DESIGN AND TECHNOLOGY

Paper 0445/12
Product Design

Key messages

- Candidates should ensure they fully understand the context and requirements of the question they choose so that their response reflects these requirements and any specification points they might add in answer to **Part (a)**.
- Candidates need to use specific terms when referring to design issues, materials, tools and manufacturing techniques.

General comments

Most candidates were well prepared to respond to the design question of their choice and many showed that they could engage competently in the design problems set in the context of golf and its associated equipment. Some candidates showed a high level of originality in their design work.

The A3 answer sheets are intended to help candidates follow the required design process and those candidates who responded as required were able to successfully demonstrate their design and thinking skills. Candidates should avoid including information not required in response to a particular part of the design process.

Comments on specific questions

Question 1

This was the most popular question and the majority of candidates understood the requirements of a mobile stand to display golf equipment clearly.

(a) Many candidates answered this starting point for the design process well as they were able to identify four additional functional points required of the stand. Successful responses included: easy to see all equipment, stable because of long clubs, aspects of easy mobility, display of small individual items, suitable for outside display, reflect golf theme, attract attention.

(b) Most candidates were able to show two methods of making the stand mobile. Appropriate responses included: single or multiple wheel systems, sliding rails, trolley jacking system, straps and other carrying systems.

(c) The majority of candidates presented three ideas and showed that they were able to be quite creative in their response to the design problem. Successful candidates enhanced their drawings with colour or other forms of highlighting and added annotations to provide information on the nature and detail of each design idea. Candidates should be encouraged to use all the space allocated to the answer for this part of the question so that they can show all information clearly.

(d) Successful candidates identified both positive and negative aspects so that they could discriminate between all three of their design ideas in relation to the context of the question. This was often more effective where some of the comments related to the functional points raised earlier in their response to **(a)**. Stronger candidates included comments which showed valid judgements rather than just simple descriptions of each design idea. Most candidates gave their chosen design idea. However, justification was sometimes too vague to gain credit.

(e) Successful candidates selected a drawing format appropriate to the design and large enough to present it clearly and then added constructional detail in the form of sketched and written annotations. Candidates are reminded of the need to add overall and some detail dimensions for the award of maximum marks.

(f) Many excellent responses selected specific materials appropriate to the design presented in **(e)**. Reasons given for choice indicated that candidates had considered the structure of their design and were familiar with the strengths and weaknesses of a range of specific materials in this context. Only a small number of candidates used generic terms such as wood, metal and thermoplastic which could not be given credit.

(g) Candidates who gave outlines that described an appropriate step-by-step manufacturing method for one part of the design solution in **(e)**, including the specific tools used, answered this question well. Responses to this part needed to develop and to include detail beyond general marking out and preparation methods that could be applied to any product. The use of simple drawings in addition to written text was generally successful.

Question 2

This question, intended for those following the Graphic Products option, was answered by a large number of candidates. Candidates were familiar with the requirements of a display package for six golf balls but some answers needed further development as they lacked the imagination that might be expected of those following a graphics option.

(a) The majority of candidates identified four additional points about the function of the display package and successful responses included: show name on golf balls, interesting shape, attractive colour, reflect 'fly high' theme, stability of storing package, easy to access balls.

(b) Most candidates had no difficulty showing two different methods of including a viewing window to make the contents visible and these included: opening in package, die cut shape, slots, different clear materials stated, opening flaps.

(c))

(d)) See **Question 1 (c) – (g)**

(e))

(f))

(g))

Question 3

A very small number of candidates answered this question.

(a) Most candidates had little difficulty identifying four additional points about the function of the counting device and these included: allow flow of balls, use of hopper, gravity or mechanical feed, does not trap fingers, stability of device and basket, method of payment.

(b) Candidates responded reasonably well by showing two different counting methods. These included: flap across delivery tube, counting wheel, optical/electronic sensor, video/computer, pneumatic click sensor, photoelectric cell.

(c))

(d)) See **Question 1 (c) – (g)**

(e))

(f))

(g))

DESIGN AND TECHNOLOGY

Paper 0445/13
Product Design

Key messages

- Candidates should ensure they fully understand the context and requirements of the question they choose so that their response reflects these requirements and any specification points they might add in answer to **Part (a)**.
- Candidates need to use specific terms when referring to design issues, materials, tools and manufacturing techniques.

General comments

Most candidates were well prepared to respond to the design question of their choice and many showed that they could engage competently in the design problems set in the context of golf and its associated equipment. Some candidates showed a high level of originality in their design work.

The A3 answer sheets are intended to help candidates follow the required design process and those candidates who responded as required were able to successfully demonstrate their design and thinking skills. Candidates should avoid including information not required in response to a particular part of the design process.

Comments on specific questions

Question 1

This was the most popular question and the majority of candidates understood the requirements of a unit to store different sizes and quantities of screw boxes in the school workshop.

(a) Many candidates answered this starting point for the design process well as they were able to identify four additional functional points required of the unit. Successful responses included: easy to see screw sizes, easy to remove and replace boxes, fixed at an appropriate height, position in workshop stated, compact so as not to be intrusive. General responses such as ‘good appearance’ or ‘waterproof’ could only be awarded credit where the specific reason for the requirement was given.

(b) Most candidates were able to show two methods of fixing such a unit to a wall. Appropriate responses included: mirror plates, dovetail hanging rail, screws through back of unit, hooks and eyes, cord over hook.

(c) The majority of candidates presented three ideas and showed that they were able to be quite creative in their response to the design problem. Successful candidates enhanced their drawings with colour or other forms of highlighting and added annotations to provide information on the nature and detail of each design idea. Candidates should be encouraged to use all the space allocated to the answer for this part of the question so that they can show all information clearly.

(d) Successful candidates identified both positive and negative aspects so that they could discriminate between all three of their design ideas in relation to the context of the question. This was often more effective where some of the comments related to the functional points raised earlier in their response to **(a)**. Stronger candidates included comments which showed valid judgements rather than just simple descriptions of each design idea. Most candidates gave their chosen design idea. However, justification was sometimes too vague to gain credit.

(e) Successful candidates selected a drawing format appropriate to the design and large enough to present it clearly and then added constructional detail in the form of sketched and written annotations. Candidates are reminded of the need to add overall and some detail dimensions for the award of maximum marks.

(f) Many excellent responses selected specific materials appropriate to the design presented in **(e)**. Reasons given for choice indicated that candidates had considered the structure of their design and were familiar with the strengths and weaknesses of a range of specific materials in this context. Only a small number of candidates used generic terms such as wood, metal and thermoplastic which could not be given credit.

(g) Candidates who gave outlines that described an appropriate step-by-step manufacturing method for one part of the design solution in **(e)**, including the specific tools used, answered this question well. Responses to this part needed to develop and to include detail beyond general marking out and preparation methods that could be applied to any product. The use of simple drawings in addition to written text was generally successful.

Question 2

This question, intended for those following the Graphic Products option, was answered by a large number of candidates. Candidates were familiar with the requirements of packaging for fifty screws and a screwdriver but some answers needed further development as they lacked the imagination that might be expected of those following a graphics option.

(a) The majority of candidates identified four additional points about the function of the packaging and successful responses included: attractive colour or shape, has impact, invites people to read about contents, includes illustrations of some products, easy to store/display.

(b) Most candidates had no difficulty showing two different methods of making the contents visible and these included: any form of window in packaging such as clear plastic, mesh, opening with retained contents, vacuum formed clear bubble.

(c))

(d)) See **Question 1 (c) – (g)**

(e))

(f))

(g))

Question 3

A very small number of candidates answered this question.

(a) Most candidates had little difficulty identifying four additional points about the function of the sorting device and these included: simple to operate, easy to store, takes wide range of screw lengths, hand operated, electric motor, easy to load and remove screws.

(b) Candidates responded well by showing two different vibrating mechanisms. These included: cam and follower, crank and slider, screw and follower, electro magnet.

(c))

(d))

(e)) See **Question 1 (c) – (g)**

(f))

(g))

DESIGN AND TECHNOLOGY

Paper 0445/32
Resistant Materials

Key messages

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

General comments

Section A

Many candidates needed to further develop the all-round knowledge and understanding required to answer all questions in this section.

Section B

This section had a number of questions with large mark allocations requiring a combination of clear and accurate sketches supported by detailed written notes. Many candidates needed to improve on their knowledge and skills to demonstrate an understanding of how to work the materials.

Comments on specific questions

Section A

Question 1

The majority of candidates achieved at least partial credit for naming the parts of the fastening device.

Question 2

Most candidates were unable to provide stages used when brazing the pegs to the mild steel base.

Question 3

The majority of candidates showed how the mortise and tenon joint could be strengthened. Many answers included the use of nails, screws or bolts inserted into the side of the joint. The strongest answers showed one or two dowels glued into the side of the joint.

Question 4

Many candidates gained at least partial credit for demonstrating a basic understanding of anthropometrics by relating the data to the height of people or to leg length.

Question 5

(a) The majority of candidates gave an accurate explanation of the term.

(b) Many candidates named stainless steel and brass as alloys.

Question 6

(a) Many candidates described how the brace increased stability, rigidity and provided greater support. Answers referring to the strength of the gate were too vague.

(b) Only a minority of candidates recognised the tee hinge that would be used with the gate.

Question 7

Most candidates gained at least partial credit for explaining the environmental impact of plastic products. Many answers referred to the non-biodegradable factor and difficulty in recycling features resulting in landfill, litter and pollution.

Question 8

Many candidates did not provide sufficient detail to support a basic drawing showing some sort of stand or support to enable the photo frame to become freestanding. Most candidates did not recognise that the 3 mm thick hardboard could not take screws. Often parts were stuck rather than glued with a named adhesive.

Question 9

(a) and (b) Most candidates could not name a die and a tap required to cut threads on a rod and inside a hole.

Question 10

Many candidates recognised that a joint made using the glue gun would set quickly. Many also recognised that there was a danger of injury from burns when using the glue gun and that the joints would not be as strong as PVA.

Section B

Question 11

(a) Many candidates were able to name specific materials for the parts of the balance. However, some candidates named materials that did not belong to the correct group; for example, naming a softwood such as pine for a hardwood and a ferrous metal such as steel for a non-ferrous metal.

(b) Many candidates produced well-drawn joints that could be used to join the support to the base of the balance. The most common included butt, half-lapped and finger joints.

(c) (i) Most candidates showed how they would cut out the slots using unconventional methods. The simplest method involved making vertical saw cuts using a tenon saw with the bulk of waste wood removed by means of a chisel. Many candidates used a coping saw to make straight cuts and filed down the remaining wood.

(ii) Similarly, many methods describing how the ends could be rounded relied greatly on the use (or misuse) of glasspaper and files when all that was required was to saw off most of the waste then finish on the sanding disc.

(d) (i) To answer this question, candidates were required to demonstrate a very basic understanding of metalworking techniques. Many candidates needed to improve on their knowledge and skills for this question, as overall performance was weak. The metal rod should have been measured using a steel rule and the length marked on the rod using a scriber. The rod would then have been secured in a vice to allow it to be sawn to length using a hacksaw. Many candidates were able to name at least one appropriate metalworking tool.

(ii) Many candidates were able to provide only one advantage of using a non-ferrous metal rather than a ferrous metal for the weights. The most common advantages included the attractive appearance and resistance to corrosion. Some candidates incorrectly stated that non-ferrous metals were lighter in weight and were cheaper.

(iii) The majority of candidates could not name the two basic centre lathe operations.

(iv) There were some good modifications drawn showing how the weights could be picked up more easily by young children. The strongest answers included some sort of machined shape allowing fingers to grip more effectively and a knurled surface that could be carried out on a centre lathe. However, many candidates provided sketches that did not show the modification clearly enough to gain credit.

(e) (i) This question required a knowledge of the features of a former or mould used when vacuum forming. To ensure that the wooden former shown in Fig. 11.6 could be used to produce the plastic pans, the only features candidates needed to show were a draft angle on the sides and rounded edges. Generally, this question was not answered well.

(ii) Many candidates understood that when heating plastic to vacuum form, if the plastic was not hot enough it would not be able to form the shape. If the plastic was too hot it could be come too thin, stretch and tear apart.

Question 12

(a) The best reasons for using MDF rather than hardwood for the dominoes included lower cost, it was easier to work and was more stable. Many candidates provided at least one reason.

(b) Most candidates sketched and named an appropriate joint for the corner of the domino box. The most common included finger and mitre joints with many half-lapped joints. Credit was awarded for accuracy of the drawings, good proportion and orientation.

(c) Very few candidates achieved maximum marks for this question. The method to fit the base inside the box with no edges visible on the outside was to use a groove, rebate or to apply some thin beads. Many candidates provided methods that were clearly visible on the outside of the box and were awarded no marks.

(d) (i) Some candidates provided drawings of excellent sawing jigs. The existing bench hook was to be modified. Some candidates ignored this and produced new jigs and little credit could be awarded.

(ii) Many candidates did not know how to square the sawn ends of the dominoes. There was an over-dependence on the use of files and glasspaper, neither of which could produce a square end. The strongest answers included the use of a smoothing, jack or block plane with the MDF supported low in a vice or showed the end of the MDF pushed against the sanding disc.

(e) Most candidates could not describe how CAM could be used to produce the dots onto the dominoes. First-hand, practical experience of CAD/CAM is to be encouraged but where this is not possible candidates must acquire at least a basic understanding of these important activities.

(f) (i) Many candidates provided one advantage of using plastic from which to make the dominoes rather than MDF. The strongest answers referred to the smooth finish, its durability and that it was easier to clean.

(ii) Many candidates correctly named injection moulding as the industrial process used to manufacture the plastic dominoes. Many gave good reasons including the repetitive accuracy and speed of the process. Those candidates who named an inappropriate process were awarded credit for reasons that were still valid.

Question 13

(a) Most candidates gave at least one property of hardwood that made it suitable for the plant holder. The most common were toughness, durability, attractiveness and resistance to moisture.

(b) There were some good answers to this question. However, some candidates did not make an accurate sketch of a dowel joint.

(c) (i) Only a minority of candidates named an appropriate type of drill that could be used to make a Ø15 hole. Twist drills were not considered appropriate and the best choices of forstner, saw tooth and flat bits were rarely stated.

(ii) Most candidates understood the purpose of the scrap wood underneath the work piece. Stronger candidates mentioned to avoid splitting, to protect the surface below, to prevent damage to the drill bit and to produce a clean hole.

(d) (i) The majority of candidates named at least one correct marking out tool. Answers included steel rule, scriber, try square and centre punch. Felt tip/marker pens were not appropriate.

(ii) To bend the mild steel to shape, candidates needed to show the strip held in a vice or clamped securely, the use of some sort of former and also needed to include the method of force used to shape the metal, usually a hammer or mallet. Many candidates gained at least partial credit for this question.

(iii) The majority of candidates gave two good reasons for painting the mild steel. The most common reasons included to improve the appearance and to prevent corrosion.

(e) Very few candidates understood the term sustainable. The majority of answers referred to the lifetime of the product rather than to why hardwood is sustainable. Hardwood can be replaced by planting new trees. Hardwood can be reused to make manufactured boards.

(f) There were many different design proposals showing how the plant holder could be made freestanding at a height of 500 mm above the ground. Many candidates did not produce clear enough sketches to communicate their ideas. In many cases candidates did not address the last part of the question that stated ‘Include details of materials, constructions, fittings and fixings’.

DESIGN AND TECHNOLOGY

Paper 0445/02
School Based Assessment

Key messages

- Centres are reminded that practical outcomes and three-dimensional prototype models should not be forwarded with the sample for moderation.
- Candidates should ensure that they produce a clear, coherent, and fluent presentation of their progress through the various sections of the design folio. They should ensure that all of the Assessment Criteria are considered.
- Candidates need to show reasoned decision making about the form, materials and construction, and of the final solution in Assessment Criterion 4.

General comments

Whilst most folders were concise and focused, some candidates included large amounts of generic information about materials, tools, finishes and manufacturing processes with very limited or no direct reference to the selected design challenge.

The majority of centres applied marks consistently and accurately. In some instances, candidates were awarded far too generous marks for some of the sections and placed above other candidates in the centre, with little or no evidence to support the marks awarded and their position in the rank order.

Centres should ensure that if more than one teacher is preparing candidates for this subject that they carefully standardise their marking to ensure an accurate rank order.

Comments on specific sections

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

This section was generally assessed accurately. The design opportunity and design brief were clearly presented by the majority of candidates. However, some candidates made limited or no reference to the needs and expectations of the selected user.

2. Research into the design brief resulting in a specification

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

Some candidates made detailed analysis of existing products and extracted useful information. Many candidates briefly described the products with no identification of key features that would help when designing.

Many candidates did not research key areas such as anthropometric data and specific details such as the sizes of objects to be kept in storage units. There was evidence of questionnaires in a number of folders but only a few candidates made conclusions from the responses.

Many specifications were fully detailed, but others were very brief and generic. Specification points needed to be detailed and justified to direct the design stages and to provide a check when evaluating.

3. Generation and exploration of design ideas

Design work presented was generally good with some examples of very high-quality presentation. However, a number of centres were too generous in their assessment in this section. The Cambridge International School Support Hub has examples of assessed coursework that would help when gauging the marks to be awarded.

Most candidates produced a small range of different discreet design ideas. To access the higher mark ranges candidates needed to explore a wider range, with some creative proposals and should have evaluated ideas in more detail before going on to the next concept.

Candidates needed to make reference to the specifications to make it clear why ideas had been selected for further development.

4. Development of proposed solution

Many candidates used models well to visualise the size, shape and proportions of the design proposal. However, candidates then needed to carry out appropriate trialling and experimentation in order to make informed decisions about the materials, construction possibilities and finishes for the product they wished to make.

5. Planning for production

This section was generally assessed accurately by most centres. Most candidates produced a dimensioned working drawing, with many including a cutting list.

Not all candidates produced a detailed, logical sequence of the stages of manufacture. Some were very brief and lacked sufficient information to manufacture the product.

6. Product realisation

Where possible candidates fully completed the manufacture of a practical outcome and there were many good quality manufactured products presented.

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

7. Testing and evaluation

Where possible candidates carried out a test of their product and produced a brief evaluation. Some candidates produced an outline of evaluation against the original specifications, but many specifications were insufficiently detailed for this to be helpful.

Not all candidates had photographic evidence to show the product in use when testing. After testing, candidates needed to identify the strengths and weaknesses of the product, and to use sketches and notes to suggest proposals for further improvement or development.

DESIGN AND TECHNOLOGY

Paper 0445/33
Resistant Materials

Key messages

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

General comments

Section A

Many candidates lacked the all-round knowledge and understanding required to answer all questions in this section.

Section B

This section had a number of questions with large mark allocations requiring a combination of clear and accurate sketches supported by detailed written notes. Many candidates did not demonstrate an understanding of how to work the materials.

Comments on specific questions

Section A

Question 1

Few candidates were able to provide the correct name for the two timber sections.

Question 2

Most candidates gained at least partial credit for naming a tool or item of equipment used to mark out and cut the aluminium tube to length. Candidates should be familiar with a steel rule, scriber and hacksaw.

Question 3

Candidates needed to look carefully at the drawing of the vacuum forming former and state two of its features. Some candidates correctly stated the draft angles, the rounded edges and the air holes.

Question 4

Many candidates tried to show a modification to the nameplate and gained partial credit. To gain further credit, candidates needed to describe how it could be made and the materials used. Many vague answers included reference to a slot for the card label. Magnets and Velcro were also stated, while some candidates screwed the card label to the nameplate.

Question 5

(a) Many candidates identified mirror as the CAD command.

(b) Most candidates gave accuracy as the main advantage of using CAD. The strongest answers related to on-screen modelling, editing tools and the ability to download data to a CNC machine.

Question 6

There were many incorrect answers to the three products shown in the question. Very few candidates knew that the metalwork vice was made from cast iron, that the fast food container was made from polystyrene (or Styrofoam). In addition, many candidates incorrectly named hardwoods for the softwood cabinet.

Question 7

Most candidates gained at least partial credit for showing a butt or piano hinge.

Question 8

Very few candidates were able to name a suitable finish for the products shown. The most common correct finish was that of galvanising for the steel bucket with only a few candidates giving correct answers, 'anodising' and 'plastic dip coating', for the comb and handle of the pliers respectively.

Question 9

Most candidates gained at least partial credit for showing how the Allen screw would be fitted but they were often less clear about the position of the barrel.

Question 10

Few candidates answered this question correctly. These answers showed a good knowledge and understanding of this type of smart material: that when thermochromic pigment is applied to the fork and spoon variations in temperature would cause changes in colour and this would alert the person feeding the young child.

Section B

Question 11

(a) Very few candidates provided a sketch showing the construction of plywood to explain why it was more suitable than solid wood for the table.

(b) Many candidates understood that most of the outside shape of the table could be cut out using a jig saw, Hegner saw or band saw. Many candidates described how a hole would need to be drilled and the blade of an appropriate saw inserted so that the middle part of the table shape could be removed. Since the question only required candidates to show how the shape could be cut out, references to files and glasspaper were irrelevant. Many candidates failed to realise that a coping saw would have limited use because of the depth of the frame.

(c) (i) The appropriate diameter for dowel was set at the range Ø6 to Ø9 mm. Many answers were outside of this range. Many diameters stated were actually greater than the 15 mm thickness of the plywood.

(ii) This question required candidates to describe a method of achieving accuracy when drilling holes for dowel joints. Most answers were incorrect. Those answers that described the use of a drilling jig or careful use of a marking gauge gained some credit but the strongest answers related to the use of dowel jigs, (metal studs that were used to make indentations in the corresponding parts) and panel pins with the heads removed to produce a similar accurate outcome.

(d) (i) This question required a basic knowledge of woodturning. Many candidates provided one reason for removing the sharp corners of the plywood table top before it could be shaped on the

woodturning lathe. The strongest answers stated that it would make the turning easier, quicker or safer.

(ii) Only a few candidates provided an appropriate or relevant check that would be carried out before switching on the lathe. Stronger answers described how the workpiece would be rotated to make sure it was free to move, that the lathe speed was set correctly or that the tee rest was set at the correct height.

(iii) Only a few candidates could name the two basic woodturning lathe tools. The most common correctly named tool was a chisel with a few scrapers and even fewer gouges.

(e) This question was not answered well. Many candidates did not recognise that the table frame would require additional strips or the use of brackets to enable the table top to be joined to the frame and legs. Many candidates did not note the instruction in the question that additional material could be used. Most answers showed crude methods of simply gluing, or screwing or nailing the parts together, often directly through the table top.

(f) (i) Most candidates recognised that it would be easier to ensure that all the parts of the table would be covered if they were painted before the parts were assembled.

(ii) Many candidates could not explain the purpose of the primer coat and why it would be applied first.

Question 12

(a) The best properties of acrylic provided by candidates included the ability to be shaped easily, the attractive appearance and the range of colours.

(b) Most candidates understood the importance of making a model of the tablet stand. Stronger answers included: to check the overall appearance, check the sizes and the benefit of make modifications to the model rather than wasting expensive acrylic.

(c) Very few candidates gained full credit for this question. Many candidates showed some understanding of the term ergonomics but others confused the term with aspects of the environment. Many candidates correctly related the design of the tablet to the user's comfort and gained partial credit.

(d) (i) and (ii) There was much confusion relating to the use of a marker pen and scriber to mark out the bend line and the cut line. Many candidates stated both tools/items of equipment but often the wrong way round. Other incorrect answers included the naming of woodworking tools such as a marking knife.

(e) (i) Many candidates named an appropriate saw with the most common being a coping, scroll or band saw. Tenon, jig and hacksaws could not remove the waste easily.

(ii) Many candidates recognised that acrylic sheet required support when being sawn because it could break or become damaged. Answers that stated that it should not move were too vague.

(f) (i) Many candidates could not identify the correct method of filing used to make the edges of the acrylic smooth.

(ii) Many candidates identified the most appropriate abrasive to make the edges of the acrylic smooth.

(g) There were many good answers to this question and candidates showed a very good understanding of this area of study. There were many answers showing the use of a strip heater or line bender heating the acrylic so that it could be shaped using a former, then held in position while the acrylic cooled. Sometimes a lack of clarity and accuracy of sketches and written notes meant that candidates did not achieve the maximum marks.

(h) (i) Most candidates gained credit for showing a practical modification to the tablet stand. The most common idea was to simply extend the existing top part of the stand and bend it to provide some sort of stop or lip to prevent the tablet from slipping off. However, many candidates ignored the final sentence of the question: 'Name all the materials used, construction details and **two** important sizes'.

(ii) Many candidates described two safety precautions to be taken when using acrylic cement. The most common correct answers included the use of a face mask, safety glasses and the use of gloves. Some candidates recognised the importance of a well-ventilated work area.

Question 13

(a) Most candidates gave one feature of a non-ferrous alloy, gaining credit for stating that it was a metal that does not contain iron or a combination of at least two metals mixed together.

(b) (i) Most candidates gave at least one benefit of using a template with the most common being (repetitive) accuracy and speed.

(ii) Very few candidates could identify both the tinsnips **and** junior hacksaw.

(c) (i) Many candidates stated the purpose of at least one of the items of equipment used when soldering but knowledge generally was weak.

(ii) There was a complete lack of knowledge of screw cutting using taps and dies. Most answers showed very little, if any, practical accuracy or relevance.

(d) (i) Although the question asked candidates to name a machine saw that could be used to remove the waste wood, many answers referred to files and glasspaper. Common correct answers included scroll, coping, band and jig saws.

(ii) As in **(i)** many candidates named tools other than planes that could be used to make the sawn edge flat and smooth. Correct answers included the jack and smoothing planes.

(e) (i) The question informed candidates that the legs of the table lamp would have an applied finish to protect the wood and make it look attractive. Candidates were to provide one other benefit of applying a painted finish. Many candidates did not read the question carefully enough and simply repeated what was stated in the question.

(ii) This part of the question was answered slightly better with candidates recognising that a clear varnish would allow the natural features of the wood to be seen.

(f) Only a minority of candidates were familiar with methods of cleaning and finishing brass to a high quality. Some candidates correctly suggested the use of silicon carbide (wet and dry) paper and use of a polish with a buffing wheel.

(g) Only a few candidates provided an accurate description of the preparation required when using epoxy resin adhesive.

DESIGN AND TECHNOLOGY

Paper 0445/41
Systems and Control

There were too few candidates for a meaningful report to be produced.

DESIGN AND TECHNOLOGY

Paper 0445/42
Systems and Control

Key messages

- Where sketches are required care should be taken that they are large enough for detail to be clearly seen.
- In questions requiring answers to be circled, candidates must ensure that they complete no more than the number of circles asked for. Errors are best corrected by neatly crossing through the incorrect answer.
- Where explanations are asked for, any points made should be justified to ensure that credit can be awarded.
- All responses should appear in the space allocated. If there is not enough room the response can be continued on additional sheets attached to the booklet. If additional sheets are used the question and part number must appear clearly next to the response.
- If a comparison is required, for example in a question asking for advantages, the response should reflect this and provide reference to the items being compared.
- Explanations should be given in sentences rather than as short notes.
- Candidates should take care not to merely repeat information that is given in the question.

General comments

The ***Section A*** questions were accessible to most candidates. Very few instances were seen of a question not being attempted.

In ***Section B*** responses were largely divided between structures and mechanisms questions and all candidates had followed the rubric in only attempting one question.

Comments on specific questions

Section A

Question 1

This question was accessible to most candidates with the majority gaining full credit for recognising the two infinite energy sources.

Question 2

(a) Several valid advantages of using CAD/CAM were found but, in a few cases, it was clear that candidates did not know the difference between CAD and CAM. The two features were blocked together in the question to highlight the fact that they could be used together to aid batch production. Several responses highlighted the increased accuracy of automated CAD/CAM systems.

(b) A range of computer-controlled manufacturing machines were named in responses. 3D printer was a popular choice, along with robot machines used in car manufacturing.

Question 3

(a) The question asked for two properties of concrete that make it suitable for bridges. The label on the photo of a bridge indicated the concrete beam, which should have led to the correct answer.

Weather resistance and high compressive strength were the most popular answers with very few using the ease of moulding concrete or the fact that it can be moulded on site to reduce transport difficulties.

(b) (i) Most responses correctly stated that steel rods could be inserted in the concrete to provide reinforcement. Access to further credit for showing the correct position for the rods was more limited. Sketches frequently showed far too many rods with no clarity on the position. Three rods placed below the centre line of the beam would be enough to counteract the weakness in tension of concrete.

(ii) Most candidates correctly identified tensile force as the force being resisted by the steel rods in concrete.

Question 4

(a) The question required identification of the effort, fulcrum and load in the lever made up of the lower jaw of the self-grip wrench. The majority of candidates identified the position of effort in the lever with the load proving most difficult to identify. In several cases the same letter had been used more than once and this was given no credit.

(b) The lever was correctly identified as being class 1 by most candidates.

Question 5

The types of motion in a clock pendulum and when cutting with a hacksaw were both identified by stronger candidates. Incorrect answers were generally found in the hacksaw example, where the movement was identified as being linear. Candidates should be taught the set terms for the four basic types of movement found in a mechanism.

Question 6

Reasons for the use of spur gears to transmit motion were not well known by weaker candidates. Stronger candidates gave the lack of slippage and ability to change the relative speed and direction of motion in two shafts.

Question 7

The construction and operation of reed switches was not fully understood in many cases. Most candidates gained partial credit for knowing that magnets are used in the operation of the switch. Many explanations then went on to incorrectly mention electromagnets being formed by the switch in operation or the contacts themselves being the magnets. Very few candidates seemed clear on the use of external magnets which operate the contacts when in close proximity.

Question 8

(a) The three symbols were well known and correctly identified in most cases. Very few candidates named the diode as an LED.

(b) Connection of resistors in parallel was correctly completed by only stronger candidates. These candidates were able to connect the paralleled resistors to the supply voltage. In a lot of cases the two power rails were connected together, resulting in a short circuit.

Section B

Question 9

(a) In most cases standard methods of joining the two pieces of softwood were clearly illustrated and annotation was meaningful. A few of the stronger solutions involved the use of gusset plates. Those candidates who showed a glued butt joint gained no credit for the functionality of this method, though credit could be gained for the quality of sketches and notes.

(b) (i) Corrugation in sheet material will increase rigidity and allow an increased load to be carried. These two points were used in several responses. One benefit that was not mentioned was the ability to overlap adjoining sheets easily, forming a watertight seal.

(ii) Any solution that showed two or more support beams crossing the corrugations at 90 º gained credit. Most of the solutions given used more than a single support beam.

(c) (i) In most cases a sensible choice of resistant material was offered for the model bridge. In a few cases the materials would have been more suited to a full-sized bridge. Wood was the most popular choice of a suitable material.

(ii) Chosen methods of joining the bridge materials were usually suitable. However, some candidates specified methods like welding, which would have been unsuitable for the size of material being joined. If aluminium soldering was the choice, it was allowed, but this would be a difficult method to control on smaller parts.

(iii) Those who gained marks for describing the joining method were generally successful in showing how the model could be tested and evaluated. Sketches were usually of good quality and gave clear indication of how tests could be carried out. The principle of applying increasing quantities of load to the bridge deck was seen in the strongest solutions. A few candidates used strain gauges or methods of accurately measuring deflection as the load caused the bridge deck to drop.

(d) (i) Nearly all candidates correctly identified the structure for Turbine **B**. However, identifying Turbine **A** was more challenging with some candidates suggesting a mass structure and others giving a shell structure. The ratio of width to height should have guided candidates toward the shell structure as a mass structure of those proportions would be unstable.

(ii) Any load that would not change whilst the turbine blades were resting gained credit.

(iii) In a few cases the examples of moving loads given were unsuitable. The weight of insects flying into the turbine was an example of this. Those candidates who chose movement in the turbine blades or wind acting on the structure gained credit.

(iv) In answering this question, candidates should have referred to the foundations and methods of fixing to the ground used for the turbine towers. If the positioning of forces acting on the tower was described as equally spread around the base this also gained credit. This was an example of a question where full credit could have been achieved by including a number of separate factors or by a detailed explanation of a single factor.

(e) In this calculation question the formula to be used was given. The first part of the calculation was to substitute the required lengths into the formula. There were several fully correct answers where the calculation was clearly laid out and the steps were easy to follow. Those who arrived at an incorrect answer in most cases did not convert the lengths to a single unit leading to a substitution of $\frac{0.35}{1.5}$ instead of $\frac{0.35}{1500}$.

Question 10

(a) (i) The crank and slider mechanism on the toy locomotive was recognised by all candidates answering this optional question.

(ii) A large number of candidates identified rotary motion as the input to the crank and slider. There were several errors on the output, which was frequently given as linear by weaker candidates, rather than the correct answer, which was reciprocating.

(iii) In this part, candidates had to give the number of lifts that the cam would perform in one rotation. Most candidates recognised that having two lobes on the cam would result in two lifting movements per revolution.

(iv) Only the strongest candidates answered this question fully correctly giving the benefits of using nylon for the cam and follower. The low friction value of the material was the reason most often given, with a few mentions of low production cost.

(b) (i) Only the strongest candidates gained credit for explaining why roller bearings can support a greater radial load. Those that did get it correct mentioned the greater contact area given by a roller compared to a ball. If the explanation continued to state that the load would be distributed over a larger area, full credit was awarded.

(ii) Lack of lubrication was the reason most frequently given for bearing failure. Dirt or abrasive material coming into contact with the bearing surface was also identified by several candidates.

(c) (i) There were no errors found in responses to this part and all candidates used an anticlockwise arrow to indicate the direction.

(ii) Knowledge of worm gears was apparent in the responses seen. The large reduction in speed was the first reason most often given. For the second reason, the compact nature of the gear arrangement was mentioned. Relatively few candidates mentioned the increase in torque or the fact that the primary shaft of the gear cannot be turned backwards.

(iii) The first challenge for candidates in this part was to present the velocity ratio in the correct format. A significant number of responses had the ratios reversed, e.g. 1:60 instead of 60:1.

When calculating the individual ratio for each stage, the ratio from B to C proved the most challenging. Any candidate who gave it as 10:3 rather than 3.33:1 was awarded credit. The final part of the calculation was for the overall velocity ratio which required each of the individual components to be multiplied. Only stronger candidates got this correct.

(d) (i) Comparison between three methods of transmitting drive was needed, with one advantage and one disadvantage for each method. The robustness of a chain drive was frequently mentioned but valid disadvantages were often missing. With the pulley and round belt, most candidates noted that the belt can slip as a disadvantage but advantages such as low cost and easy replacement were rarely seen. The use of a toothed belt was given as an advantage in terms of reducing slip. Valid disadvantages were not often seen.

(ii) Some good sketches were seen in response to the tensioning method for a drive belt.

Standard methods such as a spring assisted wheel in contact with the belt were used and adjustment was clearly explained in most cases.

Question 11

(a) (i) Benefits for the two illustrated connection methods were required. Responses should have noted that the terminal block allows for connection without the use of solder and disconnection is straightforward. With the plug and socket method, multiple connections can be made easily and orientation is made easy as the plug can only be fitted in one way.

(ii) Sketches and notes on the stripping of insulation and twisting together of the stranded connection wire were sufficient to gain full credit. Other stages could have been substituted, such as tinning the strands to prevent individual strands from being left outside of the terminal.

(b) (i) The question first required matching of the red band to the 2 per cent tolerance range in the chart. From this, the tolerance could be calculated and the upper and lower values calculated by adding or subtracting from 10 000 Ω. Candidates should be advised to take care with the units being used in this type of question.

(ii) Use of 0 Ω resistors is normal during design and construction of printed circuit boards. They are much easier and quicker to manipulate than wire links when solving the problem of how to jump over an existing track.

(iii) The calculation made use of a given formula for power. Stronger candidates correctly made the conversion of 29 mA to 0.029 A.

(iv) This part related to the resistors whose power rating was lower than that calculated in **(iii)**.

(c) (i) Use of the given time delay formula required resistance to be in ohms and capacitance to be in farads. The first stage was to convert 15 k Ω to 15 000 Ω and 1 000 µF to 0.001 F. Following this the calculation could be completed.

(ii) There were two facts about the operation of the 555 IC that were relevant to the question; the timer will trigger when pin 2 goes from high to low and at that point the output changes from low to high. The two graphs should have reflected these changes: the trigger signal remaining low for 5 seconds before returning to high as the switch is released and the output remaining high for the value calculated in **(ii)**, before returning to low.

(iii) A diode across an output transducer must be connected in reverse bias.

In this case the cathode on the diode is connected to the +9V supply and the anode to the timer output.

(iv) Protective diodes are used to prevent back emf or voltage spike form damaging the drive circuit, in this case the 555 IC.

(d) This part which tested an understanding of logic required the linking of two different signal levels. Either of the inputs could have been inverted using a NOT gate and then combined with the other input to switch on the water supply. If both inputs had been at logic 0, a NOR gate would be used and if both were at logic, an AND gate would provide the solution.

DESIGN AND TECHNOLOGY

Paper 0445/43
Systems and Control

There were too few candidates for a meaningful report to be produced.

DESIGN AND TECHNOLOGY

Paper 0445/52
Graphic Products

Key message

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

General comments

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

The standard of work was comparable to that of the previous year. However, there are areas of the syllabus, in which improvements are needed. Candidates must be able to project views in 1st angle projection and be able to draw ellipses to given major and minor axis. Practical experience of different printing methods would be useful.

Comments on specific questions

Question A1

Package for printer paper

Candidates were given a pictorial drawing of a package for a ream of printer paper.

On the started development, candidates were required to complete the development (net) to a scale of 1:3. To include:

(a) the outer shape of the package.
(b) the ellipse on the front of the package.
(c) the missing letters of PRINTER PAPER.

Most candidates completed the development (net) of the package. Some candidates had difficulty in recognising that the package had four sides all with top and bottom flaps. Several candidates found difficulty in drawing the ellipse shape to the given dimensions.

Where candidates used a trammel, this needed to be drawn on the exam paper to allow for credit to be awarded for construction of the ellipse.

Question A2

A box file

Orthographic views of a box file were given.

Candidates were asked to complete a one-point perspective of the box file that had been started on the right of the paper.

Most candidates aligned the corners given to the VP. A parallel line for the back sloping edge completed the width and a horizontal back edge provided the top. Some candidates failed to include the vertical inside corner.

Question A3

Offset Lithography

This question required candidates to have knowledge of a modern printing process. Offset Lithography has two very important advantages:

1. It can print large numbers quickly and to a good quality.
2. It can print to a cheap cost whilst maintaining the low cost.

Many successful answers were given by candidates with full explanatory notes.

Question B4

Printer table

This question was based on assembly instructions for a CKD table. The question was attempted by a small number of the candidates.

A classroom exercise to make an instruction leaflet would be most beneficial to future candidates' understanding of this commonly used application.

(a) Candidates were required to complete the planometric view to a scale of 1:10.

Credit was awarded for drawing the side 40 wide by 71 high. A tolerance was allowed of +/–3 mm. The top shelf needed to be drawn 100 down from the top edge of the side and the second shelf 250 further down. In all cases the thickness of the sides and shelves were to be 3 mm.

(b) (i) This part of the question required a full-size isometric drawing of the exploded wheel assembly on the given isometric grid. The bracket with a top of 12sq × 6sq was achieved by most candidates. The diagonal line behind the threaded shaft needed to be projected from the given exposed edge.

(ii) The Ø60 plastic wheel needed to be drawn on the centre line with a thickness of 20 mm. Candidates who used the two circle method and 'boxed' the wheel gave good answers.

(iii) Successful candidates used the same construction for the washer.

(c) Candidates were required to enhance the given drawing of the wheel to make it look realistically round. Candidates achieved this by applying graduated shading to the edge (darker at the sides) and circular arcs of diminishing radius to the top surface.

Question B5

Packaging for a printer cartridge

This question was based on a package for a printer cartridge. The question was attempted by a large number of candidates.

A pictorial view of a package for a printer cartridge was shown.

(a) Candidates were required to complete the half sized orthographic views. Marks were awarded for completing in 1st angle projection of the front and side views and the plan.

(b) Candidates were asked to provide an alternative method of closure by modifying the flap so that it can be locked in the closed position, thus preventing the ink cartridge from falling out.

(c) (i) This part of the question asked the candidate to state the meaning of

Symbol A – can be recycled

Symbol B – harmful to the environment.

(ii) Candidates were asked to explain one advantage of using CAD on a computer to draw the symbols **A** and **B**.

The advantages are:

- Quicker, because images can be copied and pasted.
- More accurate because CAD can draw to 0.001 mm.
- Safer, because can be stored on a disc.
- Easier to share, because can be sent to others by email etc.

(d) Candidates were required to complete the table to give the tools or item of equipment needed to carry out the processes. Correct answers were:

pencil, rule, square
scissors, craft knife, scalpel, Stanley knife, cutting mat, safety rule
rule, back of knife blade scissor blade
PVA glue, adhesive, double sided tape, glue spreader.

DESIGN AND TECHNOLOGY

Paper 0445/53
Graphic Products

Key message

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

General comments

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

The standard of work was comparable to that of the previous year. However, there are areas of the syllabus in which improvements are needed. Candidates must be able to project views in 3rd angle projection and be able to draw curves to touch other curves and straight lines. Practical experience of using vacuum forming to produce blister packs would be a valuable activity.

Comments on specific questions

Question A1

A photo mount for a picture frame

Candidates were given a full-size drawing of a photo mount.

On the given centre lines candidates were required to draw full-size:

(a) the rectangular shape
(b) the ellipse shape
(c) the eight-sided shape (two half octagons)
(d) the heart shape.

Most candidates completed the drawing of the photo mount. Some candidates had difficulty in drawing the two half octagons. Several candidates found difficulty in drawing the R56 arcs to the heart shape. Generally, the R15 semi-circles of the heart shape were achieved by most candidates.

Question A2

Cutting a photo mount by hand

Most candidates recognised that a safety rule (steel rule) and a cutting mat were essential when using a craft knife.

Question A3

Parts for a picture frame

Individual drawings of the four parts of a picture frame and a section through the centre of the front of the frame were given.

(a) Candidates were asked to complete the exploded isometric view by drawing the glass between the mount and the frame. Credit was awarded for the correct size and the correct position. Diagonal lines to depict glass were expected to be seen on the front surface.

(b) Candidates were also asked to draw the detail of the rectangular hole in the frame. A hole drawn 10 mm in from the edge of the frame was expected to be visible with a thickness of 2/3 mm.

Question B4

Photo holder

This question was based on a display stand used in a shop. The question was attempted by many candidates.

(a) Candidates were required to add thick and thin lines to the given pictorial view of a photo holder.

The rule for this image enhancement is that edges where only one side producing the edge is visible are made thick. Edges where both sides producing the edge are visible are left thin.

(b) A pictorial outline drawing of a wooden block photo holder with relevant dimensions was given.

Candidates were asked to compete the third angle projection views of
(i) side view
(ii) plan from the given front view.

Credit was awarded for correct projection from the given front view and the correct application of the lengths 100 and 80 centrally on the side view and plan.

(c) A drawing of a cardboard photo holder with a single rudder back support was given.

Candidates were asked to show an alternative design that would hold the photo upright on a desk, but that would fold flat when not in use. A number of excellent solutions were proposed by candidates.

(d) Candidates were told that the photo holder shown in **(c)** was to be produced by a printing run of 10 000.

(i) Candidates were asked to state a suitable method of printing the letters 'YOUR MEMORIES' on the cardboard photo holders.

(ii) Candidates were asked to explain why some types of printing are only cost effective in large quantities.

The main answer was the high set up cost but that each subsequent print is cheap. Therefore, set up costs diminish over a large print run.

Question B5

Photo frame package

This question was attempted by a small number of candidates.

A pictorial view of the package for a photo frame was given.

(a) (i) Candidates were asked to complete the half-size development (net) of the photo frame.

(ii) To complete the development (net) candidates were required to add the 55 × 30 rectangle around the image.

(b) Candidates were told that the image was originally drawn on paper and then transferred onto a computer.

(i) Candidates were asked to state one method of transferring the image from paper onto the computer.

(ii) Candidates were asked to name two ways that the image could be altered using a computer.

(iii) Candidates were asked to name one piece of CAM equipment that could be used to cut out the development (net) of the package from thin card.

(c) A blister package for the photo frame was presented as a pictorial drawing.

(i) Candidates were asked to complete the flow chart of the vacuum forming process to make the blister pack. This involved:

- drawing a decision box around 'Is it hot enough'.
- adding NO to the L/H of the box.
- inserting 'Raise Bed' to the top right column.

(ii) Draft needed to be added to the mould to make it efficient in ejecting the blister forming.