

# **Design & Technology (Systems & Control)**

General Certificate of Secondary Education **GCSE 1957**

## **Mark Schemes for the Components**

**June 2008**

**1957/MS/R/08**

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.

The mark schemes are 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.

The reports on the Examinations provide information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the syllabus content, of the operation of the scheme of assessment and of the application of assessment criteria.

Mark schemes and Reports should be read in conjunction with the published question papers.

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

© OCR 2008

Any enquiries about publications should be addressed to:

OCR Publications  
PO Box 5050  
Annesley  
NOTTINGHAM  
NG15 0DL

Telephone: 0870 770 6622  
Facsimile: 01223 552610  
E-mail: [publications@ocr.org.uk](mailto:publications@ocr.org.uk)

## CONTENTS

### General Certificate of Secondary Education Systems & Control (1957)


#### MARK SCHEMES FOR THE UNITS

<b>Unit/Content</b>	<b>Page</b>
1957/01 Paper 1 (Foundation)	1
1957/02 Paper 2 (Higher)	6
1957/03 Paper 3 (Foundation)	11
1957/04 Paper 4 (Higher)	16
1957/05 Paper 5 (Higher)	22
1957/06 Paper 6 (Higher)	27
1957/07 Paper 7 (Higher)	31
1957/08 Paper 8 (Higher)	35
Grade Thresholds	39

# 1957/01 Paper 1 (Foundation)

1	(a)	Paint/painted/acrylic paint/electroplating/galvanising/chrome/zinc plating/powder coating	1	
		Any solid wood [e.g. pine/oak] or manufactured board [e.g. blockboard]	1	2
	(b)	<b>Drawing showing</b> nut and bolt/nut bolt and washer/pop rivet <i>[do not allow screws or glue/adhesive]</i>	1	
		<b>Name giving</b> nut <b>and</b> bolt /pop rivet	1	
		<i>[allow nut and bolt named the wrong way around]</i> <i>[do not allow just 'nut' or just 'bolt']</i>		2
	(c)	(i) increased rigidity/does not bend as easily (not stronger)	1	
		<i>[do not allow any reference to handles/ improving grip]</i> <i>[do not allow reference to the process e.g. 'because it was vacuum formed]</i>		
		(ii) any suitable thermoplastic	1	
		<i>[do not allow thermoset plastics e.g. resin, epoxy, epoxy resin]</i>		2
	(d)	<b>Drawing showing</b> suitable handle/hole/area to grip/ grooves <i>[allow <b>raising/ suitable shaping</b> of the original areas already shown as slightly raised]</i>	1	
		<b>Label giving</b> reference to handle/ increased raised area/grooves	1	2
	(e)	vacuum forming/injection moulding/strip heater/blow moulding/ rim [rotational injection moulding]		1
	(f)	Allow CAD-CAM/CNC		
		Also allow reference to specific machines such as sticker machine, milling machine, laser cutter		
		<i>[do not allow reference to having the lettering in the injection mould]</i>		
		allow simple stencil + paint		1

2	(a) (i)	correct part in tension [any horizontal rod/tie/stretcher]	1	
		<i>[do not allow reference to the horizontal central support]</i>		
	(ii)	correct part in compression [any angled support rod/strut]	1	
		<i>[do not allow reference to the horizontal central support]</i>		2
	(b)	<b>Sketch showing</b> any triangulated cross member drawn [small or large] or increased thickness of member	1	
		<b>Note which mentions</b> The word 'triangulation' or 'stiffens' or increased thickness of members	1	
	(c)	kinetic electrical light/heat	1 1 1	3
	(d)	Parts are <b>clean/grease free</b> Solder <b>attached</b> to both parts/parts tinned, flux is used, parts are <b>hot enough</b> before applying braze parts <b>close</b> enough		
		<i>[do not allow a reference to use of a jig]</i>	[any one]	1
	(e)	heat resistant holds parts in accurate position/ right place easy to remove parts after brazing ]	[any two]	2

3	(a)	input process/processing LED	1 1 1	3
	(b)	<b>protect</b> transistor from high currents/voltages  allow <b>reduce</b> the current flow/ control the current		1
	(c)	acrylic		1
	(d)			1
	(e)	9.0V D.C.		1
	(f)	waterproof/hold all the electronics/no sharp edges/corners/ able to insert (remove) battery		1
	(g)	smooth surface/no undercut/resistant to heat/does not collapse under air pressure/durable/draft angle/ sloping sides	[any two]	2

- 4 (a) one fulcrum labelled  
[must be within 5mm radius of the centre of the fulcrum] 1
- (b) rapid (ease of) alternation  
auto dimensioning  
3-d modelling  
rendering  
sent directly to CAD machine  
E-mailed  
  
[do not allow reference to accuracy being better] 1
- (c) (i) vice/  
clamps/clamped/ toggle clamp  
double sided tape/ fixture  
  
*[do not allow 'jig' or 'clips']* 1
- (ii) speed of cutter/feed of cutter/diameter of cutter (not just speed)  
depth of cut *[not depth or depth of material]*  
home position/ start position/zeroed/origin  
[do not allow just speed or just depth]  
*[do not allow reference to type of material / or thickness of material]* [any two] 2
- (d) repetitive flow  
  
[allow any terms using the word 'flow'] 1
- (e) **Drawing showing**  
Shaft with nut and bolt attachment 1  
Or  
Shaft with pop rivet attachment  
*no mark for just a shaft drawn on it's own]* [
- Label** 1 2  
Of components used
- Drawing showing** 1  
Shaft DIAMETER less than 8mm to allow clearance/ pivot
- Label**  
Stating the diameter is smaller 1 2

- 5 (a) **brighter** beam  
**lasts** longer/does not **break** easily  
less energy **wasted** as heat  
[do not allow reference to being smaller or cost]  
*[do not allow 'uses less power' 'less efficient'/'less voltage']* [any one] 1
- (b) electrical storage needed/battery needed  
[do not allow reference to capacitors] [any one] 1
- (c) no need to **replace/ buy** battery  
used where batteries are **not available**  
lower **running costs/ less money wasted**  
**instant** charging  
**qualified** environmental statement e.g, batteries in landfill give off chemicals/ less resources used  
  
*[do not allow just statements such as 'environmentally friendly' 'energy efficient' or energy saving']*  
*[do not allow reference to size]* [any two] 2
- (d) ease of **operating/turning** the handle/ length of crank  
**actual grip** of handle/ finger grooves  
**comfortable shape** of case/ shaped for grip  
**strap to fit** makes it easy to carry around [any two] 2
- (e) **CASE**  
check case is correctly **FORMED**.  
*[allow reference specific features of the case e.g. no rough edges/ halves fit each other]*  
*[do not allow 'made properly']*.
- SPECIFIC PARTS**  
Reference to correct **FIT** of any part .  
e.g. lens must fit case'.  
[do not allow 'lens must fit properly'].
- OPERATION/TESTING**  
Reference to testing for correct operation .  
e.g. check the LEDs light.  
e.g. crank is easy to turn.  
*[do not allow 'is torch bright enough?', 'does light stay on long enough?' or 'how long do LEDS stay on after winding torch has stopped?']* [any two] 2
- (f) (i) photo cell/photovoltaic/solar cell/solar panel.  
[do not allow LDR]. [any one] 1
- (ii) Less fumes (pollution or CO<sub>2</sub>) given off .  
Not using up limited finite resources.  
*[do not allow 'less energy wasted' or 'friendly to the environment']* [any one] 1





## 1957/02 Paper 2 (Higher)

- 1 (a) one fulcrum labelled  
[must be within 5mm radius of the centre of the fulcrum] 1
- (b) rapid (ease of) alternation  
auto dimensioning  
3-d modelling  
rendering  
sent directly to CAD machine  
E-mailed  
  
[do not allow reference to accuracy being better] 1
- (c) (i) vice/  
clamps/clamped/ toggle clamp  
double sided tape/ fixture  
  
*[do not allow 'jig' or 'clips']* 1
- (ii) speed of cutter/feed of cutter/diameter of cutter (not just speed)  
depth of cut *[not depth or depth of material]*  
home position/ start position/zeroed/origin  
[do not allow just speed or just depth]  
*[do not allow reference to type of material / or thickness of material]* [any two] 2
- (d) repetitive flow  
  
[allow any terms using the word 'flow'] 1
- (e) **Drawing showing**  
Shaft with nut and bolt attachment 1  
Or  
Shaft with pop rivet attachment  
*no mark for just a shaft drawn on it's own]*
- Label** 1 2  
Of components used
- Drawing showing** 1  
Shaft DIAMETER less than 8mm to allow clearance/ pivot
- Label** 1 2  
Stating the diameter is smaller

- 2 (a) **brighter** beam  
**lasts** longer/does not **break** easily  
less energy **wasted** as heat  
[do not allow reference to being smaller or cost]  
*[do not allow 'uses less power' 'less efficient'/'less voltage']* [any one] 1
- (b) electrical storage needed/battery needed  
capacitors allowed with storage  
[do not allow reference to capacitors on their own ] any one] 1
- (c) no need to **replace/ buy** battery  
used where batteries are **not available**  
lower **running costs/ less money wasted**  
**instant** charging  
**qualified** environmental statement e.g, batteries in landfill give  
off chemicals/ less resources used  
  
*[do not allow just statements such as 'environmentally friendly'  
'energy efficient' or energy saving']*  
*[do not allow reference to size]* [any two] 2
- (d) ease of **operating/turning** the handle/ length of crank  
**actual grip** of handle/ finger grooves  
**comfortable shape** of case/ shaped for grip  
**strap to fit** makes it easy to carry around [any two] 2
- (e) **CASE**  
check case is correctly **FORMED**.  
*[allow reference specific features of the case  
e.g. no rough edges/ halves fit each other]  
[do not allow 'made properly']*
- SPECIFIC PARTS**  
Reference to correct **FIT** of any part .  
e.g. lens must fit case'.  
[do not allow 'lens must fit properly']
- OPERATION/TESTING**  
Reference to testing for correct operation .  
e.g. check the LEDs light.  
e.g. crank is easy to turn.  
*[do not allow 'is torch bright enough?', 'does light stay on long  
enough?' or 'how long do LEDS stay on after winding torch has  
stopped?']* [any two] 2
- (f) (i) photo cell/photovoltaic/solar cell/solar panel.  
[do not allow LDR]. [any one] 1
- (ii) Less fumes (pollution or CO<sub>2</sub>) given off .  
Not using up limited finite resources.  
*[do not allow 'less energy wasted' or 'friendly to the  
environment']* [any one] 1

3 (a)

buzzer  or  lamp (bulb)

1+1      2

(b) 30/1000 x 3  
= .09W [90 milliwatts]


1  
1      2

(c) SPDT

1

(d) (i) transistor **and** base resistor shown (must have both for mark)  
thermistor shown in input potential divider [top or bottom]

1  
1

[symbol  or label 'thermistor', are acceptable]

[Symbol rotated is acceptable]

thermistor **correctly positioned** in the bottom of the potential divider gets the extra mark

1

(ii) Statement including the word '**thermistor**' as a device to sense temperature  
(do not allow temp sensor)

1

Description of switching in the circuit in any one of three areas below;

- i.e. 'need for potential divider'
- or
- i.e. 'effect of temperature on the thermistor'
- or
- i.e. 'how to switch on the transistor'

1      2

4	(a)	the generator needs to be positioned inside the case this means the case needs to be made <b>and joined</b>	1	
		injection moulding <b>allows varying thickness/ more complex designs</b> [blow moulding parts are of single thickness/ can only have detail formed on one side]	1	2
	(b)	<b>heat plastic</b> <b>diamond</b> decision box <b>feedback loop</b> correctly added from the diamond decision box [arrows not needed]	1 1 1	3
	(c) (i)	<u><b>ATTACHMENT TO GRP + REMOVAL</b></u>		
		Sketch <u>or</u> note showing	1	
		<b>attaching support to GRP</b> panel [e.g. plate with holes, large boss with flat side and holes +screws/nuts bolts]		
		<b>stopping rotation</b> [e.g. grub screw, bolts, pins, circlip style fastener, clamping device]	1	
	(ii)	<u><b>EASY REMOVAL</b></u>		
		Sketch <u>or</u> note showing		
		<b>removal</b> of the support tube [need for simple tools to allow removal [e.g. screwdriver, spanner, allen key]                      [1 mark <b>max</b> ]	1	
		<b>EASY removal</b> [– quick release <b>without tools</b> [e.g, cam action wing nut]    [2 marks]	2	4
	(d)	stainless steel, brass or bronze [do not allow aluminium]		1

5	(a) (i)	<b>SKETCH SHOWING</b> PLASTIC lid shown with <b>raised ribs/areas or roll over edges</b> [only allow a single formed product]	1
		<b>NOTE EXPLAINING</b> The need to stiffen the lid	1
	(ii)	<b>SKETCH SHOWING</b> Hinges with <b>clear attachment</b>	1
		<b>NOTE EXPLAINING</b> use of hinges needs more than the word 'hinge' eg 'hinge allows easy opening'	1
	(b) (i)	<b>SKETCH SHOWING</b> <b>Basic</b> simple mechanism which may not fully meet the specification.	= 1 [max]
		<u><i>[candidates go no further unless they have a fully working mechanical system]</i></u>	
		Complete mechanism <b>that works</b> with levers/ linkages/ springs which meets the specification and would result in the correct raising of the lid.	= 2 [max]
		Sketch with good proportion and details of attachment between parts. <b>WHICH MUST BE A WORKING SYSTEM</b>	= 1 [max]
		<b>NOTE EXPLAINING</b> explaining mechanism which <b>MUST BE A WORKING SYSTEM</b>	=1 [max]
	(ii)	<b>Materials</b> –one specific named materials for the mechanical system steel/ stainless steel/brass/nylon	1
		<b>Components</b> - two specific named parts for the mechanism	1

# 1957/03 Paper 3 (Foundation)

1 (a) (i) **Light Emitting Diode.** 1 mark for each correct word. [3]

(ii) Responses could include:

- shape
- size
- intensity/brightness
- viewing angle
- bi-colour
- tri-colour
- flashing
- infra red output
- cost
- resistor inclusive.

1 mark for each correct. 2 x1.

[2]

(b) A protective resistor will reduce voltage in the circuit.

A protective resistor will reduce current in the circuit.

A protective resistor can be used to change the colour of an LED.

A protective resistor can change the brightness of an LED.

1 mark for each correct tick, **no marks for more than two boxes ticked.**

[2]

(c) The following methods are acceptable:

- negative leg / cathode is shorter than positive,
- use of multimeter
- trial and error using breadboard for connecting.

1 mark for suitable response.

[1]

(d) Methods could include:




- soldering iron plus desoldering tool
- powered desoldering iron
- copper braid
- soldering iron pulled through molten solder on joint
- knife or scalpel
- allow other viable method.

1 mark for heating, 1 mark for solder removal.

[2]

[Total 10]

- 2 (a) (i) 1 mark for each component with both **name** and **condition sensed** correct.  
Allow 1 mark for all three sensors or all three conditions correct.

	A 	B 	C 
name of sensor	LDR	thermistor	reed switch
condition sensed	light	heat	movement

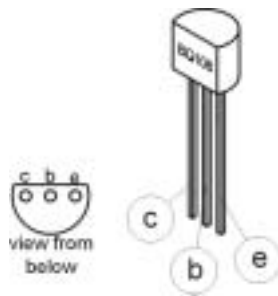
3 x 1 mark [3]

- (ii) Reference to the reed switch having a contact switching action leading to a fast response – digital device, 1 mark.  
Reference to the time taken for other two sensors to adjust to change in light/heat level – analogue device, 1 mark.  
Reference to change in conditions, 1 mark. [2]

- (b) (i) Component A, the potentiometer will allow a threshold to be set for switching the transistor. E.g. adjust voltage at the centre of potential divide.  
Allow reference to setting sensitivity of the circuit. [1]

- (ii) The pull up resistor will ensure that the voltage at point X is always at:
- 0V or supply
  - logic 0 or logic 1
  - high or low
  - resistor ensures that there is always a voltage at point X.
- 1 mark for understanding of the function. [1]

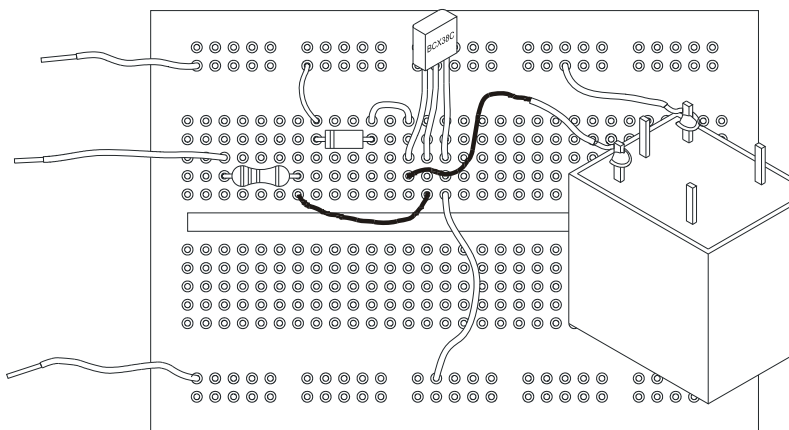
- (c) (i) 2 marks for all three correct  
1 mark for 1 correct.



- (ii) Reasons for using pad could include:
- prevent transistor legs being bent/broken/damaged
  - prevent solder pad or track being damaged
  - prevent movement of transistor
  - act as heatsink.
- 1 mark for understanding shown. [1]

[Total: 10]

- 3 (a) (i) Square wave, 1 mark. [1]
- (ii) Astable, 1 mark. **No marks for more than one tick.** [1]
- (b) (i) Components for timing are **R1** and **VR1**, 2 x 1 mark. [2]
- (ii) The capacitor will be marked with a **working voltage** which should not be **exceeded**, or less than 12V, 1 mark.  
 The capacitor is electrolytic and is polarized. **It should be connected the correct way around in the circuit**, 1 mark. [2]

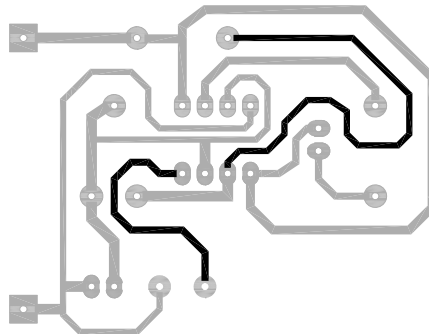


- (c) (i) 1 mark for each correct connection, 2 x 1 mark. [2]
- (ii) Explanation should refer to 12V being the coil voltage, allow operating voltage 1 mark.  
 SPDT should be written in full **Single Pole Double Throw**, 1 mark.  
 Allow marks for clear description of either point. [2]

[Total: 10]



- 4 (a) (i) Feature could include:
- pad size
  - pad shape
  - hole size (in pad)
  - track width
  - move components closer together
  - move positive / negative pads
  - board size/shape.
- 1 mark each for two suitable features, 2 x 1 mark.  
No mark for pad, track or hole without qualification. [2]
- (ii) Steps in production of auto-routed circuit will include:
- accurate drawing of schematic – using commercial software
  - route any unrouted tracks
  - remove links
  - check component placement
  - choice of component type eg preset resistor style
  - choice of board size
  - use of background copper
  - set track width.
- Allow mark for any other suitable step. [1]
- (iii) 1 mark for each correctly routed track, 2 x 1.  
Allow mark for other correct alternatives. [2]



- (b) The extra pads shown are for mounting the PCB onto a base.  
Allow mark for mention of screw holes or stress relief on wires. [1]
- (c) (i) Reasons for blocking circuits together could include:
- allow more to be produced in the same time therefore lower cost
  - ensure consistent quality
  - cut down on board wastage
  - batch production.
- Quicker or cheaper must be qualified  
Allow other suitable reasons. 2 x 1 marks. [2]
- (ii) Scored lines will allow easy removal of boards from complete block. [1]  
Also removes the need to use a guillotine or other cutting device.  
Screen layer will help in component **orientation**, component **value**  
and **position** in the circuit.  
To allow circuit information to be included [1]

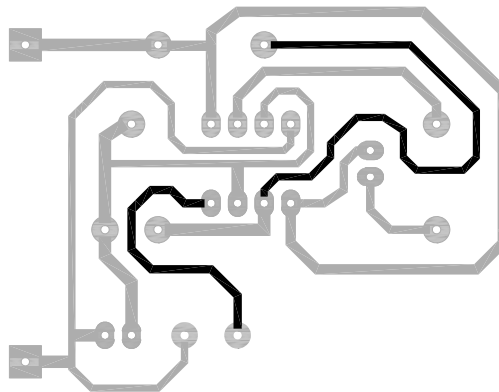
[Total: 10]

- 5 (a) (i) **Injection moulding** is the method of manufacture. [1]
- (ii) the **colour** of the plastic can be changed or the **type** of material used. [1]
- (b) Benefits of COB technology include:
- reduction in assembly costs
  - implications to production costs
  - smaller finished circuit board
  - less chance of damage during assembly
  - more robust in use
  - fewer open connections / better connection
- Allow other suitable reasons, 2 x 1 mark.  
 'Cheaper', 'quicker' etc must be qualified. [2]
- (c) (i) The purpose of the spring is to **apply pressure** to the moving contact ensuring a **good connection** with the pads. [1]
- (ii) The shaped hole gives the rotary shaft a good mechanical connection to the moving contact.  
 Does not allow rotary contact to spin. 1 mark. [1]
- (d) Methods of reducing environmental damage during disposal could include:
- making plastics with recycling symbol and type of plastics
  - ensuring that parts can be easily separated
  - ensure easy removal of batteries
  - ensure easy removal of circuit board
  - instructions for disposal
  - use of biodegradable plastics.
  - plastics used should be recyclable
  - recyclable metals on the board
  - use minimum amount materials
  - no toxic materials used in manufacture
- answers must refer to the manufactured aspect.  
 2 x 1 mark. [1]
- (e) Correct substitution into formula,  $I = 1.3 / 33 = 0.039A$  or  $39.4mA$  1 mark.  
 Divided by three LEDs =  $0.013A$ ,  $13mA$ , through each LED. 1 mark.  
 Correct answer with no working 2 marks. [2]

[Total: 10]

## 1957/04 Paper 4 (Higher)

- 1 (a) (i) Feature could include:
- pad size
  - pad shape
  - hole size (in pad)
  - track width
  - move components closer together
  - move positive / negative pads
  - board size/shape.
- 1 mark each for two suitable features, 2 x 1 mark.  
No mark for pad, track or hole without qualification. [2]
- (ii) Steps in production of auto-routed circuit will include:
- accurate drawing of schematic
  - route any unrouted tracks
  - remove links
  - check component placement
  - choice of component type eg preset resistor style
  - choice of board size
  - use of background copper
  - set track width.
- Allow mark for any other suitable step. [1]
- (iii) 1 mark for each correctly routed track, 2 x 1.  
Allow mark for other correct alternatives. [2]



- (b) The extra pads shown are for mounting the PCB onto a base.  
Allow mark for mention of screw holes or stress relief on wires. [1]
- (c) (i) Reasons for blocking circuits together could include:
- allow more to be produced in the same time therefore lower cost
  - ensure consistent quality
  - cut down on board wastage
  - batch production.
- Quicker or cheaper must be qualified  
Allow other suitable reasons. 2 x 1 marks. [2]

- (ii) Scored lines will allow easy removal of boards from complete block. [1]  
Also removes the need to use a guillotine or other cutting device.  
Screen layer will help in component **orientation**, component **value**  
and **position** in the circuit.  
To allow circuit information to be included [1]

[Total: 10]

- 2 (a) (i) **Injection moulding** is the method of manufacture. [1]
- (ii) the **colour** of the plastic can be changed or the **type** of material used. [1]
- (b) Benefits of COB technology include:
- reduction in assembly costs
  - implications to production costs
  - smaller finished circuit board
  - less chance of damage during assembly
  - more robust in use
  - fewer open connections / better connection
- Allow other suitable reasons, 2 x 1 mark.  
'Cheaper', 'quicker' etc must be qualified. [2]
- (c) (i) The purpose of the spring is to **apply pressure** to the moving contact ensuring a **good connection** with the pads. [1]
- (ii) The shaped hole gives the rotary shaft a good mechanical connection to the moving contact.  
Does not allow rotary contact to spin. 1 mark. [1]
- (d) Methods of reducing environmental damage during disposal could include:
- making plastics with recycling symbol and type of plastics
  - ensuring that parts can be easily separated
  - ensure easy removal of batteries
  - ensure easy removal of circuit board
  - instructions for disposal
  - use of biodegradable plastics.
  - plastics used should be recyclable
  - recyclable metals on the board
  - use minimum amount materials
  - no toxic materials used in manufacture
- answers must refer to the manufactured aspect.  
2 x 1 mark. [2]
- (e) Correct substitution into formula,  $I = 1.3 / 68 = 0.0191A$  or **19.1mA** 1 mark.  
Divided by three LEDs = **0.006A, 6mA**, through each LED. 1 mark.  
Correct answer with no working 2 marks. [2]

[Total: 10]

- 3 (a) (i) Specification points must refer to the function of the system and may include:
- the device must operate at a temperature up to and beyond 110°C
  - the cooling fan must switch on and off automatically
  - the thermistor housing must be rugged enough to cope with bad weather conditions
  - the system must give a warning to the driver when the fan is in operation
  - the fan must switch on at a set temperature.
- 1 mark for each relevant point, 2 x 1 mark. [2]
- (ii) If the coolant is just at a dangerous level the fan will constantly switch on and off, shortening the life of the motor. Allow reference to the fan 'hunting'.  
1 mark for understanding shown. [1]
- (b) (i) Reasons should include:
- lower tolerance which will make setting up a large batch easier
  - suitable operating temperature
  - high enough resistance at high temperature to make adjustment/balance easier.
- 1 mark for each suitable reason, 2 x 1 mark. [2]
- (ii) Suitable properties will include:
- resistance to heat
  - resistance to chemical attack
  - it is a thermoset plastic, therefore sets hard
  - will protect the thermistor
  - allows transfer of heat to the thermistor
  - waterproof.
- 1 mark for suitable property. [1]
- (c) The maximum delay will be when the variable is set to 470K.
- $$T = 1.1 \times (10K + 470K) \times 1000\mu F = 1.1 \times 480K \times 1000\mu F$$
- 1 mark for substitution of correct values into formula or correct addition of resistor values.  
T = 8.8 minutes or 528s.  
1 mark for correct answer  
Allow 1 mark for 517s  
Allow 1 mark for a correct result using any other value of resistance up to 480K. [2]
- (d) Advantages could include:
- ability to change values using software
  - circuit could be adapted for different vehicles or climates
  - less chance of components becoming obsolete
  - program can be updated during the life of vehicle
  - more accurate temperature control
  - will possibly have surplus inputs and outputs that can be utilised
  - timing section of circuit is integral and controlled by software.
- 1 mark for each suitable advantage, 2 x 1 mark. [2]

[Total: 10]

4 (a) (i) 1 mark for output X column correct, 1 mark for output Y column correct. [2]

door 1	door 2	boot lid	ignition	output at X	output at Y
0	0	0	0	0	0
0	0	1	0	1	0
0	1	0	0	1	0
1	0	0	0	1	0
0	0	1	1	1	1
0	1	0	1	1	1
1	0	0	1	1	1

(ii) The AND gate acts as a filter ensuring that there is:  
**no output unless the ignition is on.**  
 1 mark for suitable response showing understanding. [1]

(iii) If the spare input on gate 2 were left to float the output could not be predicted.  
 If the spare input was connected high the output from that gate would always be high.  
 1 mark for understanding shown. [1]

(b) The capacitor is there as a **decoupling capacitor**. It will suppress voltage spikes that could otherwise cause a change in logic level.  
 1 mark for understanding shown. E.g. protection of IC or smoothing. [1]

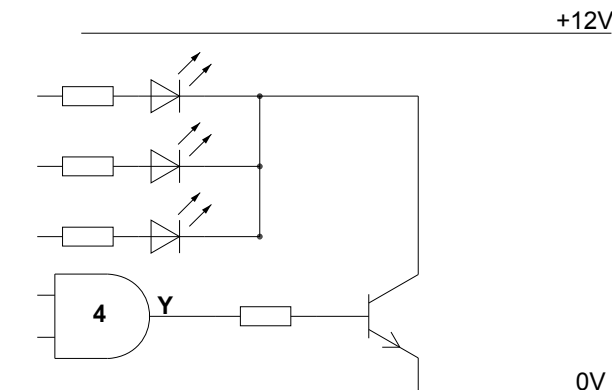
(c) (i) Benefits could include:

- avoids turning board over for checking
- overcomes faulty LED
- less risk of shorting
- ensures correct point is checked
- lower cost than LED indicator
- allows test device such as oscilloscope to be connected quickly.

Allow **qualified** reference to speed, 1 mark. [1]

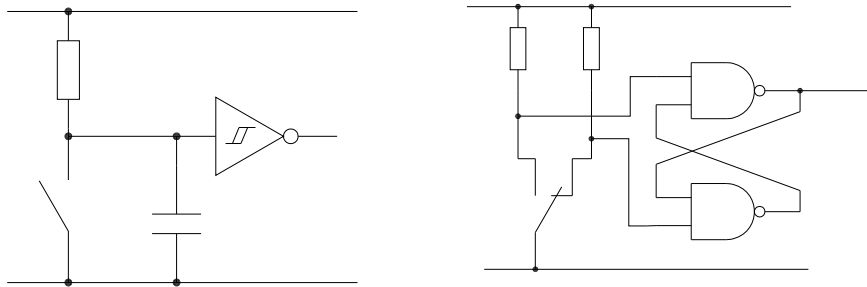
(ii) Visual response, no instruments needed, no connections necessary, speed of testing. [1]

(d) 1 mark for correct symbol for NPN transistor in suitable position on the drawing.  
 1 mark for correct connection of either base, emitter or collector.  
 1 mark for all connections correct, 3 x 1 marks. [3]



[Total: 10]

5 (a) 1 mark for method of debouncing, bistable, Schmitt device with capacitor.



1 mark for working detail showing or describing actual components used.  
 Schmitt inverter symbol with no capacitor 1 mark.  
 2 x 1. [2]

(b) (i) The bar means that when pin 10 is connected low it will be a down count, for an up count it is connected high.  
 1 mark for understanding of the pin function. [1]

(ii) BCD counter maximum **9** Full 4 bit binary counter **15**  
 1 mark for each correct. [2]

(iii) Maximum count before resetting will be **159**.  
 Allow mark for an answer of 160 or product of (b)(ii) answers. [1]

(c) Explanation should include:  
 Reset occurs when pin is high, 1 mark.  
 The inverter gives a low signal for the full minute of the count and a high at the end of the minute allowing a reset.  
 1 mark for understanding that an inverted pulse is required, 2 x 1 mark. [2]

(d) The change required should relate to the output display, 1 mark.  
 Display needs changing because of difficulty in interpreting binary output, 1 mark.  
 Allow marks or other relevant changes with good reason.  
 E.g. use LCD because of lower current draw. [2]

[Total: 10]

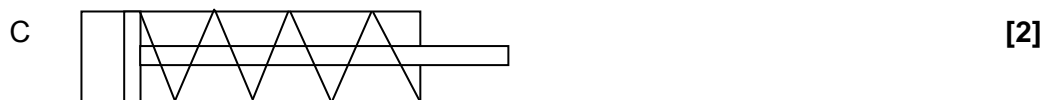


# 1957/05 Paper 5 (Higher)

1 (a)



B Main Air [1]



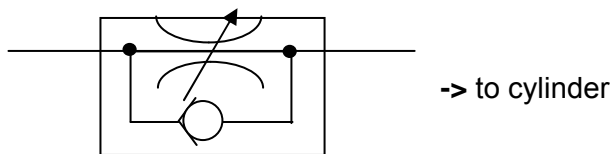
D Double acting cylinder [2]



- (b) To maintain constant supply [2x1]  
 To avoid the need for the compressor running constantly  
 To maintain a higher pressure than the compressor alone can supply.  
 To create a time delay.

2 (a) Push button spring return 3 port valve. [2]

(b) (i) [3]



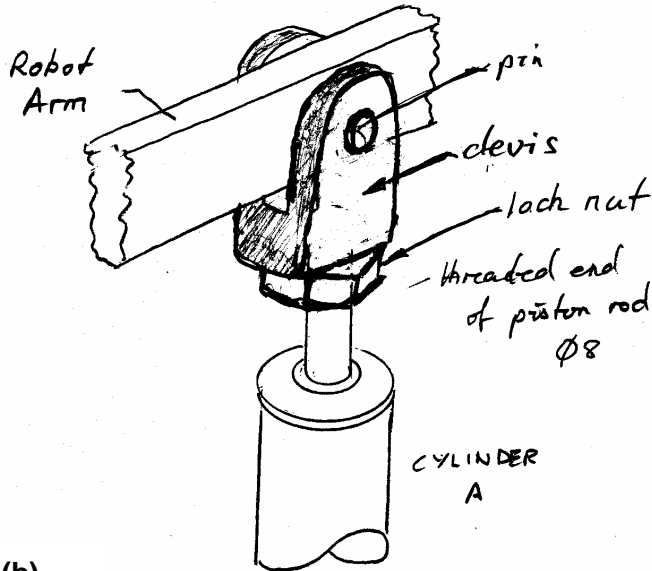
(ii) When valve X is pressed main air can pass unrestricted (by blowing the ball away) to the double acting cylinder and lifts the arm, but when the valve is released the return path is restricted and the weight of the arm brings it down at a speed determined by the setting of the unidirectional restrictor. [3]

(iii) A double acting cylinder rather than a single acting cylinder was used because the spring in the single acting cylinder would bring the arm down even quicker (1), and a single acting cylinder is a little more expensive because of the extra spring (1). [2]

- 3 (a) (i) The safety valve is an essential part of the compressed air system because if the compressor fails to shut off (1) and the pressure rises too high (1) it will release the pressure and prevent the receiver exploding (1). [3]
- (ii) The pressure gauge is essential because it displays the pressure in the system (1) and gives a visual warning of problems (1) that have caused the pressure to rise or fall from that required (1) ie the failure of another safety component in the system (or an answer that relates to these points). [3]
- (b) The reasons it is important to check for unconnected pipes before turning on the main air for the first are:
- if there are any pipes not connected they will flay around and could hit somebody
  - if pressurized air is allowed to blow on bare skin it could cause air bubbles to get in the blood stream, possibly causing death
  - the system will not be airtight and would fail to work properly
- Or any other correct response (2) for each correct response. [2]  
[2]

- 4 (a) The advantages of using CAD to design layouts are -
- they can be easily edited
  - they can be easily stored for future use
  - they can be sent anywhere in the world
  - it is more efficient
  - ready made symbols are available. **[3]**
- (b) The benefits of using simulation are:
- the circuit can be tested safely
  - can be carried out without the need for the hardware
  - it is easier and quicker to make alterations and retest. **[2]**
- (c) Two advantages for the manufacturer in changing to computer control:
- computers work 24/7
  - initial costs high but running costs lower
  - consistent quality
  - small workforce **[2]**
- (d) (i) A magnet. **[1]**
- (ii) Feedback is provided to the computer from the action of the magnet closing the reed switch when it is near it and signalling the computers' input that a switch has been closed. **[2]**

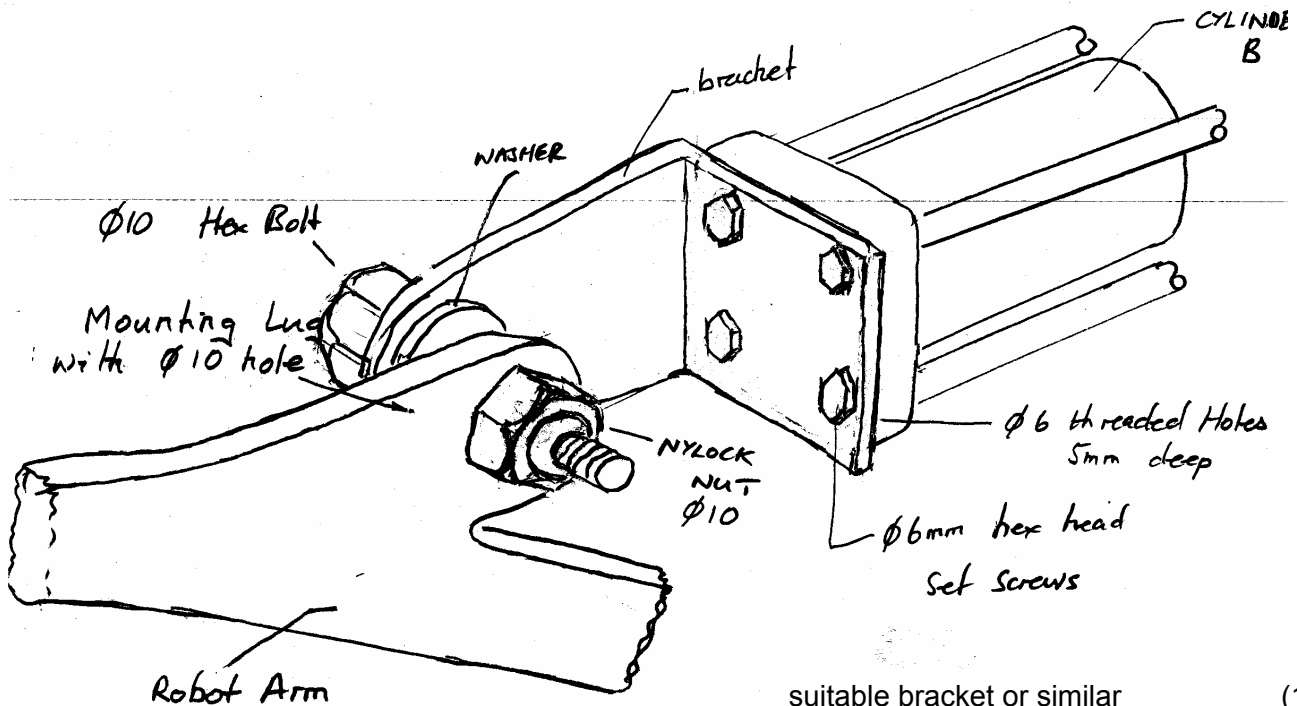
5 (a)



- suitable clevis or similar (1)
- secure attachment to piston rod (1)
- connection to arm (1)
- pin/bolt (1)
- locking device (1)

TOTAL [5]

(b)



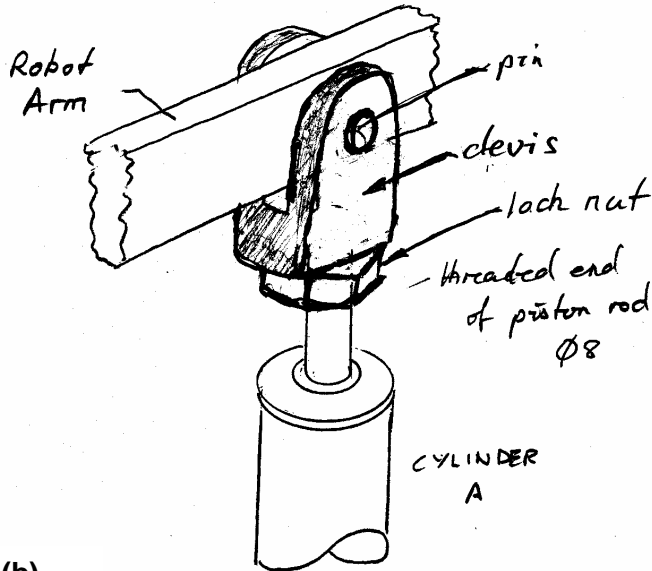
- suitable bracket or similar (1)
- secure attachment to cylinder (1)
- connection to arm (1)
- pin/bolt (1)
- locking device (1)

TOTAL [5]

## 1957/06 Paper 6 (Higher)

- 1 (a) The advantages of using CAD to design layouts are –
- They can be easily edited.
  - They can be easily stored for future use.
  - They can be sent anywhere in the world.
  - It is more efficient.
  - Ready made symbols are available **[3]**
- (b) The benefits of using simulation are –
- The circuit can be tested safely.
  - Can be carried out without the need for the hardware.
  - It is easier and quicker to make alterations and retest. **[2]**
- (c) Two advantages for the manufacturer in changing to computer control
- Computers work 24/7.
  - Initial costs high but running costs lower.
  - Consistent quality. **[2]**
- (d) (i) A magnet. **[1]**
- (ii) Feedback is provided to the computer from the action of the magnet closing the reed switch when it is near it and signalling the computers' input that a switch has been closed. **[2]**

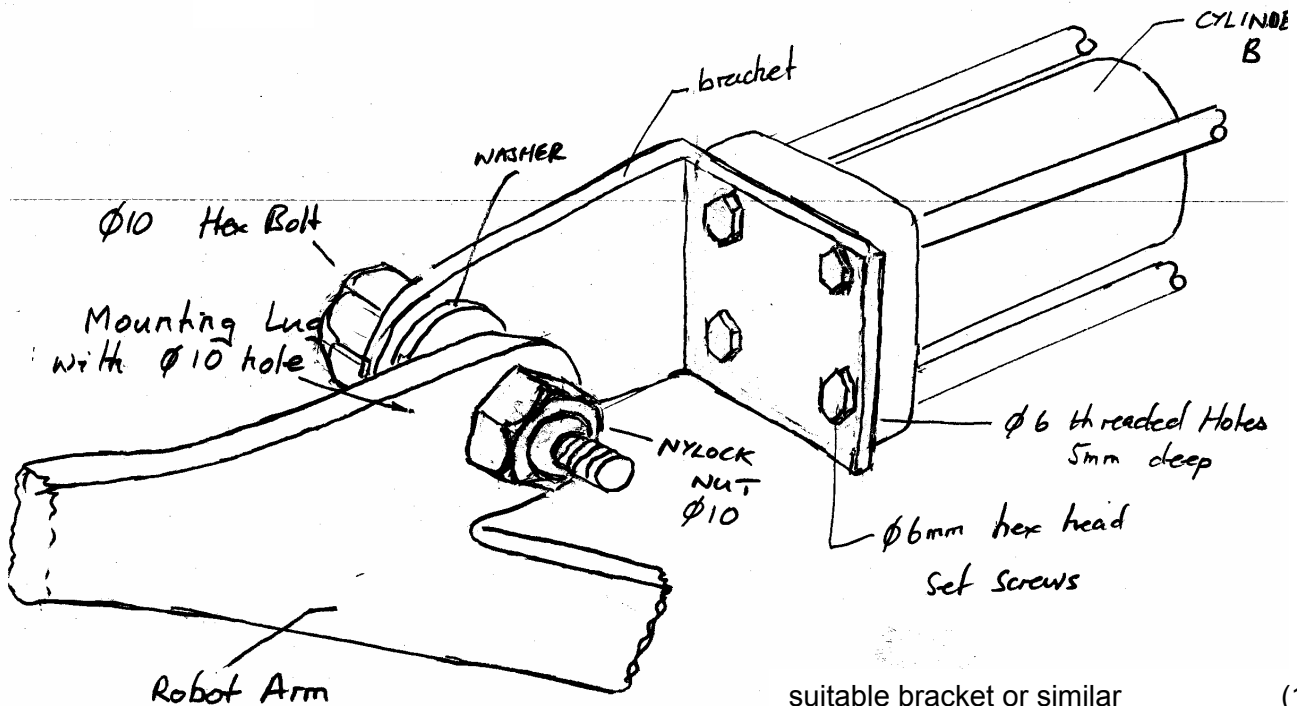
2 (a)



- suitable clevis or similar (1)
- secure attachment to piston rod (1)
- connection to arm (1)
- pin/bolt (1)
- locking device (1)

TOTAL [5]

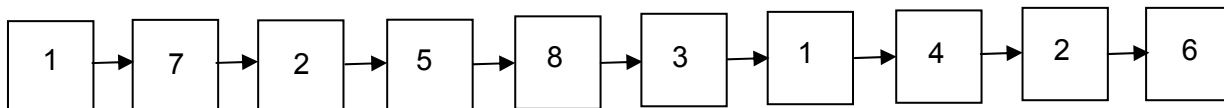
(b)



- suitable bracket or similar (1)
- secure attachment to cylinder (1)
- connection to arm (1)
- pin/bolt (1)
- locking device (1)

TOTAL [5]

3



[10]

4 (a) Calculate the minimum air supply required to rotate the arm.  $F = P \times A$

$$R = D/2 = (12/2) = 6 \quad (1)$$

$$15 = P \times \pi \times 6^2 \quad (1)$$

$$P = 15 / \pi \times 6^2 \quad (1)$$

$$P = 0.133 \text{ N/mm}^2 \quad (1)$$

$$\text{Minimum air supply pressure} = 0.13 \text{ N/mm}^2 \quad (1) \quad [5]$$

(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) (i) A cushioned double acting cylinder. [1]
- (ii) The cylinder travels at normal speed for all but the last part of the stroke (1) when it covers the main exhaust escape (1) and leaves just a small hole which creates a cushion of air trying to escape (1), this then slows down the last part of the stroke. [4]
- (b) When the valve is pressed main air will outstroke the cylinder (1) and at the same time the exhaust will be restricted (1) and hold the diaphragm valve in the exhausting position (1). If the bucket hits an obstruction the pressure on the diaphragm stops (1) and sends a signal to the 2/5 port valve to return the cylinder (1). [5]

## 1957/07 Paper 7 (Higher)

Question	Syllabus Ref	Expected Answer	Mark	Rationale
1	(a)	(i)	Reciprocating (1)	
		(ii)	Linear (1)	
		(iii)	Rotary (1)	[3]
	(b)	One wheel drawn off centre below axle (1) Second wheel drawn off centre above axle or on centre. (1)	[2]	
	(c)	(i) Follower, rod , dowel (1)	[1]	
		(ii) Cam or eccentric drawn (1) Named. (1)	[2]	
	(d)	(i) HIPS; polystyrene; ABS, polypropelene, PVC (1)	[1]	
		(ii) injection moulding; compression moulding; vac forming (1)	[1]	
2	(a)	Reduce friction, prevent hole in foamboard becoming enlarged, prevent wear between wheel and foamboard.	[1] [1]	
	(b)	Brass, pvc, nylon	[1]	
	(c)	Quieter, lighter, lower cost, easier to manufacture. easier maintenance; smoother than chain.	[1]	
	(d)	Reduced speed (1) 1/3 speed (1)	[2]	

	(e)		sketch showing a method that will Fix pulley a method that will allow Removal components labelled: screw, key, keyway or: grubscrew, spline	F (1) R (1) C (1) (1+1)	[4]	
3	(a)		Pinch roller		[1]	
	(b)		Link attached to blade and lever, compression or tension spring used appropriately named component.	(1) (1) (1)	[3]	fixed link to blade with two fixing points 3 marks
	(c)		System A: class 1, class A System B: class 3. class C	(1) (1)	[1] [1]	
	(d)		Blade only needs to be moved short distance System A gives a lower velocity ratio/more power System A VR= 3:1 System B VR= 1:4 Clear comparison for all 4 marks Note: maximum of 2 marks if no calculation.	(1) (1) (1) (1) (1)	[4]	
4	(a)		Answer must relate to production: Components are ordered from suppliers to arrive when needed for assembly, reducing need for storage; allows for changes to product without need to use up stock.	(1) (1)	[2]	
	(b)		Pollution due to transport		[1]	

	<b>(c)</b>		Visual inspection of components prior to or during assembly; use of test equipment on sizes; sample testing of products.	[1]	
	<b>(d)</b>		On-line ordering; stock picking; route planning for delivery vehicles; printing delivery labels; accountancy; re-ordering of stock.; tracking parcels; web based system (1+1)	[2]	
	<b>(e)</b>		Packaging to include information about different materials used for the product eg. plastics identification using standard symbols. Include information about how to dispose of the product; easy to disassemble money back on return. (1+1)	[2]	
	<b>(f)</b>		Trigger to hand grip distance decided as a result of anthropometric data; trigger length of lever is long compared with effort end giving good mechanical advantage; jaws shaped to take account of different size and shape of litter. (1+1)	[2]	Relate size to person using ie bending down
5	<b>(a)</b>		System A: ratchet and pawl System B: worm and wormwheel or wormgear and wheel	[1] [1]	
	<b>(b)</b>		Input: handle or winder is turned (not one word answer) Process: pawl drops into next tooth.	[1] [1]	
	<b>(c)</b>		Gives finer degree of control of the tensioning because of the high VR achievable in a worm system; (1) Enclosed, weather protection and safety related to ratchet and pawl not to handle (1) Worm systems act as a lock because worm cannot be turned by the wormwheel.	[2]	

	(d)		turn shaft: shaft and handle with flats; key & keyway; splines easy removal no protrusion of shaft features labelled.	[1] [1] [1] [1]	Tick responses/spec points total these
--	-----	--	--	--------------------------	--

## 1957/08 Paper 8 (Higher)

Question	Syllabus Ref	Expected Answer	Mark	Rationale
1	(a)	(i)	Reciprocating (1)	
		(ii)	Linear (1)	
		(iii)	Rotary (1)	[3]
	(b)	One wheel drawn off centre below axle (1) Second wheel drawn off centre above axle or on centre. (1)	[2]	
	(c)	(i) Follower, rod , dowel (1)	[1]	
		(ii) Cam or eccentric drawn (1) Named. (1)	[2]	
	(d)	(i) HIPS; polystyrene; ABS, polypropelene, PVC (1)	[1]	
		(ii) injection moulding; compression moulding; vac forming (1)	[1]	
2	(a)	Reduce friction, prevent hole in foamboard becoming enlarged, prevent wear between wheel and foamboard.	[1] [1]	
	(b)	Brass, pvc, nylon	[1]	
	(c)	Quieter, lighter, lower cost, easier to manufacture. easier maintenance; smoother than chain.	[1]	
	(d)	Reduced speed (1) 1/3 speed (1)	[2]	

	(e)		sketch showing a method that will Fix pulley a method that will allow Removal components labelled: screw, key, keyway or: grubscrew, spline	F (1) R (1) C (1) (1+1)	[4]	
3	(a)		Pinch roller		[1]	
	(b)		Link attached to blade and lever, compression or tension spring used appropriately named component.	(1) (1) (1)	[3]	fixed link to blade with two fixing points 3 marks
	(c)		System A: class 1, class A System B: class 3. class C	(1) (1)	[1] [1]	
	(d)		Blade only needs to be moved short distance System A gives a lower velocity ratio/more power System A VR= 3:1 System B VR= 1:4 Clear comparison for all 4 marks Note: maximum of 2 marks if no calculation.	(1) (1) (1) (1) (1)	[4]	
4	(a)		Answer must relate to production: Components are ordered from suppliers to arrive when needed for assembly, reducing need for storage; allows for changes to product without need to use up stock.	(1) (1)	[2]	
	(b)		Pollution due to transport		[1]	

	<b>(c)</b>		Visual inspection of components prior to or during assembly; use of test equipment on sizes; sample testing of products.	[1]	
	<b>(d)</b>		On-line ordering; stock picking; route planning for delivery vehicles; printing delivery labels; accountancy; re-ordering of stock.; tracking parcels; web based system (1+1)	[2]	
	<b>(e)</b>		Packaging to include information about different materials used for the product eg. plastics identification using standard symbols. Include information about how to dispose of the product; easy to disassemble money back on return. (1+1)	[2]	
	<b>(f)</b>		Trigger to hand grip distance decided as a result of anthropometric data; trigger length of lever is long compared with effort end giving good mechanical advantage; jaws shaped to take account of different size and shape of litter. (1+1)	[2]	Relate size to person using ie bending down
<b>5</b>	<b>(a)</b>		System A: ratchet and pawl System B: worm and wormwheel or wormgear and wheel	[1] [1]	
	<b>(b)</b>		Input: handle or winder is turned (not one word answer) Process: pawl drops into next tooth.	[1] [1]	



	<b>(c)</b>		<p>Gives finer degree of control of the tensioning because of the high VR achievable in a worm system; (1)</p> <p>Enclosed, weather protection and safety related to ratchet and pawl not to handle Worm systems act as a lock because worm cannot be turned by the wormwheel. (1)</p>	<b>[2]</b>	
	<b>(d)</b>		<p>turn shaft: shaft and handle with flats; key &amp; keyway; splines</p> <p>easy removal</p> <p>no protrusion of shaft</p> <p>features labelled.</p>	<p><b>[1]</b></p> <p><b>[1]</b></p> <p><b>[1]</b></p> <p><b>[1]</b></p>	Tick responses/spec points total these

# Grade Thresholds

General Certificate of Secondary Education  
1957 Systems and Control  
June 2008 Examination Series

## Component Threshold Marks

Component	Max Mark	A	B	C	D	E	F	G
1	50			27	22	18	14	11
2	50	28	23	18	13			
3	50			26	22	18	15	12
4	50	28	22	16	10			
5	50			33	27	22	17	12
6	50	33	27	22	17			
7	50			23	19	15	12	10
8	50	29	24	19	14			
9	100	87	76	65	53	41	29	17

## Specification Options

### Foundation Tier Electronics

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175				98	81	65	49	33
Percentage in Grade					19.93	26.45	20.29	18.12	10.15
Cumulative Percentage in Grade					19.93	46.38	66.67	84.78	94.93

The total entry for the examination was 336

### Higher Tier Electronics

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175	140	123	106	89	69	59		
Percentage in Grade		7.52	21.28	26.88	24.16	14.56	2.72		
Cumulative Percentage in Grade		7.52	28.80	55.68	79.84	94.40	97.12		

The total entry for the examination was 663

### Foundation Tier Mechanisms

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175				94	78	62	47	32
Percentage in Grade					16.57	29.72	25.71	14.29	9.71
Cumulative Percentage in Grade					16.57	46.29	72.00	86.29	96.00

The total entry for the examination was 374

### Higher Tier Mechanisms

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175	144	126	108	91	72	62		
Percentage in Grade		6.34	18.01	26.37	24.21	18.30	3.89		
Cumulative Percentage in Grade		6.34	24.35	50.72	74.93	93.21	97.12		

The total entry for the examination was 708

### Foundation Tier Pneumatics

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175				106	87	68	50	32
Percentage in Grade					9.38	25.00	28.13	15.63	15.63
Cumulative Percentage in Grade					9.38	34.38	62.5	78.13	93.75

The total entry for the examination was 33

### Higher Tier Pneumatics

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175	141	125	109	93	73	63		
Percentage in Grade		4.41	14.71	32.35	25.00	20.59	2.94		
Cumulative Percentage in Grade		4.41	19.12	51.47	76.47	97.06	100.0		

The total entry for the examination was 68

**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	4.60	13.11	18.24	22.10	20.39	9.83	5.13	3.28
Cumulative Percentage in Grade	4.60	17.70	35.94	58.04	78.44	88.26	93.4	96.67

The total entry for the examination was 2182

Statistics are correct at the time of publication.

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

**OCR Customer Contact Centre**

**14 – 19 Qualifications (General)**

Telephone: 01223 553998

Facsimile: 01223 552627

Email: [general.qualifications@ocr.org.uk](mailto:general.qualifications@ocr.org.uk)

**[www.ocr.org.uk](http://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

© OCR 2008

