GCE

Design & Technology

Advanced GCE **A2 7822-3**

Advanced Subsidiary GCE **AS 3822-3**

Mark Schemes for the Units

June 2009

3822-3/7822-3/MS/R/09

Oxford Cambridge and RSA Examinations

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MARK SCHEMES FOR THE UNITS

2520/01 Product Design 1

1 **(a)** Justified design requirements include:

- sharp enough cutters to effectively and neatly cut nails so as to leave tidy well manicured finish
- sufficient leverage to cut nails without over exertion
- rust proof material, need to be cleaned, hygiene
- sufficient springiness of blades to spring open when pressure released
- handle designed so that it can be folded flat when not in use for ease of storage.
- effective grip to prevent fingers slipping

No marks awarded for statements referring to obvious product function eg must cut nails.

For **three** justified design requirements 1 x 3 **[3]**

(b) Examples could be:

- pressure required to cut
- lever size, thumb
- nail shape on blades
- level to blade distance when holding clipper between thumb and finger
- thickness of nail.

For **three** examples (1 mark) described with sketch (1 mark) or well described with no sketch (2 marks).

2 x 3 **[6]**

(c) Reasons could include:

- cost, throwaway/use once products
- difficult to maintain
- rapidly changing fashions
- material choice
- urgent need – face masks
- celebrity endorsement
- specific function products (channel tunnel borer)

For **three** reasons 1 x 3 **[3]**

(d) Issues included in discussion could be:

- protection
- additional materials – cost
- additional stage in production
- advertising
- environmental concerns.

Examples could be:

- cleaning products – reuse packaging
- additional space in transport, help protect
- minimalist 'value product' packaging.

P	relevant points/issues	up to 3 marks
Q	quality of explanation	up to 2 marks
S	specific example/evidence	1 mark **[6]**

Total [18]

2 **(a)** Ways could be:

- 2D modelling of ideas on screen
- 3D modelling of ideas on screen
- nets cut out with laser cutter
- virtual reality modelling
- range of other CAM applications, rapid prototyping, router, embroidery system, miller, lathe.

For **four** ways 1 x 4 **[4]**

(b) Ways could be:

- database to record current stock
- internet ordering when supplies are required
- scanning systems for component/stock tracking
- bar codes.

For **two** ways clearly described:
Statement (1 mark) Exemplification/ justification (1 mark) 2 x 2 **[4]**

(c) Ways could be:

- stress analysis
- visual sensors for dimension/tolerance/colour checking
- computer operated tensile/hardness/impact testing systems
- simulation systems
- temperature testing in food, ceramic and metal industries (recalibrates ovens, kilns etc)
- specialist software (eg Excel do not accept Word). 2 x 2 **[4]**

(d) Issues included in discussion could be:

- more use of mechanical fixings, less use of adhesives
- careful material selection
- increased consumer appreciation of environmental product
- increased production time, cost implications.
- consumer maintenance

Examples could be:

- BMW and most car companies
- domestic ‘white’ electrical products washing machines, fridges.

P	relevant points/issues	up to 3 marks
Q	quality of explanation	up to 2 marks
S	specific example/evidence	1 mark **[6]**

Total [18]

3 (a) Justified design requirements include:

- able to be washed regularly, will get very dirty
- easily identified, inter school sports
- range of sizes to suit school age range
- tough fabric, rough usage
- durable, last at least one year.

For **three** justified design requirements 1 x 3 **[3]**

(b) Factors could include:

- fashion trends
- seasonal products
- price
- effective promotion.

For **three** ways 1 x 3 **[3]**

(c) Example could be:

- white products – fridges, freezers, clean, bright
- red – safety switches/danger, warning
- blue – traditional boys colour
- pink – traditional girls colour (may have gender as 1 mark)
- green – environmentally friendly colour

Example 1 mark explanation 1 mark 2 x 3 **[6]**

(d) Issues included in discussion could be:

- real need for product
- pressure on parents
- encourage/win over new buyers
- raise awareness.
  cost implications

Examples could be:

- celebrities
- free gifts
- BOGOF.

P	relevant points/issues	up to 3 marks
Q	quality of explanation	up to 2 marks
S	specific example/evidence	1 mark **[6]**

Total [18]

4 (a) Justified design requirements include:

- withstand weathering, situated outdoors
- effective spike to enable secure fixing in ground (can move to different positions)
- bright enough light to light up immediate area, path, flower bed
- effective photovoltaic system (suitable area) to obtain enough solar energy
- effective and long lasting storage system
- sensor to turn light on when ambient light dips below set level, automatic, not manually operated
- may accept qualified 'no sharp edges' as children play in garden?

For **three** justified design requirements 1 x 3 **[3]**

(b) Reasons could be:

- no need for trailing cables
- green source of energy
- no additional costs
- product is in the open.

For **three** reasons 1 x 3 **[3]**

(c) Factors could be:

- sun catchment area
- internal components
- sufficient height to illuminate chosen area
- clear section determines illumination area.

For **three** factors well described 3 x 2 **[6]**
Statement (1 mark) Exemplification/justification (1mark)

(d) Issues included in discussion could be:

- initial cost
- reliability of source
- level of power produced
- environmentally clean/space required.

Examples could be:

- great increase in Solar power systems in Germany
- great advances in photo voltaic technology and parabolic mirror systems.

P	relevant points/issues	up to 3 marks
Q	quality of explanation	up to 2 marks
S	specific example/evidence	1 mark **[6]**

Total [18]

5 (a) Justified design requirements include:

- large enough to carry average daily shopping
- robust for regular use
- comfortable handles, do not cut into hands with full load
- easily folded/stored when not in use, not take up space/clutter
- strong enough to prevent sharper objects (box corners) from tearing the bag.

No marks awarded for statements referring to obvious product function eg must hold shopping

For **three** justified design requirements 1 x 3 **[3]**

(b) Ways could include:

- reduce packaging
- recycle/reuse – reduce wastage
- reduce energy consumption (efficient systems)
- reduce/review transport arrangements
- dispose of waste correctly.

For **three** reasons 1 x 3 **[3]**

(c) Variable costs could include:

- materials
- labour
- energy
- packaging.
- transportation

For **three** costs well described 2 x 3 **[6]**
Statement (1 mark) Exemplification/justification (1 mark)

(d) Issues included in discussion could be:

- secure storage
- transportation
- expensive – cost cutting
- incineration
- scale, amount produced
- could be recycled.

Examples could be:

- treatment centres (UK take toxic industrial waste from around the world for processing)
- local initiatives – generating heat from waste.

P	relevant points/issues	up to 3 marks
Q	quality of explanation	up to 2 marks
S	specific example/evidence	1 mark **[6]**

Total [18]

2520/02 Product Design 1

1 (a) (i) Eg ash, mahogany, oak, beech, hickory, sycamore – 1 mark for each. **[2]**

(ii) Strong, often easy to work, hardwearing (durable) good appearance, take a variety of finishes, stable/non warping, resistant to rotting. **[2]**

(b) Marking out of mortise and tenon – use of marking/mortise gauge/ try square (2)
wasting – for mortise use of drills/mortise chisels/morticer – for tenon use of tenon saw/chisels, power router/band saw (2)
fitting – sawing and fitting fox wedges/use of adhesive (2)
finishing – cleaning up surfaces with plane/glass paper – fitting panel into plough/groove (2)
[8]

(c) Where the product is going to be used ie interior/exterior
the nature of finish required – ie tough, glossy
whether the material has any natural oils
cost/time taken to apply
quality of finish
consumer demand/fashion/aesthetics

[P] Relevant points/issues (up to 3 marks)
[Q] Quality of explanation of two issues (up to 2 marks)
[S] Specific example/evidence (1 mark) **[6]**

Total Marks [18]

2 (a) (i) Eg aluminium alloy, brass, bronze, duralumin, steel (no trade names) **[2]**

(ii) Eg toughness, strength, hardwearing, durable, lightweight, malleability, corrosion resistant **[2]**

(b) Die casting (high pressure).

Mention should be given to:

molten (heat) aluminium	(1)	
two part die closed (under pressure)	(1)	
poured/forced under pressure	(2)	
cooling time	(1)	
ejection from the mould	(1)	
removal of excess material	(1)	
mould design – female, rounded corners, tapers/draft angles, sprue	(2)	
ejector pins (1)/repeatability (1)	(2)	**[8]**

(c) Discussion could include:
easy to replace
low cost
no investment in machinery
saves time
JIT
Quality control

[P] Critical examination of issues	(3)	
[Q] Quality of explanation	(2)	
[S] Supporting examples/evidence	(1)	**[6]**

Total Marks [18]

3 **(a)** Very good finish, glossy appearance, tough/durable, lightweight, high impact strength, easily formed, easy to clean, colour 1 mark for each. **[2]**

(b) High volume process, good surface finish can be achieved, theromoplastics used, low unit cost, quality, detail, accuracy, complexity of design, not wasteful of materials **[2]**

(c) Details of moulds – split (1), rounded corners, draft angles (1), sprue, ejector pins (1), the process, hopper (1)
clear annotated diagram showing:
granules (1) heated (1), injected under pressure into mould (1)
cooling time (1)/water cooled (1)
moulding ejected (1) – sprue removed (1)
repeatability (1) **[8]**

(d) Eg cost, fashion/trend/function/performance, appearance, marketing/advertising, ergonomic issues (ease of use), storage

[P] Relevant points/issues	(up to 3 marks)	
[Q] Quality of explanation of two issues	(up to 2 marks)	
[S] Specific example/evidence	(1 mark)	**[6]**

Total Marks [18]

4 (a) (i) Lightweight, low cost, easily to print onto, relatively strong
Recyclable (2x1) **[2]**

(ii) Grams per square metre (1)
Density/Weight (1) **[2]**

(b) Mechanical paper production:

- wood pulp made into slurry with water and starch to break down the cellulose
- slurry mixed and deposited onto a fine mesh (moving by conveyor) up to 2000m per min
- when fibres touch they lock together forming fine web – water drains away through mesh
- paper web then passes through a series of pressing rollers
- further moisture is removed by absorption as the web is carried on thick felts
- web then passes through heated cylinders (drying)
- size press – coatings added to paper
- polished calendar rollers polish/glaze – improve finish
- paper is rolled and cut/slit to size **[8]**

(c) Discussion could include:

- economic: cost of materials vs revenue from advertising
- enables products to be stored and transported safely and efficiently
- environmental: obsolescence issues, recycling, energy used in production
- reduces the need to pack individual items

[P] Critical examination of issues (3)
[Q] Quality of explanation (2)
[S] Supporting examples/evidence (1) **[6]**

Total Marks [18]

5 (a) (i) Cyan, magenta **[2]**

(ii) Cyan (not blue), yellow **[2]**

(b) 4 marks for any 4 quality checks eg:

- registration marks
- crop marks
- densitometer/colour scales
- correct paper/alignment
- correct links
- visual checks
- bleed areas

1 mark for description of use of registration marks, 1 mark for correct symbol
1 mark for description of use of colour marks, 1 mark for use of densitometer **[8]**

(c) Discussion could include:

For the manufacturer
quality control testing helps to reduce scrap and wastage
ensures higher quality/consistent/accurate product
increases productivity – hence profits
improves company reputation – company/brand loyalty

For the customer
confidence in the product/company
product more accurate/reliable providing value for money

[P] Points and issues (3)
[Q] Quality of explanation (2)
[S] Supporting examples/evidence (1) **[6]**

Total Marks [18]

6 (a) (i) Easy to wash, stretchy, breathes, lightweight, absorbent
Comfortable
Reduced care/doesn't need to be ironed/durable **[4]**

(b)

- Logo designed on computer
- Computer linked to embroidery machine
- Logo adjusted (checked for size/accuracy)
- Embroidery machine loaded with appropriate yarns
- Polo shirt aligned accurately
- Logo machined
- Polo shirt removed – final finishing
- Polo shirt checked for accuracy/quality **[8]**

(c) Discussion could include:

- speed
- accuracy
- quality
- repeatability
- may require non skilled labour/less labour
- cost of training
- replacement costs of machinery
- investment in new machinery may require higher scales of production to justify expenditure

[P] Critical examination of issues (3)
[Q] Quality of explanation (2)
[S] Supporting examples/evidence (1) **[6]**

Total Marks [18]

7 (a) (i) Eg zips, buttons, poppers, Velcro, clips **[2]**

(ii) Tolerance – the amount by which the measurement can vary from the norm +/-3 = max of 6mm – 1 mark for size variation, 1 mark for mentioning 6mm - allowance **[2]**

(b)

Marking out with tailors' chalk	(1)
Lay planning details – main body plus two sides (5 sides)	(2)
Details of detachable strips on corners	(1)
Components for joining strips (detachable)	(1)
Cutting out – mention warp/weft/selvedge	(3)
Tacking	(1)
Sewing/reinforcing for straps – double stitch	(1)
Finishing/trimming loose ends	(1) **[8]**

(c) Discussion could include:
the use of cheap labour in developing countries,
poor working conditions/exploitation – possible issues surrounding the use of child labour
demand for low cost products in UK forces manufacturing overseas resulting in fewer manufacturing jobs
environment

[P] Points and issues	(3)	
[Q] Quality of explanation	(2)	
[S] Supporting examples/evidence	(1)	**[6]**

Total Marks [18]

2521/01 Product Design 1

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Examples could be:

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Examples could be:

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- reduce energy consumption (efficient systems)
- reduce/review transport arrangements
- dispose of waste correctly.

For **three** reasons 1 x 3 **[3]**

(c) Variable costs could include:

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- energy
- packaging.
- transportation

For **three** costs well described 2 x 3 **[6]**
Statement (1 mark) Exemplification/justification (1 mark)

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- secure storage
- transportation
- expensive – cost cutting
- incineration
- scale, amount produced
- could be recycled.

Examples could be:

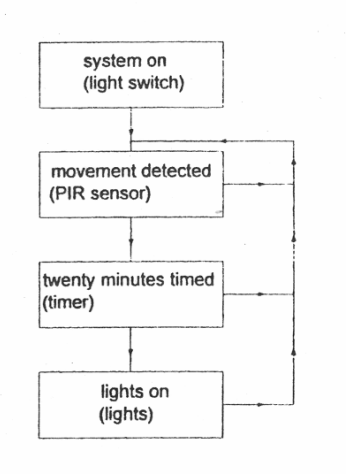
- treatment centres (UK take toxic industrial waste from around the world for processing)
- local initiatives – generating heat from waste.

P	relevant points/issues	up to 3 marks
Q	quality of explanation	up to 2 marks
S	specific example/evidence	1 mark **[6]**

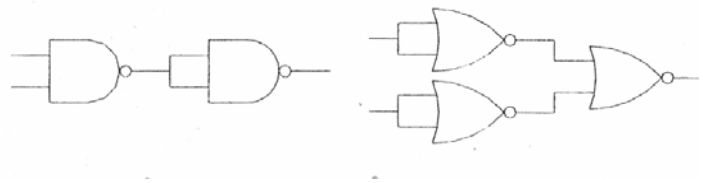
Total [18]

2521/02 Systems and Control Technology 1

1 (a) (i) Correct order, 2 marks **[2]**



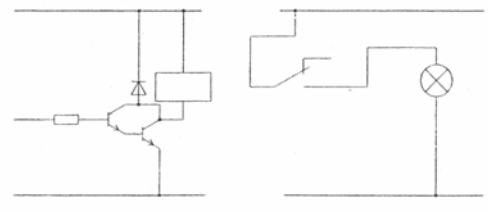
(ii) Use of NAND or NOR gates correctly drawn, (1)
Correct configuration.
NOT gates can be from either NAND or NOR. (1) **[2]**



(b) (i) Breakdown of 1200 into binary components,
1024 + 128 + 32 + 16 gives Q11, Q8, Q6, Q5 as outputs required, allow pin numbers. 1 mark for each correctly identified. (4 x 1) **[4]**

(ii) Use of AND gate or gates 1 mark.
Output signal of gates taken to pin 11, 1 mark.
Response can be either notes or diagrams. **[2]**

(c) Functional method of operating relay. (1)
Connections to lamp. (1) **[2]**



(d)
- Issues raised
- Initial cost
- IT skills needed
- Speed of programming
- Universal understanding of programme
- Employment reduction
- Automated assembly.

(3) P

Quality of answer.	(2) Q	
Supporting examples	(1) S	**[6]**

Total: [18]

2 (a) (i) Sensors could be:

- Motion.
- Pressure pads.
- Door magnetic.

Or any other correct sensor. 2x1 **[2]**

(b) Switch 1 – Set or trigger Q high. Not Q low. **[1]**
Switch 2 – Reset. **[1]**
R2 – Pull up resistor protects from short circuit. **[1]**

(c) (i) IC. 1 is an op-amp in comparator mode. **[1]**

(ii) Balanced op amp inputs ration 1:2 ratio. 1 mark
Answer 5K **[2]**
If 2:1 used with answer 20k 1 only

(d) Advantages of an LDR could be:

- Readily available
- Cost effective
- Robust

Disadvantages of an LDR could be:

- Not linear
- Accuracy **[4]**
- Range

(e) Issues raised could be:

- Profits limited.
- Costs extra.
- Feedback from R/C centres as customers.
- Circuit board and components waste management.
- EEC inspection and regulation.
- Or any other correct points relevant to question. (3) P

Qualification of two points. (2) Q
Supporting evidence. (1) S **[6]**

Total 18 marks

3 (a) (i) Different mix actions.
Widens range of capability.
Allows range of mixture densities.
Sells product. 2x1 **[2]**

(ii) Gearbox.
Motor speed control. 2x1 **[2]**

(b) (i) Worm and wheel/spiral pinion gear. **[1]**

(ii) Benefits could be:
- Large speed reduction.
- High torque.
- Smooth action.
- Change of direction. **[1]**

(c) (i) Gear X – Pinion gear, idler gear. **[1]**

(ii) Input = 2400
Ratio 48/24 = 2:1 = 4800
Ratio 24/96 = 1:4 = 4800/4 = 1200.
One mark answer, one mark working. **[2]**

(d) Drawing must have:
- Inner case, outer case (1)
- Ball cage (1)
- Labels correctly used (1) **[3]**

(e) Main points are:
- Fit of parts
- Ease of assembly
- Power of screwdrivers – pressure on seams and fixings
- Cost of accurate moulds
- Tooling and maintenance
- Cad/Cam used for design of tooling
- Capability to repeat over high volumes
- Staff expertise
- Standardised parts
- Any other correct points.

(3) P

Qualification of two points.
Supporting examples. (2) Q
(1) S **[6]**

Total 18 marks

4 (a) Precautions could be:

- Guard in place – chuck tight.
- Work clamped down.
- Eye protection.
- Clothing protected.
- Drill speed correct.
- Machine turned off at end.
- Any other correct precaution for this machine — 1 mark each **[2]**

(b) (i) Rack (1) and pinion (1) **[2]**

(ii) Purpose is to position the chuck vertically, give downward pressure to the drill and raise it after drilling. (1)
Rotary to linear. (1) **[2]**

(c) (i) $\frac{\text{driver revs x diameter of driver}}{\text{diameter of driven}}$

Pulley 1 2000x30/110=545
2 2000x50/75=1333
3 2000x75/50=3000
4 2000x110/30=7333 rpm — 1 mark each **[4]**

Give max (2) marks if list is inverted but otherwise correct.

(ii) Woodruff key, keyway and key, grub screw or staked. 1 mark each **[2]**

(d) Issues raised:

- Employment.
- Skills levels.
- Setting up costs.
- Unable to do one offs.
- On-line manufacture.
- Any other relevant correct points. (3) P

Any other relevant correct points **[6]**

Quality of answer. (2) Q
Supporting examples used. (1) S

Total 18 marks

5 (a) (i) Valve A. **[1]**

(ii) Foot pedal operated. **[1]**

(b) (i) As the cylinder outstrokes the clamping mechanism moves the end of the piston rod. (1) to the left, or clamp (1) and so the cylinder must swing to accommodate this movement (1). **[3]**

(ii) Valve A or B (1) and C (1). **[2]**

(iii) The foot pedal would have to be operated all the time the clamp was being used or similar. **[1]**

(c) Correct symbol – 1 mark
Correct position – 2 marks
Correct orientation – 1 mark **[4]**

(d) Points could be:

- Operator protection systems.
- Speed of operation.
- Hand versus machine.
- High wear rate of pivots.
- Lubrication.
- Force of clamping.
- Installation costs.
- Any other correct point. **(3) P**

Quality of answer. **(2) Q**
Supporting examples used. **(1) S** **[6]**

Total 18 marks

6 **(a)** Factors could be:
Power supply
Noise
Venting
Pressure regulation
Connections to machine
Weight 1 mark each **[2]**

(b) **(i)** Problems could be:
In hopper
When fired
Where tennis ball drops in front of ram 1 mark each **[2]**

(ii) Table should be completed as:

B +		A -
A -	a -	
	b -	A +

(1 mark each) **[6]**

(iii) Explanation could be along the lines of:
The machine has to continue until A- is reached.
The time will be fairly short but there is no way to interrupt the sequence.

(1 mark each) **[2]**

(c) Issues raised
Environmental protection
Water ingress
IP insulation
H & S
Filters
Cleaning
Fencing
Any other correct relevant points (3) (P)

Quality of explanation (2) Q
Supporting examples/evidence (1) S **[6]**

Total 18 marks

2524/01 Product Design 2

1 Fig 1 shows a hardwood table.

(a) (i) Any two suitable hardwoods named, eg:
- Teak
- Oak
- Mahogany
- Iroko.

2 x 1 mark [2]

(ii) Two suitable adhesives named, eg:
- PVA
- Pearl Glue
- Scotch Glue
- 'Cascamite' , 'Aerolite'
- Urea formaldehyde adhesive
- UV Resin.

2 x 1 mark [2]

(iii) Reversed grains
Biscuit jointed
Planing edge of boards
Tongue groove jointing
Gluing
Cramping – with appropriate device
Surface finishing

4 x 1 mark [4]

(b) (i) Description of any suitable joint could include, eg simple stub mortise:
- Detail of 'leg' part of joint
- Detail of 'rail' part of joint
- Detail of how mortise is cut
- Detail of how tenon is cut
- Work cramped or held while gluing
- Work jigged or set to correct angle
- Curing time or method identified.

4 x 1 mark [4]

(ii) Description of suitable attachment:
- Metal bracket
- Wooden block
- Screw through rail
- Wooden toggles and slots in rail
- Allowance for movement

2 x 1 mark for suitable attachment
2 x 1 if attachment allows for movement (4)

(c) Discussions could centre various selection issues such as:

- Grain
- Compressive/tensional/torsion strength
- Working characteristics
- Aesthetics
- Suitability for internal use
- Stability
- Weight
- Availability
- Sustainability.

P relevant points/issues up to 3 marks
Q quality of explanation up to 3 marks
S specific examples/evidence up to 2 marks [8]

Total: [24]

2 Fig 2 shows an aluminium alloy can with a ring pull. The can is used for carbonated drinks.

(a) (i) Four reasons given:
- Malleable
- Impervious to gas
- Easily shaped
- Recyclable
- Reference to non-corrosion
- Hygienic
- Lightweight.

4 x 1 mark [4]

(ii) Two features described:
- Stiffness of tab
- Weakness of opening
- Safety edges on tabs
- Tensile strength of rivet
- Leverage
- Size and shape of ring.

2 x 2 marks [4]

(b) Description could include:
- Process starts with punching a flat blank
- Produced from stiff cold-rolled sheet
- The flat blank is formed into a cup
- The cup is then pushed through a different forming process called “ironing” which forms the can
- The bottom of the can is also shaped at this time
- The malleable metal deforms into the shape of an open-top can
- The side of the can is significantly thinner than either the top and bottom areas, where stiffness is required
- Plain lids are stamped out from a coil of aluminium
- Lids transferred to another press that converts them to easy-open ends
- The conversion press forms an integral rivet button in the lid and scores the opening
- The tabs are formed in another die from a separate strip of aluminium
- The tab is pushed over the button, which is then flattened to form the rivet that attaches the tab to the lid
- Finally, the top rim of the can is trimmed and pressed inward or “necked” to form a taper conical where the can will later be filled and the lid attached.

8 x 1 marks [8]

(c) Discussion centred on the economic implications of continuous production methods and could include positive or negative points:

- Cost of ‘dedicated’ machinery
- Down time costs
- Storage during 'slack' order periods
- Possible inflexibility of line
- Lower production costs
- Possibly lower training costs

P relevant points/issues up to 3 marks
Q quality of explanation up to 3 marks
S specific examples/evidence up to 2 marks [8]

Total: [24]

3 Fig 3 shows a battery operated portable drill. The two part casing is made from injection moulded ABS.

(a) (i) Four reasons given:
- High impact strength
- Suitable for injection moulding
- Can be easily coloured
- Electrical insulator
- Clip/screw joints can be moulded into body
- Scratch resistant
- Durable
- Wear resistant surface.

4 x 1 mark [4]

(ii) Two suitable joining methods:
- Self tapping screws
- Suitable nut and bolt fixture
- Plastic welding
- Clip joints.

2 x 1 mark for method
2 x 1 for description (4)

(b) Description of injection moulding:
- Hopper
- Screw
- Hydraulic/electric motor
- Heating jacket
- Cooling jacket
- Granular/pellet plastic
- Mould close
- Injection carriage forward
- Metering
- Carriage retract
- Mould partial cool
- Mould open
- Ejection
- Split/multi part mould

8 x 1 mark [8]

(c) Discussion centres on the environmental implications of using battery powered equipment and could include:
- Use of heavy metals in production
- Toxic chemical in production
- Safe disposal of battery
- Recharge versus standard battery
- Limited recharges before disposal.

P relevant points/issues up to 3 marks
Q quality of explanation up to 3 marks
S specific examples/evidence up to 2 marks [8]

4 Fig 4 shows a special edition CD case made from board and plastic.

(a) (i) Two suitable surface finishes named:
- Varnish
- UV Varnish
- Laminating.

2 x 1 mark [2]

(ii) Two reasons given:
- Aesthetics
- Gloss finish
- Damp proof card
- Clean surface.

2 x 1 mark [2]

(iii) Two disadvantages described:
- Difficulty in determining print run size
- Non-standard CD case therefore increased cost
- Dedicated case to CD useless for another CD
- Unused cases are wasted
- Board surface could wear with use.

2 x 1 mark for disadvantage
2 x 1 mark for description [4]

(b) Description of offset lithography printing process could include:
- CMY colour rolls
- Ink fountain
- K roll
- Dampening solution fountain
- Dampening roll
- Printing plate
- Blanket cylinder
- Impression cylinder
- Feed pile
- Delivery pile.

8 x 1 mark [8]

(c) Discussion will centre on the marketing implications for the designers of packaging of multimedia products and could include:
- Appropriately designed for target market
- Eye-catching
- Suitable to product
- Compliant with retailers' requirements
- Promotes image of enterprise
- Distinguishable from competitors' products.

P relevant points/issues up to 3 marks
Q quality of explanation up to 3 marks
S specific examples/evidence up to 2 marks [8]

Total: [24]

5 Fig 5 shows a box used for packaging and transporting an electronic scanner.

(a) (i) Labelled drawing could include details showing:
- Multi-layer board
- Bleached surface
- Pulp/corrugated core.

2 x 1 mark [2]

(ii) **Two** reasons could include:
- Good strength/weight ratio
- Good surface to print on
- Pulp or corrugated centre will protect scanner
- Available in large sheet form and rolls.

2 x 1 mark [2]

(iii) Two joining methods described:
- Industrial staples
- Double sided tape
- Contact adhesive.

2 x 1 mark for method
2 x 1 mark for description [4]

(b) Sketch could include eight of the following:
- Correct proportion
- Net will work correctly
- Details of fold lines
- Fold lines in correct position
- Base locking tabs shown
- Base lock will work
- Top lock slot in correct position
- Handle slot in correct position
- Handle can be fitted to net
- Inner top lid shown correctly
- Joined side panels enable secure join.

8 x 1 mark [8]

(c) Discussions centres on the design of packaging and the environmental issues:
- Designs using less virgin material
- Material can be further recycled easily (card v EPS)
- Less material same packaging requirements
- Best shape may not use less material
- Material used decomposes in reasonable period if land-filled
- Consumer/Group pressure to reduce waste.

P relevant points/issues up to 3 marks
Q quality of explanation up to 3 marks
S specific examples/evidence up to 2 marks [8]

Total: [24]

6 Fig 6 shows a waistcoat made from cotton velvet fabric with a taffeta lining.

(a) (i) Any two, one mark each:

- Thread
- Buttons
- Ribbon
- Buckle/loop
- Interfacing strips.

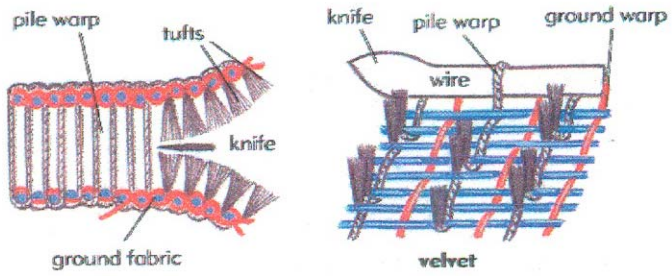
[2]

(ii) Any three, one mark each:

- Hardwearing
- Looks good, appealing
- Comfortable/non irritating
- Natural fibre – seen as environmentally friendly
- Warm to wear due to pile
- Gives the impression of luxury, expense.

[3]

(iii) Any three points, one mark each, either in diagram or text:



- A ground fabric is woven
- An extra set of yarn is used to create the pile
- These threads are cut in velvet.

[3]

either

- Velvet can be made by weaving two fabrics face to face
- With a set of yarns passing between them
- These are then cut
- Makes two pieces of velvet
- May be cut to make it even
- Brushed and steamed.

or

- The extra threads we lee on the surface of the fabric during weaving
- They are woven over looping wires or cutting wires
- When the wires are removed, it cuts the extra threads
- The pile is cut to make it even
- It is then brushed and steamed.

(b) Any eight points in a logical order, diagrams or notes.
One mark must be allocated to specific reference to working with a pile fabric:

- Pattern pieces need to be laid on the same way round to ensure the colour is the same for each section of the waistcoat and the pile runs the same way
- Cut the pieces out and transfer the pattern symbols
- Stitch darts
- Attach ribbon/back straps at back side seams, as indicated by pattern markings
- Stitch side seams following direction of the pile
- Stitch one of the shoulder seams
- Make up lining in the same way, omitting pocket flaps
- Place lining and velvet RS together and stitch together, leaving shoulder seam
- Trim and clip seams
- Turn through to RS
- Stitch shoulder seam
- Mark and make buttonholes
- Attach buttons
- Press – using needle board or similar devise to prevent crushing of pile
- Quality checks.

[8]

(c) Discussion could include reference to:

- More expensive to make
- Good for image of company
- Needs to reduce fertilisation or use environmentally friendly methods – computer controlled
- Irrigation – must maintain the balance computer controlled
- Chemicals used to protect from disease can contaminate the soil, water or atmosphere, need to reduce the impact – degrade in the environment
- Breeding pest resistant varieties
- Using natural predators rather than pesticides
- Is renewable and gives off oxygen, taking in carbon dioxide
- May be tax incentives
- Improve manufacturing processes – reduce water, chemicals, energy used
- Recycle water and heat used
- Use enzymes or biodegradable chemicals
- Filter and clean up waste generated during the process.

P relevant points/issues up to 3 marks
Q quality of explanation up to 3 marks
S specific examples/evidence up to 2 marks [8]

Total: [24]

7 Fig 7 shows a children's ball pit play tent made for outdoor use.

(a) (i) Any three points, one mark each:

- Hardwearing/durable
- Washable
- Tear resistant/good tensile strength
- Anti static
- Not damaged by sunlight
- Will not rot/damaged by mildew
- Flame resistant
- Air permeable.

[3]

(ii) Any one, one mark:

- See through
- So child does not feel 'penned in'
- So others can see in to check on children inside
- So children can go in safely
- To allow air to circulate
- To reduce cost of fabric.

[1]

(iii) Any two, one mark for identification of method, one for description:

- Bias binding – see above methods
- Ribbon – can be applied as for binding, see above.

- Close zig-zag – left hand diagram, and/or suitable written description
- Overlocking – centre diagram, and/or suitable written description
- Narrow hem – right diagram, and/or suitable written description.

[4]

(b) Any eight points in a logical order:

- Pattern pieces shown which fit together to form product
- Pattern symbols shown, eg straight grain, notches
- Cut fabric shapes, transfer pattern markings as necessary
- Make up opening in net section – neaten edges/bind
- Strengthen corners of opening
- Add fastening to hold door open
- Bind/neaten edges of opening in the top section
- Prepare base section
- Fit top or base, either can be done first
- Fit base or top, which ever needs doing
- Neaten edges of the sections added last
- Fit frame work
- Quality checks.

[8]

(c) Discussion could include reference to:

- Design must be robust enough to withstand outdoor use
- Fabrics must have suitable performance characteristics for outdoor use
- Special finishes may need to be applied to fabrics, eg waterproof, rot proof, stain resistance
- Must not be damaged by sunlight
- If need to be left outside for prolonged periods, they may need to be secured
- More leisure time means more opportunities for designing products
- Smart and Modem materials offer design opportunities
- Wide range of products, gardening, toys, protection for furniture, boats, cars, bikes etc
- Tents and awnings for caravans
- Wind tents for on the beach, fishing tents for protection from the elements, windbreaks for on the beach
- Boats, sails etc, kites and power kites.

P relevant points/issues up to 3 marks
Q quality of explanation up to 3 marks
S specific examples/evidence up to 2 marks [8]

Total: [24]

2525/01 Systems and Control Technology 2

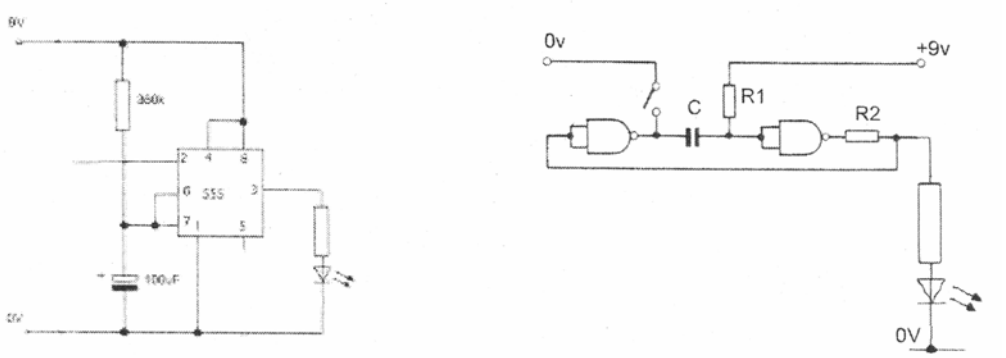
1 (a) (i) Single Pole Single Throw. **[1]**

(ii) P = 24 x .025 = 0.6 Watts. **[1]**

(b) (i) Terminal S is to SET the output of the D-type flip-flop to 1. **[1]**

(ii) The code must be entered in the correct order. Each of the three pushbuttons are wired to the clock terminal of their 'own D-type flip-flop. Assuming all flip-flops are reset at start pressing SW1 will cause the output of IC1a to go high since IC1a is a T-type.(1) This will cause IC3a to go high, provided SW5 and the button pressed match, and make the D terminal of IC1b go high. (1) When SW2 is pressed the output of IC1b goes high and so causing the output of IC3b to go high provided, as before, the switches match. (1) This action is repeated for SW3 and IC2a and IC3c (1) which will cause the led, D1, to illuminate and the solenoid release. (1) If a wrong button is pressed at any time all the flip-flops will reset. **[5]**

(c) (i) A suitable 555 timer or NAND gate timer would be expected.



1.1 RI x C = 40secs (1), trigger input (1), led output (1), rest of circuit correct (1). **[4]**

(ii) Suitable combination of OR inputs from pushbuttons to counter input. (1) Counter output to AND gate with output from timer. (1) Timer trigger signal. (1) Output from AND gate to reset switch output. (1) Or similar suitable correct response. **[4]**

(d) P = Identify a range of relevant issues I points. **[3]**

Q = Quality of explanation as to why these issues are relevant. **[3]**

S = Use of specific examples or supporting evidence. **[2]**

Issues could include: Need to look at alternatives, reduce waste in the home, use more efficient devices, shop around for energy, lower standard of living, wage rises, civil unrest, old people in danger or other relevant points.

Total: [24]

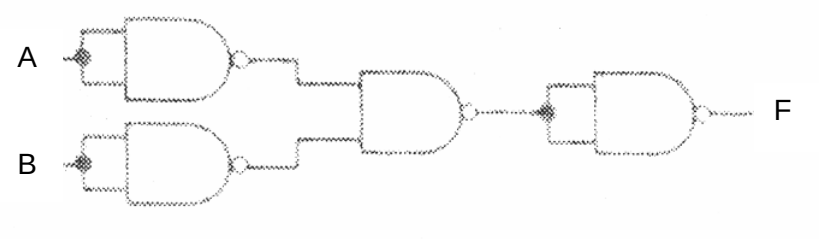
2 (a) (i) Complementary Metal Oxide Semiconductor. **[1]**

(ii)

B	A	Z
0	0	1
0	1	0
1	0	0
1	1	0

[1]

(iii)



[2]

One mark for input gates, one mark for last two gates.

(b) (i) If all tilt switches are closed the AND function of ic1, 2 and 3 will light the green LED (1).
If none of the tilt switches are closed the combination of ic4, ic5 and ic6 will light the red LED (1).
For any other combination of tilt switches ic7 will light the amber LED (1). **[3]**

(ii) R = (9 - 1.8v)/0.016A = 7.2v/0.016A = 450 Ohms **[1]**

(c) (i) Source: the ability of a gate to act as a current supply (1) when the output of the gate is high.(1) **[2]**

(ii) Candidates could use a suitable transistor/MOSFET from the output of the final logic gate, ic7 for example, have the led/resistor and buzzer in parallel in the collector circuit. A suitable free-wheeling diode is required.
Equally candidates could use a suitable relay, again with the led/resistor and buzzer in parallel in the collector circuit. A free-wheeling diode is required in parallel with the relay coil.
(1) for free-wheeling diode, (1) for led/resistor and buzzer in parallel (1),
(1) for correct connection to logic gate and supply. **[3]**

(d) (i) Surface Mount Technology - Solder paste is placed on the surface of the PCB at the points where components will be placed. (1) Surface Mount Devices are placed on the paste on the surface of the PCB before being fed into reflow oven that melts the solder. (1) OR An alternative process involves dispensing adhesive on the board, onto which components are placed by machine. (1) The adhesive is cured to hold the components in place. The board is passed over a solder wave which provides the solder for the joints. (1) **[2]**

(ii) Smaller products due to better 'packing density' of components.
Better QC due to SMT. Or relevant points. **[1]**

(e) P = Identify a range of relevant issues/points. **[3]**
Q = Quality of explanation as to why these issues are relevant. **[3]**
S = Use of specific examples or supporting evidence. **[2]**

Issues could include: Extra cost to manufacturer, perhaps increased price so less sales, may increase size of product/packaging, sale of spare batteries, selling feature, better quality product, disposal of battery, consumers pay more, recharging issues, extends life of product or other relevant points.

[Total: 24]

3 (a) (i) Ductility is the ability of a material to be drawn out longitudinally to a smaller cross section (1) while elasticity is the ability of a material to return to its original shape after being deformed. (1) **[2]**

(ii) Strength is a materials ability to resist a force without breaking (1) whereas hardness is a materials ability to resist indentation or wear. **[2]**

(iii) Could offer: Type of load, wear, corrosion, uniformity of material, amount of cable. Any two. One mark each. **[2]**

(b) (i) Reduction: 10/50 x 10/50 x 10/60 (1) = 1/5x5x6= 1/150(1) **[2]**

(ii) Compound **[1]**

(iii) Nylon, aluminium alloy, composites (eg duracon). Any one. **[1]**

(iv) Final gear transfers a large torque, so requires a stronger material than other gears, less lubrication, weight. **[2]**

(v) Large reduction in a small space. Drum locked when motor not running. 908 change in drive direction. Any one. **[1]**

(c) Drum speed = 7000 /150 (or as calculated previously)

= 47rpm or 0.78rev/sec. (1)
Time = 1000mm/(0.78 x π (x 80) (1)
= 5.1 seconds. (1) **[3]**

(d) P = Identify a range of relevant issues/points. **[3]**
Q = Quality of explanation as to why these issues are relevant. **[3]**
S = Use of specific examples or supporting evidence. **[2]**

Issues could include: Less cars, less pollution, better for environment, clearer roads, cheaper for consumer, saves oil/petrol which is a finite resource, not as convenient for the user, not as acceptable on rainy days, resistance to change, cost, rates/taxes, or other relevant points.

[Total: 24]

4 (a) (i) Square thread for transmitting forces. **[1]**

(ii) Lead = number of starts x pitch. (1) For single start pitch = lead. (1) Or similar. **[2]**

(iii) Multiple start threads produce more rapid motion.
Have a greater lead than single start.
One point well explained. Up to (2) **[2]**

(b) VR = distance moved by effort/distance moved by load
= 2 x π x 200/8 (1)
= 157 (1) **[2]**

(c) Taking moments about A:
CW = 1m x 2700N = CCW = 3m x B
2700N = 3B
900N (1) = B and A = 2700 - 900 = 1800N (1) **[2]**

(d) (i) Correct name (eg Izod, Charpy, Brinell) or other destructive test (eg. Compression test, Function test) **[1]**

(ii) Suitable sketch (Up to 2). Annotation (Up to 2). **[3]**

(iii) Explanation of test well explained (Up to 2). Achieves its purpose (Up to 2). **[3]**

(e) P = Identify a range of relevant issues/points. **[3]**
Q = Quality of explanation as to why these issues are relevant. **[3]**
S = Use of specific examples or supporting evidence. **[2]**

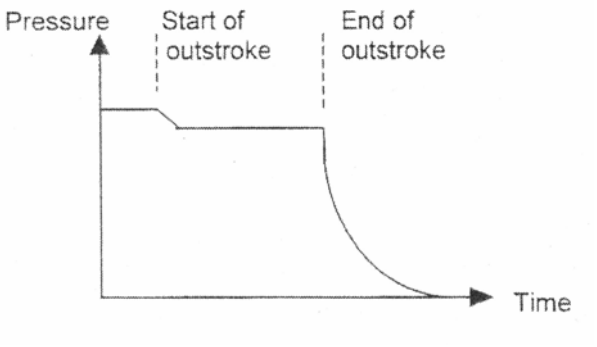
Issues could include: Loss of money from accounts, additional debts run up by thief, loss of reputation, possible bankruptcy, refused credit, possible illness brought on by associated stress, suicidal or other relevant points.

[Total: 24]

5 (a) (i) Outstroke speed reduced. **[1]**
No change to maximum outstroke force. **[1]**

(ii) Restricting the exhaust from a cylinder results in a smoother movement (1).
Restricting the air flow into the valve results in a jerky movement and the speed may become unstable at the end of the stroke. (1) **[2]**

(iii)



Pressure high during outstroke and pressure drops to 0 at end of outstroke. (1)
Correctly labelled axes. (1) **[2]**

(iv) When window fully open pressure at point P will be 0 (1) so therefore the diaphragm valve will be in the default/relaxed/as drawn position. (1) **[2]**

(v) Many alternatives. Plunger/Roller-trip/Lever-operated valve moved by window itself. Close air bleed.
Appropriate detection method. (1) Suitable component/so (1) Correctly drawn circuit. (1) **[3]**

(b) (i) Therefore, W = 0.2 x 100 x A x 7 m^3 /min (1)
Area = 0.02^2 x π = 0.001257m^2
W = 0.2 x 100 x 0.001257x7(1) W 0.176m^3/min (1) Must state correct units. **[3]**

(ii) The formula would need to include the reduction in area of piston on the in-stroke caused by the piston rod. (1) This would require two separate calculations, one for out-stroke and one for in-stroke. (1) Or similar explanation. **[2]**

(c) P = Identify a range of relevant issues/points. **[3]**
Q = Quality of explanation as to why these issues are relevant. **[3]**
S = Use of specific examples or supporting evidence. **[2]**

Issues could include: Lower costs, less deliveries -less pollution, good for the environment, tessellation, recycling, possibly cheaper product passing on savings, selling point or other relevant points.

[Total: 24]

6 (a) (i) Mass would represent the expected load for a typical drawer (1) so making the test realistic. **[1]**

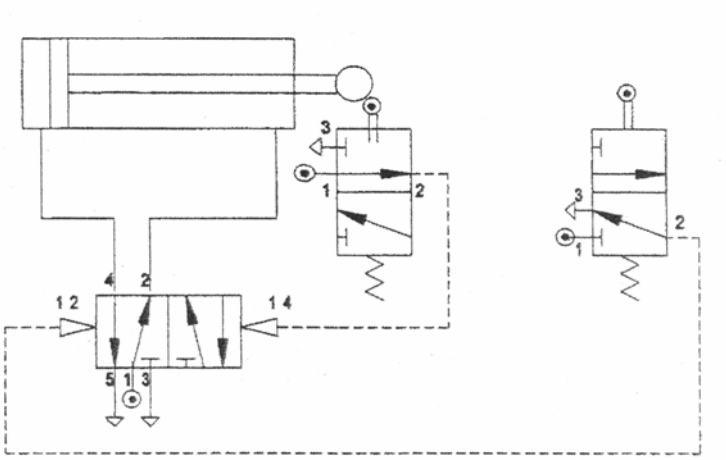
(ii) 5 x 365 x 4 = 7300 + tolerance for leap years, 1 or 2. **[1]**

(iii) (7300 x 2)/3600 = 4.05hours + tolerance as (ii). **[1]**

(iv) No! most likely response. In-out too linear; real life will result in pushing off-centre, for example.
Or, greater weight in drawer, weight not evenly distributed, runners will have differing friction.
Reason. (1) Explanation. (1) **[2]**

(b) (i) Double-acting cylinders give control of motion (speed and force) in both directions. Or Spring on single-acting cylinder may not be strong enough to open the drawer. **[1]**

(ii)



Circuit example only. Various alternatives possible; pressure decay and reservoir timing are two further possibilities.
Use of appropriate components. (1) Correct interconnections. (1) Working circuit. (1) Correct actuators on valves. (1) **[4]**

(c) F = P x A F = (0.7N/mm2 x n x 252)14 (1) F = 343.61N (1) Must state units. **[2]**

(d) (i) Economic design and operation, reliable, minimal maintenance, compact, fast response, easy integration with other systems. Anyone, well explained. (up to 2) **[2]**

(ii) Factor of safety entails allowing for the expected and unexpected to avoid any safety issues. In practise this would mean increasing the number of cups above that required (1) to allow for circumstances such as:
Poor seal at cup, faulty cup/s, board not correctly positioned, pressure loss, board heavier than expected. Any one (1). **[2]**

(e) P = Identify a range of relevant issues/points. **[3]**
Q = Quality of explanation as to why these issues are relevant. **[3]**
S = Use of specific examples or supporting evidence. **[2]**

Issues could include: Better quality product, more reliable product, extra costs involved, less returns, potentially better name for products, more consumer confidence or other relevant points.

[Total: 24]

Grade Thresholds

Advanced GCE Design and Technology (7822, 7823)
Advanced Subsidiary GCE Design and Technology (3822, 3823)
June 2009 Assessment Series

Unit Threshold Marks

Unit		Maximum Mark	A	B	C	D	E	U
2518	Raw	90	68	60	52	44	37	0
	UMS	90	72	63	54	45	36	
2519	Raw	120	96	84	72	60	48	0
	UMS	120	96	84	72	60	48	
2520	Raw	90	61	54	48	42	36	0
	UMS	90	72	63	54	45	36	
2521	Raw	90	60	53	46	39	32	0
	UMS	90	72	63	54	45	36	
2522	Raw	90	70	62	55	48	41	0
	UMS	90	72	63	54	45	36	
2523	Raw	90	71	63	55	48	41	0
	UMS	90	72	63	54	45	36	
2524	Raw	120	76	69	62	55	49	0
	UMS	120	96	84	72	60	48	
2525	Raw	120	77	70	63	56	50	0
	UMS	120	96	84	72	60	48	

Specification Aggregation Results

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

	Maximum Mark	A	B	C	D	E	U
3822, 3823	300	240	210	180	150	120	0
7822, 7823	600	480	420	360	300	240	0

The cumulative percentage of candidates awarded each grade was as follows:

	A	B	C	D	E	U	Total Number of Candidates
3822	18.7	42.1	70.2	89.4	98.1	100	532
3823	8.3	25.0	41.7	72.2	94.4	100	36

532 candidates aggregated this series for 3822

36 candidates aggregated this series for 3823

	A	B	C	D	E	U	Total Number of Candidates
7822	18.1	41.7	67.1	87.7	97.4	100	2468
7823	27.8	51.9	74.4	88.0	99.2	100	136

2468 candidates aggregated this series for 7822

136 candidates aggregated this series for 7823

For a description of how UMS marks are calculated see;
http://www.ocr.org.uk/examsystem/understand_ums.html

Statistics are correct at the time of publication

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