'clog up' the holes.
- (d) This question allowed candidates to answer in a set of processes or techniques with which they had practical experience. Many answers showed the wheels cut out from a board and shaped using files or a sanding disk. Other techniques involved the wood turning lathe and injection moulding. Where CAM/CNC was used it was vital that details of CAD downloaded to a machine, the setting up of materials etc. were provided for maximum marks. This question was 'broken down' into three specific bullet points that were designed to help candidates focus on the important elements of the question to be addressed.
- (e) The majority of candidates named dowel correctly.
- (f) The best advantages of making toys from plastic rather than wood involved the durability of plastic, the inherent colour (meaning no applied finish necessary) and resistance to weather/external use. Some candidates stated that a wide variety of colours were available but this could also apply to wooden toys that are painted.

Question 12

This was the second most popular question attempted by candidates.

- (a) Many candidates completed the development (net) accurately.
- (b) Answers were extremely disappointing. The vast majority of candidates did not know how to finish the edges of acrylic to a high quality. To help candidates answer this question, the first stage, that of draw filing the edges, was given. This meant that **no more** filing should take place. The stages involved use of some form of scraper, the use of wet and dry (silicon carbide) paper and finally, use of the polishing mop and an appropriate compound. Most candidates carried on filing and gained no marks. Good answers referred to the use of **different grades** of wet and dry paper. Incorrect references to 'sandpaper' were common and the use of emery cloth inappropriate. The mark scheme did accept 'wet and dry sandpaper'. The techniques involved in answering this question correctly are basic when working with acrylic.
- (c) (i) The majority of candidates gained marks for this question. There were many excellent answers showing a drill used to make a hole for the blade of a coping saw or scroll saw and finally, the use of a file to make the edges smooth. Those candidates who chose to use CAM/CNC needed to give details of the process to gain maximum marks and not just a statement 'CAM/CNC'.
(ii) The most common correct answers included clamping the acrylic securely, setting the drill to a slow speed and supporting the acrylic underneath with a sacrificial board.
- (d) There were many good answers with the majority of candidates confident with the techniques associated with bending acrylic. Some candidates denied themselves maximum marks for not paying close enough attention to the question; bend **A** was shown to be an acute angle but some answers showed a former or jig made to 90°.
- (e) Most candidates gained at least 2 marks for showing some form of 'shelf' or support for the pens and pencils under the existing desk tidy. The other common correct modification involved extending the existing base and bending it under to provide support. The main reason candidates did not

achieve marks was due to either inappropriate constructional techniques or a total lack of this information.

- (f) Some candidates applied techniques associated with plastics to the question of bending aluminium. Candidates generally answer questions requiring any basic knowledge of metalworking techniques badly. There were, however, some excellent answers showing the aluminium sheet held between folding bars in a vice and bent to shape using a mallet or a hammer with scrap wood to prevent bruising.
- (g) Many candidates gained one mark for stating that self-finishing meant that no applied finish was required but many candidates did not explain further that the surface would only require the use of abrasive papers or a polishing mop to gain a second mark for a full explanation.

Question 13

This was the most popular question attempted by candidates.

- (a) The advantages of using MDF rather than plywood are that it is easier to work, it provides a smoother finish and that it does not splinter like plywood. Candidates provided at least one of these advantages but many responses referred incorrectly to costs, strength and that it was lighter in weight.
- (b) There were many good answers to this question; safe rounded edges, the size of the puzzle pieces appropriate for a child, the use of bright colours and the simplicity of the puzzle being the most common correct answers.
- (i) There was a wide variety of responses to this question. Many candidates did not show the construction of plywood clearly enough to gain marks. The important part was to show the layers of plywood at 90° to each other supported by an additional note describing how this contributed to the strength and stability of the board.
- (ii) There were many excellent answers to this question. The most common methods of making the hole in the plywood involved the use of a drill used to make a hole for the blade of a coping saw or scroll saw and, finally, the use of a file to make the edges smooth. Some candidates showed a hole saw that would only partially complete the operation. For maximum marks candidates needed to be technically accurate when naming the tools and equipment they would use. Those candidates who chose to use CAM/CNC needed to give details of the process to gain maximum marks and not just a statement 'CAM/CNC'.
- (iii) There were many excellent answers showing at least two G cramps, correctly named, securing the two pieces of plywood together and using the correct type of adhesive. PVA was the most common correct answer.
- (iv) Many candidates achieved at least 1 mark for this question. The main advantages of using vacuum formed plastic were that it would be produced faster, it was lighter weight, inherent colour meaning that no applied finishing was required and vacuum forming ensured consistent quality when batch produced.
- (d) Many candidates completed the abbreviations correctly: Computer Aided Design and Computer Aided Manufacture. However, there were many innovative but incorrect answers.
- (e) Generally, answers to this question were good. There were many references to checking sizes and the quality of the surface finish. The important element of quality control is that it dealt with checks that would be carried out **during** manufacture.
- (f) Many candidates stated that MDF and plywood **are** made up of recycled materials rather than that they could be. Many good answers described how manufactured boards come from renewable sources whereas the use of plastics resulted in depletion of a finite source and to difficulties of recycling some plastics.

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Key messages

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- 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 did not display 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 11(d)**, when the question asked candidates to “*show how you would cut out the square hole....*” no marks are allocated for providing details of *marking* out.

Comments on specific questions

Section A

Question 1

The majority of candidates provided three safety precautions taken when using the drilling machine.

Question 2

The best answers and most common advantages of using chipboard for making furniture included: cheaper than solid wood, more easily available, that it was more environmentally friendly and that it was more stable. Popular misconceptions included: it was easier to work and it was lighter in weight than solid wood.

Question 3

Only a small minority of candidates were able to name a suitable adhesive for each of the situations given. The most common correct answer was using epoxy resin for gluing metal parts together. Many candidates stated PVA for wooden boat building, but without the qualification of ‘water proof’, no mark was awarded. Candidates should know about a range of modern adhesives for a wide variety of uses.

Question 4

Only a small minority of candidates were able to name a suitable finish for the three products given. The most common correct answer was to use dip coating for the handle of the junior hacksaw. A minority of candidates recognised that the wooden chopping board could be left unfinished or that an application of olive oil would be suitable.

Question 5

Many candidates achieved at least 1 mark for stating that die casting could be used to produce intricate shapes or that it was a fast process well-suited to mass production.

Question 6

Most candidates named riveting or pop riveting correctly.

Question 7

- (a) Most candidates achieved the mark for stating that the staggered nails arrangement would provide more strength or stability or that it prevented the wood from splitting.
- (b) Only a minority of candidates were able to name accurately a specific type of nail that could be used to join the pieces of wood together. To gain 1 mark the name; round wire nail, oval or panel pin had to be precise.
- (c) The only correct methods of pulling nails out of wood were the claw hammer and pincers. Many candidates recognised that a claw hammer could be used by references to '*the other end of the hammer*' but could not actually provide the name to gain 1 mark.

Question 8

The majority of candidates did not read the question carefully and provided exploded views of mortise and tenon joints. The question required candidates to '*...show the marking out for a mortise and tenon joint*'. Some candidates did show the marking out with varying accuracy.

Question 9

Many candidates achieved at least 1 mark for selecting the appropriate centre lathe operation.

Question 10

Candidates should be able to name different plastics that are used to make a wide variety of products. However, this does not appear to be the case. Melamine is used to make tableware, PVC to make plumbing fittings and nylon to make curtain rails. These three plastics are basic materials. In addition to these, there were alternative plastics for each of the products that would also have been correct answers.

Section B

Question 11

This was the least popular question attempted by candidates.

- (a) The majority of candidates achieved at least 2 marks for this question. While the uses of the scriber and scroll saw were straightforward to most candidates, use of the file and wet and dry paper were not. The file would be used to remove the waste remaining after the scroll saw cut out the shape. Wet and dry paper is used as part of the finishing process.
- (b) Most candidates understood the dangers of using acrylic cement and provided sensible safety precautions, the most common correct answers included: adequate ventilation, wearing gloves to protect hands and wearing safety glasses to shield the eyes.
- (c) The question asked candidates to '*... give **two** properties of aluminium that make it suitable for the photograph holder*'. Most candidates gave properties that applied to aluminium generally, but **not**

specifically to the photograph holder. Weight and an ability not to rust are not relevant to a photograph holder. The best answers referred to it being malleable, self-finished and attractive.

- (d) This question required candidates to demonstrate their knowledge and understanding of basic metalworking techniques in order to cut out the square hole in the 1mm thick aluminium sheet. While many candidates achieved a mark for drilling a hole in the sheet first, many of the stages described following this were inaccurate and lacked any real understanding of working with metal. Many candidates recognised that the shape would then be sawn out but described use of coping saws or fret saws that can only be used to cut wood. Many candidates used tin snips, which had some credit, but which would require filing to complete the square shape. Often the filing stage was not provided.
- (e) To finish aluminium to a high quality requires a basic knowledge of metal finishing techniques and to apply these in the correct sequence. Many candidates started by filing the aluminium. This was incorrect as it would inflict scratches to the surface. Wet and dry (silicon carbide) paper was used with some candidates correctly specifying different grades. Some candidates correctly described how a polishing mop or 'buffing wheel' could be used with polishing compound to produce a high quality finish. The use of metal polish (Brasso) was also an acceptable stage.
- (f) The majority of answers failed to address the key element of the question: '*A batch of twenty identical aluminium photograph holders...*' There were some technically good answers using a wooden block as a former with a mallet or hammer **and** scrap wood (to prevent bruising to the aluminium) to produce a single photograph holder but which would not have been easy to reproduce in quantity.
- (g) (i) The benefits of using CAD to design the photograph holder are that it allows on-screen modelling, it can produce fully dimensioned drawings, a high degree of accuracy, clients are able to view design proposals electronically and that data can be downloaded to connected CNC machines. Many answers stated some benefits of CAD that could also be applied to, and therefore were no different to, traditional drawing methods.
- (ii) The most common benefits of CAM included speed, accuracy and the capacity to mass produce accurately and consistently.

Question 12

- (a) Many candidates described a property of solid wood that made it suitable for the planter; the most common correct answers including its resistance to outdoor use, its durability and attractive appearance.
- (b) The majority of candidates named two suitable solid woods; the most common hardwoods being oak, teak and mahogany and softwoods such as pine and cedar.
- (c) The majority of candidates named paint, varnish and oils as suitable finishes for the planter. Some candidates suggested wax which would not be hardwearing or durable.
- (d) There were many good answers to the first part of the question: the modification to make it easier to carry. The majority of candidates showed either an applied handle fitted to the planter or some sort of 'cut-outs' for a person's hand to fit into. The materials and/or constructional details, asked for in the second part of the question, were often either technically inaccurate or unclear due to poor quality sketches. Some candidates showed the modification as a set of wheels for which no credit was given.
- (e) (i) With a large allocation of 12 marks available to candidates for this question it was essential that they read the question carefully **before** attempting to answer. There were numerous very good answers that addressed **each** of the methods of construction: wood screws, nuts and bolts and finally, dowels and adhesive. Many candidates did set out their answers clearly but there were many sketches where it was difficult to understand which part of the planter was being assembled using which of the three methods. Many candidates showed the sides joined to the ends using screws. Screwing into end grain of solid wood is not good practice, was not rewarded. The better option was to use dowels and adhesive. The use of nuts and bolts was also sometimes impractical.

- (ii) Most candidates achieved marks for providing at least some accurate stages for a customer to assemble the planter.

Question 13

- (a) The majority of candidates identified three areas of research for the magazine rack; the most common relating to the sizes of magazines, the quantity to be stored, the location, customer preferences and existing products. Where candidates gave the length, width and thickness of magazines only 1 mark was awarded. Weight was not considered to be relevant.
- (b) Most candidates correctly gave the benefits of using a template as speed and repetitive accuracy.
- (c) (i) Most candidates described how the strip heater or line bender would be used to soften the acrylic. There were two essential features of the bending process: the use of an accurate mould or former and a method of retaining the acrylic while it cooled. Simply placing the acrylic under running water was not sufficient and it required some form of retention through clamping.
- (ii) Many candidates recognised that the line bender or strip heater softened a specific area of the acrylic but that the oven heated the whole area making it more difficult to shape and the possibility of it deforming.
- (d) (i) Very few candidates described how some form of jig could be used or that the strips could be taped together and sawn to the same length. Many answers referred to the use of a template which would function exactly the same as measuring with a rule. There was also an over-dependence on use of laser cutter to do perform the task. This was not necessary at all.
- (ii) There were some excellent answers to this question. Many candidates achieved marks for showing the strips secured by means of G cramps and were awarded 2 marks. For the 'extra' 2 marks candidates needed to show how the strips could be spaced equally. The best answers showed additional 'spacer' strips inserted to provide accurate spacing.
- (e) (i) Candidates needed to replace the acrylic ends with a manufactured board as solid wood would result in short grain and subsequent splitting. The base and strips could be replaced with solid wood. There were some designs that included the innovative use of 'flexiply' for the base and others that laminated the base to produce a single piece of material. Many responses included **some** good elements but only a minority gained maximum marks for the redesigned rack.
- (ii) There were many excellent answers to this question. Generally, candidates showed a good understanding of environmental issues when explaining why wooden magazine racks could be considered to be more environmentally friendly. The best answers referred to the sustainability of wood compared to plastics and the difficulties concerning the recycling of some plastics.

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. A small number of candidates had started one question and then gone on to complete a different question.
- Candidates should be reminded that legible handwriting and clear sketches with annotation are in their interest. Use of pencil for diagrams is to be encouraged as errors can be erased if necessary.
- It is important that responses are produced only in the allocated response area for the question; however, if a response is placed in a space on a page other than the intended one, candidates should add an arrow from the correct space to the actual position of the response. If more space is required extra sheets can be attached to the booklet.
- Unqualified single word or short responses such as 'cheap' and 'fast' and 'easy' will gain no credit.
- All working should be shown for calculation questions.
If only the answer to the calculation is given, full marks are awarded but no part marks for the stages in arriving there can be awarded.
- A small number of candidates had failed to offer any sort of response to parts of a question; candidates should be encouraged to attempt an answer that could potentially gain a mark rather than leaving a blank space.

General Comments

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

Communication and presentation were generally clear, in both written and sketched responses. In **Question 7 of Section A** excellent sketches were seen to illustrate the effects of loading a concrete beam.

Once again a number of examples of single word or short responses were seen, terms such as 'cheap' 'light' and 'insulator' were offered as benefits of plastics over wood in **Section A Question 3**. Both of the materials could be described as insulators against heat but only plastics are generally used as electrical insulators. Candidates should be advised that short or single word responses must be qualified in order to gain a mark, e.g. plastics can be moulded to form a casing.

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

Comments on Specific Questions

Section A

Question 1

- (a) The majority of candidates recognised the light dependent resistor or LDR; the thermistor was identified as a thermometer in a number of cases. In this question the precise names were required; light or heat sensor was not enough to gain the marks.

- (b) An equal proportion of candidates fell in each of the mark categories, 0, 1 or 2. Those who knew that the resistance changed in inverse proportion to light gained both marks. Those who stated that the resistance value followed the light level, as one went up so did the other, only gained one mark. Those who simply interpreted the graph could gain a mark from noting that the resistance had fallen.

Question 2

- (a) A high proportion of correct answers were seen. Those who lost marks had generally not added the values correctly or were uncertain about the multiples, $k\Omega$ or $M\Omega$.
- (b) A high proportion of correct answers were seen, showing the resistors connected in series.

Question 3

As noted in the General Comments section marks were lost through the use of unqualified one word responses. A high proportion of valid answers gained the mark. These included reference to no finish being needed and ease of forming into a shape.

Question 4

- (a) A high proportion correctly identified the first order lever.
- (b) The type of motion in the can opener was rotary; those who identified it as oscillating were allowed a mark although strictly oscillation involves movement in an uninterrupted way.
- (c) The question asked for force arrows to show where effort should be applied for the maximum load; this was at the end of each handle. Those who placed the arrows in the centre of the handle only gained a single mark.

Question 5

Knowledge of gear wheels and the effects of gearing were generally good; the majority of candidates gained at least one mark.

Question 6

Where explicit examples had been given the majority of responses gained a mark. Those who relied on the generic responses, such as, pneumatic or potential, or any form of energy that cannot be stored, did not gain the mark.

Question 7

The question asked why the reinforcing rods are positioned below centre. A number of responses lost marks through not addressing that point. Those who used their sketches to illustrate the result of loading a beam with compression at the top and tension on the lower face were rewarded.

Question 8

This question differentiated well between candidates. The majority saw that the force at **B** was compression. The centre rod **A** was described as a 'steel tie rod', this should have led to the answer being that the tie rod is in tension. Very few responses noted that the force at **C** would be bending due to the load from the roofing material.

Question 9

Comparison between carbon fibre as a composite material and steel were generally well known and most candidates correctly identified at least one advantage. Over half of the candidates gained marks for giving two advantages.

Section B

Question 10

- (a) (i) Most responses correctly identified the frame structure.
- (ii) Approximately 30% of responses did not know that the structure was being kept rigid by triangulation.
- (iii) There was some confusion between struts and ties but the majority of responses correctly identified the gusset plate.
- (iv) To illustrate the result of shear force acting on a bolt or rivet a sketch should have shown two plates held in place by the bolt or rivet. In some cases the bolt had been omitted but marks were still gained for showing the opposing forces that would cause shear. The best responses showed three views, the plates and bolt, followed by a drawing showing the force arrows and the final view showing the sheared bolt.
- (b) This question relied on the candidates knowing the stress/strain curve for mild steel. In a number of cases the curve was correctly drawn but the elastic limit and upper yield point had been transposed.
- (c) (i) The first part of the calculation involving conversion from kg to Newton was generally completed accurately. The cross sectional area of the cable in many cases had errors in the units used or use of dimension rather than radius. Small variations in the value of pi were allowed in the final stage of the calculation. Almost half of the responses gained full marks.
- (ii) Again in this part a number of errors were seen in the units used; one of the values had to be converted to match the other. Where this was done the final answer was generally correct.
- (d) (i) The correct response was to identify the hole nearest to the top of the beam as compressive forces would not do as much damage as tensile forces in the lower half.
- (ii) This part of the question was only answered correctly by higher order candidates. Three valid points gave all of the marks; a full explanation of one of two given points also resulted in full marks.
- (e) A number of responses failed to gain any marks as they had devised pulley systems rather than the required lever system. The better responses showed a method that gave equal lift to the inspection cover spread across both handles. The lever needed a fulcrum in order to operate and a frequent fault with the systems drawn was to use a schematic drawing of a fulcrum rather than one that would be functional. Use of shear legs was one valid method of providing a fulcrum. There were two marks available for a calculation showing that the effort required would be 100 N or less. In too many responses the calculation resulted in a lever with an unrealistic length, in some cases in excess of 20 m.

Question 11

- (a) (i) The majority of responses gained either one or both marks for this part. Reference to turning the adjusting handle generally gained the first mark. The second mark was for reference to any other moving part of the adjusting system.
- (ii) The lubrication points were correctly identified in most cases. Surprisingly a number of candidates had failed to offer any response to this part.
- (iii) Lubricating oil was the required response but those who put either 'oil' or 'grease' were allowed a mark.
- (iv) Most gave at least one valid reason for lubricating moving parts; giving a full explanation or mentioning a second reason was seen less frequently.
- (b) (i) Very few candidates appeared familiar with a single acting cylinder. The fact that it is pneumatically powered in only one direction and returns under spring pressure was rarely recognised.

- (ii) Differences between single and double acting cylinders were known only by a few. Having controllable speed in both directions and remaining outstroked when the air is cut off were not widely recognised.
- (c) (i) This part was generally answered well, the first example which was an eccentric was known to fewer than the pear/egg shaped cam or the snail cam.
 - (ii) The circle was correctly drawn around the snail cam in the majority of cases.
- (d) (i) Most responses noted that a ball bearing will reduce friction; reduced need for lubrication was allowed though strictly this only applies if the bearing is sealed for life.
 - (ii) Very few candidates understood the most important feature of a compound gear train in that two different diameter gears will be fixed to rotate on the same shaft, allowing larger changes in gear ratio in a small space.
 - (iii) This calculation was generally completed accurately with one mark awarded for the correct ratio being used and a second for the speed calculation.
- (e) Just under half of the responses scored no marks in this part. Those that did respond generally knew a standard method of tensioning a belt and were able to show it using notes and sketches. Those that chose the use of a jockey wheel/idler pulley generally gained all three marks.

Question 12

- (a) (i) The majority of candidates knew about the toxic nature of lead and gained the mark.
 - (ii) The purpose of flux was not well known. Breaking down of surface tension, cleaning a joint with an active flux or prevention of oxides forming were the required answers. Very few candidates mentioned any of these. Those who mentioned allowing the solder to flow were given credit.
 - (iii) The obvious risks of burns and eye damage were given with a number of responses noting the danger of eye damage from solder 'spitting'.
 - (iv) Use of goggles to prevent eye damage was a common response that gained credit. The wearing of gloves was not awarded a mark as it would be impractical as a defence against burns; using the soldering iron stand and taking care not to touch the hot parts of a circuit were acceptable.
- (b) (i) Just over half of the responses showed understanding of the term 'common cathode'.
 - (ii) A high proportion of candidates knew which segments would be lit to display a '5' and the majority gained the three available marks. Very few had connected the common cathode low with a '0' in the box for the fourth mark.
 - (iii) There was little understanding shown of the relevance of the 2V drop on each segment. Those who did correctly deduct this from the supply voltage generally gained all three marks for a correct calculation.
 - (iv) Most responses gained both marks for this part. The smaller size of the DIL package was a common response and the fact that individual resistors could be changes appeared in a number of the benefits for separate resistors.
- (c) Approximately half of the answers given were totally correct and gained two marks. A common error was to treat the tracks as connections and put a curve in one of the lines to show a crossover with no connection. There were a number of correct solutions that could have been used.
- (d) Those that were aware of how a pull down resistor works generally got all of the marks. Most errors occurred in the connection of the resistor; the connection from switch to positive rail was generally correct.
- (e) (i) The shape of an astable signal was well known and in most cases accurately drawn.
 - (ii) Almost all of the responses gave a 555 timer IC as being able to provide an astable signal. NAND or NOR gates could also have been used, as could a PIC IC.

DESIGN AND TECHNOLOGY

Paper 0445/05
Project

General comments

The work that Centres do in preparing their candidates for moderation and the care and attention over the administrative tasks required to accurately complete documentation is appreciated.

The 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 projects chosen were appropriate. A large number of candidates selected interesting and challenging briefs. Most candidates selected a brief that allowed them to demonstrate appropriate manipulative skills and show an understanding of materials and their characteristics in relation to their use.

An increasing number of candidates made very good use of clients or 'experts' to give specific information relating to the particular need. They also helped when developing the specification and assisted in the testing and evaluation of the final product.

The majority of candidates managed their time effectively to ensure that a functional product was completed leaving sufficient time for appropriate testing and evaluation.

Some Centres included individual candidate assessment sheets with supporting comment. These were very helpful for Moderators to see how and where marks were awarded.

Centres are reminded that both the MS1 form and the Coursework Assessment Summary Form 0445/05/CW/S/10 should be carefully completed and submitted with the sample.

Some Centres, after internal moderation, inserted a different total mark on the Coursework Assessment Summary Form. It is important to indicate 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.

In a small number of cases, work was submitted by Centres where candidates produced very similar research, design and practical outcomes. Centres are encouraged to allow scope for candidates to pursue individual projects.

Group projects are not permissible unless there is clear evidence of the work produced by each individual candidate.

It is recommended that this report is read in conjunction with the Moderator's Comments on School Based Assessment of Coursework.

Comments on specific headlines

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

Candidates generally completed this section well and it was assessed accurately by most Centres. In most cases candidates explained the need fully, using photographs where appropriate, and described the user

group before producing a clear and detailed design brief. Some Centres were lenient in awarding marks in this section: a brief statement of intent 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

Most candidates produced concise, focused and relevant research. Some candidates produced very large amounts of information on materials, processes, the majority of which was not related to the brief.

When candidates analyse existing products, they should be encouraged to highlight the particular design strengths and weaknesses and use this information both when generating a specification and when designing.

It is important that candidates obtain information which will guide their designing. This will include essential information such as the details and dimensions of items to be stored or fitted into the product.

When including anthropometric data, candidates should only select those particular anthropometric features that apply to their brief. A number of candidates gathered the views of potential users through the use of well-structured and carefully worded questionnaires.

To achieve the higher mark range in this section, candidates must include all relevant information such as important sizes, and only include research that is related to their brief.

Specifications were generally detailed and justified; most candidates included the specific details of the requirements for their product.

3. Generation and exploration of Design Ideas

Many candidates produced well-presented, innovative and creative design proposals. Whilst the majority of Centres assessed this section accurately and in line with Cambridge standards, some were lenient. To access the middle and higher mark range, candidates must produce a wider range of different, well-annotated possibilities.

Candidates must clearly evaluate their ideas with reference to the specification.

4. Development of Proposed Solution

A number of Centres were too generous in their allocation of marks for this section. Candidates are required to show from their evaluation of their initial design ideas the progression of their thinking and their decision-making regarding the development of a final idea. They should include details of materials and construction methods, through trialling, testing and modelling. A number of candidates made very good use of 2D and 3D modelling and computer aided images to develop their design proposal.

5. Planning for Production

Most candidates produced appropriate, dimensioned working drawings and these were generally of a good standard. Some candidates made very good use of CAD.

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

A good test of the quality of a working drawing is whether there is sufficient detail for the product to be manufactured by someone else.

6. Product Realisation

Most candidates use their time effectively and complete the manufacture of a practical outcome. There were many examples of outstanding, high quality manufactured products presented.

Most candidates used a number of good quality photographs to show full details of their product. Many gave photographic evidence of key stages of manufacture of the product to emphasise particular features and the quality of making.

Centres must ensure that candidates include clear evidence of their practical outcome. Marks cannot be accepted for the practical realisation if there is no photographic evidence of the candidate's work.

Centres are reminded that the marks allocated to making should reflect three aspects: the overall complexity of the product, the level of skill demonstrated by the candidate, and the quality of the making of the final product. In some cases scale models are submitted that are not of a sufficient quality to access the higher mark range.

Candidates are advised to ensure that their practical outcome can be used in the environment for which it is designed and can be fully tested and evaluated.

Most Centres were accurate in awarding marks commensurate with the quality of work produced.

7. Testing and Evaluation

Some candidates achieved the higher mark range by testing the product in its intended environment and producing detailed evaluations of successes and possible weaknesses.

Most made clear reference to the specification. A number of candidates included third party evaluations from clients or potential users of the product, which is to be encouraged.

A number of Centres tended to be slightly lenient in assessing this section. To access the higher mark range, candidates must test and evaluate the product, in its intended environment where possible, and produce detailed and meaningful conclusions leading to proposals for further development.