

Design & Technology (Systems & Control)

General Certificate of Secondary Education **GCSE 1957**

Mark Schemes for the Components

June 2006

1957/MS/R/06

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CONTENTS

General Certificate of Secondary Education

GCSE Design and Technology: Systems and Control (1957)

MARK SCHEMES FOR THE COMPONENTS

Unit	Content	Page
1957/01	Core: Paper 1 – Foundation	1
1957/02	Core: Paper 2 – Higher	5
1957/03	Electronics: Paper 3 – Foundation	11
1957/04	Electronics: Paper 4 – Higher	17
1957/05	Pneumatics: Paper 5 - Foundation	23
1957/06	Pneumatics: Paper 6 – Higher	27
1957/07	Mechanisms: Paper 7 - Foundation	31
1957/08	Mechanisms: Paper 8 - Higher	35
*	Grade Thresholds	39



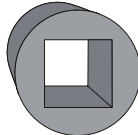
Mark Scheme 1957/01
June 2006

- 1 (a) polyurethane/varnish/wax/paint (1)
vinyl/polythene/nylon/other suitable named/plastic/metal (1)
acrylic paint/paint/electroplate/chrome/zinc/plastic coating/power coating (1)
- (b) screw/cross head bolt (1)
- (c) screwdriver/spanner/allen key (1)
- (d) must hold a suitable number of bottles
holes must be large enough for the bottles to fit in
must hold the bottles securely
must have smooth edges/corners (3)
- (e) (i) wear gloves/don't touch the hot areas of the machine/don't trap fingers/care with sharp edges/don't leave unattended (1)
- (ii) Mould in position/plastic is secured/ plastic hot enough/no air leaks (1)
- 2 (a) nut and bolt/coach bolt (drawn) (1)
Nut and bolt/coach bolt (labelled) (1) (2)
- (b) saves time/faster (1)
consistency/all the same (1) (2)
(not better quality/accuracy)
- (c) pivot shown (1)
- (d) handle longer (drawn) (1)
handle longer (note) (1)
- hand grip (drawn) (1)
(suitably named or (note) (1) (4)
- (e) Lubrication/ self lubricating materials(wire/pulley)/bearing (1)
- 3 (a) Comfortable/easier to hold/fits hand (not safety) (1)
- (b) Input (1)
CPU/transistor/I.C./ AMP (1)
Output (1) (3)
- (c) electrical (1) (2)
light (1)
- (d) Resistor/variable resistor (1) (1)
Alters base current/biases/alters threshold/trigger point (1)
Quality of explanation (1) (2)
- (e) don't inhale fumes/air extraction/care of hot iron/care of hot solder solder/wear goggles/wash hands (1)

4	(a)	Statement of advantage e.g. no need to remove glasses in changing light levels	(1)	
		Explanation relates to material properties/human performance improvement	(1)	(2)
	(b)	Smart	(1)	(1)
	(c)	(i)		
		frames go back to original shape	(1)	
		quality of explanation e.g. (sports people band their frames more often)	(1)	(2)
		(ii)		
		Advantage of metal=easier to recycle than plastic	(1)	
		Advantage of metal=not an oil based material	(1)	
		Advantage of metal=no toxic chemicals released after use	(1)	(2)
	(d)	repetitive flow	(1)	(1)
	(e)	Often cheaper labour/overheads/land/not cheaper materials		(2)
		Plentiful supply of labour		
		Grants available for development		
		Fair trade		
		Close to new markets		
5	(a)	(i)		(1)
		lathe		
		(ii)		
		faster/work 24/7/less errors/lower costs (qualified)		(1)
	(b)	(i)		(1)
		injection moulding		
		(ii)		(1)
		allows moulding direct onto metal screw		
		allow better/finer detail		
	(c)	thread is correctly formed	(1)	
		diameter of stud is correct	(1)	
		length of thread is correct	(1)	
		Any dimensional check	(1)	
		Metal and plastic are joined	(1)	
		Full forming of the stud	(1)	
		Check for smooth moulding	(1)	(2)
	(d)	Less risk of damage to stud	(1)	
		More compact	(1)	
		More ergonomic	(1)	
		Safety (qualified)	(1)	
		Less chance of slippage/better grip	(1)	
	(e)	Rapid alteration, specialist manufacturing skills are not needed for machinery		(2)
		Less errors(easy transfer of design)		(2)

Mark Scheme 1957/02
June 2006

1	(a)	Statement of advantage e.g. no need to remove glasses in changing light levels	(1)		
		Explanation relates to material properties/human performance improvement	(1)	(2)	
	(b)	Smart	(1)	(1)	
	(c)	(i)	frames go back to original shape	(1)	
			quality of explanation e.g. (sports people band their frames more often)	(1)	(2)
		(ii)	Advantage of metal=easier to recycle than plastic	(1)	
			Advantage of metal=not an oil based material	(1)	
			Advantage of using metal=no toxic chemicals released after use	(1)	(2)
	(d)	repetitive flow	(1)	(1)	
	(e)	Often cheaper labour/overheads/land/not cheaper materials		(2)	
		Plentiful supply of labour			
		Grants available for development			
		Fair trade			
		Close to new materials			
2	(a)	(i)	lathe	(1)	
		(ii)	faster/work 24/7/less errors/lower costs (qualified)	(1)	(1)
	(b)	(i)	injection moulding	(1)	(1)
		(ii)	Allows moulding direct onto metal screw	(1)	(1)
			Allow better/finer detail		
	(c)		thread is correctly formed	(1)	
			diameter of stud is correct	(1)	
			length of thread is correct	(1)	
			Any dimensional check	(1)	
			Metal and plastic are joined	(1)	
			Full forming of the stud	(1)	
			Check for smooth moulding	(1)	(2)
	(d)		Less risk of damage to stud	(1)	
			More compact	(1)	
			More ergonomic	(1)	
			Safety (qualified)	(1)	
			Less chance of slippage/better grip	(1)	(2)
	(e)		Rapid alteration.	(1)	
			Specialist manufacturing skills are not needed for machinery	(1)	(2)
			Less errors(easy transfer of design)	(1)	

3	<p>(a) comfortable to hold/fits hand (1) not too heavy (1) display not covered by hand (1) buttons/controls suitable size (1) (2)</p> <p>(b) LDR/photodiode (1)</p> <p>(c) bulb (1+1)  (1+1) (4)</p> <p>buzzer  (plus old symbols accepted)</p> <p>(d) variable resistor (component stated) (1+1) (2) alters biasing of transistor</p> <p>(e) dry soldered joint. faulty component (1) flat battery (1) solder bridge (1) Breaks in circuit (1) Polarity problem (1) (1)</p>
4	<p>(a) (i) friction (1) (ii) rotary to linear (1+1) (2)</p> <p>(b) Separate parts are involved (1) Rapid production (1) Cheaper (qualified) (1) (2) Standard parts can be used (1)</p> <p>(c) (i) safety, theft, only 1 handle for many nets (1) (1) (ii) suitable shape allowing detachment and positive drive (2) (4) note to explain each improvement (2)</p> 
5	<p>(a) Disadvantage=does not bend easily (1) Disadvantage=needs to be painted/does corrode (1) Disadvantage=it is heavier</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>(b) details of support for ring (drawn) (1) details of support for ring (note) (1)</p> <p>details of attachment to back board (drawn) (1) details of attachment to back board (note) (1) (4)</p> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Note and Sketch to show</p> <ul style="list-style-type: none"> • Minimum material (e.g. frame structure/shell structure) (1) • Easily moved (e.g. wheels/skids/handles) (1) • Stability (e.g. weighting, jacks, large base) (1) Quality of communication (1) (4) </div>

Mark Scheme 1957/03
June 2006

- 1 (a) (i) 1 mark for each correct.

push switch	C
slide switch	D
microswitch	E
rotary switch	B
toggle switch	A

[4]

- (ii) **push switch** or **microswitch**. 1 mark for either
Accept correct letter from Fig 2, **C, E**

[1]

- (b) Advantage or solder could include:

- permanent joint
 - not easy to accidentally disconnect
- 1 mark for suitable reason

[1]

Advantage of crimp connector could include:

- easy to disconnect
 - safer attachment process, e.g. no soldering, no mains electricity
 - no heat involved
 - speed of assembly / disassembly
- 1 mark for suitable reason

[1]

- (c) (i) Position **B**, 1 mark for correct answer, allow indication on the diagram.

[1]

- (ii) Stages could include:

- cleaning tip of iron with tip cleaner
- heating iron
- wiping on sponge
- applying solder to tip

accept

- switching iron on
 - dipping in flux
- Any two stages 1 mark each

[2]

- 2 (a) (i) Advantages of LED include:
- lower purchase cost
 - lower running cost
 - variety of colours
 - variety of shapes
 - less chance of breakage once installed
 - longer life
 - take up less space
 - Does not get hot
- Accept 'cheaper' only if it is qualified.
2 x 1 mark for relevant points. [2]
- (ii) Both resistor is there to limit current to the LED, allow protect LED. [1]
- (iii) The LED will appear to be **dimmer** or **not work** at all if resistor value is increased. [1]
- (b) 1 mark for each correct.
- no connection from resistor to positive rail [1]
 - LED is connected the wrong way around [1]
allow indications on the breadboard diagram
 - supply leads could be reversed
- (c) (i) The variable resistor is to allow setting of point where op-amp output is changed. Allow reference to adjustment of the circuit or it is set when the light comes on. [1]
- Diode D is to prevent damage if the circuit is connected with reverse polarity. Allow mark for understanding of the function. [1]
- (d) (i) The meter reading will decrease if the thermistor is heated. [1]
- (ii) Epoxy resin is a suitable adhesive; e.g. Araldite, potting compound. Must be a thermosetting adhesive. No mark for glue gun. [1]

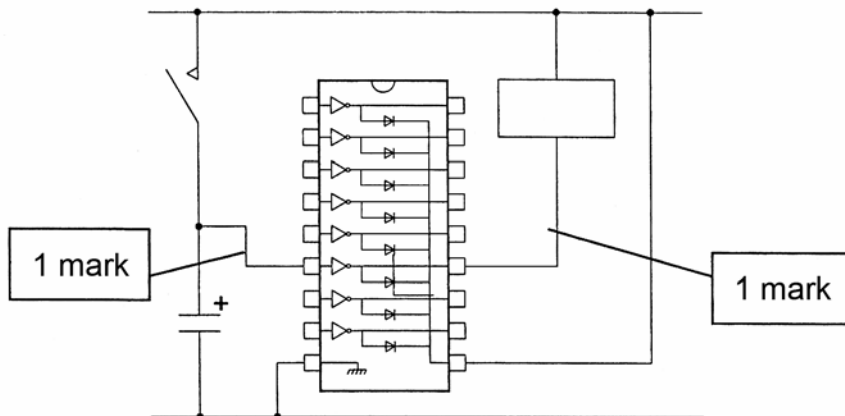
3 (a) (i) Capacitor is for storage of charge while the circuit is operating.
Allow mark for reference to storage. [1]

(ii) Specification points should include reference to:

- must be operated by a switch
- must have a suitable output for those who cannot hear
- must have light as an output
- must have sound as an output
- must output for a set time after switch release

2 x 1 mark for relevant points. [2]

(b) 1 mark for switch/capacitor junction to pin 6.
1 mark for pin 13 to RLA1.
Each area must be correct to gain the mark. [2]



(c) (i) Advantages could include:

- set length of output pulse
- not possible to give extended press on bell
- output operates for a minimum time so less easy to miss

1 mark for suitable advantage. [1]

(ii) Output 'on' time can be extended by

- increasing the value of C1
- adding a resistor in series with R1

[1]

(d) (i) Logic gate is **NOR**, 1 mark. [1]

(ii) Joining the NOR gates inputs makes them NOT gates or inverters,
or ensures the same logic level at each input, 1 mark. [1]

(iii) Not gate, inverter or NAND gate could also be used in the arrangement,
1 mark. [1]

- 4 (a) Benefit of storage:
- can be saved to computer / CD / disc or other media device
 - takes up less space
 - easy to find, recover
 - more can be stored in a controlled way – no stretching of paper or damage to layout
- 1 mark for relevant benefit.
- Benefit of editing:
- easy to alter
 - updating is quick
 - section of circuit can be used in new circuits
- 1 mark for relevant benefit.
- benefit of transport – allow reference to speed
 - can easily be posted on a disc or CD, without damage to drawing
- 1 mark for relevant benefit. **[3]**
- (b) (i) Moulded lettering has to be included in the cost of tooling, which is very high, once produced it is not possible to change or edit the lettering; **[1]**
- (ii) Warning symbols are often moulded so that they cannot be removed, label can be pulled off, lettering on label may fade, 1 mark for suitable reason. Allow any response that indicates the labels are not permanent. **[1]**
- (c) (i) Environmental problems could include:
- more incentive to replace items that are still functional
 - large numbers of redundant products to be disposed of
 - increased use of energy in production
 - increased pollution from distribution / production
 - dangerous components or materials used in the items etc
- allow reference to 'throwaway society'
- 2 x 1 mark for relevant problems identified. **[2]**
- (d) (i) PCB layout could be improved by:
- increasing size of pads
 - increasing width of tracks
 - leaving less space between components
 - removing need for links
 - adding information to copper side
- allow reference to the size of the board
- 1 mark for relevant response. **[1]**
- (ii) Information is missing in the following areas:
- height of the components is not given by this view
 - thickness of the board is not given
 - some components not included on the view e.g. battery
- 1 mark for missing dimension identified.
- 1 mark for relevance to the casing design or
- 2 marks for clear explanation of a single point. **[2]**

- 5 (a) (i) Criteria will include:
- number of cases to be produced
 - suitability of method for the chosen material
 - availability of process
 - cost of mould etc
 - recyclable nature of the material used
 - required speed of production
- 2 x 1 mark for suitable criteria. [2]
- (ii) Property identified must refer to flexibility or ability of material to be deformed/bent without breaking. [1]
- (b) Grills are there:
- to let sound out of casing, 1 mark
 - to allow smoke to enter the casing, 1 mark
- Allow 2 marks for a clear description of either one. [2]
- (c) (i) Method is used to:
- speed assembly
 - reduce number of tools needed
 - reduce part count
 - allow for machine assembly
- Allow other suitable reasons. [1]
- (ii) This type of screw head needs a specific screwdriver to remove it, it is tamperproof. [1]
- (d) 1 mark for electrolytic capacitor, battery / connector or piezo sounder. Allow mark for capacitor. [1]
- (e) Explanation could include:
- test button on top of casing
 - flashing LED
 - raised plastic flap when battery is removed
 - casing cannot be closed
 - backup facility for mains power
 - intermittent beep when battery gets low
- 2 marks for clear explanation
2 x 1 mark for mentioning two points in less depth. [2]

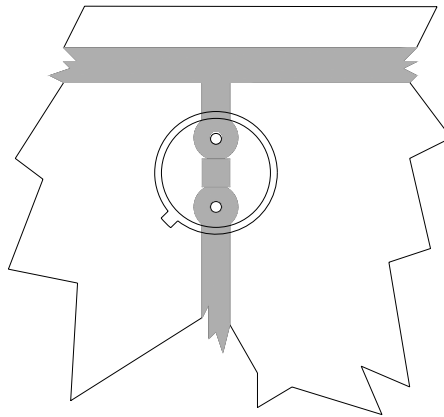
Total for paper [50]

Mark Scheme 1957/04
June 2006

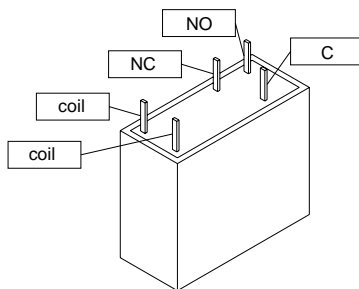
- 1 (a) Benefit of storage:
- can be saved to computer / CD / disc or other media device
 - takes up less space
 - easy to find, recover
 - more can be stored in a controlled way – no stretching of paper or damage to layout
- 1 mark for relevant benefit.
- Benefit of editing:
- easy to alter
 - updating is quick
 - section of circuit can be used in new circuits
- 1 mark for relevant benefit.
- benefit of transport – allow reference to speed
 - can easily be posted on a disc or CD, without damage to drawing
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- (b) (i) Moulded lettering has to be included in the cost of tooling, which is very high, once produced it is not possible to change or edit the lettering; [1]
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- more incentive to replace items that are still functional
 - large numbers of redundant products to be disposed of
 - increased use of energy in production
 - increased pollution from distribution / production
 - dangerous components or materials used in the items etc
allow reference to 'throwaway society'
- 2 x 1 mark for relevant problems identified. [2]
- (d) (i) PCB layout could be improved by:
- increasing size of pads
 - increasing width of tracks
 - leaving less space between components
 - removing need for links
 - adding information to copper side
- allow reference to the size of the board
1 mark for relevant response. [1]
- (ii) Information is missing in the following areas:
- height of the components is not given by this view
 - thickness of the board is not given
 - some components not included on the view e.g. battery
- 1 mark for missing dimension identified.
1 mark for relevance to the casing design or
2 marks for clear explanation of a single point. [2]

- 2 (a) (i) Criteria will include:
- number of cases to be produced
 - suitability of method for the chosen material
 - availability of process
 - cost of mould etc
 - recyclable nature of the material used
 - required speed of production
- 2 x 1 mark for suitable criteria. [2]
- (ii) Property identified must refer to flexibility or ability of material to be deformed/bent without breaking. [1]
- (b) Grills are there:
- to let sound out of casing, 1 mark
 - to allow smoke to enter the casing, 1 mark
- Allow 2 marks for a clear description of either one. [2]
- (c) (i) Method is used to:
- speed assembly
 - reduce number of tools needed
 - reduce part count
 - allow for machine assembly
- Allow other suitable reasons. [1]
- (ii) This type of screw head needs a specific screwdriver to remove it, it is tamperproof. [1]
- (d) 1 mark for electrolytic capacitor, battery / connector or piezo sounder. Allow mark for capacitor. [1]
- (e) Explanation could include:
- test button on top of casing
 - flashing LED
 - raised plastic flap when battery is removed
 - casing cannot be closed
 - backup facility for mains power
 - intermittent beep when battery gets low
- 2 marks for clear explanation
2 x 1 mark for mentioning two points in less depth. [2]

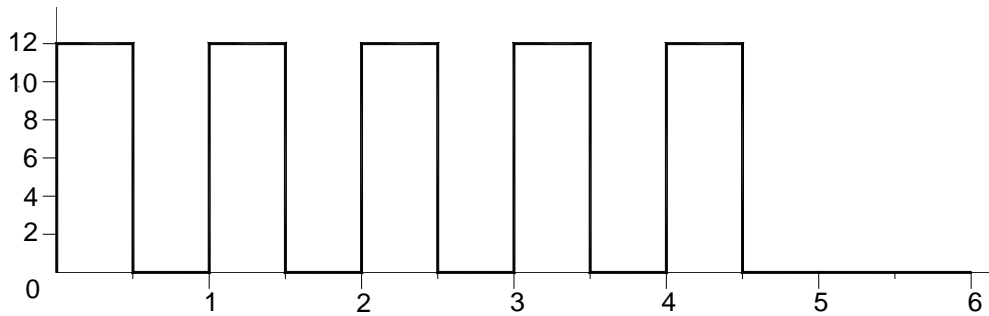
- Q.3 (a) (i)** Specification points should refer to –
- temperature range
 - response time
- 2 x 1 marks
no marks for reference to size, diameter or price. **[2]**
- (ii)** 1 mark for reference to –
- horizontal position allowing more even illumination
 - self cleaning with rain
 - North light facing gives even illumination **[1]**
- (iii)** 1 mark for drawing of photodiode in position.
The tag must be in correct quadrant of circle for mark to be awarded. **[1]**



- (b) (i)** Purpose of relay is to –
- isolate control circuit from lamp circuit
 - allow a high current device to be controlled by low current
 - allow a high voltage device to be controlled by low voltage **[1]**
- (ii)** Light level just at switching point will cause relay to ‘hunt’, or switch on and off rapidly. **[1]**
- (c) (i)** $I = W/V$, $I = 300/230$, 1 mark. Answer **1.304A**, accept **1.3A**, (1) **[2]**
- (ii)** Use of correct terms, **NO, C, coil**, (1)
Correct identification of pins, (1) **[2]**



- Q.4 (a) (i)** Correct 5 pulses (1), correct frequency (1).
Allow uneven mark/space ratio, but shape must be square wave.



[2]

- (ii) 59k – allow any value in the range 57k – 61k inclusive. [1]

- (iii) 100k no mark for other values. [1]

- (b)** Changes needed are :- any 2 from:

- pin 7 should join to positive rail not pin 8 (1)
- the lead from pin 4 to 0V rail is missing (1)
- remove connection from pin 8 to positive rail. [2]

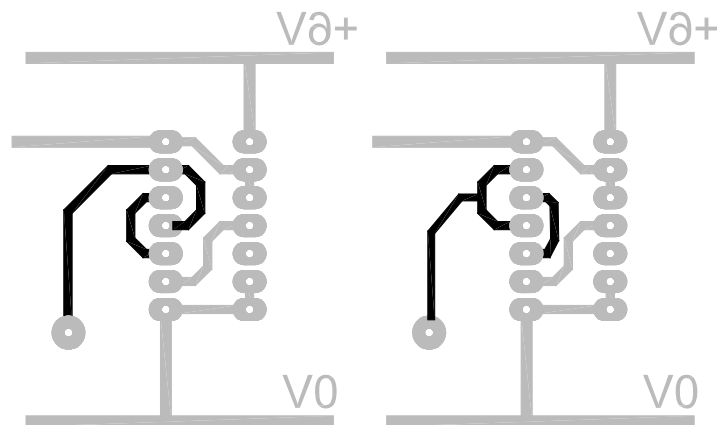
- (c) (i)** Calibration is carried out by placing test circuit in a controlled temperature or using an object of correct temperature against the thermistor, (1). the potentiometer is then turned until test LED is just switching on, (1). Allow 2 marks for clear explanation of either part of process. [2]

- (ii)** Benefits of PIC microcontroller could include:

- AD converter meaning no comparator needed
- astable frequency can be precise
- can be reprogrammed
- number of flashes easily controlled
- temperature range can be easily varied
- on screen simulation
- IC can be copied
- reduced part count in the circuit

1 mark for each valid benefit. [2]

- Q.5 (a) (i)** Suitable sensors could include –
- reed switch
 - proximity sensor
 - optical sensor eg LDR or infra red, (1) [1]
- (ii)** Requirement are for fast rise time, (1) no contact bounce, (1)
Allow reference to a clean signal. Amplitude must match CMOS
input 2 x 1 [2]
- (iii)** Extra items could include two Schmitt inverters with capacitor to remove
contact bounce or RS bistable, this could be NAND, NOR, 4043, 4044.
1 mark for components, 1 mark for correct connections.
Allow 1 mark for use of a Schmitt device [2]
- (b) (i)** LED number **6** will be operated. [1]
- (ii)** Binary output will not be readily understood by users, (1) [1]
Easier to read connected output.
- (c)** 1 mark each for connections A, B and C. Each connection must be
accurately placed and not touching incorrect pads or tracks for mark 3 x 1 [3]



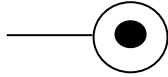
Total marks [50]

Mark Scheme 1957/05
June 2006

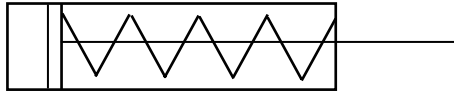
1 B
[1]



C
[1]



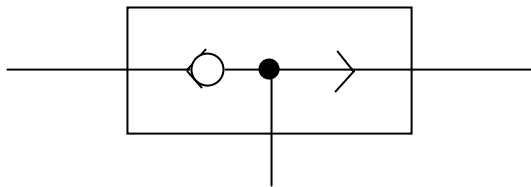
D
[2]



E Plunger operated [1] 3/2 [1] spring return valve [1]
any 2

[2]

F
[2]



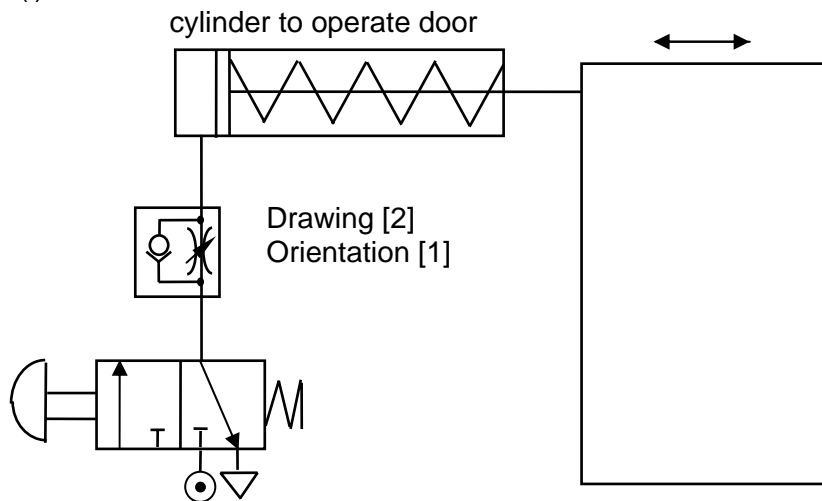
(b) Component F, the shuttle valve, is often included in sliding door systems because it allows the operation of the door from each side (1), it is an or gate (1).

[2]

2 (a) Push button operated [1] 3/2 [1] spring return valve [1]. (any 2)

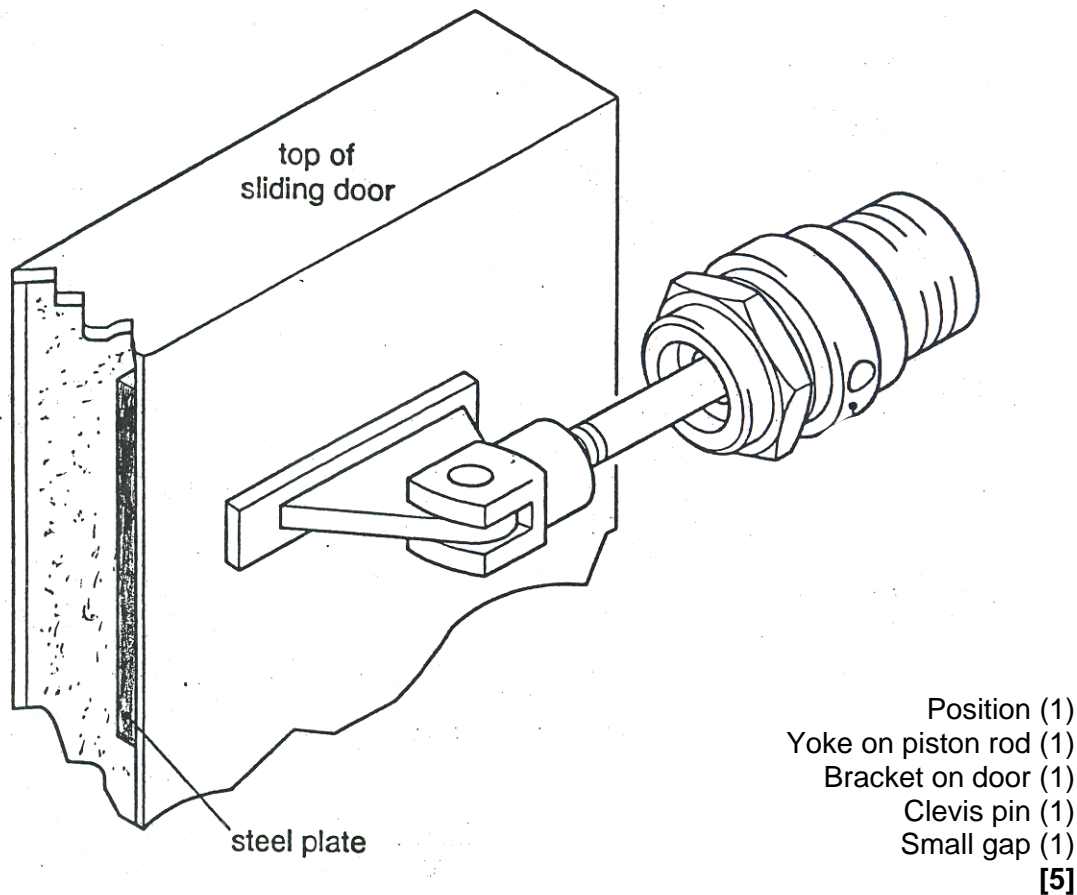
[2]

(b) (i)



- (b) (ii) A uni-directional restrictor works by allowing air to pass unrestricted through one way by blowing the ball away (1), but in the opposite direction the ball is blown into the socket (1) and the air must pass through the restrictor (1). **[3]**
- (iii) This system would not be suitable because the door would start closing as soon as the button was released. Pr 0-2 **[2]**
- 3 (a) (i) The safety valve is an essential part of the compressed air system because if the compressor fails to shut off, and the pressure rises too high, it will release the pressure and prevent the receiver exploding. **[2]**
- (ii) The drain valve is the method that can drain the water that has built up in the receiver/reservoir due to the water created in the pressurised air. **[2]**
- (iii) The pressure regulator with valve allows the pressure to be regulated and displayed on a gauge. **[2]**
- (iv) The air receiver stores the air and maintains sufficient air pressure to the circuit even when the compressor is off. **[2]**
- (b) It is important to check that there are no unconnected pipes because they will flay around and could hit somebody.
If pressurised air is allowed to blow on the skin it could cause air bubbles to get in the blood stream, possibly causing death. **[2]**
- 4 (a) Accuracy of drawing, Able to copy and paste components. Quicker to draw complex designs. Easy to save and draw images. Make changes to existing drawings more easily. Modelling and testing, Symbol library **[1] + [1] + [1]**
- (b) To help evaluate the integrity of the circuit. To test the flow. To test the viability of different components. To find problems and solve them through simulation.
Actual components not needed (i.e. cheaper) **[1] + [1]**
- (c) Loss of workforce, and the need to retrain for the new technology.
More I.T. skilled operators needed **[1] + [1]**
- (d) (i) The sensors are triggered by the magnetic insert on the piston. **[1]**
- (ii) When the computer receives a signal from X (1) it then sends a signal to the 5/2 solenoid valve. (1) **[2]**

5 (a)

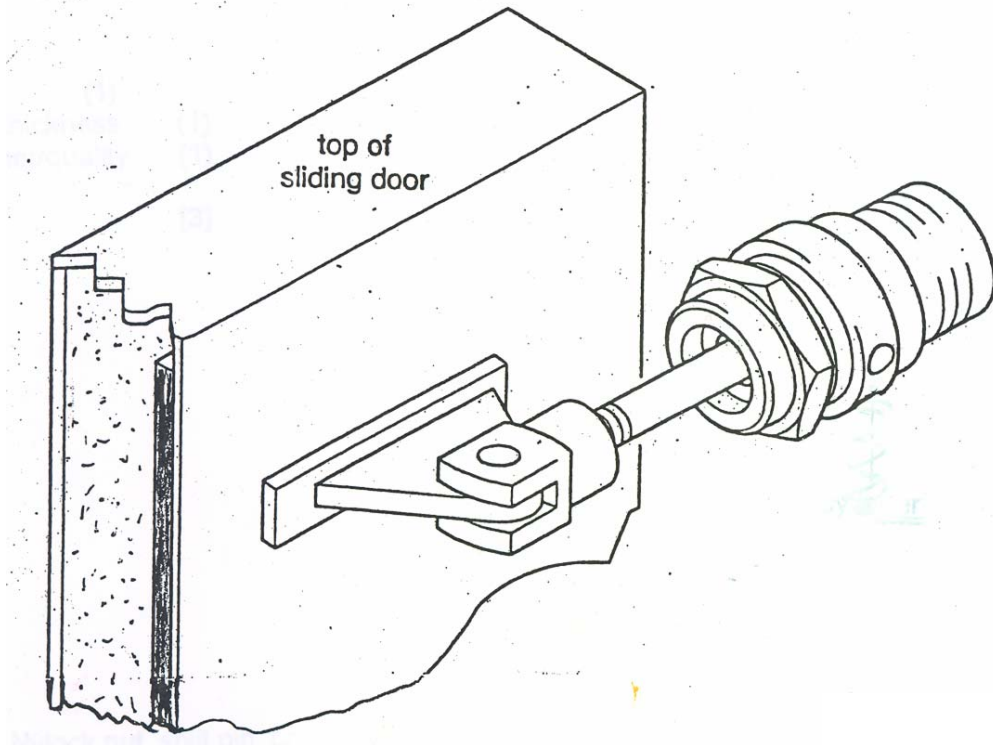


- (b) When the piston stops moving forward, the pressure in the exhaust line and pilot line to the diaphragm valve reduces (1). When this happens the diaphragm will reset, by the spring (1) and causes a pilot signal to be sent to the 5/2 valve (1). This causes the direction of the air flow to the cylinder to be reversed (1) repressurising the pilot line which causes the valve to signal the piston to instroke (1). **[5]**

Mark Scheme 1957/06
June 2006

- 1 (a) Accuracy of drawing, able to copy and paste components. Quicker to draw complex designs. Easy to save and draw images. Make changes to existing drawings more easily. Modelling and testing. Symbol library [1] + [1] + [1]
- (b) To help evaluate the integrity of the circuit. To test the flow. To test the viability of different components. To find problems and solve them through simulation. Actual components not needed . . . cheaper [1] + [1]
- (c) Loss of workforce, and the need to retrain for the new technology. More I.T. skilled workers needed [1] + [1]
- (d) (i) The sensors are triggered by the magnetic insert on the piston. [1]
 (ii) When the computer receives a signal from X (1) it then sends a signal to the 5/2 solenoid valve. (1) [2]

2 (a)

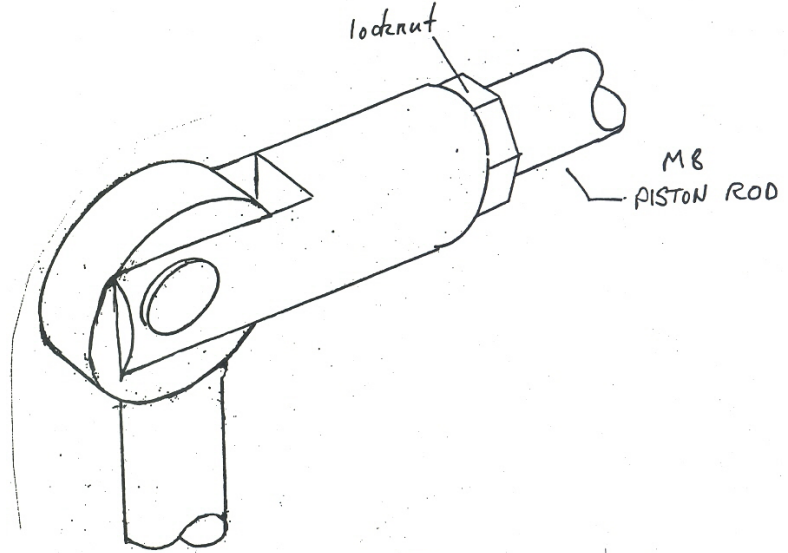


- Position (1)
 Yoke on piston rod (1)
 Bracket on door (1)
 Clevis pin (1)
 Small gap (1)
 [5]

- 2 (b) When the piston stops moving forward, the pressure in the exhaust line and pilot line to the diaphragm valve reduces (1). When this happens the diaphragm will reset, by the spring (1) and causes a pilot signal to be sent to the 5/2 valve (1). This causes the direction of the air flow to the cylinder to be reversed (1) repressurising the pilot line which causes the valve to signal the piston to instroke (1). [5]

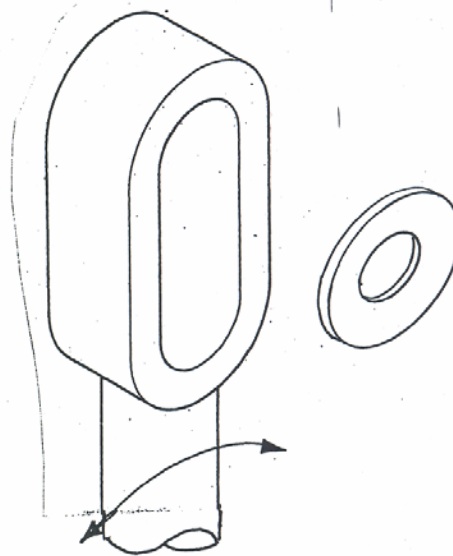
- 3 (a)
 locknut on p/rod (1)
 slot or similar (1)
 Pin (1)
 Pin retaining (1)
 Quality (1)

[5]



- 3 (b)
 slot (1)
 wall thickness (1)
 washer/quality (1)

[3]

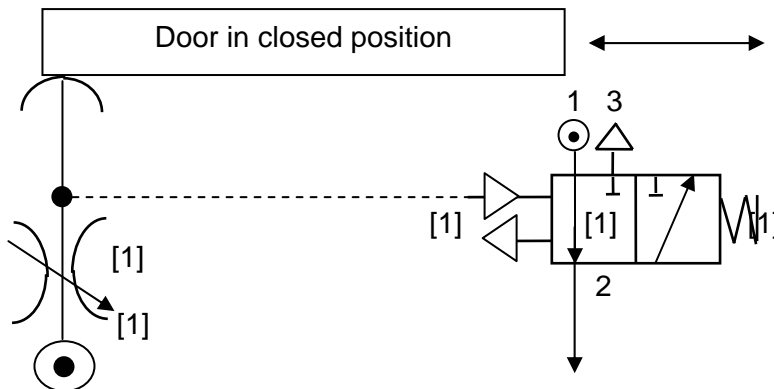


- 3 (c) Nylock nut, split pin, castle nut, double nuts, locktite
 Any two

[1] + [1]

- 4 (a) Calculate the minimum air supply required to open the door. $F = P \times A$
- $R = D/2 = (32/2) = 16$ (1)
- $100 = P \times \pi \times 16^2$ (1) ($\pi \times 16^2 = 804.35$)
- $P = 100 / \pi \times 16^2$ (1)
- $P = 0.12$ (1) (accept 0.13)
- Minimum air supply pressure in N/mm^2 (1) [5]
- (b) The minimum pressure calculated was based on the full area of the Piston (1) but on the instroke the area of the piston rod must be Considered (1). The result is that there is less area for the pressure to act on (1) so less force produced (1). [4]
- (c) Increase the air supply pressure. [1]

- 5 (a)



Air supply to the tram control that will allow it to move.

- (b) When the door is closed a low pressure air signal is diverted to the diaphragm valve (1) and it changes state (1) and main air is sent to the tram control to allow it to move (1) If the door opens the low pressure is vented (1) and the diaphragm valve changes back cutting the air to the tram control. (1) [5]

Mark Scheme 1957/07
June 2006

1	(a)	Linear		1	
		Rotary		1	
		Oscillate		1	
		Note: correctly placed for mark			
	(b)	cam, eccentric, on axle (allow protrusion from surface of wheels)	1		
		pivot through neck or extension of neck to form follower or lever	1		
		working correctly	1	3	
	(c)	(i) Beech, allow any named hardwood except Balsa & Teak		1	
		(ii) non splinter, non toxic, durable, hard, close grain. Aesthetic		1	
		(iii) Varnish, paint, wax, stain.		1	
	(d) increased friction, stop wheels slipping, increased grip. (Mechanical solutions only)		1		
2	(a)	Mechanism can be tested easily; easy to make changes; low cost		1	
		(b) Paper fastener; drawing pin; screw/nut, plastic rivet, butterfly clips Not dowel or split pin		1	
			(c) weight added to lever in contact with paddle - 1 mark only		
			coiled compression spring between lever and box top - 1 mark only		
		tortion or leaf type spring used in appropriate position - 2 marks			
		tension spring - 2 marks			
		Coiled comp. spring between vertical part of lever and additional stop. 2 marks			
		tension spring with fixings indicated - 3 marks			
		annotation indicating the need for light springs - additional 1 mark			
		extension of hand lever to form a pendulum effect - full marks		4	
	(d)	side location	S 1		
		end location	E 1		
		guide for drill	G 1		
		secure hold	H 1	4	
3	(a)	(i) cantilever: class 2; 2 nd order		1	
		(ii) calliper: class 1; 1 st order		1	
	(b) Easier to set up or adjust; even wear; greater MA. Less effort		1		
	(c) MA $60/20 = 3$	1			
		Braking force $5N \times 3 = 15N$	2	3	
		(note if incorrect MA is carried forward correctly allow 2 marks)			
		(allow 3 marks for correct answer with no calculation)			
(d)	(i)	Allows for different rim thickness; allows for adjustment to compensate for pad wear; allows for easy removal of wheel;		2	
		(ii) sketches to show splines or keyway (1) and key (1)		2	
		Bolt with point = key 1 mark			
		Flat on shaft 1 mark, shaped hole to match flat 1 mark,			
		Square shaft 2 marks			

4	(a) mill; engraver; router; micro router laser cutter. (not lathe)		1
	(b) workpiece datum; X,Y and Z coordinates; feed rates; spindle speed; tool size (1 mark only for co-ordinates)		3
	(c) changes to colours easy to make; respond to requests for spares, short runs explanation required for two marks		2
	(d) easy access secure storage – safe, cannot cause accidental opening positive closing - locking detail of how it works (reference to mechanical features)	E 1 S 1 P 1 D 1	4
5	(a) single handed operation; quicker closing and opening; no turning force on workpiece; greater MA = tighter grip explanation needed for marks (not easier to use) do not accept “use as spreader”	1 + 1	2
	(b) Jaws to hold round bars ie. vee grooves Note: 1 mark only for concave jaw, soft jaw, rubber material.		2
	(c) Polymorph granules heated and moulded to fit comfortably in hand, Tested, reshaped where necessary, until best form produced. Low temperature used. Rigid material when cold.		2
	(d) Secured at each end (locate, fix) Easy removal	L,F 2 E 1	
	Labelled components	F 1	4
			Total 50

Mark Scheme 1957/08
June 2006

- 1 (a) mill; engraver; router; micro router laser cutter. (not lathe) 1
- (b) workpiece datum; X,Y and Z coordinates; feed rates; spindle speed; tool size (1 mark only for co-ordinates) 3
- (c) changes to colours easy to make; respond to requests for spares explanation required for two marks 2
- (d) easy access E 1
 secure storage – safe cannot cause accidental opening S 1
 positive closing - locking P 1
 detail of how it works D 1 4
 (reference to mechanical features)
- 2 (a) single handed operation; quicker closing and opening; no turning force on workpiece; greater MA = tighter grip explanation needed for marks (not easier to use) do not accept “use as spreader” 1 + 1 2
- (b) Jaws to hold round bars ie. vee grooves 2
 Note 1 mark only for concave jaw, soft jaw, rubber material
- (c) Polymorph granules heated and moulded to fit comfortably in hand, Tested, reshaped where necessary, until best form produced. Low temperature used. Rigid material when cold. 2
- (d) Secured at each end (locate, fix) L,F 2
 Easy removal E 1
 Labelled components F 1 4
- 3 (a) more efficient braking; not affected by mud or water explained 2
- (b)
- ```

 graph LR
 A[Input:
Brake fluid
forced into
cylinder] --> B[Process:
Piston forced out
of cylinder;
Caliper pulled
towards disc or
brake pads
pushed onto
disc]
 B --> C[Output:
Brake pads
forced together
against both
sides of disc.
Bike slows
down/stops]

```
- (c) Kinetic – heat (or sound) 1
- (d) Length of inner cable is altered by turning threaded outer sleeve. locknut tightened to prevent sleeve loosening as a result of vibration. 1
- (e) several linkages have potential for siezing up; lubrication of cables running in sleeves reduces effort needed to apply brake; reduce friction; reduce wear and tear. 2

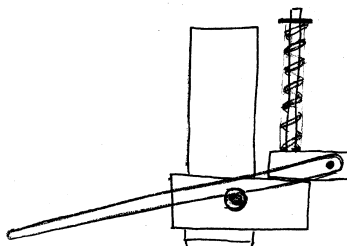
4(a) (i) Ratio A:  $44/11 = 4:1$  1  
 $50 \times 4 = 200\text{rpm}$  1 2 Ratio  
 B:  $22/22 = 1:1$  1  
 $50 \times 1 = 50\text{rpm}$  1 2  
 If no calculation but answer correct – full marks

(ii) circumference of wheel:  $0.7 \times 3.14 = 2.198\text{m}$  (2.199/2.2) 1  
 speed:  $2.198 \times 100 = 219.8 \text{ mpm}$  (219.9/220) 1 2  
 (Allow mark if incorrect answer to circumference is applied correctly)

(b) Maintains tension in chain 1  
 allow for slack caused by gear changing resulting in the 1 2  
 smaller gears in use  
 (c) Attachment 1  
 Secure 1 2

5(a) ease of adjustment E 1  
 secure fixing eg. Pinch bolt; Stops vertical movement V 1  
 Stops rotational movement R 1 3

(b) Must be a lever system  
 spring stop S 1  
 return spring R 1  
 (must cause drill to return)



fixed pivot point for lever P 1  
 load point L 1

annotation A 1 5

(c) Explanation of how mechanical advantage affects output movement 2  
 i.e. if anti-clockwise moment is much greater than clockwise moment much less force is required to lower the drill.  
 Or longer distance beyond load point compared with short distance from load to pivot less effort is needed.

**total 50**

## General Certificate of Secondary Education (D&T) (1957)

### June 2006 Assessment Series

#### Component Threshold Marks

| Component | Max Mark | A  | B  | C  | D  | E  | F  | G  |
|-----------|----------|----|----|----|----|----|----|----|
| 01        | 50       |    |    | 26 | 22 | 18 | 14 | 10 |
| 02        | 50       | 30 | 25 | 20 | 15 |    |    |    |
| 03        | 50       |    |    | 28 | 24 | 20 | 17 | 14 |
| 04        | 50       | 29 | 24 | 19 | 14 |    |    |    |
| 05        | 50       |    |    | 32 | 25 | 18 | 11 | 4  |
| 06        | 50       | 31 | 24 | 18 | 11 |    |    |    |
| 07        | 50       |    |    | 23 | 19 | 16 | 13 | 10 |
| 08        | 50       | 30 | 25 | 21 | 16 |    |    |    |
| 09        | 105      | 85 | 73 | 62 | 50 | 38 | 27 | 16 |

#### Syllabus Options

##### Foundation Tier Electronics

|                                | Max Mark | A* | A | B | C    | D    | E    | F    | G    |
|--------------------------------|----------|----|---|---|------|------|------|------|------|
| Overall Threshold Marks        | 175      |    |   |   | 97   | 81   | 65   | 49   | 33   |
| Percentage in Grade            |          |    |   |   | 20.9 | 24.4 | 23.5 | 14   | 10.5 |
| Cumulative Percentage in Grade |          |    |   |   | 20.9 | 45.3 | 68.7 | 82.8 | 93.3 |

The total entry for the examination was 629

##### Higher Tier Electronics

|                                | Max Mark | A*   | A    | B    | C    | D    | E    | F | G |
|--------------------------------|----------|------|------|------|------|------|------|---|---|
| Overall Threshold Marks        | 175      | 138  | 122  | 105  | 89   | 70   | 60   |   |   |
| Percentage in Grade            |          | 8.39 | 29   | 55.7 | 79.1 | 93.7 | 97.1 |   |   |
| Cumulative Percentage in Grade |          | 8.39 | 20.6 | 26.7 | 23.5 | 14.5 | 3.4  |   |   |

The total entry for the examination was 1110

##### Foundation Tier Mechanisms

|                                | Max Mark | A* | A | B | C    | D    | E    | F    | G    |
|--------------------------------|----------|----|---|---|------|------|------|------|------|
| Overall Threshold Marks        | 175      |    |   |   | 93   | 77   | 61   | 46   | 31   |
| Percentage in Grade            |          |    |   |   | 19.5 | 22.9 | 25   | 20.3 | 7.9  |
| Cumulative Percentage in Grade |          |    |   |   | 19.5 | 42.4 | 67.3 | 87.6 | 95.5 |

The total entry for the examination was 498



### Higher Tier Mechanisms

|                                | <b>Max Mark</b> | <b>A*</b> | <b>A</b> | <b>B</b> | <b>C</b> | <b>D</b> | <b>E</b> | <b>F</b> | <b>G</b> |
|--------------------------------|-----------------|-----------|----------|----------|----------|----------|----------|----------|----------|
| Overall Threshold Marks        | 175             | 139       | 124      | 107      | 91       | 72       | 62       |          |          |
| Percentage in Grade            |                 | 9.4       | 30.8     | 58.4     | 82.8     | 94.9     | 97.7     |          |          |
| Cumulative Percentage in Grade |                 | 9.4       | 21.4     | 27.7     | 24.4     | 12       | 2.8      |          |          |

The total entry for the examination was 898

### Foundation Tier Pneumatics

|                                | <b>Max Mark</b> | <b>A*</b> | <b>A</b> | <b>B</b> | <b>C</b> | <b>D</b> | <b>E</b> | <b>F</b> | <b>G</b> |
|--------------------------------|-----------------|-----------|----------|----------|----------|----------|----------|----------|----------|
| Overall Threshold Marks        | 175             |           |          |          | 103      | 83       | 64       | 45       | 26       |
| Percentage in Grade            |                 |           |          |          | 20       | 23.1     | 18.5     | 13.9     | 18.5     |
| Cumulative Percentage in Grade |                 |           |          |          | 20       | 43.1     | 61.5     | 73.4     | 93.9     |

The total entry for the examination was 65

### Higher Tier Pneumatics

|                                | <b>Max Mark</b> | <b>A*</b> | <b>A</b> | <b>B</b> | <b>C</b> | <b>D</b> | <b>E</b> | <b>F</b> | <b>G</b> |
|--------------------------------|-----------------|-----------|----------|----------|----------|----------|----------|----------|----------|
| Overall Threshold Marks        | 175             | 146       | 127      | 108      | 89       | 68       | 57       |          |          |
| Percentage in Grade            |                 | 7.5       | 34.3     | 29.9     | 16.4     | 9        | 3        |          |          |
| Cumulative Percentage in Grade |                 | 7.5       | 41.8     | 71.6     | 88.1     | 97       | 100      |          |          |

The total entry for the examination was 67

### Overall

|                                | <b>A*</b> | <b>A</b> | <b>B</b> | <b>C</b> | <b>D</b> | <b>E</b> | <b>F</b> | <b>G</b> |
|--------------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|
| Percentage in Grade            | 5.6       | 13.6     | 17.3     | 22.4     | 17.1     | 10.7     | 6.1      | 3.7      |
| Cumulative Percentage in Grade | 5.6       | 19.2     | 36.5     | 58.9     | 76       | 86.6     | 92.7     | 96.3     |

The total entry for the examination was 3267



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