

# DESIGN AND TECHNOLOGY

---

Paper 0445/05  
Project

## General comments

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

Candidates could improve further by including only relevant evidence in their folders. A concise and detailed folder making best use of each page is recommended.

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.

Most Centres applied marks consistently and accurately and were in line with the standards set by the Awarding Body. There were a few instances however, where individual candidates within the sample submitted were awarded disproportionate marks resulting in an inaccurate rank order. Presenting the candidates in the correct rank order is vital. When more than one teacher in a Centre is marking internal assessments, the Centre must make arrangements for all candidates to be assessed to a common standard and that an accurate rank order is agreed.

Moderators take great care in ensuring that all candidates are awarded marks in line with approved standards.

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

## Comments on specific sections

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

Most Centres awarded marks accurately for this section. Some Centres need to improve on how they award marks, a brief statement of what is to be designed will not access the middle or higher mark ranges. To access the higher mark range, candidates must analyse the need in detail and consider the requirements of possible users.

The design opportunity and design brief were communicated well. Candidates would benefit from looking at the needs and expectations of the selected user group in more detail. It would also be useful to consider the type of environment in which the designed product will be used and highlight key issues.

## **2. Research into the Design Brief resulting in a Specification**

Most candidates produced focused and relevant research. Some candidates need to improve by producing relevant information that is related to the brief. In order to access higher marks, research must be more focused on the chosen situation and specifications should state the main functions and qualities of the product. For example, candidates designing storage for cosmetic items should research the range of measurements of items to be stored.

Most candidates analyse existing products as part of their research. Candidates would improve by being able to draw out details that will help them when designing. Candidates should highlight the design strengths and weaknesses and use this information when generating a specification and when designing.

Good examples of research focused on the key, relevant information which was necessary to support the candidates' designing. High level personal observation and analysis when researching lead to a detailed and relevant specification.

Some specifications were clear, detailed and justified. In order to access higher marks, candidates need to ensure that their specification is relevant to the product that they wish to design.

## **3. Generation and exploration of Design Ideas**

There were many examples of well-presented, innovative and creative design proposals. Most Centres assess this section accurately and in line with CIE standards.

Some candidates needed to improve by clarifying why ideas had been selected for further development. To access the higher mark range, a wide range of different, well-annotated possibilities is required. Ideas should be evaluated on their suitability for further development and should refer to the specification.

## **4. Development of Proposed Solution**

Some Centres could improve on how they award marks in this section.

Many candidates had clear evidence of their developmental work. Some candidates need to improve by providing relevant evidence in their folders.

Having established which design is to be developed and made, candidates need to work out the most suitable materials and methods of construction. They need to explain why these specific materials have been selected. The number of components and their sizes need to be established.

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

## **5. Planning for Production**

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

To achieve the highest mark ranges, drawings should include all details necessary such as key dimensions, additional fixtures used e.g. hinges and screws, and finishes applied. The planning section should also include, where appropriate, a cutting list showing selected materials and quantity.

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

Candidates should be reminded to include details of specific tools, equipment, adhesives, and finishes.

## 6. Product Realisation

Many Centres continue to be accurate and fair in awarding marks commensurate with the quality of work produced.

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

Some candidates produced scale models of potentially large products. In order to achieve higher marks, these models needed to be constructed to the standard required. 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. Architectural models were generally made to a high standard and were appropriate for user/client testing and evaluation.

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

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

## 7. Testing and Evaluation

Testing and evaluation was covered well, with many candidates clearly showing detailed testing against the original design criteria. Where appropriate, candidates should test the product in the environment in which it is to be used, or by users or clients who are likely to use the product. It is beneficial to include these user trials and record the opinions of the consumer, summarising the feedback and suggesting modifications. There should be clear photographic evidence of testing in this section.

Centres are assessing this section accurately but some tend to be too lenient.

Many candidates tested their products against their original specification. To achieve higher marks, candidates needed to suggest proposals for further development.

Photographic evidence should be included in this section.

# DESIGN AND TECHNOLOGY

---

Paper 0445/11  
Product Design

## Key messages

In their responses to part **(d)**, candidates should be encouraged to provide justified evaluations on both positive and negative aspects of the proposed design ideas. Descriptions of the three design ideas being proposed cannot be awarded marks as evaluation responses 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. Manufacturing methods are required as responses to part **(g)**.

## General comments

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

**Question 1** was the most popular question, followed by **Question 2** with no candidates choosing **Question 3**.

## Comments on specific questions

### **Question 1**

Candidates appeared to understand fully the design requirements of a product for holding condiments in a cafe. It was clearly a design idea with which they were familiar in their normal day-to-day experiences. Suggested ideas showed evidence of original thinking with imaginative outcomes.

- (a)** Candidates were able to identify four functional points required of the product in addition to those outlined in the question. Successful responses to this introductory part of the question included: easy to access, portable, hygienic, easy to clean, minimal size, matches café environment, etc.
- (b)** Candidates had no difficulty showing two ways by which products could be stacked and these included: base/top inside top/base, rebates, pins/lugs, location slots, vertically, horizontally, etc.
- (c)** Responses to this part of the design questions have improved over recent examinations and the majority of candidates were able to draw three different ideas. Successful candidates used the whole space provided to produce clear drawings using appropriate techniques so that design details were clear to the viewer. Marks were awarded for the quality of communication techniques so drawings should be enhanced through the use of shading or colour and appropriate annotation added. Marks were also awarded for the suitability of ideas and successful candidates explained their thinking and added detail as they progressed.
- (d)** The majority of candidates evaluated effectively each of their design ideas in turn and then identified the chosen idea with reasons for choice stated. Many candidates had produced a table, marking or ticking each design idea against specification points. Candidates are required to comment on particularly strong and weak aspects of each of their design ideas before making their choice.

- (e) There was evidence of good quality drawing in the presentation of the proposed design solution and constructional detail was provided, either as part of the main presentation or through annotation or other surrounding smaller drawings. Candidates are free to choose their own drawing method so long as all constructional detail is clear to the viewer and significant dimensions are included.
- (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.
- (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. In order to be awarded marks, it is important that the process is specific to the chosen product and not general in nature.

### Question 2

This question clearly appealed to those candidates following the Graphic Products option and most appreciated that a portable promotional board 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, menus will not blow away, easy access to menus, lightweight to carry, easy to fold/store, etc.
- (b) The majority of candidates were familiar with different methods of holding menus and appropriate suggestions included: vertical slot, horizontal 'letter box' slot, under flap, under clip, elastic band, etc.
- (c)
- (d)
- (e) See **Question 1 (c) – (g)**
- (f)
- (g)

### Question 3

There were no responses to this question.

# DESIGN AND TECHNOLOGY

---

Paper 0445/12  
Product Design

## Key Messages

In their responses to part **(d)**, candidates should be encouraged to provide justified evaluations on both positive and negative aspects of the proposed design ideas. Descriptions of the three design ideas being proposed cannot be awarded marks as evaluation responses 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. Manufacturing methods are required as responses to part **(g)**.

## General Comments

Successful candidates followed the design process as set out on the A3 answer sheets showing that they could apply their design skills in an imaginative and creative way. Candidates tended to respond well when they focused their answers on the precise stage of the design process as set out on the A3 answer sheets. The three questions presented fairly open design situations based on situations in hotels whereby candidates could apply specific areas of knowledge and interest developed during the period of their study. **Question 1** was the most popular question, with smaller numbers of candidates answering **Question 2** and **Question 3**.

## Comments on Specific Questions

### **Question 1**

Candidates appeared to understand fully the design requirements of a portable unit for drink making items in a hotel bedroom and it was clearly one with which they were familiar in their normal day-to-day experiences. Suggested ideas showed evidence of original thinking with imaginative outcomes.

- (a)** Candidates were able to identify four functional points required of the portable unit in addition to those outlined in the question. Successful responses to this introductory part of the question included: easy access to items; hygienic; easy to clean; items kept separate; waterproof; heatproof; matches hotel/room environment; easy to carry; electrically safe; etc.
- (b)** Candidates had no difficulty showing two methods of protecting the portable unit against water damage and these included: made from waterproof materials; laminated with a plastic; cover surface with glass/plastic/non-ferrous metal/ceramic tiles; plastic coating; paint/varnish; etc.
- (c)** Responses to this part of the design questions have improved over recent examinations and the majority of candidates were able to draw three different ideas. Successful candidates used the whole space provided to produce clear drawings using appropriate techniques so that design details were clear to the viewer. Marks were awarded for the quality of communication techniques so drawings should be enhanced through the use of shading or colour and appropriate annotation added. Marks were also awarded for the suitability of ideas and successful candidates explained their thinking and added detail as they progressed.

- (d) The majority of candidates evaluated effectively each of their design ideas in turn and then identified the chosen idea with reasons for choice stated. Many candidates had produced a table, marking or ticking each design idea against specification points. Candidates are required to comment on particularly strong and weak aspects of each of their design ideas before making their choice.
- (e) There was evidence of good quality drawing in the presentation of the proposed design solution and constructional detail was provided, either as part of the main presentation or through annotation or other surrounding smaller drawings. Candidates are free to choose their own drawing method so long as all constructional detail is clear to the viewer and significant dimensions are included.
- (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.
- (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. In order to be awarded marks, it is important that the process is specific to the chosen product and not general in nature.

### Question 2

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

- (a) Most candidates were able to suggest four additional functional points to those identified in the question and successful responses included: impact in reception area; light in weight; appropriate size; colourful; counter top or floor standing; easy to assemble; include details of walks; etc.
- (b) The majority of candidates were familiar with different methods of attracting attention on a promotional unit of this type and appropriate suggestions included: motor/pendulum/cam movement; sound; lights; video; bold lettering/colour; etc.
- (c)
- (d)
- (e) See **Question 1 (c) – (g)**
- (f)
- (g)

### Question 3

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

- (a) Additional points about the function of the mobile case carrying device included: balance; weight issues; size/shape; methods of securing cases; no damage to cases; ease of use; appropriate for hotel environment; etc.
- (b) Most candidates were able to identify two mechanisms that would lift heavy objects including: pulley systems; gear systems; rack and pinion; winch; track system; pneumatics system; ramp; moving belt; etc.

(c)  
(d)

(e) See **Question 1 (c) – (g)**

(f)  
(g)



# DESIGN AND TECHNOLOGY

---

Paper 0445/13  
Product Design

## Key messages

In their responses to part **(d)**, candidates should be encouraged to provide justified evaluations on both positive and negative aspects of the proposed design ideas. Descriptions of the three design ideas being proposed cannot be awarded marks as evaluation responses 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. Manufacturing methods are required as responses to part **(g)**.

## General comments

Successful candidates followed the design process as set out on the A3 answer sheets showing that they could apply their design skills in an imaginative and creative way. Candidates tended to respond well when they focused their answers on the precise stage of the design process as set out on the A3 answer sheets. The three questions presented fairly open design situations, based on the feeding of animals whereby candidates could apply specific areas of knowledge and interest developed during the period of their study. **Question 1** was the most popular question, followed by **Question 2** with a fairly small number of candidates choosing **Question 3**.

## Comments on specific questions

### **Question 1**

Candidates appeared to understand fully the design requirements of a bird feeding station. It was clearly a design idea with which they were familiar in their normal day-to-day experiences. Suggested ideas showed evidence of original thinking with imaginative outcomes.

- (a)** Candidates were able to identify four functional points required of the bird feeding station in addition to those outlined in the question. Successful responses to this introductory part of the question included: easy access for birds, hygienic, easy to clean, food does not blow away, water does not spill, access to top up food and water, predators kept away, fits garden environment, etc.
- (b)** Candidates had no difficulty showing two ways of holding bird food and/or water in place and these included: recesses in surface, edge around feeder, cover on feeder, receptacles fixed down/screwed/clipped in place, etc.
- (c)** Responses to this part of the design questions have improved over recent examinations and the majority of candidates were able to draw three different ideas. Successful candidates used the whole space provided to produce clear drawings using appropriate techniques so that design details were clear to the viewer. Marks were awarded for the quality of communication techniques so drawings should be enhanced through the use of shading or colour and appropriate annotation added. Marks were also awarded for the suitability of ideas and successful candidates explained their thinking and added detail as they progressed.

- (d) The majority of candidates evaluated effectively each of their design ideas in turn and then identified the chosen idea with reasons for choice stated. Many candidates had produced a table, marking or ticking each design idea against specification points. Candidates are required to comment on particularly strong and weak aspects of each of their design ideas before making their choice.
- (e) There was evidence of good quality drawing in the presentation of the proposed design solution and constructional detail was provided, either as part of the main presentation or through annotation or other surrounding smaller drawings. Candidates are free to choose their own drawing method so long as all constructional detail is clear to the viewer and significant dimensions are included.
- (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.
- (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. In order to be awarded marks, it is important that the process is specific to the chosen product and not general in nature.

### Question 2

This question clearly appealed to those candidates following the Graphic Products option and most appreciated that packaging for bird food would need to be produced through the use of semi resistant materials.

- (a) Most candidates were able to suggest four additional points to those identified in the question and successful responses included: easy to store, attractive colour/shape, manageable size, easy to hold/grip, easy to open, keeps food dry/fresh, etc.
- (b) The majority of candidates were familiar with different resealing methods that could be used and appropriate suggestions included: fold in/over flap, plastic screw cap, plug, clip, zip, etc.
- (c)
- (d)
- (e) See **Question 1 (c) – (g)**
- (f)
- (g)

### Question 3

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

- (a) Additional points about the function of the feeding device included: hygienic, easy to clean, easy access for animal, easy to fill, quiet in use, does not scare cat, keeps food fresh, etc.
- (b) Most candidates were able to identify two ways of controlling the supply of food including: flap, sliding door, conveyer belt, bucket, Archimedean screw, etc.
- (c)
- (d)
- (e) See **Question 1 (c) – (g)**
- (f)
- (g)

# DESIGN AND TECHNOLOGY

---

Paper 0445/21  
Graphic Products

## Key messages

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

## General comments

Candidates were required to complete all questions in **Section A (A1, A2 and A3)** and then go on to answer *either B4 or B5* from **Section B**. 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 parts of **Question A3** or answered all the questions. Candidates would benefit from reading instructions carefully.

The standard of work could have been further improved on. There are areas of the syllabus in which additional knowledge and understanding are needed, for example, candidates must be able to draw simple solid objects in Planometric projection. Candidates must also be able to recognise the appropriate use of Vacuum forming plastics. In addition, candidates need to understand the Industrial process of Die cutting (Stamping) and Embossing card. The development of nets for packaging is also an area for improvement along with the statutory symbols and other customer information that are required to be added to the surface of the package.

## Comments on specific questions

### **Question A1**

*Plastic drinks cup, lid and straw*

A pictorial image of a plastic drinks cup was given. Many candidates added to the started side view, the outline of the lid. Most candidates added an outer circle correctly in the plan view. Full marks were awarded to candidates who used dotted lines for the three inner circles correctly in the plan view.

### **Question A2**

- (a) This question asked the candidate to name a method of manufacturing for the lid. Acceptable answers were Vacuum forming and Blow moulding.
- (b) Candidates were asked to draw the given straw with a 45° bend. Most candidates drew the centre line at 45° but did not make the upper part of the straw above the bend the same thickness as the existing straw. The top of the straw needed to have a break symbol drawn that was consistent with that given at the top of the straight straw.
- (c) The given cup is wider at the top because it has been moulded. To facilitate ejection from the mould, the sides of the cup must have 'draft'. An advantage of this is that it improves grip for the user and prevents the cup from slipping through the users fingers.

### Question A3

#### *Face shape*

To gain higher marks, candidates needed to attempt all parts of this compulsory question.

- (a) The question asked candidates to draw a planometric view to a scale of 2:1. In planometric projection, the front face is drawn in true view and the depth is drawn away from the face at 90°. This system of projection makes the drawing of circular parts on the face much easier as they can be drawn with compasses in their true shape. Two circular holes were required. In this projection, the depth of the material would be visible inside both holes.
- (b) Candidates were asked to show a method of attaching the foam board hexagon face to the cup. Many methods of gluing the face to the side or base were given. The acceptable adhesive was PVA as other adhesives would 'melt' the foam board.
- (c) The question asked why the face would be added. Correct responses included: appeals to children, adds interest, looks nicer, used for advertising.

### Question B4

#### *Card sleeve for plastic pot*

This question was derived from an actual 'Graphic Product' used for paste/pate products packaged in plastic pots.

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

- (a) Candidates were asked to complete the development (net) of the card sleeve.
  - (i) Many candidates added the surface above the top given surface to the correct width. The rectangle below the given surface was drawn by many candidates to the correct width. The length was determined by the drawing of the lower face. The lower face had to be to the same overall dimensions of the upper face and a quadrant drawn to the top right hand corner.
  - (ii) This part of the question required the candidate to add the missing glue tab. The location was given by a clue in the existing drawing. The top given surface had a fold line indicated.
  - (iii) Many candidates completed the lettering by adding the **S H R** and **U**.
- (b) The acceptable method of cutting out 10 000 development (nets) is by using the commercial process of 'Die cutting'.

A die stamp is made to the cut profile that has a sharp metal edge (blade). Vertical pressure is made on the card by the blade and the profile is cut out. The die stamp can also have 'blunt' blades that mark and crease for the folds. Waste is removed and the development (net) is ready for hand/machine folding.
- (c) Sketches and notes were required to show what is meant by embossing. Many candidates gave illustrated responses to a shape or letter being 'raised/pressed in' to the surface of card.
- (d) The symbol shown was an international symbol to show that the material can be recycled. The number denotes that it is a specific plastic (polystyrene).

## Question B5

### *Package for biscuits*

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

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

- (a) Many candidates completed a two point perspective view of the package. Some candidates did not use both VP1 and VP2 for their solution. The edge and the closure proved to be the two most difficult parts for many candidates. The three lines denoting the inner edges when viewed through the window, were accepted to the candidates own solution.
- (b) (i) Many candidates gave cellophane or acetate for the window. Other acceptable answers included: polypropylene, polystyrene, PET, HIPS.  
  
(ii) Many good examples of attaching the clear plastic windows to the package were seen. Tools for cutting and the use of a cutting mat/steel rule appeared in many responses. High scoring responses showed the plastic sheet larger than the opening in the package and the correct application of adhesive/double sided tape.
- (c) (i) Candidates were required to complete a list of information that should be printed on the package. Acceptable answers include: Bar code, Product name, Recycle symbol, does not contain nuts, estimated weight.  
  
(ii) The hole shown in the closure of the package is to enable the product to be hung on a point of sale hook/peg.

# DESIGN AND TECHNOLOGY

---

Paper 0445/22  
Graphic Products

## Key messages

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

## General comments

Candidates were required to complete all questions in **Section A (A1, A2 and A3)** and then go on to answer **either B4 or B5** from **Section B**. 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 parts of **Question A3** or answered all the questions. Candidates would benefit from reading instructions carefully.

The standard of work could have been further improved on. There are areas of the syllabus in which additional knowledge and understanding are needed, for example, candidates must be able to draw shapes with arcs in isometric. Candidates must also have an understanding of the process of manufacture of concept models from foam board. In addition, candidates need to know how images of shapes can be obtained for modelling, by using a computer to search and capture. Knowledge of commercial printing methods is also an area for improvement.

## Comments on specific questions

### **Question A1**

#### *Car Transporter*

A pictorial image of a cab and trailer of a model car transporter was given. Candidates were asked to complete the given views. One wheel needed to be added to the correct size and in projection on the end view. Two missing lines were on the plan (back of cab and bottom of the windscreen) and two on the end view (top of engine and top of chassis).

### **Question A2**

- (a) A pictorial view of the trailer lowering mechanism showing the links was given. Candidates were asked how the card strips could be joined allowing them to move. Correct answers showed a paper fastener or plastic 'scrivet'.
- (b) A schematic diagram showed the path taken by the link mechanism. Candidates were asked to show the path of point **A** as the point **X** folded down to a horizontal position around **Y**. A correct loci solution would show the right hand arc moving through a quadrant around the right hand point. The arc needs to be stopped in at least three positions and the top line extended to plot the new position of **A**. Finally by connecting up the plots, an arc from **A** is described.

### Question A3

#### *Foam board car shape*

Candidates would benefit from reading all the instructions carefully and attempting all parts of this compulsory question.

- (a) The question asked candidates to construct a 2:1 isometric drawing of the car shape that had been made from foam board. Whilst most candidates drew to the correct height and length, many solutions had not been 'crated' and the 'shape' was not correct. The wheels were added by many candidates, but again they had not been 'crated' and were not elliptical.
- (b) Candidates were asked for two reasons why foam board was a suitable material for this purpose. Correct responses included: easy to cut, rigid, surface can be drawn (painted) on.
- (c) This part of the question asked how a computer could be used to search and capture a car shape. For search, acceptable responses were: use an internet search engine ('Google') and type into the search box. For capture, acceptable answers were: right click on image, copy, paste.

### Question B4

#### *Package for an ice lolly*

This question was derived from an actual 'Graphic Product' used for sales purposes.

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

- (a) Candidates were asked to complete the development (net) of the packaging for the ice lolly.
  - (i) Many candidates added the left and right (right angle) triangles to the given central triangle. An isosceles triangle for the base needed to be added to the right triangle so that its sloping edge was attached to the vertical of the right hand triangle. Fold lines were to be evident in the correct convention between all triangles.
  - (ii) This part of the question required the candidate to add a glue tab to the base triangle base (matching the given triangle) and to the top of both the left hand and the right hand triangles. A final glue tab was to be added to the sloping edge of the base triangle.
  - (iii) Many candidates completed the name ice lolly. It is important that when lettering is asked for, it must be to the same style, size and spacing to gain full marks.
- (b) The question asked for the printing method needed to produce 10 000 copies of the packaging for the ice lolly. The correct response was the Lithography process. Key words in the process are: original image, scanning, colour separation, printing plates, CYMK, printing of separate colours, registration/alignment of each colour. Responses ranged from a full description of the process to limited details with only one or two stages. In order to access higher marks, candidates needed to provide full details of the process.
- (c) This part of the question asked for a colour for the fruit shape and for candidates to justify their choice. The ideal response was: mainly red with a smaller amount of green so that the two colours are in keeping with that seen on a strawberry fruit.

## Question B5

### *Toy packaging*

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

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

- (a) Many candidates completed a two point perspective view of the packaging. Some candidates did not use both VP1 and VP2 for their solution. The inner edges and the semi-circular tab proved to be the two most difficult parts for many candidates. The three lines denoting the inner edges when viewed through the window, were accepted to the candidates own solution.
- (b) Many candidates gave good examples of making the clear plastic cover to the packaging. Tools for cutting and the use of a cutting mat/steel rule appeared in many responses. High scoring responses described how the cover could be vacuum formed. Responses that explained a method of fabrication did not score quite so many marks.
- (c) Candidates were required to complete the sketch to show how the semi-circular tab could be formed. A solid cut line was to be used to the semi-circle and fold lines to the right and left of the diameter. A rectangular hole needed to be added above the semi-circle so that when the tab is folded down, the hanging slot is not obscured.



# DESIGN AND TECHNOLOGY

---

Paper 0445/23  
Graphic Products

## Key messages

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

## General comments

Candidates were required to complete all questions in **Section A (A1, A2 and A3)** and then go on to answer *either B4 or B5* from **Section B**. 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 parts of **Question A3** or answered all the questions. Candidates would benefit from reading instructions carefully.

The standard of work could have been further improved on. There are areas of the syllabus in which additional knowledge and understanding are needed, for example, candidates must be able to draw simple solid objects in Planometric projection. Candidates must also be able to recognise the appropriate use of Vacuum forming plastics. In addition, candidates need to understand the Industrial process of Die cutting (Stamping) and Embossing card. The development of nets for packaging is also an area for improvement along with the statutory symbols and other customer information that are required to be added to the surface of the package.

## Comments on specific questions

### **Question A1**

*Plastic drinks cup, lid and straw*

A pictorial image of a plastic drinks cup was given. Many candidates added to the started side view, the outline of the lid. Most candidates added an outer circle correctly in the plan view. Full marks were awarded to candidates who used dotted lines for the three inner circles correctly in the plan view.

### **Question A2**

- (a) This question asked the candidate to name a method of manufacturing for the lid. Acceptable answers were Vacuum forming and Blow moulding.
- (b) Candidates were asked to draw the given straw with a 45° bend. Most candidates drew the centre line at 45° but did not make the upper part of the straw above the bend the same thickness as the existing straw. The top of the straw needed to have a break symbol drawn that was consistent with that given at the top of the straight straw.
- (c) The given cup is wider at the top because it has been moulded. To facilitate ejection from the mould, the sides of the cup must have 'draft'. An advantage of this is that it improves grip for the user and prevents the cup from slipping through the users fingers.

### Question A3

#### *Face shape*

To gain higher marks, candidates needed to attempt all parts of this compulsory question.

- (a) The question asked candidates to draw a planometric view to a scale of 2:1. In planometric projection, the front face is drawn in true view and the depth is drawn away from the face at 90°. This system of projection makes the drawing of circular parts on the face much easier as they can be drawn with compasses in their true shape. Two circular holes were required. In this projection, the depth of the material would be visible inside both holes.
- (b) Candidates were asked to show a method of attaching the foam board hexagon face to the cup. Many methods of gluing the face to the side or base were given. The acceptable adhesive was PVA as other adhesives would 'melt' the foam board.
- (c) The question asked why the face would be added. Correct responses included: appeals to children, adds interest, looks nicer, used for advertising.

### Question B4

#### *Card sleeve for plastic pot*

This question was derived from an actual 'Graphic Product' used for paste/pate products packaged in plastic pots.

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

- (a) Candidates were asked to complete the development (net) of the card sleeve.
- (i) Many candidates added the surface above the top given surface to the correct width. The rectangle below the given surface was drawn by many candidates to the correct width. The length was determined by the drawing of the lower face. The lower face had to be to the same overall dimensions of the upper face and a quadrant drawn to the top right hand corner.
- (ii) This part of the question required the candidate to add the missing glue tab. The location was given by a clue in the existing drawing. The top given surface had a fold line indicated.
- (iii) Many candidates completed the lettering by adding the **S H R** and **U**.
- (b) The acceptable method of cutting out 10 000 development (nets) is by using the commercial process of 'Die cutting'.
- A die stamp is made to the cut profile that has a sharp metal edge (blade). Vertical pressure is made on the card by the blade and the profile is cut out. The die stamp can also have 'blunt' blades that mark and crease for the folds. Waste is removed and the development (net) is ready for hand/machine folding.
- (c) Sketches and notes were required to show what is meant by embossing. Many candidates gave illustrated responses to a shape or letter being 'raised/pressed in' to the surface of card.
- (d) The symbol shown was an international symbol to show that the material can be recycled. The number denotes that it is a specific plastic (polystyrene).

## Question B5

### *Package for biscuits*

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

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

- (a) Many candidates completed a two point perspective view of the package. Some candidates did not use both VP1 and VP2 for their solution. The edge and the closure proved to be the two most difficult parts for many candidates. The three lines denoting the inner edges when viewed through the window, were accepted to the candidates own solution.
- (b) (i) Many candidates gave cellophane or acetate for the window. Other acceptable answers included: polypropylene, polystyrene, PET, HIPS.  
  
(ii) Many good examples of attaching the clear plastic windows to the package were seen. Tools for cutting and the use of a cutting mat/steel rule appeared in many responses. High scoring responses showed the plastic sheet larger than the opening in the package and the correct application of adhesive/double sided tape.
- (c) (i) Candidates were required to complete a list of information that should be printed on the package. Acceptable answers include: Bar code, Product name, Recycle symbol, does not contain nuts, estimated weight.  
  
(ii) The hole shown in the closure of the package is to enable the product to be hung on a point of sale hook/peg.

# 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. Many candidates gave one-word answers to questions requiring more detailed responses. The number of lines for the answer and the space provided give an indication of the depth of answer required.

Candidates need to improve their communication skills. They must try to provide clearly drawn sketches when attempting questions that begin with the statement: *Use sketches and notes to...* In addition, notes should enhance and make clearer what they have drawn.

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 needed to improve their knowledge and understanding for this section.

### **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 11(e)(i)**, the question asked candidates to "...show how the area could be removed and the edges made smooth." In **Question 12 (d)(i)** the question specifically asked for details about '...how the slot could be cut out...' No marks were allocated for providing details of marking out. To gain higher marks, candidates need to ensure that their responses contain relevant detail.

## Comments on specific questions

### **Section A**

#### **Question 1**

Most candidates achieved at least 2 marks for identifying the G cramp and vice. Some candidates recognised the bench hook and fewer candidates named the bench stop.

#### **Question 2**

**(a),(b)** Candidates needed to improve their knowledge for this question. Many candidates described workshop processes where a mask and gloves would be worn. However, some candidates did not describe an actual workshop process and stated, for example, '*when working with hot metal*' or '*stop breathing in dust*'. To gain higher marks, candidates needed to show understanding of the question by providing more detail in their response.

### Question 3

Most candidates chose 'heated' correctly.

### Question 4

- (a) Candidates needed to improve their knowledge for this question. Many candidates did not understand that the reason for joining three boards together to make the table top was that solid wood is only available in narrow boards.
- (b) Most candidates drew the end grain correctly with board number 2 inverted.
- (c) Many candidates named the sash cramp correctly. 'F' clamp and speed clamps were also accepted.

### Question 5

Many candidates gained at least 1 or 2 marks for correctly identifying stainless steel for the sink unit; cast iron for the vices and aluminium for the aircraft bodies.

### Question 6

Some candidates drew an accurate chamfered edge or bevelled edge.

### Question 7

- (a) The best temporary joints were screws or nuts and bolts.
- (b) The best permanent joints were acrylic cement [or the equivalent] and rivets. Many candidates did not understand the terms 'temporarily' or 'permanently'. For example, many candidates used 'sticky tape' to join the parts permanently.

### Question 8

Some candidates named the tongue and groove method of joining.

### Question 9

- (a) The body of the modelling knife would be made by die casting. 'Casting', on its own, was acceptable. Some candidates answered this question correctly.
- (b) Irrespective of whether or not candidates identified the process correctly in part (a) some candidates named aluminium correctly as the material from which the knife would be made.

### Question 10

Many candidates did achieve 1 or 2 marks, but only some candidates were able to complete **both** drawings and describe how the tools would be used.

## Section B

### Question 11

- (a) (i),(ii) Many candidates named a suitable softwood and manufactured board for the table. The most common softwoods were pine and parana pine; the most common manufactured boards plywood, chipboard and MDF.
- (b) Candidates needed to read the question carefully. Many candidates misread this question and described how the table top could be made safer and child-friendly rather than focusing on ways by which the top could be more hardwearing. There were some excellent answers describing the application of polyurethane varnish or paint and plastic laminate.

- (c) (i) Many candidates used a countersink drill to hide the head of the screw. This would be only partially successful as the width of the rail was 60 mm. The best answers were to counterbore a hole that would allow a shorter length of screw to secure the rail to the underside of the top.
- (ii) Many candidates showed some sort of knock-down fitting that could be used, but to achieve maximum marks the fitting needed to be shown in the correct position and be clearly recognisable.
- (d) (i) Many candidates gave two benefits of using a jig: the most common being speed and repetitive accuracy.
- (ii) There were a few excellent drilling jigs drawn that located positively against the sides of the rails. However, some candidates needed to improve their knowledge of jigs as they did not understand what a jig was or its purpose. Many candidates achieved at least 1 mark for showing a 'template' with two holes drilled in it that could be placed over the end of the rails.
- (e) (i) Many candidates gained marks for this question. Some candidates needed to further develop their understanding of this question by focusing on the removal of the area only. To gain maximum marks a drill was required to drill a hole into which the blade of a saw [or router] would be inserted to remove the waste. This would be followed by the use of a file then glasspaper to smooth the cut edges.
- (ii) There were some excellent answers to this question. The best answers showed a rectangular shaped container with some form of lipping to prevent it falling through the cut-out. For maximum marks candidates needed to name an appropriate material and describe how it would be constructed. Candidates need to ensure that they answer all parts of a question as often, candidates did not address this part of the question.

## Question 12

- (a) Many candidates gave two good items of research for the cycle rack; the most common relating to parts of the cycle that could be supported, their dimensions and the location of the rack.
- (b) Candidates needed to read this question carefully. Some candidates looked at Fig.11 carefully enough and provided details of how the support would be pivoted. The question stated: '*Sketch and name a suitable method of joining parts A to the back shown in Fig.11*'. All the relevant parts were labelled clearly. The best answers showed clear sketches of a dowel, mortise and tenon or housing joint with the appropriate name.
- (c) (i) Most candidates drew the development of the support in good proportion. Some candidates did not add the two 'shaped' end pieces.
- (ii) Candidates needed to improve their knowledge for this question. Some candidates considered the non-magnetic property of non-ferrous metals to be important to the design of the cycle rack. This was not relevant. The best answers referred to non-ferrous metal being easier to shape and that it did not rust.
- (d) (i) Candidates needed to further develop their knowledge and understanding for this question. Some candidates provided details showing how the slot would be marked out. This was not rewarded. Many candidates confused metalworking techniques with those associated with working with wood; for example, using a band saw to cut metal. The best answers showed tinsnips being used to cut the metal. Some candidates used a hacksaw which could only be used to cut part of the metal due to the depth of the frame. The edges could be finished with a hand and round or half-round files followed by emery cloth. Marks were awarded for these details.
- (ii) Candidates needed to further develop their knowledge and understanding for this question. Some candidates showed the metal being heated before it was bent to shape. This is not necessary, as the metal is malleable. Maximum marks were awarded for showing the sheet metal held between folding bars or scrapwood in a vice and the use of a mallet or hammer with scrapwood to apply force. Some candidates showed the metal being bent by hand.
- (e) Candidates needed to further develop their knowledge for this question. There were many different methods of locking the support horizontally. Many of these were not practical. The simplest and

most appropriate solutions showed the use of nuts and bolts through parts **A** and each side of the metal support.

- (f) Most candidates achieved at least 1 or 2 marks for showing a basic modification to the cycle rack in order to store the cycle helmet.

### Question 13

- (a) The majority of candidates gained at least 1 or 2 marks for providing three specification points for the lorry. The most common points included the toughness and durability of the lorry to withstand use, the movement created by the wheels and ‘tipping’ action and the possible use of colour to attract children.
- (b) (i) The majority of candidates chose to give four main stages for the injection moulding process. Many candidates achieved at least 1 or 2 marks for **accurately** describing part of the process. Candidates choosing the between-centres woodturning process needed to further develop their knowledge for this question.
- (ii) For 3 marks candidates needed to show some form of axle onto which the wheel could be fitted and how the wheel could rotate while staying secure. The best correct answers showed **either** the wheel glued to the axle which could then move **or** the wheel fitted loosely to the axle while retained by some sort of pin. Most candidates achieved at least partial success while some showed completely practical methods, clearly sketched and annotated.
- (c) Many candidates drew an inverted view of the ‘hopper’ that would be used as a former and gained 2 marks. For the maximum 4 marks, candidates needed to show the draft angles and radiused corners. This was achieved by many candidates.
- (d) The 6 marks were divided between showing a realistic and practical solution and demonstrating technical knowledge by providing details of materials, fittings and constructions. The best answers were based on the use of hinges or pivots that would enable the hopper to tip. Because the hopper was not ‘sitting’ on the lorry it was necessary to provide some sort of platform to which the hinges or pivots could be fixed. Although many candidates achieved some marks for partially successful solutions and added details, there were some excellent solutions that addressed all the parts of the question and gained maximum marks.
- (e) (i),(ii) The important feature of this question was that it asked candidates to give benefits of finishes **other than** the purpose of protection. Most candidates correctly stated that paint would enhance the appearance of the toy and help attract children. Some candidates understood that varnish would allow the natural features of the grain to be seen.
- (f) Candidates needed to read this question carefully and focus on the benefits to a **manufacturer** for producing toys made from plastic rather than wood-based materials. There were some excellent answers by some candidates explaining that the production processes for plastic manufacture, [after set-up costs] were extremely efficient compared to the fabrication processes required to manufacture wood-based toys.



# DESIGN AND TECHNOLOGY

---

Paper 0445/32  
Resistant Materials

## Key messages

Candidates need to read the questions carefully and be clear about what the question is asking before attempting an answer. Many candidates gave one-word answers to questions requiring more detailed responses. The number of lines for the answer and the space provided give an indication of the depth of answer required.

Candidates need to improve their communication skills. They must try to provide clearly drawn sketches when attempting questions that begin with the statement: *Use sketches and notes to....* In addition, notes should enhance and make clearer what they have drawn.

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 needed to improve their knowledge and understanding for this section.

### **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(d)**, the question asked candidates to '*show how the base and ends could be joined together...*' In **Question 12(f)** the question specifically asked for details about '*how the curved shape of the roof could be produced.*' No marks were allocated for providing details of marking out. To gain higher marks, candidates need to ensure that their responses contain relevant detail.

## Comments on specific questions

### **Section A**

#### **Question 1**

Most candidates chose PVA correctly.

#### **Question 2**

Most candidates gained 1 mark for showing the leg with the scribe-like point but fewer candidates showed the two legs of the odd-leg callipers.

#### **Question 3**

Most candidates chose 'smart' correctly for the thermochromic material.

#### **Question 4**

Some candidates drew **both** the groove **and** the rebate. There were many tongue and groove joints drawn. Candidates need to improve their knowledge of joints.

### Question 5

Many candidates gained at least 2 marks for correctly identifying the items used to fasten materials together. For **A**, candidates needed to name **both** the nut **and** bolt for 1 mark. It was not necessary to specify the type of rivet, screw or nail to achieve 1 mark for each of the items **B**, **C** and **D**.

### Question 6

Many candidates drew the alternating direction of the grain correctly.

### Question 7

Candidates needed to improve their knowledge for this question in order for them to identify a specific plastic for each of the products. Many candidates achieved only 1 or 2 marks maximum. Candidates need to be able to 'match' specific materials with products when answering questions relating to wood, metal and plastics.

### Question 8

- (a) Many candidates did name chipboard correctly although MDF was a common incorrect answer.
- (b) For 2 marks candidates needed to describe how offcuts or tiny pieces of wood would be combined with an adhesive to form the board. References to sawdust, recycled wood or that it was shredded were not rewarded. The best answers also added that the materials would be compressed to produce the board.
- (c) Some candidates needed to improve their knowledge for this question. While most candidates did circle the correct answer, 'cost', many candidates thought that the most important benefit was either 'weight', 'appearance' or 'strength'.

### Question 9

- (a) Candidates needed to improve their knowledge for this question. Many candidates stated thicknesses that were inappropriate. Many candidates gave dimensions that related to the width of mild steel rather than to its thickness. Some candidates provided a range of sizes which was unacceptable. Candidates are reminded that they should know the standard sizes and sections of wood, metal and plastics.
- (b) The most common correct answers stated welding, brazing and soldering as permanent methods of joining the mild steel. Riveting (not pop riveting) was also correct. Some candidates needed to improve their knowledge for this question as they named adhesives that would not be practical and many named temporary methods involving the use of screws or nuts and bolts.

### Question 10

- (a) (i & ii) Many candidates named an appropriate non-ferrous metal, the most common being aluminium with copper and brass also accepted. Candidates were less accurate with their choice of ferrous metal. Stainless steel was the most popular correct answer while stating 'steel' gained no marks. This is because it was unclear which form of steel it was, as there are many forms of steel, some of which would not be suitable.
- (b) Many candidates gave two good reasons for fitting a base to the toast rack. The best answers referred to an increased stability, it would collect crumbs and that it would be easier to pick up.

## Section B

### Question 11

- (a) The best answers referred to the angled board for artist comfort, the convenience of the unit to store equipment, the ledge to retain paper and the large flat surface to draw on. Some candidates did not gain marks as they repeated 'storage unit', 'ledge' or 'support' without further description.

- (b) Candidates needed to improve their knowledge for this question.  
**Board** – Some candidates stated a specific solid wood for the board, for example, beech or pine, rather than an acceptable manufactured board such as plywood, MDF or blockboard.  
**Storage Unit** – The most common correct response for this question was acrylic and HIPS.  
**Ledge** – Some candidates stated a soft wood or manufactured board instead of a hardwood. Most hardwoods were acceptable.  
**Support** – Some candidates did not qualify what kind of steel they would use. It is essential that candidates are specific when selecting a resistant material for a particular product or purpose.
- (c) (i) The important words in this question were ‘portable’ and ‘power saw’. A band saw is not portable. The most common correctly named saw was the jig saw. Circular saws, that can be portable, were also accepted.
- (c) (ii) Many candidates gave a sensible safety precaution: the most common referring to no loose clothing, safety of hands, securing the work piece and no trailing lead.
- (d) (i) Candidates needed to improve their knowledge for this question. Some candidates were able to describe **two** features of the former used to vacuum form the storage unit. The draft angle, radiused edges and no undercuts were the most common correctly described features. While vent holes would be a feature of the overall process, the question specifically referred to the former and therefore no marks were awarded for vent holes.
- (d) (ii) Most candidates achieved at least 1 mark. If the plastic was not hot enough it would not form. Conversely, if the plastic was too hot it could melt or cause webbing.
- (e) (i) Many candidates outlined that the board was only 15 mm thick and drilling holes into it would not give sufficient support for the rod. Others stated that the holes would be visible on the front of the board and some candidates explained that the hardwood blocks allowed the rod to have greater support due to deeper holes being able to be drilled.
- (e) (ii) There were some excellent answers to this question. The best answers showed the rod secured in a vice which would also act as a former around which the rod could be bent. The use of a hammer had to be accompanied by scrap wood to prevent bruising or use of a mallet. However, there were many inappropriate methods that used heat unnecessarily on the rod before bending it. Some candidates stated that an 8 mm diameter metal rod could be bent at a right angle by hand with, or without, one end being held in a vice or being clamped.
- (f) There were some excellent alternative methods of supporting the drawing board. Some candidates proposed adjustable angles while most developed ideas for one fixed angle. The best ideas were often the simplest: the use of two ‘wedge-shaped’ solid wood or manufactured board pieces joined to the underside of the board by means of a groove or housing or by pin and/or screws and adhesive. Some methods used a single piece that could ‘run’ the length of the board and be secured to it underneath by similar joining methods or included a hinge. While it was possible for candidates to gain valuable marks for a partially successful design, many candidates did not address the final part of the question, i.e. to ‘*include details of materials and constructions*’.
- (g) Many candidates gained marks for providing one benefit of using a portable power sander: the most common correct answer that it could produce a smooth surface free from marks and scratches. Many candidates stated that it was ‘quicker’, but without adding ‘*than sanding by hand*’, a mark was not given.

### Question 12

- (a) Many candidates gave properties of acrylic that would be acceptable for products other than the bird feeder. Properties such as 'colourful' and 'self-finished' were not relevant whereas properties such as 'can be moulded to shape', 'durable outdoors', 'wind and waterproof' were better answers.
- (b) Candidates needed to improve their knowledge for this question, as many were unable to name the hole saw used to produce the Ø50 holes.
- (c) (i) Many candidates named an appropriate machine saw that could be used to cut out the shape, with a band saw, jig saw and scroll saw the most common correct answers.
- (c) (ii) While many candidates named a half-round or round file there were many incorrect tools stated including the sanding disc and coping saw.
- (c) (iii) Many candidates were able to provide an appropriate safety precaution used when operating a disc sander: the most popular answers referring to no loose clothing, hair tied back and other items of PPE. Some candidates incorrectly stated that gloves should be worn.
- (d) There were some excellent clear sketches produced by some candidates and reference to a suitable adhesive was often included. However, some sketches were poorly executed, out of proportion and required more detailed annotation. Often a butt joint was shown, simple glued and sometimes with an inappropriate adhesive such as epoxy resin or acrylic cement.
- (e) (i) Many candidates named correctly a chinagraph pencil or felt tip pen (or similar) to mark the surface of the acrylic. Unfortunately a scribe would leave a permanent mark as would a marking gauge or marking knife.
- (e) (ii) Many candidates achieved at least 1 mark for this question. Correct responses usually referenced holding the acrylic low down or close to a vice, sawing slowly, using a saw with a fine blade or ensuring the acrylic was protected or supported by scrap wood.
- (f) Many candidates thought that the acrylic could be softened on a line bender or strip heater, even though the piece of acrylic was 120 mm wide and needed to be softened across its entire width as well as length. Some candidates drew examples of bending jigs or formers that did not resemble the shape that needed to be created for the roof. Injection moulding was offered by some candidates. There were some excellent answers to this question showing the acrylic heated in an oven or alternatively, a hot air gun being used. Formers were sketched, often with a male and female, and some form of clamping or retaining the curved shape while the acrylic cooled was included.
- (g) (i) Many candidates described two features of the former used to vacuum form the storage unit. The draft angle, radiused edges and no undercuts were the most common correctly described features.
- (g) (ii) Many candidates have a good knowledge and understanding of the vacuum forming process. There were many excellent answers showing clear, logical stages in the process. The overall quality of sketches and notes was better than other questions requiring similar methods of response.

### Question 13

- (a) (i) Many candidates named an appropriate manufactured board including MDF, plywood, chipboard and blockboard. Some candidates needed to improve their knowledge for this question as they did not understand the term 'manufactured board' and named solid woods such as 'pine'.
- (a) (ii) Candidates needed to improve their understanding of this question because answers such as 'strong' or 'cheap' without qualification gained no marks. 'Hardwearing' and 'stable' were the most common reasons for choosing a manufactured board.

- (b)(i) Candidates needed to read this question carefully. Corner **A** clearly showed the corner of the end frame made from hardwood 25 · 25. The most appropriate joints were the mortise and tenon, bridle or dowel joints. A butt joint was not appropriate. For maximum marks, candidates needed to not only select an appropriate joint but draw it in the same orientation and in reasonable proportion to that shown in Fig. 15. Candidates need to improve their understanding of the difference between the terms 'temporary' (which is asked for in part (b)(ii)) and 'permanent' (asked for in this question).
- (b)(ii) The best correct answers showed a knock-down fitting, a small bracket or detailed sketches and notes showing how countersunk screws could be used. There were many joints drawn by candidates that involved the use of an adhesive which could not therefore be termed 'temporary'.
- (c)(i) Most candidates achieved at least 1 mark for this question. Some candidates were able to describe the logical progression from medium to a fine grade of glasspaper. Some candidates did understand the purpose of the damp cloth to remove the dust. Some even referred to 'raising the grain'. However, candidates needed to improve their knowledge of cork blocks.
- (c)(ii) Many candidates understood why polyurethane varnish was a suitable finish for the computer desk. Some answers, such as 'looks nice', could have been more relevant. The best answers referred to the finish being hardwearing or stain resistant. Although 'waterproof' may be a property of the finish it was not appropriate for a computer desk.
- (d)(i)&(ii) Many candidates gave correct answers to both parts of this question. The length and width of the desktop was decided upon by measuring the sizes of the items that would be positioned on it. The height of the desk was decided upon after consideration of anthropometric data.
- (e) Candidates needed to read this question more carefully. Many candidates produced annotated sketches showing the drawer sliding under the desk top on some form of runners fixed to the support pieces on each end frame. Most candidates did not note that the drawer was 600 mm wide while the distance between the internal faces of the two supports was 900 mm and therefore their ideas would not work. Other candidates had shown the drawer as 250 mm wide and 600 mm deep on their designs. Some candidates had created a small open carcass to fit beneath the desk top into which the drawer could slide in and out. There were some excellent answers to this question, but many were not appropriate. Candidates needed to fully attempt this question because even if the design drawn was only partially successful, marks could still be gained, by addressing the last part of the question. *'Include details of materials, constructions and **two** important sizes'*.
- (f) There were many good answers to this question. Some candidates, needed to improve their knowledge because they thought that self-assembly furniture must be weak because it uses manufactured boards and a range of fittings that allow the furniture to be assembled and sometimes to be taken apart. These fittings and the materials can result in incredibly robust items of furniture. The most appropriate answers focused on the difficulties consumers may face when assembling the furniture: missing components, difficult to understand instructions, the time taken to assemble the product and a lack of tools or technical skill.

# 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. Many candidates gave one-word answers to questions requiring more detailed responses. The number of lines for the answer and the space provided give an indication of the depth of answer required.

Candidates need to improve their communication skills. They must try to provide clearly drawn sketches when attempting questions that begin with the statement: *Use sketches and notes to...* In addition, notes should enhance and make clearer what they have drawn.

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 needed to improve their knowledge and understanding for this section.

### **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 11(e)(i)**, the question asked candidates to "...show how the area could be removed and the edges made smooth." In **Question 12 (d)(i)** the question specifically asked for details about '...how the slot could be cut out...' No marks were allocated for providing details of marking out. To gain higher marks, candidates need to ensure that their responses contain relevant detail.

## Comments on specific questions

### **Section A**

#### **Question 1**

Most candidates achieved at least 2 marks for identifying the G cramp and vice. Some candidates recognised the bench hook and fewer candidates named the bench stop.

#### **Question 2**

**(a),(b)** Candidates needed to improve their knowledge for this question. Many candidates described workshop processes where a mask and gloves would be worn. However, some candidates did not describe an actual workshop process and stated, for example, '*when working with hot metal*' or '*stop breathing in dust*'. To gain higher marks, candidates needed to show understanding of the question by providing more detail in their response.



### Question 3

Most candidates chose 'heated' correctly.

### Question 4

- (a) Candidates needed to improve their knowledge for this question. Many candidates did not understand that the reason for joining three boards together to make the table top was that solid wood is only available in narrow boards.
- (b) Most candidates drew the end grain correctly with board number 2 inverted.
- (c) Many candidates named the sash cramp correctly. 'F' clamp and speed clamps were also accepted.

### Question 5

Many candidates gained at least 1 or 2 marks for correctly identifying stainless steel for the sink unit; cast iron for the vices and aluminium for the aircraft bodies.

### Question 6

Some candidates drew an accurate chamfered edge or bevelled edge.

### Question 7

- (a) The best temporary joints were screws or nuts and bolts.
- (b) The best permanent joints were acrylic cement [or the equivalent] and rivets. Many candidates did not understand the terms 'temporarily' or 'permanently'. For example, many candidates used 'sticky tape' to join the parts permanently.

### Question 8

Some candidates named the tongue and groove method of joining.

### Question 9

- (a) The body of the modelling knife would be made by die casting. 'Casting', on its own, was acceptable. Some candidates answered this question correctly.
- (b) Irrespective of whether or not candidates identified the process correctly in part (a) some candidates named aluminium correctly as the material from which the knife would be made.

### Question 10

Many candidates did achieve 1 or 2 marks, but only some candidates were able to complete **both** drawings and describe how the tools would be used.

## Section B

### Question 11

- (a) (i),(ii) Many candidates named a suitable softwood and manufactured board for the table. The most common softwoods were pine and parana pine; the most common manufactured boards plywood, chipboard and MDF.
- (b) Candidates needed to read the question carefully. Many candidates misread this question and described how the table top could be made safer and child-friendly rather than focusing on ways by which the top could be more hardwearing. There were some excellent answers describing the application of polyurethane varnish or paint and plastic laminate.

- (c) (i) Many candidates used a countersink drill to hide the head of the screw. This would be only partially successful as the width of the rail was 60 mm. The best answers were to counterbore a hole that would allow a shorter length of screw to secure the rail to the underside of the top.
- (ii) Many candidates showed some sort of knock-down fitting that could be used, but to achieve maximum marks the fitting needed to be shown in the correct position and be clearly recognisable.
- (d) (i) Many candidates gave two benefits of using a jig: the most common being speed and repetitive accuracy.
- (ii) There were a few excellent drilling jigs drawn that located positively against the sides of the rails. However, some candidates needed to improve their knowledge of jigs as they did not understand what a jig was or its purpose. Many candidates achieved at least 1 mark for showing a 'template' with two holes drilled in it that could be placed over the end of the rails.
- (e) (i) Many candidates gained marks for this question. Some candidates needed to further develop their understanding of this question by focusing on the removal of the area only. To gain maximum marks a drill was required to drill a hole into which the blade of a saw [or router] would be inserted to remove the waste. This would be followed by the use of a file then glasspaper to smooth the cut edges.
- (ii) There were some excellent answers to this question. The best answers showed a rectangular shaped container with some form of lipping to prevent it falling through the cut-out. For maximum marks candidates needed to name an appropriate material and describe how it would be constructed. Candidates need to ensure that they answer all parts of a question as often, candidates did not address this part of the question.

## Question 12

- (a) Many candidates gave two good items of research for the cycle rack; the most common relating to parts of the cycle that could be supported, their dimensions and the location of the rack.
- (b) Candidates needed to read this question carefully. Some candidates looked at Fig.11 carefully enough and provided details of how the support would be pivoted. The question stated: '*Sketch and name a suitable method of joining parts A to the back shown in Fig.11*'. All the relevant parts were labelled clearly. The best answers showed clear sketches of a dowel, mortise and tenon or housing joint with the appropriate name.
- (c) (i) Most candidates drew the development of the support in good proportion. Some candidates did not add the two 'shaped' end pieces.
- (ii) Candidates needed to improve their knowledge for this question. Some candidates considered the non-magnetic property of non-ferrous metals to be important to the design of the cycle rack. This was not relevant. The best answers referred to non-ferrous metal being easier to shape and that it did not rust.
- (d) (i) Candidates needed to further develop their knowledge and understanding for this question. Some candidates provided details showing how the slot would be marked out. This was not rewarded. Many candidates confused metalworking techniques with those associated with working with wood; for example, using a band saw to cut metal. The best answers showed tinsnips being used to cut the metal. Some candidates used a hacksaw which could only be used to cut part of the metal due to the depth of the frame. The edges could be finished with a hand and round or half-round files followed by emery cloth. Marks were awarded for these details.
- (ii) Candidates needed to further develop their knowledge and understanding for this question. Some candidates showed the metal being heated before it was bent to shape. This is not necessary, as the metal is malleable. Maximum marks were awarded for showing the sheet metal held between folding bars or scrapwood in a vice and the use of a mallet or hammer with scrapwood to apply force. Some candidates showed the metal being bent by hand.
- (e) Candidates needed to further develop their knowledge for this question. There were many different methods of locking the support horizontally. Many of these were not practical. The simplest and



most appropriate solutions showed the use of nuts and bolts through parts **A** and each side of the metal support.

- (f) Most candidates achieved at least 1 or 2 marks for showing a basic modification to the cycle rack in order to store the cycle helmet.

### Question 13

- (a) The majority of candidates gained at least 1 or 2 marks for providing three specification points for the lorry. The most common points included the toughness and durability of the lorry to withstand use, the movement created by the wheels and ‘tipping’ action and the possible use of colour to attract children.
- (b) (i) The majority of candidates chose to give four main stages for the injection moulding process. Many candidates achieved at least 1 or 2 marks for **accurately** describing part of the process. Candidates choosing the between-centres woodturning process needed to further develop their knowledge for this question.
- (ii) For 3 marks candidates needed to show some form of axle onto which the wheel could be fitted and how the wheel could rotate while staying secure. The best correct answers showed **either** the wheel glued to the axle which could then move **or** the wheel fitted loosely to the axle while retained by some sort of pin. Most candidates achieved at least partial success while some showed completely practical methods, clearly sketched and annotated.
- (c) Many candidates drew an inverted view of the ‘hopper’ that would be used as a former and gained 2 marks. For the maximum 4 marks, candidates needed to show the draft angles and radiused corners. This was achieved by many candidates.
- (d) The 6 marks were divided between showing a realistic and practical solution and demonstrating technical knowledge by providing details of materials, fittings and constructions. The best answers were based on the use of hinges or pivots that would enable the hopper to tip. Because the hopper was not ‘sitting’ on the lorry it was necessary to provide some sort of platform to which the hinges or pivots could be fixed. Although many candidates achieved some marks for partially successful solutions and added details, there were some excellent solutions that addressed all the parts of the question and gained maximum marks.
- (e) (i),(ii) The important feature of this question was that it asked candidates to give benefits of finishes **other than** the purpose of protection. Most candidates correctly stated that paint would enhance the appearance of the toy and help attract children. Some candidates understood that varnish would allow the natural features of the grain to be seen.
- (f) Candidates needed to read this question carefully and focus on the benefits to a **manufacturer** for producing toys made from plastic rather than wood-based materials. There were some excellent answers by some candidates explaining that the production processes for plastic manufacture, [after set-up costs] were extremely efficient compared to the fabrication processes required to manufacture wood-based toys.

# DESIGN AND TECHNOLOGY

---

Paper 0445/42  
Systems and Control

## Key messages

Candidates should be reminded that clear writing and clear annotation to sketches are important. Responses should appear in the space allocated for that response. Any part of a response that does not fit the space should be placed on additional sheets attached to the booklet. If additional sheets are used the question and part number must appear clearly next to the response.

Candidates should be reminded that failure to make a response will always result in no mark being awarded for that question. If an answer is offered there is a chance that it will gain a mark.

In questions that require either a single answer or a set number of answers it is important that candidates do not enter additional answers; this could result in the examiner not being able to give credit to a correct response.

Generic answers such as 'cheap' or 'strong' are unlikely to gain marks. Where possible candidates should be reminded to give specific, justified responses.

If a comparison is required, the response should reflect this and provide reference to both items being compared.

Where terms are chosen from a given list, it is important that candidates do not use terms that do not appear in the list.

Where questions ask for an example to be included, there are normally marks allocated for the choice of a suitable example.

## General comments

The majority of candidates followed the rubric regarding the optional questions, only attempting one question from the three available. In a few cases, a question had been started and then abandoned after a few parts had been attempted. Candidates should be advised to read through all of the questions before making a choice, this would help to ensure only one question being attempted.

All of the compulsory questions In Section A were attempted by the majority of candidates. Knowledge of the syllabus was good and in many cases, careful thought had been given to forming a response. The standard of sketching seen in response to those questions requiring a visual answer was good, with adequate annotation being used.

In Section B the most popular question was **Question 9**, based on Mechanisms. The least popular was **Question 10**, based on Electronics. The Structures based question, resulted in a slightly higher mean score than the other two.

## **Comments on specific questions**

### **Section A**

#### **Question 1**

- (a) The properties of rigid PVC were well known. Candidates needed to also identify advantages when comparing with the structural properties of wood and so would benefit from improving their knowledge in this area. The stability of rigid PVC along with its resistance to damp and insect attack was frequently noted.
- (b) This question was asking the opposite; advantages of wood when compared to plastics. The comparison had to be clear in order for the marks to be awarded. Many candidates noted that wood as a natural resource is renewable and biodegradable. Aesthetic advantages were a popular response which gained credit.

#### **Question 2**

- (a) The majority of responses were based on the lighter weight offered by a hollow section. Some candidates noted that it is possible to have more precision in the dimensions of a steel beam. The high strength to weight ratio was a common response that gained a mark.
- (b) Candidates needed to improve their knowledge for this question. A high number of responses confused the laminated beam with a decorative plastic laminate applied to a surface. A number of clear, accurate sketches were seen but the second mark available for indication of how the laminates are joined together was often not awarded. Annotation to indicate use of adhesive was sufficient to gain this mark.
- (c) Aesthetic reasons were the most popular correct response for why laminated beams are used. Some candidates had noted that the length of the beam could be much greater than when using natural timber or that curves can be easily produced.

#### **Question 3**

The general principle of mechanical advantage was well known. Candidates need to improve on their responses by using relevant examples in their answers. One mark was awarded for explaining that mechanical advantage is a measure of load divided by effort or that it is often expressed as a ratio.

#### **Question 4**

- (a) Many candidates gained a mark for stating that bearings reduce friction, allowing controlled movement of one surface against another.
- (b) Candidates needed to improve their knowledge and understanding for this question. The question called for some judgement by candidates on the given purpose of the bearing. The majority of candidates chose the correct lubricants, oil and grease, but in some cases had placed them alongside the incorrect use. There were a number of alternative solutions given, mainly relating to commercial products; unless it was clear that the product could be used for the given purpose it was not awarded a mark.
- (c) A high proportion of responses noted that nylon is 'self lubricating' and has a low coefficient of friction. In order to access higher marks, candidates would benefit from improving their knowledge in this area as generic responses related to the strength of the material were not given credit.

#### **Question 5**

Candidates who had read the question carefully realised that control of the hazards of chemicals is largely down to restricting access to those who could be harmed by them. Mention of restriction to teachers or technicians was a common feature. Personal protective equipment was allowed for one mark, provided that the equipment was relevant to the hazards.

### Question 6

- (a) The majority of candidates had correctly chosen resistance as the physical property that changes in both of the given transducers. This could have been arrived at either by recognition of the illustration or of the circuit symbol. Incorrect responses mentioned the condition being measured by one of the sensors, e.g. temperature.
- (b) This question was well answered with the majority of candidates noting that light travels very fast, causing a quick response in the LDR whereas a change in temperature will take far longer to alter the resistance in a thermistor.

### Question 7

- (a) The general principal of the rotary switch in allowing more than one device or output to be controlled by a single component was well known. The fact that the common terminal is connected to each of the other twelve terminals as the switch is rotated was not so widely recognised.
- (b) Some candidates realised that the flat on the spindle is there to allow a control knob to be attached without it rotating on the spindle. The flat is also seen on a potentiometer spindle which candidates may be more familiar with.

### Section B

### Question 8

- (a) (i) The strain gauge was identified by a good proportion of those who answered this question.
- (a) (ii) Candidates who recognised the strain gauge knew that the property being measured in a strain gauge is resistance.
- (a) (iii) This part was well answered, with both marks being gained by a high proportion of candidates. In some cases the correct forces were chosen but assigned to the wrong face of the steel strip. Some candidates had named forces such as bending or shear. Marks were only awarded for tension on the top face and compression on the bottom face.
- (a) (iv) The dial gauge was the only method of non-electronic measurement that gained marks on this part. Other methods involving use of a ruler are not accurate enough to be practical. Marks were awarded for drawing a dial gauge, for having it in a suitable position and for showing how it was fastened to the test rig. Many candidates did not gain the third mark as the dial gauge was shown unattached to anything.
- (b) (i) This question produced responses that showed clear understanding of how the packaging provided protection. Some candidates referred to the multiple layers on the folded edges that would provide extra support. Most had noted that the moulded inner package included shaping that would increase rigidity and help to prevent the contents from being crushed.
- (b) (ii) The term corrugated was known to the majority of candidates. Clear sketches with meaningful annotation were seen.
- (b) (iii) There were two marks available for this part, one for showing the corrugations running downwards from the wall to allow the 80° angle of the supporting timber to direct rain away. The second mark was for showing an overlap in the sheets to provide a waterproof joint. Some candidates gained the second mark. The information that candidates should have used was that six uncut sheets were to be used. With no overlap that would provide cover over a width of 4.8 m; the width of the carport as shown was 4 m.
- (c) (i) The gusset plate was correct, in most cases with fixing points clearly visible. The brace was often drawn as a tie; no mark was given for this. A third mark was given if both reinforcement methods were drawn using functional proportions.

- (c) (ii) Candidates needed to improve their knowledge for this question. The question required a force triangle to be drawn to scale in order to arrive at the force acting on the chain. Some responses showed a completed triangle; most had carried out a calculation using trigonometry to arrive at a figure. If the answer given was correct it was awarded a single mark.
- (d) The question gave a scenario that required a designed solution to a problem that included full details in the question. Those who had not given details of suitable materials or joining methods, did not gain access to two of the marks. The other two marks were awarded for design of a stable structure and for supporting the plant to its full height. Sketches and notes were clear and well presented.
- (e) Understanding of torsion was very good, although in some cases no example was given to support the explanation.

### Question 9

- (a) (i) Some candidates correctly identified the brake lever as being second order or second class. Those who did not gain the mark had identified it as a first order lever.
- (a) (ii) There were a number of benefits of a cable linkage that could have been used. The most popular were flexibility of routing the cable and its high tensile strength. A high number of those answering the question correctly identified at least one benefit.
- (a) (iii) Drawbacks of cable linkage were centred mainly on the cable being prone to stretching or in some case breaking.
- (a) (iv) Candidates needed to improve their knowledge for this question as they found the calculation challenging. Part marks for the working were common, proving that showing all working is beneficial even if the final answer is incorrect. If the force at the brake lever had been incorrectly calculated credit was given if the second part had been carried out accurately.
- (b) (i) This question was very well answered with much response gaining all three marks. Candidates need to remember to use terms in their response that appear in the list.
- (b) (ii) Answers to this part varied from the specific examples that were expected to the generic forms of energy such as elastic potential and gravitational potential energies. Although the question clearly stated that examples should not be related to electrical energy there were a number of responses that included rechargeable batteries and photovoltaic cells.
- (b) (iii) This was another question that required an example to be given. Where this happens it is important for candidates to identify a suitable example that can be used to illustrate other points made. Reduction in weight or friction and improved aerodynamics could have been used as examples of reduction in energy demand.
- (c) (i) The ratchet and pawl was a well-known mechanism and responses included very good drawings of the component parts. In those drawings where gravity could have operated the pawl the lack of a return spring was overlooked.
- (c) (ii) The snail cam was the most popular correct choice as an alternative mechanism restricted to a single direction of rotation. The other option that could have been used is the worm and wheel.
- (d) (i) Candidates needed to improve their knowledge and understanding for this question. The method that was most popular was to increase the rise of the cam profile. Various other suggestions were used for the second method but moving the fulcrum point in the rocker was the only other correct solution.
- (d) (ii) The rocker has an oscillating motion which was recognised by many but confused with reciprocating motion by a significant minority.
- (e) (i) The question concerned two illustrations showing threads with different pitch and profile. A number of candidates gained the mark through clear description rather than knowledge of the technical terms. In most cases it was the pitch that was referred to rather than the profile.

- (e) (ii) This part was well answered with candidates recognising that smaller pitch results in more turns to move the same linear distance.

### Question 10

- (a) (i) Candidates needed to improve their knowledge for this question. Of the four switches illustrated, the reed switch and push switch were the best known. The rocker switch was frequently mistaken for a toggle switch and the microswitch was the example that was left unidentified in a small number of cases.
- (a) (ii) Those who had correctly identified the reed switch gained the mark for stating that it is operated by a magnet.
- (a) (iii) Candidates needed to improve their knowledge for this question. There were a number of cases where the question was not attempted but those who did attempt it gained at least one of the marks for showing the switch connected as an SPST switch.
- (a) (iv) The common connections were correctly identified by a higher percentage than had gained marks for the previous question. This is a case where returning to check a previous answer could have been beneficial.
- (b) (i) Understanding of the reasons for using a relay was shown in about half of the responses seen. Allowing different voltages on the motor and control circuits was the most popular reason given with isolation of the two circuits being given as a safety aspect.
- (b) (ii) The diode was widely recognised with many candidates having at least a basic understanding of its use. The mark for recognising the problem of back emf was often gained through a description rather than use of the technical term. The component being protected, the transistor was in many cases not mentioned or it was indicated that the relay was being protected.
- (b) (iii) Candidates needed to improve their knowledge and understanding for this question. This question based on the understanding of how a transistor operates was not well answered. There was some understanding of the base leg requiring a set voltage before it would operate but very few responses referred to the base/emitter circuit or the amplification caused by the gain of the transistor. On the output side very few mentioned the emitter/collector circuit.
- (b) (iv) The calculation in this part was answered well with many candidates gaining both of the available marks.
- (b) (v) Those who had successfully calculated the current in the motor circuit only had to match the available relays to their result. There was only one relay that was rated at 6 V and had a current rating greater than the 8.3 A from the calculation.
- (b) (vi) Candidates needed to improve their knowledge for this question. The component requiring identification was a fuse, which was recognised by many candidates; however it was in a number of cases mistaken for a resistor.
- (c) (i) The PCB layout was completed to a high standard in most cases. There were a number of possible solutions that could have been used. In most cases Tracks had been given thickness and routes were restricted to horizontal and vertical.
- (c) (ii) Good practical reasons for using a terminal block were given in the majority of cases. The ease of connection and disconnection was the most popular choice. Other valid reasons included the lack of heat on components from soldering and the ability to use larger wires in the connection.



# DESIGN AND TECHNOLOGY

---

Paper 0445/43  
Systems and Control

## Key messages

Candidates should be reminded that clear writing and clear annotation to sketches are important. Responses should appear in the space allocated for that response. Any part of a response that does not fit the space should be placed on additional sheets attached to the booklet. If additional sheets are used the question and part number must appear clearly next to the response.

Candidates should be reminded that failure to make a response will always result in no mark being awarded for that question. If an answer is offered there is a chance that it will gain a mark.

In questions that require either a single answer or a set number of answers it is important that candidates do not enter additional answers; this could result in the examiner not being able to give credit to a correct response.

Generic answers such as 'cheap' or 'strong' are unlikely to gain marks. Where possible candidates should be reminded to give specific, justified responses.

If a comparison is required, the response should reflect this and provide reference to both items being compared.

Where terms are chosen from a given list, it is important that candidates do not use terms that do not appear in the list.

Where questions ask for an example to be included, there are normally marks allocated for the choice of a suitable example.

## General comments

The majority of candidates followed the rubric regarding the optional questions, only attempting one question from the three available. In a few cases, a question had been started and then abandoned after a few parts had been attempted. Candidates should be advised to read through all of the questions before making a choice, this would help to ensure only one question being attempted.

All of the compulsory questions In Section A were attempted by the majority of candidates. Knowledge of the syllabus was good and in many cases, careful thought had been given to forming a response. The standard of sketching seen in response to those questions requiring a visual answer was good, with adequate annotation being used.

In Section B the most popular question was **Question 9**, based on Mechanisms. The least popular was **Question 10**, based on Electronics. The Structures based question, resulted in a slightly higher mean score than the other two.





## **Comments on specific questions**

### **Section A**

#### **Question 1**

- (a) The properties of rigid PVC were well known. Candidates needed to also identify advantages when comparing with the structural properties of wood and so would benefit from improving their knowledge in this area. The stability of rigid PVC along with its resistance to damp and insect attack was frequently noted.
- (b) This question was asking the opposite; advantages of wood when compared to plastics. The comparison had to be clear in order for the marks to be awarded. Many candidates noted that wood as a natural resource is renewable and biodegradable. Aesthetic advantages were a popular response which gained credit.

#### **Question 2**

- (a) The majority of responses were based on the lighter weight offered by a hollow section. Some candidates noted that it is possible to have more precision in the dimensions of a steel beam. The high strength to weight ratio was a common response that gained a mark.
- (b) Candidates needed to improve their knowledge for this question. A high number of responses confused the laminated beam with a decorative plastic laminate applied to a surface. A number of clear, accurate sketches were seen but the second mark available for indication of how the laminates are joined together was often not awarded. Annotation to indicate use of adhesive was sufficient to gain this mark.
- (c) Aesthetic reasons were the most popular correct response for why laminated beams are used. Some candidates had noted that the length of the beam could be much greater than when using natural timber or that curves can be easily produced.

#### **Question 3**

The general principle of mechanical advantage was well known. Candidates need to improve on their responses by using relevant examples in their answers. One mark was awarded for explaining that mechanical advantage is a measure of load divided by effort or that it is often expressed as a ratio.

#### **Question 4**

- (a) Many candidates gained a mark for stating that bearings reduce friction, allowing controlled movement of one surface against another.
- (b) Candidates needed to improve their knowledge and understanding for this question. The question called for some judgement by candidates on the given purpose of the bearing. The majority of candidates chose the correct lubricants, oil and grease, but in some cases had placed them alongside the incorrect use. There were a number of alternative solutions given, mainly relating to commercial products; unless it was clear that the product could be used for the given purpose it was not awarded a mark.
- (c) A high proportion of responses noted that nylon is 'self lubricating' and has a low coefficient of friction. In order to access higher marks, candidates would benefit from improving their knowledge in this area as generic responses related to the strength of the material were not given credit.

#### **Question 5**

Candidates who had read the question carefully realised that control of the hazards of chemicals is largely down to restricting access to those who could be harmed by them. Mention of restriction to teachers or technicians was a common feature. Personal protective equipment was allowed for one mark, provided that the equipment was relevant to the hazards.

### Question 6

- (a) The majority of candidates had correctly chosen resistance as the physical property that changes in both of the given transducers. This could have been arrived at either by recognition of the illustration or of the circuit symbol. Incorrect responses mentioned the condition being measured by one of the sensors, e.g. temperature.
- (b) This question was well answered with the majority of candidates noting that light travels very fast, causing a quick response in the LDR whereas a change in temperature will take far longer to alter the resistance in a thermistor.

### Question 7

- (a) The general principle of the rotary switch in allowing more than one device or output to be controlled by a single component was well known. The fact that the common terminal is connected to each of the other twelve terminals as the switch is rotated was not so widely recognised.
- (b) Some candidates realised that the flat on the spindle is there to allow a control knob to be attached without it rotating on the spindle. The flat is also seen on a potentiometer spindle which candidates may be more familiar with.

### Section B

### Question 8

- (a) (i) The strain gauge was identified by a good proportion of those who answered this question.
- (a) (ii) Candidates who recognised the strain gauge knew that the property being measured in a strain gauge is resistance.
- (a) (iii) This part was well answered, with both marks being gained by a high proportion of candidates. In some cases the correct forces were chosen but assigned to the wrong face of the steel strip. Some candidates had named forces such as bending or shear. Marks were only awarded for tension on the top face and compression on the bottom face.
- (a) (iv) The dial gauge was the only method of non-electronic measurement that gained marks on this part. Other methods involving use of a ruler are not accurate enough to be practical. Marks were awarded for drawing a dial gauge, for having it in a suitable position and for showing how it was fastened to the test rig. Many candidates did not gain the third mark as the dial gauge was shown unattached to anything.
- (b) (i) This question produced responses that showed clear understanding of how the packaging provided protection. Some candidates referred to the multiple layers on the folded edges that would provide extra support. Most had noted that the moulded inner package included shaping that would increase rigidity and help to prevent the contents from being crushed.
- (b) (ii) The term corrugated was known to the majority of candidates. Clear sketches with meaningful annotation were seen.
- (b) (iii) There were two marks available for this part, one for showing the corrugations running downwards from the wall to allow the 80° angle of the supporting timber to direct rain away. The second mark was for showing an overlap in the sheets to provide a waterproof joint. Some candidates gained the second mark. The information that candidates should have used was that six uncut sheets were to be used. With no overlap that would provide cover over a width of 4.8 m; the width of the carport as shown was 4 m.
- (c) (i) The gusset plate was correct, in most cases with fixing points clearly visible. The brace was often drawn as a tie; no mark was given for this. A third mark was given if both reinforcement methods were drawn using functional proportions.

- (c) (ii) Candidates needed to improve their knowledge for this question. The question required a force triangle to be drawn to scale in order to arrive at the force acting on the chain. Some responses showed a completed triangle; most had carried out a calculation using trigonometry to arrive at a figure. If the answer given was correct it was awarded a single mark.
- (d) The question gave a scenario that required a designed solution to a problem that included full details in the question. Those who had not given details of suitable materials or joining methods, did not gain access to two of the marks. The other two marks were awarded for design of a stable structure and for supporting the plant to its full height. Sketches and notes were clear and well presented.
- (e) Understanding of torsion was very good, although in some cases no example was given to support the explanation.

### Question 9

- (a) (i) Some candidates correctly identified the brake lever as being second order or second class. Those who did not gain the mark had identified it as a first order lever.
- (a) (ii) There were a number of benefits of a cable linkage that could have been used. The most popular were flexibility of routing the cable and its high tensile strength. A high number of those answering the question correctly identified at least one benefit.
- (a) (iii) Drawbacks of cable linkage were centred mainly on the cable being prone to stretching or in some case breaking.
- (a) (iv) Candidates needed to improve their knowledge for this question as they found the calculation challenging. Part marks for the working were common, proving that showing all working is beneficial even if the final answer is incorrect. If the force at the brake lever had been incorrectly calculated credit was given if the second part had been carried out accurately.
- (b) (i) This question was very well answered with much response gaining all three marks. Candidates need to remember to use terms in their response that appear in the list.
- (b) (ii) Answers to this part varied from the specific examples that were expected to the generic forms of energy such as elastic potential and gravitational potential energies. Although the question clearly stated that examples should not be related to electrical energy there were a number of responses that included rechargeable batteries and photovoltaic cells.
- (b) (iii) This was another question that required an example to be given. Where this happens it is important for candidates to identify a suitable example that can be used to illustrate other points made. Reduction in weight or friction and improved aerodynamics could have been used as examples of reduction in energy demand.
- (c) (i) The ratchet and pawl was a well-known mechanism and responses included very good drawings of the component parts. In those drawings where gravity could have operated the pawl the lack of a return spring was overlooked.
- (c) (ii) The snail cam was the most popular correct choice as an alternative mechanism restricted to a single direction of rotation. The other option that could have been used is the worm and wheel.
- (d) (i) Candidates needed to improve their knowledge and understanding for this question. The method that was most popular was to increase the rise of the cam profile. Various other suggestions were used for the second method but moving the fulcrum point in the rocker was the only other correct solution.
- (d) (ii) The rocker has an oscillating motion which was recognised by many but confused with reciprocating motion by a significant minority.
- (e) (i) The question concerned two illustrations showing threads with different pitch and profile. A number of candidates gained the mark through clear description rather than knowledge of the technical terms. In most cases it was the pitch that was referred to rather than the profile.

- (e) (ii) This part was well answered with candidates recognising that smaller pitch results in more turns to move the same linear distance.

### Question 10

- (a) (i) Candidates needed to improve their knowledge for this question. Of the four switches illustrated, the reed switch and push switch were the best known. The rocker switch was frequently mistaken for a toggle switch and the microswitch was the example that was left unidentified in a small number of cases.
- (a) (ii) Those who had correctly identified the reed switch gained the mark for stating that it is operated by a magnet.
- (a) (iii) Candidates needed to improve their knowledge for this question. There were a number of cases where the question was not attempted but those who did attempt it gained at least one of the marks for showing the switch connected as an SPST switch.
- (a) (iv) The common connections were correctly identified by a higher percentage than had gained marks for the previous question. This is a case where returning to check a previous answer could have been beneficial.
- (b) (i) Understanding of the reasons for using a relay was shown in about half of the responses seen. Allowing different voltages on the motor and control circuits was the most popular reason given with isolation of the two circuits being given as a safety aspect.
- (b) (ii) The diode was widely recognised with many candidates having at least a basic understanding of its use. The mark for recognising the problem of back emf was often gained through a description rather than use of the technical term. The component being protected, the transistor was in many cases not mentioned or it was indicated that the relay was being protected.
- (b) (iii) Candidates needed to improve their knowledge and understanding for this question. This question based on the understanding of how a transistor operates was not well answered. There was some understanding of the base leg requiring a set voltage before it would operate but very few responses referred to the base/emitter circuit or the amplification caused by the gain of the transistor. On the output side very few mentioned the emitter/collector circuit.
- (b) (iv) The calculation in this part was answered well with many candidates gaining both of the available marks.
- (b) (v) Those who had successfully calculated the current in the motor circuit only had to match the available relays to their result. There was only one relay that was rated at 6 V and had a current rating greater than the 8.3 A from the calculation.
- (b) (vi) Candidates needed to improve their knowledge for this question. The component requiring identification was a fuse, which was recognised by many candidates; however it was in a number of cases mistaken for a resistor.
- (c) (i) The PCB layout was completed to a high standard in most cases. There were a number of possible solutions that could have been used. In most cases Tracks had been given thickness and routes were restricted to horizontal and vertical.
- (c) (ii) Good practical reasons for using a terminal block were given in the majority of cases. The ease of connection and disconnection was the most popular choice. Other valid reasons included the lack of heat on components from soldering and the ability to use larger wires in the connection.