

Design & Technology

Advanced GCE A2 7822-3

Advanced Subsidiary GCE AS 3822-3

Mark Schemes for the Units

January 2007

3822-3/7822-3/MS/R/07J

OCR (Oxford, Cambridge and RSA Examinations) is a unitary awarding body, established by the University of Cambridge Local Examinations Syndicate and the RSA Examinations Board in January 1998. OCR provides a full range of GCSE, A level, GNVQ, Key Skills and other qualifications for schools and colleges in the United Kingdom, including those previously provided by MEG and OCEAC. It is also responsible for developing new syllabuses to meet national requirements and the needs of students and teachers.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by Examiners. It does not indicate the details of the discussions which took place at an Examiners' meeting before marking commenced.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

© OCR 2007

Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annersley
NOTTINGHAM
NG15 0DL

Telephone: 0870 870 6622
Facsimile: 0870 870 6621
E-mail: publications@ocr.org.uk

CONTENTS

Advanced GCE Design and Technology: Product Design (7822)

Advanced GCE Design and Technology: Systems and Control (7823)

Advanced Subsidiary GCE Design and Technology: Product Design (3822)

Advanced Subsidiary GCE Design and Technology: Systems and Control (3823)

MARK SCHEMES FOR THE UNITS

Unit	Content	Page
2520	Product Design 1	1
2521	Systems and Control Technology 1	11
2524	Product Design 2	23
2525	Systems and Control Technology 2	43
*	Grade Thresholds	53

**Mark Scheme 2520
January 2007**

Section A

- 1 (a) Justified design requirements include:
- Robust to protect delicate electronic workings
 - Easy to operate and understand how to use to avoid frustration and dissatisfaction
 - Long battery life so that it can be used for long periods on the move or away from power source
 - Appropriate size and weight to carry about the person for easy storage/movement
 - Justified aesthetic comment

No marks awarded for statements referring to obvious product function eg must play music.

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

- (b) Examples could be:
- Clear, easy to read text to indicate track/menu
 - Easy to hold and operate with one/two hands
 - Lightweight for easy storage
 - Colour and texture

A clear description related to ergonomic features up to 2 marks,
For **three** examples described 3 x 2 **[6]**

- (c) Example could be:
- no need to design all new components, speeds up lead time! cost benefits
 - readily available components to manufacture / repair
 - standardised parts usually high quality as companies can specialise

Example 1 mark, clear explanation up to 2 marks **[3]**

- (d) Discussion could include:
- introduction, growth, maturity, decline of product
 - market surveys to inform of trends
 - effective research and development
 - awareness of competition
 - promotion / advertising
 - use of standard parts/components
 - batch production JIT production to avoid unsold stock

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) (i) products could be:		
	<ul style="list-style-type: none"> • drinks cans aluminium • drinking cups polystyrene • car bumpers ABS 		
	For two products including material	2 x 1	[2]
	(ii) conserve materials feel good reduce wastage/litter		
	For two reasons	2 x 1	[2]
	(b) 1 Geothermal description to include:		
	<ul style="list-style-type: none"> - clear sketch 1 mark - hole drilled into earth 1 mark - return system 1 mark - earth heats/steams water pumped into system 	1 mark	[4]
	2 Hydroelectric description to include:		
	<ul style="list-style-type: none"> - clear sketch - dam/lake - water falling - turbines to generate energy 	1 mark 1 mark 1 mark 1 mark	[4]
	(c) Discussion could include:		
	<ul style="list-style-type: none"> - emissions - alternative energy systems - visual pollution/siting - noise pollution - disposal of toxic 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]

- 3 (a) Justified design requirements include:
- securely hold set number of eggs for safe transport from shop to home
 - clear instructions eg sell by date
 - to be rigid enough to carry without structural collapse
 - provide storage packaging at home
 - minimum space/size for storage/transportation
 - justified cost implication of packaging

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

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

- (b) Checks could be:
- dimensional check
 - visual check of processes
 - positioning of print
 - quality of print
 - method of closure

For **three** checks well described 2 x 3 **[6]**

- (c) Example could be:
- re usable packaging
 - choice of recyclable material
 - minimising use of material

Example 1 mark
Well explained 2 marks **[3]**

- (d) Discussion could include:
- appropriate advertising
 - effective target marketing
 - sampling/demonstrating products
 - trial periods
 - cost implications

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:
- range of sizes to ensure comfortable fit for wide range of users
 - soft fabric to avoid skin irritation
 - colour to match other bathroom textiles
 - relatively moisture absorbent to help to dry body
 - secure yet simple securing system (belt) for speed of use and modesty

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

- (b) Features could be:
- length of sleeves
 - distance to pockets
 - body/chest size
 - distance across shoulders for sleeve attachment
 - overall length of robe

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

- (c) Description of features could include

One off

- hand made/embroidered
- lots of additional adornment, features
- selected high quality materials
- individual customer requirements
- high unit cost

Batch Production

- larger quantities eg for specialist retailers, hotel chains
- can be repeated over a period of time
- increased or decreased according to demand

Mass Production

- very large quantities eg general retailer (hospitals?)
- continuous production
- high cost specialist automatic equipment

For 6 features described 6 x 1 **[6]**

- (d) Discussion could include:
- training
 - wages
 - availability
 - flexibility/transfer of skills

- P relevant points/issues
 Q quality of explanation
 S specific example/evidence

up to 3 marks
 up to 2 marks
 1 mark

[6]

Total [18]

- 5 (a) Justified design requirements include:
- easy to erect and dismantle (in case of high winds/rain)
 - easy and firm siting to ensure that it does not move when fixed (strong winds)
 - brightly coloured for easy identification on crowded beaches
 - easy to adjust to speed up setting up or taking down
 - not affected by hostile environment to ensure reasonable life expectancy

No marks awarded for statements referring to obvious product function eg must shade from sun

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

- (b) Considerations could be:
- no parts where fingers can get trapped
 - effective sun shade/choice of material
 - point not too sharp/easily covered when transporting
 - strength requirements of opening and shutting sun shade I mechanism involved

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

- (c) Fundamental rights could be:
- product purchased must be safe to use/be fit for purpose (SoGA)
 - product purchased must do what manufacturer states that it does (as described)(SoGA)
 - product purchased must be of satisfactory quality (SoGA)
 - must be fit for specific purpose which buyer makes clear to seller (eg pen write at any angle)
 - consumers must not be misled on price/price reductions (CPA)
 - customers who sign credit agreements in own home have a cooling off 5 day period in which they can change their mind (CCA)

For each right well explained 3 x 2 **[6]**

- (d) Discussion could include:
- brand loyalty
 - product satisfaction
 - maintenance issues/fashion trends (update)
 - price factors (testing usually means product costs more)
 - do not want to keep purchasing repeat products - some want to change products

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]

Section B

- 1 (a) (i) eg ash, mahogany, oak, beech, hickory, sycamore, not balsa, not softwood - 1 mark for each [2]
- (ii) the function of the stretcher is to **provide** stability and rigidity to the chair, hold legs apart/together, connects rails [2]
- (b) description of steam bending:
 Material cut to length
 Soak in water
 Place in steam chamber
 Leave to steam for pre-set time
 Clamp timber into former (2)
 Leave to dry
 Remove from former
 Any 8 points [8]
- (c) Discussion could include:
 The aesthetic quality, costs, availability of materials, physical properties of the wood such as strength, the type of finish required, the intended final use such as interior or exterior.
- | | | | |
|---|--------------------------------------|---------------|-----|
| 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] |
- 2 (a) (i) aluminium, stainless steel, brass, bronze, steel, duralumin, 1 mark for each [2]
- (ii) corrosion; electro-plating and justification [2]
- (b) Electro-plating:
 Fettleing, polishing, de-greasing
 Tap placed in tank of electrolyte (liquid metal substance)
 Current applied/electricity switched on
 Flow of electrons cathode to anode
 Left in solution for pre-set time depending on thickness required
 Alloy deposited on tap
 Multiple plating copper, nickel, chrome
 QC check (visual)
 Tap removed and cleaned
 Polished
 Any 8 [8]
- (c) Discussion could include:
 Rounded corners, tapered edges etc in casting/moulding, fabrication such as turning and joining techniques allow any shape to be made (but obvious cost factor)
- | | | | |
|---|--------------------------------------|---------------|-----|
| 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] |

- 3 (a) any suitable thermoplastic – eg polypropylene, acrylic, ABS, PVC, polycarbonate - 1 mark for each **[2]**
- (ii) sprue marks (nipple), seams/splits, ejector pin marks, spark eroded finish, moulded webs **[2]**
- (b) 4 common techniques identified:
 Use of webs
 Rounded corners
 Folds
 Thickening of sections
 Increasing the depth of sections
 Adding holes to large sections to allow for folded edges
 Steel inserts
 1 mark for sketch, 1 mark for description x 4 **[8]**
- (c) Discussion could include:
 Fashion often influences design in terms of style and colour, trends – eg car design, environmental trends, smart plastics, composites, high performance plastic, medical uses, environmental plastics
- | | | | |
|---|--------------------------------------|---------------|------------|
| 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] |
- 4 (a) leg lightweight, low cost, strong, stable, rigid, recyclable **[4]**
- (b) • artwork/origination – digitising/scanning
 • colour separation
 • individual films produced – printers marks attached 1 mark for film production two marks if 4 separate films mentioned
 For each screen (x4)
 • screen prepared by coating with light sensitive emulsion with controlled lighting
 • screen exposed to UV light
 • screen washed to remove emulsion
 • screen fitted to table
 • board placed on screen
 • ink applied
 • board removed/ink dried
 • second screen applied
 • ink applied
 • board removed/dried
 • any 8 points **[8]**
- (c) Discussion:
 A throw away culture, products are not made to last, they are cheaper, people buy more products (more regularly), products are rarely repaired (just replaced) manufacturers constantly tinkering with designs to encourage new sales
- | | | | |
|---|--------------------------------------|---------------|------------|
| 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] |

- 5** (a) (i) paper, thin plastic, card [2]
- (ii) digital printing uses toner rather than wet inks – printer works directly from the computer (school based digital printers eg versa cams can be accepted) [2]
- (b) a net that has 4 triangular sides (1)
 A top (1)
 Cut lines (1)
 Fold lines (1)
 Incorporates a non glued closure system (0/1/2)
 Accuracy/efficacy of design (0/1/2) [8]
 Should incorporate either standard tuck flap, postal lock, slit lock or crash base
- (c) discussion could include:
 Cost, quality, quantity required, investment, consideration, training requirements, space (less space required for digital), fear of poorer quality
- | | | | |
|---|--------------------------------------|---------------|-----|
| 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] |
- 6** (a) (i) polyamide (nylon), polyester/cotton (not leather) [2]
- (ii) hardwearing/durable/strong (accept one of these),
 Washable
 Easy care
 Easy to colour and dye
 Water resistant [2]
- (b) Information about the pattern pieces needed could include:
 Correct size and shape
 Straight grain shown
 Number of each piece required
 Seam allowance indicated
 Notches/balance marks
 Components needed .. thread/zip
 Order of work:
 Cut pieces and transfer markings
 Sew zip onto 2 pieces
 Sew zip into main body
 Attach the strap
 Attach the sides
 Remove frayed edges (use of overlocker)
 8 points 1x mark for each point [8]
- (c) discussion could include:
 Level of skills required, cost of fabrics/machinery/overheads, quality and market potential of the product, quantity required. Discussion could include batch production, JIT, modular (cellular) systems, use of CAD/CAM, global production, environmental issues
- | | | | |
|---|--------------------------------------|---------------|-----|
| 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] |

- 7 (a) (i) Cotton/polyester/polyamide(nylon)
Answer will be different according to the fibre given
 Cotton: washable
 Absorbent
 Hardwearing/durable/abrasion resistant
 Easy to colour and dye
 Comfortable next to the skin/soft to handle, natural fibre and so not likely to irritate
 Polyester or polyamide:
 Machine washable
 Minimum ironing required
 Fast drying
 Soft or firm to handle
 Very strong or abrasion resistant/durable
 Crease resistant
 Do not accept easy to print. [2]
- (ii) Cost of: quality of fabric
 Components
 Printing/dyeing processes
 Skill level of machinist required
 Transportation of materials/components
 Inclusion of 'designer' logos (copyright costs)
 Set up costs of the print design [2]
- (b) design produced using a CAD system (CorelDraw or named programme)
 Design must be reversed before it is printed onto the paper
 Pattern printed onto special paper
 Position of the design to be marked to the tee shirt front
 Paper placed print side down on to the tee shirt front
 Transferred to the fabric using a pressurized heated calendar machine (an iron on process)
 The temperature is high enough for the dyestuff to pass into a vapour and onto the fabric, diffusing into the fibres
 The design would be printed onto the tee shirt front piece before assembly or some form of protection would need to be inserted into the tee shirt to stop the print marking the back
 The process is well suited to synthetic fabrics [8]
- (c) discussion could include:
 Avoiding the use of materials that damage the environment, sustainable resources and agricultural methods, eg Cotton.
 Reducing the consumption of materials and resources, recycling materials, eg Polartec fleece from plastic bottles, use biodegradable materials eg cotton, Lyocell/Tencel.
 Reduction of pesticides, chemicals and water in natural fibre production.
- | | | | |
|---|--------------------------------------|---------------|-----|
| 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] |

**Mark Scheme 2521/01/02
January 2007**

Section A

- 1 (a) Justified design requirements include:
- Robust to protect delicate electronic workings
 - Easy to operate and understand how to use to avoid frustration and dissatisfaction
 - Long battery life so that it can be used for long periods on the move or away from power source
 - Appropriate size and weight to carry about the person for easy storage/movement
 - Justified aesthetic comment

No marks awarded for statements referring to obvious product function eg must play music.

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

- (b) Examples could be:
- Clear, easy to read text to indicate track/menu
 - Easy to hold and operate with one/two hands
 - Lightweight for easy storage
 - Colour and texture

A clear description related to ergonomic features up to 2 marks,
For **three** examples described 3 x 2 **[6]**

- (c) Example could be:
- no need to design all new components, speeds up lead time! cost benefits
 - readily available components to manufacture / repair
 - standardised parts usually high quality as companies can specialise

Example 1 mark, clear explanation up to 2 marks **[3]**

- (d) Discussion could include:
- introduction, growth, maturity, decline of product
 - market surveys to inform of trends
 - effective research and development
 - awareness of competition
 - promotion / advertising
 - use of standard parts/components
 - batch production JIT production to avoid unsold stock

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) (i)	products could be: <ul style="list-style-type: none"> • drinks cans aluminium • drinking cups polystyrene • car bumpers ABS 		
		For two products including material	2 x 1	[2]
	(ii)	conserve materials feel good reduce wastage/litter		
		For two reasons	2 x 1	[2]
	(b)	1 Geothermal description to include: <ul style="list-style-type: none"> - clear sketch 1 mark - hole drilled into earth 1 mark - return system 1 mark - earth heats/steams water pumped into system 	1 mark	[4]
		2 Hydroelectric description to include: <ul style="list-style-type: none"> - clear sketch - dam/lake - water falling - turbines to generate energy 	1 mark 1 mark 1 mark 1 mark	[4]
	(c)	Discussion could include: <ul style="list-style-type: none"> - emissions - alternative energy systems - visual pollution/siting - noise pollution - disposal of toxic 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]	

- 3 (a)** Justified design requirements include:
- securely hold set number of eggs for safe transport from shop to home
 - clear instructions eg sell by date
 - to be rigid enough to carry without structural collapse
 - provide storage packaging at home
 - minimum space/size for storage/transportation
 - justified cost implication of packaging

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

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

- (b)** Checks could be:
- dimensional check
 - visual check of processes
 - positioning of print
 - quality of print
 - method of closure

For **three** checks well described 2 x 3 **[6]**

- (c)** Example could be:
- re usable packaging
 - choice of recyclable material
 - minimising use of material

Example 1 mark
Well explained 2 marks **[3]**

- (d)** Discussion could include:
- appropriate advertising
 - effective target marketing
 - sampling/demonstrating products
 - trial periods
 - cost implications

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:
- range of sizes to ensure comfortable fit for wide range of users
 - soft fabric to avoid skin irritation
 - colour to match other bathroom textiles
 - relatively moisture absorbent to help to dry body
 - secure yet simple securing system (belt) for speed of use and modesty

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

- (b) Features could be:
- length of sleeves
 - distance to pockets
 - body/chest size
 - distance across shoulders for sleeve attachment
 - overall length of robe

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

- (c) Description of features could include

One off

- hand made/embroidered
- lots of additional adornment, features
- selected high quality materials
- individual customer requirements
- high unit cost

Batch Production

- larger quantities eg for specialist retailers, hotel chains
- can be repeated over a period of time
- increased or decreased according to demand

Mass Production

- very large quantities eg general retailer (hospitals?)
- continuous production
- high cost specialist automatic equipment

For 6 features described 6 x 1 **[6]**

- (d) Discussion could include:
- training
 - wages
 - availability
 - flexibility/transfer of skills

- P relevant points/issues
 Q quality of explanation
 S specific example/evidence

up to 3 marks
 up to 2 marks
 1 mark

[6]

Total [18]

- 5 (a) Justified design requirements include:
- easy to erect and dismantle (in case of high winds/rain)
 - easy and firm siting to ensure that it does not move when fixed (strong winds)
 - brightly coloured for easy identification on crowded beaches
 - easy to adjust to speed up setting up or taking down
 - not affected by hostile environment to ensure reasonable life expectancy

No marks awarded for statements referring to obvious product function eg must shade from sun

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

- (b) Considerations could be:
- no parts where fingers can get trapped
 - effective sun shade/choice of material
 - point not too sharp/easily covered when transporting
 - strength requirements of opening and shutting sun shade I mechanism involved

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

- (c) Fundamental rights could be:
- product purchased must be safe to use/be fit for purpose (SoGA)
 - product purchased must do what manufacturer states that it does (as described)(SoGA)
 - product purchased must be of satisfactory quality (SoGA)
 - must be fit for specific purpose which buyer makes clear to seller (eg pen write at any angle)
 - consumers must not be misled on price/price reductions (CPA)
 - customers who sign credit agreements in own home have a cooling off 5 day period in which they can change their mind (CCA)

For each right well explained 3 x 2 **[6]**

- (d) Discussion could include:
- brand loyalty
 - product satisfaction
 - maintenance issues/fashion trends (update)
 - price factors (testing usually means product costs more)
 - do not want to keep purchasing repeat products - some want to change products

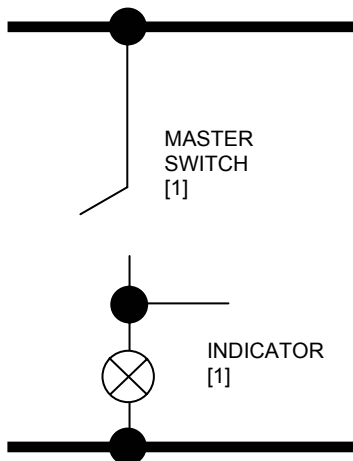
P	relevant points/issues	up to 3 marks	
Q	quality of explanation	up to 2 marks	
S	specific example/evidence	1 mark	[6]

Total [18]

Section B

- 1 (a) Two specification points could be:
- must be switched by turnstile
 - must switch on/off
 - must communicate/show person
 - must count entries 2 x 1
 - electrically safe [2]
- (b) (i) Common cathode [1]
- (ii) 4511 is active high, pulls down volts, alter voltage [1]
- (c) (i) The turnstile switch will give an uneven signal [1]
 The counter will be inaccurate [1]
- (ii) The 1microf capacitor acts as a filter. Removing the peaks of the spikes or ripples from the switch prevents contact bounce. Any – one mark [1]
- (d) Notes should include methods such as timer for period of entry, auto start when turnstile is operated otherwise off, key switch same as door lock [1] for each max [2]

Minimum circuit such as:



No diagrams but correct notes or vice versa max [2]

- (e) Points could be:
- Accuracy
 - Recording capability
 - Safety regulations adhered to
 - Danger of relying on system
 - Operator error
 - Power failure
 - Additional information can be added
 - Or any other correct point

2 points qualified [3]
 1 specific example [2]
 18 marks [1]

- 2 (a) Two specification points could be:
- Pull strength above weight of door
 - Fast action
 - Short stroke
 - Easy reset - spring return
 - Silent action
- Any two 2 x 1 [2]

(b) (i)

	Action of TR1	Action of TR2
		TR2 SWITCHES ON [1]
	POSITIVE CHARGE AT C1 TO GATE OF TR1 [1]	ENERGISES RELAY [1]

If reversed max [1] [3]

(ii) Circuit is a bistable [1]

(iii) If mouse bridges contacts the circuit will oscillate [1] and relay will switch on/off [1] until the mouse moves away [1] 3 x 1 [3]

(iv) Diode is across relay coil to power feed because of oscillation problem [1]
Correct way round [1] 2 x 1 [2]

If candidate states that no diode is required with FET max [1]
(v) To protect transistor on switch off of relay coil-back emf [1]

(c) Points could be:

- Finite resources
- Waste problems
- Throwaway society
- Advertising pressures on individuals
- Globalisation
- Transportation
- Or any other correct point (need to focus on question)

2 points qualified [3]

1 specific example [2]

18 marks [1]

- 3 (a) (i) Reasons could be:
- Reduce vibration
 - Allows slight shaft misalignment
 - Softens start and finish of shaft movement
 - Allows motor change
 - Cost effective maintenance
- 2 x 1 [2]
- (ii) Maintenance could be:
- Tightness of bolts
 - Replacement of rubber disc when perished
 - Cleaning off machine oil
- 2 x 1 [2]
- (iii) • 320/10 = 32 turns per action
- 64 turns in total [1]
- 64/10 = 6.4 rps [1] If only one way but correct [1]
- [2]
- (b) (i) Advantages could be:
- Faster action
 - Less maintenance required with toothed belt
 - Friction of inclined plane removed
 - Lighter mechanism
 - Self resetting
 - Requires less space
- 2 x 1 [2]
- (ii) Looking for:
- Ratio of drive belt pulleys chosen and tested
 - Indexing nature of toothed belt
 - Start and finish point
 - Adjust speed to match conveyor
 - Quality sketches to back up points [1]
- 4 x 1 [4]
- (c) Points could be:
- Better use of resources
 - Fewer waste problems
 - Employment changes
 - Few or no operators
 - Safety gains and losses
 - JIT
 - Change in product line slower
 - Optimised tooling use
 - Globalisation
 - Transportation against pollution
 - Or any other correct point
- 2 points qualified [3]
- 1 specific example [2]
- 18 marks [1]

- 4 (a) (i) Reciprocating [1]
- (ii) Furthest distance out is sum of G+H
Travel of H and G must not exceed length of runners
Speed of action controlled by length of H 2 x 1 [2]
- (b) (i) Easy to change, good grip, same direction
Allows slippage in jam situation, cost effective, will run out of line etc
2 x 1 [2]
- (ii) The whip in belt is allowed for, wind up on start, wear on belt taken up [1]
- (iii) Loading, length of belt run, speed of operation,
manufacturers spec, size of belt 2 x 1 [2]
- (c) Looking for understanding of peg hole adjustment [1]
Effect on travel [1]
Small sector on return [1]
Quality sketches [1] [4]
Smaller bull ring allow for max [1]
- (d) Points could be:
- Better safety - less hands on
 - Fewer waste handling problems
 - Better trained employees
 - Few or no operators
 - Safety losses because of low supervision
 - JIT implications
 - Change in product line faster
 - Less time for checks
 - Optimised tooling use
 - Global differences in outlook
 - Exploitation of third world
 - Or any other correct point
- 2 points qualified [3]
1 specific example [2]
18 marks [1]

- 5 (a) (i) Speed control, restrictors [1]
 Cushioned cylinders
 Lower air pressure [1]
- (ii) Auto return circuit [1]
 Computer control with solenoid valves [1]
- (b) Looking for - Threaded fitting [1]
 Lock nut, loctite, pinned [1]
 Bolted, welded, riveted to chassis [1]
 Functional [1]
 Quality sketches [1] [5]
 If chassis is just drilled and tapped for rod max[2]
- (c) Looking for - Understanding of air consumption
 Rapid refill of cylinders moving fast needs high volume
 Capacity of compressor
 Receiver 3 x 1 [3]
- (d) Points could be:
- Access to system
 - Water clearing
 - Clean air supply
 - Props during maintenance
 - Life of ride
 - Certification
 - Liable to do them
 - Better trained employees
 - Safety inspections
 - Or any other correct point
- 2 points qualified [3]
 1 specific example [2]
 18 marks [1]

- 6 (a) (i)** When the button is pressed main air goes from 1-2
 The cylinder outstrokes fast
 Returns slowly due to restrictor
 Spring causes return 3 x 1 **[3]**
- (ii)** Remove A takes away all speed control
 Return will be as fast as the spring tension allows
 Spring will be subject to fatigue 3 x 1 **[3]**
- (b) (i)** Looking for - outstroke of cylinder initiates flow through the restrictor [1]
 Slowly fills reservoir [1], delay from speed of pressure rises in reservoir [1],
 until enough to switch over
 Air operated 3 port valve causing instroke of cylinder [1] **[4]**
- (ii)** Add restriction, smaller/larger cylinder, lower/raise pressure, add cushion
 2 x 1 **[2]**
- (c)** Points could be:
- Diminishing workforce
 - Social implications
 - Loss of control
 - Globalisation
 - Exploitation
 - Maintenance issues
- 2 points qualified **[3]**
 1 specific example **[2]**
 18 marks **[1]**

**Mark Scheme 2524/01/02
January 2007**

1 Fig. 1 shows a chair with side frames made by laminating wood veneers.

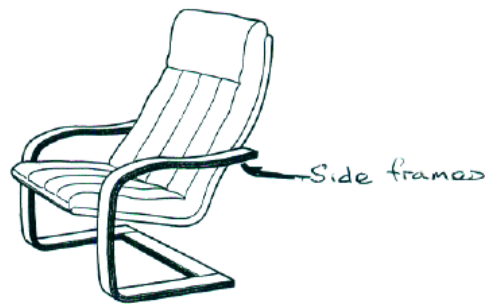


Fig. 1

(a) (i) Name **four** hardwoods that are commonly used as veneer in furniture manufacture.

Answer could include:

- Oak
- Walnut
- Beech
- Mahogany
- Ash
- Birch
- Maple
- Teak.

1 mark each

[4]

(ii) State **two** ways in which the veneers can be used to enhance the properties of the chair.

- Laminating increase strength of legs
- Aesthetics
- Possible weight reduction.

1 mark each

[2]

(iii) Give **two** reasons why laminating has been used in the manufacture of the side frames of the chair in preference to solid timber.

- Ability to use constructional veneers internally
- Easier to achieve bends in the form
- Constant strength throughout
- Smaller amounts of rare woods used.

1 mark each

[2]

- (b) The chairs are to be produced commercially in a batch of 500.

Describe how the side frames of the chair could be manufactured in this quantity.
Use sketches where appropriate.

- Veneers cut to size
- More than one former shown
- Veneers layered
- Resin between layers
- Formers shown with laminates under pressure
- Curing time considered
- Frame released
- Frame cleaned of excess resin
- Frame trimmed to size
- Frame finished with suitable coating ready to be assembled.

1 mark for each point raised

[8]

- (c) Discuss the implications of using hardwoods for the manufacture of furniture.

Points of discussions could involve:

- De-forestation
- Time of re-growth of trees
- Non-local production/exportation/importation of timber
- Possible extinction of some species of trees.

1 mark for each point raised (max 3)

1 mark for each qualification (max 3)

1 mark each example (**must be used in context to a discussion point raised**)
(max 2)

[8]

2 Fig. 2 shows a saucepan made from stainless steel.

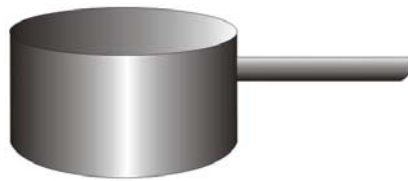


Fig. 2

(a) (i) Give **four** reasons why stainless steel is a suitable material for saucepans.

- Ease of single piece manufacture
- Aesthetic looks (quality)
- Easy to clean
- Hygienic
- Good heat conductor
- Does not/difficult to 'stain'.

1 mark each

[4]

(ii) Name **two** other metals that are used to make saucepans.

- Cast iron
- Copper
- Aluminium alloy.

[2]

(iii) Name **two** surface finishes that are applied to saucepans.

- Chromium
- Enamel
- 'Teflon'/non-stick coating.

[2]

(b) The saucepans are to be produced in a batch of 20,000.

(i) Describe how the body of the saucepan could be manufactured by press forming. Use sketches where appropriate.

- Blank holder
- Press tool
- Hydraulic press
- Blank
- Lip being formed
- Drawing
- Taper

1 mark each

[4]

The handle is to be attached to the body by spot welding.

(ii) Describe the process of spot welding. Use sketches where appropriate.

- Copper (electrode)
- Electrode
- Electrodes being shown both sides of weld
- Pressure applied
- Heat affected zone
- Weld being formed in a 'spot'.

1 mark each

[4]

(c) Discuss the implications of energy costs associated with the life cycle of metal products.

Points of discussion could involve:

- Energy used to convert raw material
- Heating, lighting of manufacturing unit
- Transportation of goods
- Energy cost of recycling manufacturing waste.

1 mark for each point raised (max 3)

1 mark for each qualification (max 3)

1 mark for each example (**must be used in context to a discussion point raised**)
(max 2)

[8]

3 Fig. 3 shows a plastic bottle designed to hold a liquid toilet cleaner.

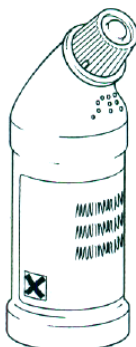


Fig. 3

(a) (i) Name **two** thermoplastics suitable for making plastic bottles to hold liquid toilet cleaners.

- HDPE
- PP
- PS.

1 mark each

[2]

(ii) Describe **two** safety features incorporated into the design of the bottle shown in Fig 3.

- 'Child proof' tops
- Warnings embossed in Braille
- Printed warning signs
- Safety instructions printed on label.

1 mark for each feature

[2]

(iii) Describe **two** ergonomic features considered in the design of the bottle shown in Fig 3. Use sketches where appropriate.

- Size of top
- Texturing on top
- Finger grips on bottle
- Size of bottle to fit hand.

1 mark for each feature description

1 mark for each diagram showing feature

[4]

(b) Describe how the bottles would be produced by the blow moulding process. Use sketches where appropriate

- Parison
- Extruded tube
- Two part mould
- Heating of mould
- Crimping of tube to form seal
- Partial inflation
- Continued heating
- Final inflation
- Ejection of bottle
- Insertion of new parison
- Collection of bottles.

1 mark each

[8]

(c) Discuss the environmental implications of using cleaning agents and chemicals.

Points of discussions could involve:

- Mixing of chemicals producing toxic gases
- Leeching of chemicals into water courses
- Safe disposal of unused chemicals.

1 mark for each point raised (max 3)

1 mark for each qualification (max 3)

1 mark each example (**must be used in context to a discussion point raised**)
(max 2)

[8]

- 4 Fig. 4 shows a birthday card that has part of its surface coated with ink containing phosphorescent pigments that glow in the dark.

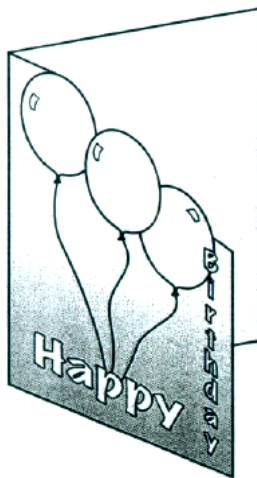


Fig. 4

- (a) (i) Give **two** other examples of printed objects where phosphorescent pigments are used.

- Emergency warning signs
- Exit signs
- Watch/clock faces
- 'Night scene' pictures/posters
- Novelty mask – Halloween etc.

1 mark each

[2]

- (ii) Explain how phosphorescent pigments work.

- Pigment absorbs light energy
- Pigment temporarily stores light energy
- Pigment slowly releases light energy.

1 mark each

[2]

- (iii) State **four** other surface treatments used to enhance birthday cards.

- Embossing
- Foil blocking
- Glitter
- Plastic coating
- Stuck on badge
- Stamping out
- Spot varnishing.

1 mark each

[4]

- (b) The birthday card would be manufactured commercially by die cutting.

Describe how the press forme would be designed and manufactured. Use sketches where appropriate.

Award marks for design of die-cutter, manufacture and diagram showing the make up of a die cutter.

- Designed on computer
- Details transferred to laser cutter
- Backing board placed onto laser
- Slots cut into backing board ready to receive metal strips
- Metal strips inserted by hand
- Backing board (normally plywood)
- Cutting blade shown
- Creasing tool shown
- Foam inserts.

1 mark each

[8]

- (c) Discuss the implications for a manufacturer of greeting cards when implementing health and safety legislation.

Points of discussions could involve:

- Hours of work
- Lighting/Heating levels
- Safety training
- First Aid provisions
- Protective equipment
- Safety guards
- Control of hazardous materials
- Fire exits.

1 mark for each point raised (max 3)

1 mark for each qualification (max 3)

1 mark each example (**must be used in context to a discussion point raised**)
(max 2)

[8]

5 Fig. 5 shows a printed poster on a bus shelter.

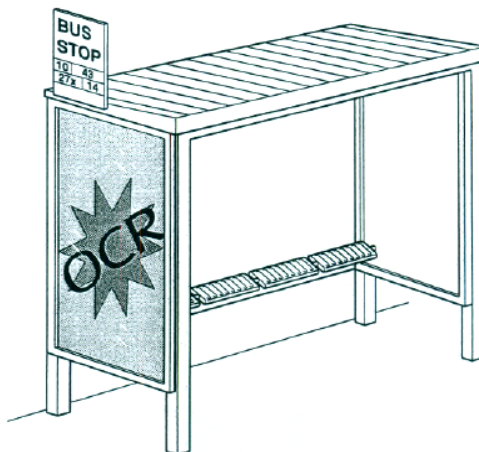


Fig. 5

(a) (i) Name **two** colours that are used in process colour printing.

- Cyan
- Magenta
- Yellow
- Black.

1 mark each

[2]

(ii) Name **two** methods that could be used to protect the poster.

- Toughened glass
- Polycarbonate sheet
- Laminated
- Varnished finish.

1 mark each

[2]

(iii) Use annotated sketches to show **two** quality control marks used by printers on large posters.

- Crop marks
- Ink density marks
- Colour dots.

1 mark each for description

1 mark each for sketch of mark

[4]

- (b) A local company requires a very small production run of 20 display posters.

Describe how the posters would be produced by digital printing. Use sketches where appropriate.

- Images imported to computer
- Text added
- Mention of some type of Design Package
- Image sent to printer
- Digital form
- Electro-photographic printing
- Toner
- Amount of toner deposited due to electro static properties
- Dry or liquids can be used
- Any substrate can be printed on
- Ink jet printing
- Electro-statically charged inks.

1 mark each

[8]

- (c) Discuss the moral issues associated with displaying printed advertising material.

Points of discussion could involve:

- Use of partial nudes
- False representation
- Playing on the public's weakness
- Offensive to some religions
- Children's pester power.

1 mark for each point raised (max 3)

1 mark for each qualification (max 3)

1 mark each example (**must be used in context to a discussion point raised**)
(max 2)

[8]

6 (a) (i) Any **four**, one mark each:

- Cotton makes the fabric comfortable as is absorbent
- Polyester makes the fabric easy care – dries quickly
- Polyester crease resistant
- Polyester makes it hard wearing
- Polyester reduces cost
- Cotton is pleasant next to the skin – non irritating.

[4]

(ii) Any **two**, one mark for each:

- Quick – stitches, neatens and trims edges all at once
- Stretches the fabric so seam does not break
- May have a safety stitch to prevent the seam unravelling
- Strong seam as three or four threads are used.

[2]

(iii) One mark for naming component, one for reason:

- Thread – to join sections together/specialist manufacture of components
- Ribbing for neck edge – to neaten edge and allow it to stretch and recover
- Labels/care labels/swing tags etc information for the customer
- Speed of manufacture/ease of manufacture/quality of product could apply to any component.

[2]

(b) Eight points in a logical order, any of the methods:

Making a screen

- Screen is a wooden frame with a fabric such as organza stretched over it
- Screen fabric coated in a light sensitive chemical
- Design produced in negative, opaque
- Placed on screen exposed to light to 'fix' areas to block dye
- Excess chemical – unfixed – washed off
- One screen needed per colour
- Screen can be created by laser etching areas away.

Carousel Screen Printing – the most appropriate method.

- Screens arranged around a central point
- One screen per colour with a 'base' beneath each screen to secure 'T' shirt
- Screens rotate round each 'station' in turn, printing one colour each
- Colours fixed by heat.

Rotary

- The design should be printed onto the fabric before cutting out of the garment shapes
- Cylindrical screens used
- Inks pumped into screen from reservoir
- Squeezed onto fabric from by squeegee on inside
- One screen per colour
- Fixed by heat.

Flat bed

- The design should be printed onto the fabric before cutting out the garment shapes
- Fabric held on conveyor belt
- Fabric moves one screen width at a time
- Screen lowered when fabric in position
- Inks introduced on screen
- Moved across fabric by squeegee
- Screen lifted for next cycle
- One screen per colour
- Fixed by heat.

[8]

(c) Points to include:

- When to introduce colour – fibre, yarn, fabric, product
- Fibres and fabrics used for product – absorb dyes differently
- Finishes applied to fabric will affect take up of dye
- Fashionable colours
- Number of colours to be used – more colours increases cost and production time
- Equipment available – will more need to be bought?
- Skills of workforce
- Cost
- Disposal of waste products
- Customer preferences – environmentally friendly methods
- Health and safety issues for workers
- Testing to ensure no irritation to consumer.

Range and relevance of issues relating to the question

[3]

Quality of the reasoning and the explanation

[3]

Suitable use of examples and evidence to support the discussion

[2]

[Total: 24]

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

- Hardwearing
- Washable
- Non-flammable
- Textured/good texture/soft
- Stable
- Stain resistant.

[3]

(ii) One mark for naming method, up to two for diagram:

- Velcro – a section on the inside of the cushion on opposite sides, stitched by hand or machine. A good diagram will show the stitching holding it in place and the two different textures of the Velcro
- Ties – one on each side. These could be fabric, ribbon or cord. A good diagram will show how the ties are attached, into the seam or stitched on afterwards and how the loose end of the ties is neatened eg folded and stitched, zig-zagged or tied in a knot
- Press-studs/poppers – one on each side. Good diagrams will show the stitching holding the popper in place
- Tabs with button and buttonhole. A good diagram will show the stitching holding the button in place and the stitching of the button hole. The button could be stitched directly onto the cushion, but the button hole will need to be worked on a 'tab' so that it will fasten.

[3]

(iii) Two methods named, one mark each:

- Pre – manufactured eyes
- Embroidered – hand or machine
- Printed – transfer, screen printed, block
- Buttons
- Beads/sequins.

[2]

(b) Pattern Pieces

- Pattern pieces should form a 'net' suitable to make the cushion. There are several ways to work and attach the head section. The pattern pieces shown need to be considered with the method the candidate suggests for making up. The 'body' could simply be a square, or could have a curved section to attach the head. The head section can also be made in a number of ways and the pattern pieces will vary according to how the candidate decides to make it
- Pattern pieces should show symbols such as the straight grain arrow \longleftrightarrow 'dots' to mark position of details such as the tail, head, ears, eyes, fastening to hold the cushion in folded form, etc, possibly 'notches' to help align the pieces
- Information such as the name of the pattern piece and the number to cut out of the fabric.

Components

- Thread – possibly a selection to work the different colours
- Fastening to hold cushion in folded shape – see a (ii) answers
- Facial features – may name embroidery thread, interfacing (vilene), bondaweb, stitch and tear, pre-manufactured components such as plastic eyes, nose, whiskers
- Filling for the cushion.

Making up – one possible order, but there is more than one way to do it.

- Lay pattern pieces onto fabric
- Cut out
- Transfer pattern markings
- Work face features
- Make up ears if separate to main head section
- Attach ears to head section
- Assemble head section
- Turn to right side and stuff and attach to body section
- Make up tail and attach to body section
- Attach fastening to underside of cushion
- Join top body section to bottom
- Turn to right side
- Stuff
- Sew up opening.

NB there are alternative orders which will work. It may help to break down the 8 marks into the three sections – pattern pieces, components and the order of work. This can be discussed at the standardisation meeting. This question asks for a lot of information from the candidate. [8]

(c) Point to include:

- Dry cleaning – use of chemicals and possible pollution
- Electricity needed to operate the machines – impact of energy production on the environment
- Making the machinery needed – and disposal
- Heated water not to be released into environment, and the energy used to heat it
- Generating heat to dry clothes
- Washing in the home – powders and softeners, detergents which work at low temperatures
- The use of enzymes in wash powders and other chemicals
- Pressing and ironing – electricity needed and heat generated
- Large scale laundry operations for hotels etc
- Hygienic treatments for hospital – energy use.

Range and relevance of issues relating to the question	[3]
Quality of the reasoning and the explanation	[3]
Suitable use of examples and evidence to support the discussion	[2]

[Total 24]

QUESTION 1,2,3,4,5 1,2,3	GENERIC MARK SCHEME FOR SECTION B UNIT 2524/02 UNIT 2525/02		MARKS AVAILABLE
--------------------------------	---	--	--------------------

SPECIFICATION POINTS (SP) A3 Sheet 1 of 4			
SP	<p>8 Specification Points which are qualified and justified 2 marks each.</p> <p>8 clear statements which are specifically related to the focussed topic</p> <p>8 clear and relevant justification points</p> <p>A clear relevant statement 1 mark</p> <p>A clear relevant justification 1 mark</p> <p>Any generic statements that are not explicitly related to the focus = 0 marks</p> <p>A point repeated or a simple repetition of information already stated in the question is awarded a circled lower case 'r'</p> <p>A circled lower case 'r' = 0 marks</p>	<p>8 x 1</p> <p>8 x 1</p>	16

INITIAL IDEAS (ID) A3 Sheet 2 of 4 and A3 Sheet 3 of 4			
R	<p>Range of ideas.</p> <p>0-2 No-weak range of initial ideas (superficial change of shape lacking any depth or detail)</p> <p>3-4 Limited-some evidence of variation and range of ideas logically laid out</p> <p>5-6 Good range of different ideas clearly laid out and understood by a third party</p> <p>7-8 Good range of appropriate innovative significantly different ideas</p> <p>9-10 A wide range of appropriate innovative significantly different ideas</p>		10
S	<p>Design ideas relating to the <u>functional aspects of the specification.</u></p> <p>0-1 No-little functional aspects of the specification identified or considered</p> <p>2-3 Limited-some functional aspects of the specification identified or considered</p> <p>4-5 Clear-detailed evidence of the majority of the functional aspects have been considered in some depth</p>		5
V	<p>Quality of design thinking relating to volume production and wider market issues.</p> <p>0-1 No-little consideration given to market issues or volume production in the design thinking</p> <p>2-3 Limited-some superficial consideration given to market issues or volume production in the design thinking</p> <p>4-5 Clear-detailed evidence that consideration has been given to market issues or volume production in the design thinking</p>		5

C	<p>Detail Consideration of construction. Methods/construction/component/assembly detail, appropriate to the product and the chosen materials. Knock down fittings and relevant fixings will be given credit.</p> <p>0-1 No-little consideration given to suggested appropriate (alternative) methods of construction or assembly</p> <p>2-3 Limited-some consideration given to suggested appropriate (alternative) methods of construction or assembly</p> <p>4-5 Clear-detailed evidence has been considered in relation to appropriate (alternative) methods of construction or assembly</p>		5
M	<p>Consideration of specific materials and components (may include calculations or specific values for components).</p> <p>Generic terms not acceptable:</p> <ul style="list-style-type: none"> • Plastics-thermoplastics, thermosetting • Wood-hardwood, softwood • Cloth-natural fibre, synthetic fibre • Metal-ferrous, non-ferrous • Paper, card and board <p>0-1 No-little mention of relevant and appropriate specific materials and components</p> <p>2-3 Some consideration given to relevant and appropriate specific materials</p> <p>4-5 Clear evidence of relevant and appropriate specific materials and components</p>		5
D	<p>Consideration of dimensional detail (may include calculations).</p> <p>Overall dimensions plus some detailed dimensions required (circuit diagrams/layouts, systems diagrams, flow diagrams).</p> <p>0 No indication of scale, dimensions or calculations</p> <p>1 Limited indication of scale, dimensions or calculations</p> <p>2 Evidence of general sizes of scale, dimensions and calculations</p> <p>3 Detailed sizes given in component parts or sub parts of the design</p>		3
E	<p>Evaluation of the suitability of the ideas with reference to the specification.</p> <p>0-1 No-little evidence of evaluation commentary</p> <p>2-3 Limited-some evidence of subjective evaluation commentary</p> <p>4-5 Clear-detailed evidence of evaluation commentary (may-must include some objective content). Look for intellectual depth of design analysis and formative thinking</p>		5

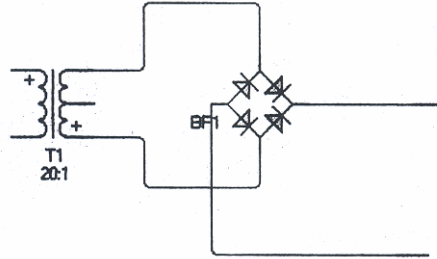
FEATURES SUITABLE FOR DEVELOPMENT (FD) A3 Sheet 4 of 4.			
F	<p>Appropriate features identified and clearly described. All major aspects of the design should be evident; this may be in the form of annotation of a final drawing or part drawings, or may be in the form of expanded text eg bullet point-listing. Candidates could refer to the design features in terms of strengths and weaknesses. Ideally there should be at least three different features identified.</p> <p>0 No-little features identified-concept drawing only, superficial commentary</p> <p>1-2 Limited-some internal and or external appropriate features identified. Lacks realistic proposals and detail</p> <p>3-4 Clear-detailed evidence of internal and or external appropriate features identified. Contains constructive and realistic proposals and detail</p>		4
J	<p>Appropriate justification of the choices made with reference to the specification.</p> <p>0 No-evidence of justification made, (descriptive, superficial and subjective)</p> <p>1-2 Limited-some evidence of justification (superficial descriptive statements with elements of objectivity)</p> <p>3-4 Clear-detailed intellectual constructive justification is evident. Justification is fluent objective and appropriate</p>		4

EFFICIENT COMMUNICATION (CS) A3 Sheets 1-4			
CS	<p>Communication skills and techniques.</p> <p>0 No-weak level of graphical skill/annotation evidenced by poor use of communication methods no apparent quality</p> <p>1-2 Low level of graphical skill/annotation</p> <p>3-4 Limited-some graphical skill/annotation evidenced by one form of communication method (eg 2D only) lacking appropriate techniques of detail</p> <p>5-6 Reasonable evidence of variation and range of graphical techniques/annotation appropriately used</p> <p>7-8 Fluent range of a variety of graphical presentation techniques in evidence with some annotation</p> <p>9-10 Fluent design thinking that is evident and expressed coherently and cohesively and easily followed and understood by a third party. (Circuit diagrams, systems diagram, exploded views, sectional views 2D and 3D views enlarged detail views and fluent annotation are appropriately used)</p>		10

[Total : 72]

**Mark Scheme 2525
January 2007**

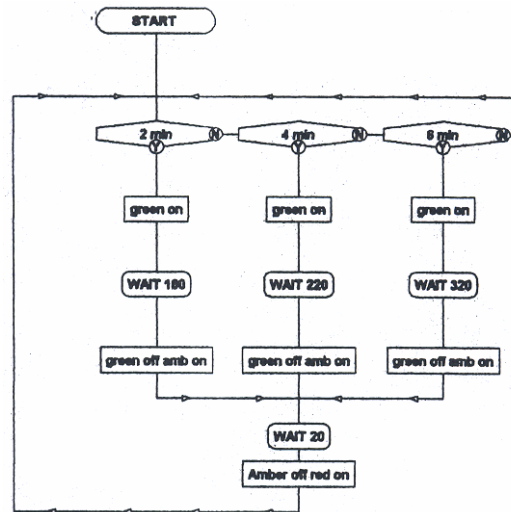
- 1 (a) alkaline, lithium, zinc chloride. Any two. [2]
 (b) (i) 20:1. [1]
 (ii) One for transformer, one for bridge rectifier.



- (iii) Smoothing – producing a steady dc waveform by smoothing out (levelling) the pulsating dc from rectifier bridge (1) using a large capacitance in parallel (1) with dc supply, or similar. [2]

(c) $P = 0.5/5.1 = 98\text{mA}$. (1) $\frac{12 - 5.1}{0.98}$ (1) = $6.9 / 0.98 = 7R$ (1) [3]

- (d) As below or similar. [6]



1 for start/stop box or start and loop, 1 for three correct inputs (must include loop at start), 1 for lighting green light, 1 for correct timing of all green lights, 1 for amber light timing, 1 for amber off red on.

- (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:

Cheaper to run, limited life, no batteries to change/buy, more expensive to buy initially, final disposal or similar issues.

[Total: 24]

- 2 (a) (i) Summing amplifier. [1]
- (ii) Mixer, addition in analogue computing. [1]
- (iii) Reverses polarity of signal. [1]
- (iv) Most Significant Bit. [1]
- (b) high open-loop voltage gain, high input impedance, low output impedance.
Any two, one mark each. [2]
- (c) (i) 7.5 volts. [1]
- (ii) Gain = R_f / R_i . So, 5 volts to 0.5 volts gives ratio of 10:1 (1)
Therefore, $R_a = 100k / 0.1 = 1M\Omega$ (1)
Therefore, $R_b = R_a / 2 = 500k$ (1)
Therefore, $R_c = R_a / 4 = 250k$ (1)
Therefore, $R_d = R_a / 8 = 125k$ (1). [5]
- (d) 10k variable connected between pins 1 and 5 with the wiper connected to – Vs.

1 for variable, 1 for pin 1 / 5 connections, adjust variable to ensure zero output when zero input, max. 2 for notes. [4]
- (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:

Constantly being updated, pressure from children/adverts/friends, keeping up with trends, cost, fashion, new technology or other relevant points.

[Total: 24]

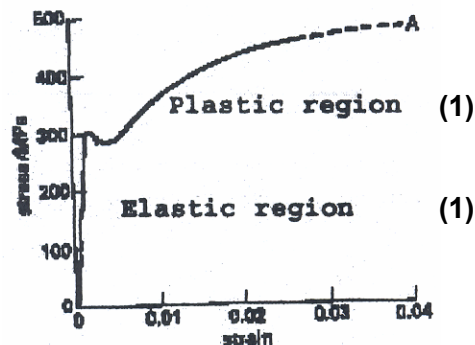
- 3 (a) Cheaper, quieter, self lubricating or similar correct response. Any two, one mark each. [2]
- (b) Use of rack and pinion gear system at output. [2]
- (c) Low torque motor (1), gearbox increases torque (1). Small movement, large torque required at output to move locking/unlocking lever (1), limited space (1), or similar correct response. [4]
- (d) (i) The clutch's purpose is to disengage when the engine/motor is idling so that the output shaft does not rotate. When the engine/motor speeds up the clutch engages so applying the drive.
The centre shaft and weights spin as one. (1) If they are spinning slowly enough, the weights are held against the shaft by the spring. (1) If the engine/motor spins fast enough the centrifugal force on the weights overcomes the force being applied by the spring, and the weights are forced outward. (1) They come in contact with the inside of the drum and the drum starts to spin. (1) The drum, weights and centre shaft become a single spinning unit because of the friction between the weights and the drum. Or similar response. [4]
- (ii) Simple and effective method of transferring motion.
Allows mechanical opening of the door without damage to the motor or gearbox.
Can prevent expensive damage to system.
Minimises battery use.
Or similar suitable response.
Any two points well explained. (2 x 2) [4]
- (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:

Cost to consumer, easier to repair, needs less qualified staff, quicker, warranty issues or similar issues.

[Total: 24]

- 4 (a) (i) Compressive. [1]
(ii) Tensile. [1]
- (b) (i) Brinell test, Rockwell, impact, tensile, compression, etc. Any one. [1]
(ii) X-ray, ultrasonic, visual, magnetic, etc. Any one. [1]
- (c) Uniformity of material, dynamic or static load, wear, corrosion, modes of failure. Any two, one mark each. [2]
- (d) (i) Load = $500 \times 10 = 5000\text{N}$ (1)
 $A = \frac{\pi \times d^2}{4}$ (1) = 0.000050265 (1)
Stress = load/area = $5000\text{N} / 0.000050265$ (1)
= $99.5\text{MN} / \text{m}^2$ (1) [4]
(ii) $0.002 / 5$ (1) = 0.0004 (1) [2]
- (e) (i) Z [1]
(ii) Explanation Max. of 2, if largely explanation. (1)



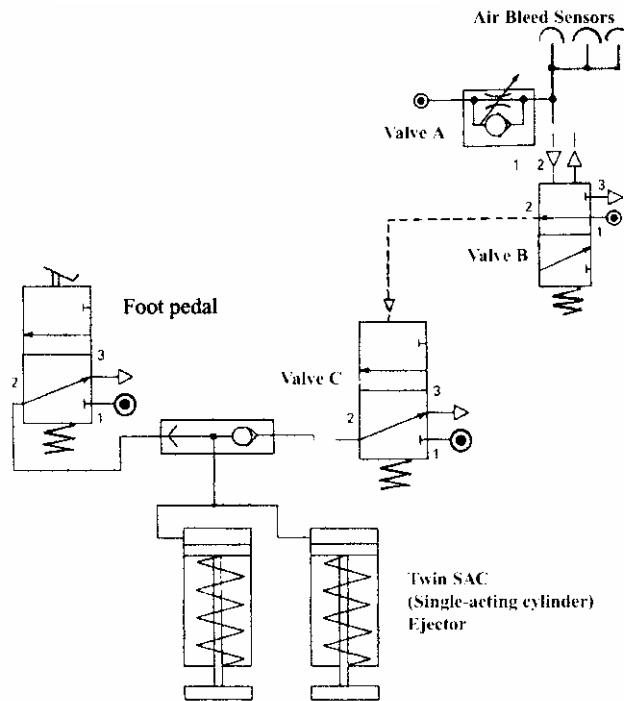
- [3]
- (f) P = Identify a range of relevant issues/points. [3]
Q = Quality of explanation as to why these issues are relevant. [3]
S = Use of specific examples or supporting evidence. [2]

Issues could include:

Cost, strength, resilience, hardness, weight, fitness for purpose, ease of manufacture, waste, or similar suitable issues.

[Total: 24]

- 5 (a) (i) PIC Stamp, Smart Box, PLC or similar. Any two, one mark each. [2]
- (ii) Easy to change program, simpler to design, simpler to use, easier maintenance or similar. Any two, one mark each. [2]
- (b) (i) Once air bleed is blocked, the restricted mains air from Valve A will have no access to exhaust (1) and so will cause Valve B to operate(1). Air will pass through Valve B 12 and this will be pilot air on Valve C (1) which will allow main air through to cause both SACs to outstroke (1). Or similar explanation. [4]
- (ii) The loading on both must be exactly the same (1) and piping must be symmetrical. (1) [2]
- (iii) (1) for correct symbol of required valve, (1) for being in parallel (use of shuttle valve) (1) correct operation. [3]



- (c) $F = p \times A$ So, $0.6 \times \pi \times 20^2$ (1) = 754N Both, therefore, $754 \times 2 = 1508N$ (1)
 95% efficiency so, $1508 \times 0.95 = 1433N$, (1) to nearest integer. [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: Cost of ICT, CNC machines, easy to download prototype to CNC, easy to change/develop prototype, less material waste/cost once system set up or similar issues.

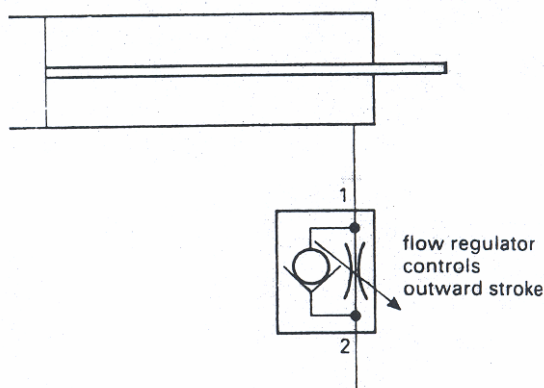
[Total: 24]

- 6 (a) (i) NOT. [1]
- (ii) 1 0 and 1 2 refer to the air flow through the valve caused by the specific pilot. 1 0 means no air flow and 1 2 means airflow from port 1 to port 2. Well explained, up to (2). [2]
- (iii) Initially it must be assumed that when air is applied to the circuit valve C will cause valve A to move piston of cylinder D fully negative. The air supply to cylinder D is also supplied to valve C 1 0 so cutting off pilot air to valve B 1 4 and so allowing valve A to have an effect.

Operating valve A sends pilot air to valve B 1 2 which allows mains air to send cylinder D fully positive. (1) Since air is no longer applied to NOT valve C 1 0 it switches to 1 2 (1) applying signal air to 1 4 on 5-port valve and sending cylinder negative. (1) This puts signal air on valve C 1 0 removing the signal to 1 4 on 5-port valve. (1)

Or any similar explanation that shows a suitable understanding. [4]

- (b) A unidirectional flow regulator is placed in exhaust of cylinder D. Flow regulator in exhaust, (1) flow regulator correct way round, (1) correctly drawn. (1) [3]



- (c) Main air to valve A 1 derived from roller trip/unidirectional roller trip/plunger valve operated by guard in fully negative position or similar correct response. Suitable valve chosen, (1) position correct to achieve objective, (1) correctly drawn, (1) correct piping for correct operation. (1) [4]
- (d) Ring main in this context is an air supply starting and finishing at the compressor (1), piped in a circle or ring around the factory (1) with connection points at regular intervals. Similar in principle to an electrical ring main with socket outlets. [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:

Peace of mind, guarantee of quality, could be more expensive product, expectation of long service of product, not expecting any problems or similar issues.

[Total: 24]

QUESTION 1,2,3,4,5 1,2,3	GENERIC MARK SCHEME FOR SECTION B UNIT 2524/02 UNIT 2525/02		MARKS AVAILABLE
--------------------------------	---	--	--------------------

SPECIFICATION POINTS (SP) A3 Sheet 1 Of 4			
SP	<p>8 Specification Points which are qualified and justified 2 marks each.</p> <p>8 clear statements which are specifically related to the focussed topic</p> <p>8 clear and relevant justification points</p> <p>A clear relevant statement 1 mark</p> <p>A clear relevant justification 1 mark</p> <p>Any generic statements that are not explicitly related to the focus = 0 marks</p> <p>A point repeated or a simple repetition of information already stated in the question is awarded a circled lower case 'r'</p> <p>A circled lower case 'r' = 0 marks.</p>	<p>8 X 1</p> <p>8 X 1</p>	16

INITIAL IDEAS (ID) A3 Sheet 2 of 4 and A3 Sheet 3 of 4			
R	<p>Range of ideas.</p> <p>0-2 No-weak range of initial ideas (superficial change of shape lacking any depth or detail)</p> <p>3-4 Limited-some evidence of variation and range of ideas logically laid out</p> <p>5-6 Good range of different ideas clearly laid out and understood by a third party</p> <p>7-8 Good range of appropriate innovative significantly different ideas</p> <p>9-10 A wide range of appropriate innovative significantly different ideas.</p>		10
S	<p>Design ideas relating to the <u>functional aspects of the specification.</u></p> <p>0-1 No-little functional aspects of the specification identified or considered</p> <p>2-3 Limited-some functional aspects of the specification identified or considered</p> <p>4-5 Clear-detailed evidence of the majority of the functional aspects have been considered in some depth.</p>		5
V	<p>Quality of design thinking relating to volume production and wider market issues.</p> <p>0-1 No-little consideration given to market issues or volume production in the design thinking</p> <p>2-3 Limited-some superficial consideration given to market issues or volume production in the design thinking</p> <p>4-5 Clear-detailed evidence that consideration has been given to market issues or volume production in the design thinking.</p>		5

C	<p>Detail Consideration of construction Methods/construction/component/assembly detail, appropriate to the product and the chosen materials. Knock down fittings and relevant fixings will be given credit.</p> <p>0-1 No–little consideration given to suggest appropriate (alternative) methods of construction or assembly</p> <p>2-3 Limited-some consideration given to suggested appropriate (alternative) methods of construction or assembly</p> <p>4-5 Clear-detailed evidence has been considered in relation to appropriate (alternative) methods of construction or assembly.</p>		5
M	<p>Consideration of specific materials and components (may include calculations or specific values for components)</p> <p>Generic terms not acceptable:</p> <ul style="list-style-type: none"> • Plastics-thermoplastics, thermosetting • Wood-hardwood, softwood • Cloth-natural fibre, synthetic fibre • Metal-ferrous, non-ferrous • Paper, card and board. <p>0-1 No-little mention of relevant and appropriate specific materials and components</p> <p>2-3 Some consideration given to relevant and appropriate specific materials</p> <p>4-5 Clear evidence of relevant and appropriate specific materials and components.</p>		5
D	<p>Consideration of dimensional detail (may include calculations). Overall dimensions plus some detailed dimensions required (circuit diagrams/layouts, systems diagrams, flow diagrams).</p> <p>0 No indication of scale, dimensions or calculations</p> <p>1 Limited indication of scale, dimensions or calculations</p> <p>2 Evidence of general sizes of scale, dimensions and calculations</p> <p>3 Detailed sizes given in component parts or sub parts of the design.</p>		3
E	<p>Evaluation of the suitability of the ideas with reference to the specification.</p> <p>0-1 No-Little evidence of evaluation commentary</p> <p>2-3 Limited-some evidence of subjective evaluation commentary</p> <p>4-5 Clear-detailed evidence of evaluation commentary (may-must include some objective content). Look for intellectual depth of design analysis and formative thinking.</p>		5

FEATURES SUITABLE FOR DEVELOPMENT (FD) A3 Sheet 4 of 4			
F	<p>Appropriate features identified and clearly described. All major aspects of the design should be evident; this may be in the form of annotation of a final drawing or part drawings, or may be in the form of expanded text eg bullet point listing. Candidates could refer to the design features in terms of strengths and weaknesses. Ideally there should be at least three different features identified.</p> <p>0 No-little features identified-concept drawing only superficial commentary</p> <p>1-2 Limited-some internal and or external appropriate features identified. Lacks realistic proposals and detail</p> <p>3-4 Clear-detailed evidence of internal and or external appropriate features identified. Contains constructive and realistic proposals and detail.</p>		4
J	<p>Appropriate justification of the choices made with reference to the specification</p> <p>0 No-evidence of justification made, (descriptive, superficial and subjective)</p> <p>1-2 Limited-some evidence of justification (superficial descriptive statements with elements of objectivity)</p> <p>3-4 Clear-detailed intellectual constructive justification is evident. Justification is fluent objective and appropriate.</p>		4

EFFICIENT COMMUNICATION (CS) A3 Sheets 1-4			
CS	<p>Communication skills and techniques</p> <p>0 No-weak level of graphical skill/annotation evidenced by poor use of communication methods no apparent quality</p> <p>1-2 Low Level of graphical skill/annotation</p> <p>3-4 Limited-some graphical skill/annotation evidenced by one form of communication method (eg 2D only) lacking appropriate techniques of detail</p> <p>5-6 Reasonable evidence of variation and range of graphical techniques/annotation appropriately used</p> <p>7-8 Fluent range of a variety of graphical presentation techniques in evidence with some annotation</p> <p>9-10 Fluent design thinking that is evident and expressed coherently and cohesively and easily followed and understood by a third party. (Circuit diagrams, systems diagram, exploded views, sectional views 2D and 3D views enlarged detail views and fluent annotation are appropriately used.</p>		10

[TOTAL : 72]

**Advanced GCE Design Technology (7822, 7823)
Advanced Subsidiary GCE Design & Technology (3822, 3823)
January 2007 Assessment Series**

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u
2519	Raw	120	96	84	72	60	48	0
	UMS	120	96	84	72	60	48	0
2520	Raw	90	57	51	45	39	34	0
	UMS	90	72	63	54	45	36	0
2521	Raw	90	60	54	48	42	36	0
	UMS	90	72	63	54	45	36	0
2522	Raw	90	72	63	54	45	36	0
	UMS	90	72	63	54	45	36	0
2523	Raw	90	72	63	54	45	36	0
	UMS	90	72	63	54	45	36	0
2524	Raw	120	73	66	60	54	48	0
	UMS	120	96	84	72	60	48	0
2525	Raw	120	82	74	66	59	52	0
	UMS	120	96	84	72	60	48	0

Specification Aggregation Results

Overall threshold marks in UMS (i.e. 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	13.2	28.9	57.9	77.2	99.1	100	116
3823	0	22.2	44.4	88.9	100	100	9

3822: 116 candidates aggregated this series

3823: 9 candidates aggregated this series

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

	A	B	C	D	E	U	Total Number of Candidates
7822	7.1	28.6	64.3	92.9	100	100	14
7823	0	100	100	100	100	100	2

7822: 14 candidates aggregated this series

7823: 2 candidates aggregated this series

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

Statistics are correct at the time of publication

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

(General Qualifications)

Telephone: 01223 553998

Facsimile: 01223 552627

Email: helpdesk@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored



Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553